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Dust in the Wind? The Bell Tolls for Crematory Mercury

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COMMENT

DUST IN THE WIND? THE BELL TOLLS FOR CREMATORY MERCURY

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I. INTRODUCTION

Cremation is becoming the method of choice for dealing with the deceased in the United States. Although environmental concerns often motivate this choice, cremations are not ecologically benign. Most significantly, the global environment is suffering from crematory emissions of mercury due to incineration of dental amalgam fillings. Until now, these emissions have been considered too low to merit regulation in the United States. Because cremation is becoming more widespread, some state governments have begun to craft policies targeting crematory mercury in the context of broader efforts to eliminate mercury pollution.

There are two basic choices for eliminating crematory mercury: installing filtration technologies to capture the toxin, or mandating that all dental amalgam fillings be removed from a body prior to cremation. Given the costliness of the first option and the practical and socio-cultural challenges of the second, governments should adopt a comprehensive approach that educates the public about this issue, encourages voluntary removal of fillings at death, fosters existing ecological alternatives to cremation and develops new alternatives, and uses market incentives and targeted legislation to help the cremation industry reduce its harmful impacts.[1]

Part II of this Comment outlines the toxicity and behavior of mercury. Part III asserts that cremation is a significant and growing source of mercury pollution. Part IV describes the current regulatory atmosphere for crematory mercury vapor: the federal government's decision to leave it largely unregulated and the efforts of a few states, including Maine, Minnesota, and Colorado, to begin tackling this problem. Part IV also contains a case study discussing whether agencies in the San Francisco Bay Area of California are effectively addressing crematory mercury. Part V explores the options of either capturing mercury emitted from crematories or pulling teeth containing dental amalgam fillings prior to cremation. It also includes an assessment of our collective capacity to change cultural death practices in order to address this threat. Part V concludes with a mention of two alternatives to cremation: green burial and promession.

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[1] "Cremation industry," as used in this Comment, refers to businesses involved in—but not necessarily limited to—cremation. Crematory operators may also be in the mortuary services industry and/or the cemetery services industry. *See* CREMATION ASS'N OF N. AM., 2006 CANA CREMATION CONTAINER, DISPOSITION AND SERVICE SURVEY FINAL RESULTS 9 (2006), http://www.cremationassociation.org/docs/06disposition.pdf.

II. MERCURY IS TOXIC AND PREVALENT

The modern scientific consensus is that mercury, even in minute amounts, is extremely toxic. A recent article in the Journal of Law and Health states, "Arguably, mercury ranks as the second most poisonous compound on earth, and no agency or health organization would dispute that mercury is toxic."[2] It is the most toxic substance on the U.S. Department of Health and Human Services' Priority List of Hazardous Substances, and it trails only arsenic and lead in frequency of occurrence in this country.[3] In its various forms,[4] mercury is "permanently recycled in the physical, chemical and biological processes in the environment"[5] and cannot be broken down or processed into different constituents.[6] As a result, it accumulates as it passes through the food chain.[7]

Humans are most often exposed to a particularly potent form called methylmercury, which can severely impair biological functions.[8] Chronic, low-level exposure to methylmercury is toxic to the kidneys, while high-dosage exposure can cause permanent damage.[9] Although such intense exposure is rare for the general population, "[t]he problem of methylation of past and present . . . mercury discharges continues, and the long retention time of mercury by [aquatic] sediments delays the elimination of contamination for many years."[10]

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[2] Kimberly M. Baga, *Taking a Bite Out of the Harmful Effects of Mercury in Dental Fillings: Advocating for National Legislation for Mercury Amalgams*, 20 J.L. & HEALTH 169, 179 (2007) ("Many healthcare organizations, including the American Public Health Association, the California Medical Association, and Health Care Without Harm, support a ban on any mercury-containing product used by humans.").

[3] Lyn Patrick, *Mercury Toxicity and Antioxidants*, 7(6) ALT. MED. REV. 456, 456 (2002), *available at* http://findarticles.com/p/articles/mi_m0FDN/is_6_7/ai_96416600 ("Mercury toxicity is also considered the second-most common cause of acute heavy metal poisoning . . . .").

[4] For a complete description of mercury's chemical behavior, see LOUIS M. SCARMOUTZOS & OWEN E. BOYD, ENVIRONMENTAL AND TOXICOLOGICAL CONCERNS OF DENTAL AMALGAM AND MERCURY 9-17 (2003), http://www.mvssolutions.com/mercury.pdf.

[5] OSPAR Comm'n, 2000, *Background Document on Mercury and Organic Mercury Compounds* 3 (2004 update), http://www.ospar.org/documents/dbase/publications/p00100_Mercury%20and%20Organic%20Mercury%20Compounds.pdf.

[6] SCARMOUTZOS & BOYD, *supra* note 4, at 3.

[7] MICHELLE ALLSOPP ET AL., UNIV. OF EXETER, U.K., INCINERATION AND HUMAN HEALTH 76, http://www.inceneritori.org/incin.pdf (last visited Mar. 7, 2008) [hereinafter INCINERATION AND HUMAN HEALTH] (citing a 1989 World Health Org. study). "Bioaccumulation" refers to the pooling, over time, of a substance in the tissues of an organism. SCARMOUTZOS & BOYD, *supra* note 4, at 3.

[8] U.S. EPA, EPA'S ROADMAP FOR MERCURY 3 (2006), http://www.epa.gov/mercury/pdfs/FINAL-Mercury-Roadmap-6-29.pdf [hereinafter ROADMAP FOR MERCURY]; *see also* INCINERATION AND HUMAN HEALTH, *supra* note 7, at 76.

[9] INCINERATION AND HUMAN HEALTH, *supra* note 7, at 76 (citing "damage to the [central nervous system], the kidneys, and the developing foetus").

[10] INCINERATION AND HUMAN HEALTH, *supra* note 7, at 76; *see also* Dan Krotz, *Gold Rush*

Moreover, methylmercury seriously threatens other species, especially those whose consumption of fish (or of fish-eating prey) makes exposure more likely.[11] Methylmercury has been detected in fish, eagles, otters, and endangered Florida panthers.[12] Depending on the exposure level, the effects can include mortality, reduced fertility, slower growth, and abnormal behavior that adversely affects survival.[13]

Factories, power plants, incinerators, hospitals, and other industries release mercury pollution into the atmosphere.[14] Natural sources of mercury vapor include forest fires and volcanic eruptions.[15] Once airborne, mercury vapor may drift over vast distances,[16] so pinpointing a source of particular mercury pollution can be very difficult.[17] In 1996, the Massachusetts Department of Environmental Protection estimated that of the 1800 to 3700 pounds of mercury deposited yearly onto the state's land and water, as much as 59% may have come from out of state.[18] Elemental mercury may reside in the atmosphere for up to a year,[19] so emissions from one continent are likely to contribute to deposition on other continents.[20] A study by the United Nations Environment Programme suggests that "up to 50% of anthropogenic[21]

Still Haunts San Francisco Bay, SCIENCE@BERKELEY LAB (Nov. 29, 2005), http://www.lbl.gov/Science-Articles/Archive/sabl/2005/November/01-gold-rush.html. "Methylation" refers to the process by which elemental mercury becomes methylmercury. *See* SCARMOUTZOS & BOYD, *supra* note 4, at 9-17.

[11] ROADMAP FOR MERCURY, *supra* note 8, at 7.

[12] *Id.*

[13] *Id.*

[14] *See* BARRY R. LEOPOLD, USE AND RELEASE OF MERCURY IN THE UNITED STATES 6 (2002), http://www.epa.gov/nrmrl/pubs/600r02104/600r02104prel.pdf.

[15] OSPAR Comm'n, 2000, *supra* note 5, at 4.

[16] *Id.* at 5.

[17] It is not impossible, however. Researchers are now able to use isotope analysis to identify some emission sources. Telephone Interview with Sarah Rothenberg, Postdoctoral Fellow, San Francisco Estuary Inst. (Mar. 4, 2008) [hereinafter Rothenberg].

[18] MASS. DEP'T OF ENVTL. PROT., TOXICS AND HAZARDS: MERCURY IN MASSACHUSETTS (1996), http://www.mass.gov/dep/toxics/stypes/hgexsum.htm. Drift and deposition of airborne pollutants is difficult to characterize; Massachusetts' estimate is based on "preliminary data." *Id.*; *see also* ROADMAP FOR MERCURY, *supra* note 8, at 53 (estimating that the nationwide deposition from other parts of the world equals 83%, with the United States and Canada sharing responsibility for the other 17%).

[19] U.N. Env't Programme, *Global Mercury Assessment* § 83 (2002), http://www.chem.unep.ch/mercury/Report/GMA-report-TOC.htm.

[20] *See, e.g.*, Matt Pottinger et al., *Invisible Export – A Hidden Cost of China's Growth: Mercury Migration*, WALL ST. J., Dec. 20, 2004, *available at* http://yaleglobal.yale.edu/display.article?id=5058.'

[21] "Anthropogenic" means originating from human activities. MERRIAM-WEBSTER ONLINE DICTIONARY, ANTHROPOGENIC, http://www.merriam-webster.com/dictionary/anthropogenic (last visited Feb. 10, 2008).

mercury deposited to North America is from external sources."[22] Further, the study notes that such deposition may be temporary because mercury can be released again to the air from water and soil surfaces.[23]

Global atmospheric "background" mercury significantly increases the mercury burden at most locations.[24] Small amounts of mercury are continually settling into watersheds from the air;[25] cumulatively, the mercury concentration in lakes and streams may reach threatening levels. "Approximately one gram of mercury, the amount in a single fever thermometer, is deposited to a 20-acre lake each year from the atmosphere. This small amount, over time, [if totally infused into the food chain,] can contaminate the fish in that lake, making them unfit" for regular consumption.[26] Thus, the estimated forty-three pounds per year of crematory mercury produced in Oregon alone[27] is enough—conceptually—to contaminate 19,500 lakes and to poison the food chains

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[22] U.N. Env't Programme, *supra* note 19, at § 83.

[23] *Id.* at § 84; *see also* ALAN C. HEYVAERT ET AL., DEP'T OF ENVTL. SCI. & POLICY, UNIV. OF CAL. AT DAVIS, ATMOSPHERIC LEAD AND MERCURY DEPOSITION AT LAKE TAHOE, http://trg.ucdavis.edu/research/annualreport/contents/lake/ article11.html (last visited Mar. 7, 2008) ("[I]t is possible that air parcels traveling toward Tahoe could entrain [mercury] volatilized from the waste of historical gold and silver mining.").

[24] U.N. Env't Programme, *supra* note 19, at § 81 ("Similarly, virtually any local source contributes to the background concentration—the global mercury pool in the biosphere—much of which represents anthropogenic releases accumulated over the decades.").

[25] *See, e.g.*, HEYVAERT ET AL., *supra* note 23 (describing atmospheric mercury deposition into Lake Tahoe, "a relatively pristine, non-industrialized subalpine basin").

[26] Edward B. Swain, Minn. Pollution Control Agency, One Gram of Mercury in a Twenty Acre Lake: Origin of the Phrase (Oct. 2007) (unpublished manuscript, on file with author). This statement is often cited to describe mercury's potent toxicity. Telephone Interview with Ned Brooks, Mercury Reduction Coordinator, Minn. Pollution Control Agency (Oct. 29, 2007). For it to be true, the annual gram must be effectively and entirely absorbed into the food chain. *Id.* This, in turn, would depend on a multitude of factors, including lake depth, sediment composition, and the presence of sufficient bacteria or other microorganisms. *See, e.g.*, ROADMAP FOR MERCURY, *supra* note 8, at 4 ("Aquatic ecosystems respond to changes in mercury deposition in a highly variable manner as a function of differences in their chemical, biological, and physical properties. Depending on the characteristics of a given ecosystem, methylating microbes convert a small but variable fraction of the inorganic mercury in the sediments and water derived from human activities and natural sources into methylmercury.").

[27] OR. DEP'T OF ENVTL. QUALITY, MERCURY REDUCTION STRATEGY 15 (2002), http://www.deq.state.or.us/about/eqc/agendas/attachments/2006aug/D-AttBMercuryReduction Strategy.pdf. While the Oregon D.E.Q. recorded its estimates with "low" confidence, *id.* at 5, this 2001 estimate is based on assumed emissions of one gram of mercury per cremation, *id.* at 15, which is lower than other, well-founded estimates. *Cf.* PETER MAXSON, CONCORDE EAST/WEST SPRL, MERCURY IN DENTAL USE: ENVIRONMENTAL IMPLICATIONS FOR THE EUROPEAN UNION 9-10 (2007), http://www.zeromercury.org/EU_developments/Maxson%20Dental%2014May2007%20-%20A5colour.pdf (reprinting the results of several studies and concluding that, "[w]hile the range of estimates is large, they converge at approximately 3 g mercury per person cremated.").

within.[28] Forty-three pounds is only roughly 3% of Oregon's total emissions; this indicates the heavy overall burden of mercury pollution.[29] Nationally, forty-four states, one territory, and two Indian tribes have issued fish consumption advisories warning some people to limit their consumption of fish from certain water bodies because of methylmercury contamination.[30]

Because the dangerous effects of mercury pollution are so well established, many governments and non-governmental organizations are coordinating efforts to eliminate it.[31] However, while the U.S. Environmental Protection Agency (EPA) has identified cremation as a source of mercury,[32] the agency has thus far excluded crematory emissions from any explicit regulation.[33] Meanwhile, some state governments are exploring ways to reduce crematory mercury[34] ("cremercury"[35]), and EPA has stated its intent to address specific point sources of mercury emissions in conjunction with broader regional efforts.[36]

III. CREMATION IS A SIGNIFICANT SOURCE OF MERCURY EMISSIONS

The cremation of human bodies with mercury dental fillings[37] is

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[28] Forty-three pounds equals 19,504 grams; at one gram per lake, this roughly equals 19,500 lakes. Importantly, this is a conceptual—not actual—scenario. *See supra* note 26.

[29] *See* OR. DEP'T OF ENVTL. QUALITY, *supra* note 27, at 5.

[30] ROADMAP FOR MERCURY, *supra* note 8, at 16.

[31] EPA is involved with several such efforts, including the following: U.S./Canada Great Lakes Binational Toxics Strategy, the New England Governors/Eastern Canadian Premiers Regional Mercury Action Plan, the Commission for Environmental Cooperation North American Regional Action Plan for Mercury, the U.N. Economic Commission for Europe Convention on Long-Range Transboundary Air Pollution Protocol on Heavy Metals, the U.N. Environment Programme Mercury Program, the U.N. Industrial Development Organization Global Mercury Project, and the Arctic Mercury Project. ROADMAP FOR MERCURY, *supra* note 8, at 55-57.

[32] U.S. EPA, MERCURY STUDY REPORT TO CONGRESS VOLUME II: AN INVENTORY OF ANTHROPOGENIC MERCURY EMISSIONS IN THE UNITED STATES ES-5 (1997), http://www.epa.gov/ttncaaa1/t3/reports/volume2.pdf.

[33] E-mail from Marsha Marsh, Health Scientist, U.S. EPA, to author (Oct. 13, 2007) (on file with author). The Agency does not address crematory mercury at all in its recent ROADMAP FOR MERCURY. *See generally* ROADMAP FOR MERCURY, *supra* note 8. However, the U.N. Environment Programme, with whom EPA is involved in broad mercury reduction efforts, explicitly discusses methods to reduce crematory mercury emissions. U.N. Env't Programme, *supra* note 19, at § 124.

[34] Telephone Interview with Mark McMillan, Mgr., Mercury Program, Colo. Dep't of Public Health & Env't (Nov. 1, 2007) [hereinafter Mark McMillan].

[35] The cremation industry coined the term "cremains" from "cremated ashes." JESSICA MITFORD, THE AMERICAN WAY OF DEATH REVISITED 17 (Vintage 1996) (1963). This Comment follows suit with "cremercury."

[36] ROADMAP FOR MERCURY, *supra* note 8, at 59.

[37] "For over 150 years, mercury-containing fillings (often called 'silver' or 'amalgam') have

increasingly figuring into local, regional, and international pollution-reduction efforts as a significant and reducible source of airborne mercury.[38] While almost all other domestic anthropogenic mercury sources, like cement kilns, waste incinerators, and other industries, are reducing mercury output because of targeted legislation and improved technology,[39] cremation stands alone in the United States as a mercury source that is projected to rise sharply.[40] This is due to the convergence of two trends: first, for several more decades people are going to be dying with more mercury amalgam dental fillings than previously; second, the dramatic, ongoing increase in cremation rates means that a great number of these fillings appear destined for incineration.[41]

The average cremation emits two to three grams of mercury,[42] almost exclusively from the volatilization of dental amalgam fillings.[43] EPA estimates that the U.S. population constitutes a reservoir of as much as 1000 tons of mercury in fillings.[44] As of 2000, 175,000 U.S. dentists were installing roughly 100 million amalgams in patients' teeth each year.[45] Even if dental mercury amalgam fillings are phased out,[46] the

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been used extensively to fill dental cavities. Four metals—mercury, silver, copper and tin—primarily comprise amalgam, with mercury being approximately 50% by weight. While use of mercury-free dental fillings is becoming more prevalent, most dentists in the United States still use mercury-containing amalgam." MERCURY POLICY PROJECT, DON'T LET IT GO TO YOUR HEAD: PHASING OUT MERCURY TOOTH FILLINGS 3 (2007), http://www.mercurypolicy.org/new/documents/DentalHgReportFinalnew0107.pdf. By one estimate, each amalgam filling contains from .37 to .74 gram of mercury. John Reindl, Summary of References on Mercury Emissions from Crematoria 3 (Aug. 27, 2007) (unpublished study, on file with author).

[38] John Reindl, Summary of References on Mercury Emissions from Crematoria 18 (Aug. 27, 2007) (unpublished study, on file with author).

[39] *See, e.g.*, ROADMAP FOR MERCURY, *supra* note 8, at 22 ("Medical waste incinerators and municipal solid waste combustors are now subject to stringent control standards that require facilities to reduce mercury emissions by over 90% from 1990 levels. These efforts have contributed to reducing overall mercury emissions to the air by about 45% (from 220 tons in 1990 to 113 tons in 1999).").

[40] Telephone Interview with Ned Brooks, Mercury Reduction Coordinator, Minn. Pollution Control Agency (Oct. 29, 2007) [hereinafter Ned Brooks].

[41] MERCURY POLICY PROJECT, *supra* note 37, at 5.

[42] *See, e.g.*, PETER MAXSON, CONCORDE E./W. SPRL, MERCURY IN DENTAL USE: ENVIRONMENTAL IMPLICATIONS FOR THE EUROPEAN UNION 9-10 (2007), http://www.zeromercury.org/EU_developments/Maxson%20Dental%2014May2007%20-%20A5colour.pdf.

[43] *See* LEOPOLD, *supra* note 14, at 64.

[44] MERCURY POLICY PROJECT, *supra* note 37, at 4. Fillings constantly emit mercury vapor. "However, since the average daily intake for a person with fillings is 1.24 micrograms of mercury (USDHHS 1993), the amount of mercury 'lost' before cremation is minuscule." LEOPOLD, *supra* note 14, at 65-66.

[45] MERCURY POLICY PROJECT, *supra* note 37, at 4 ("In 2004, [EPA] estimated that dental clinics use[d] 34 tons of mercury annually, 14% of the total annual mercury consumption in the U.S.") (citing KING COUNTY DEP'T OF NATURAL RES., MANAGEMENT OF HAZARDOUS DENTAL WASTES IN KING COUNTY, 1991-2000 (2000); WATER ENV'T FED'N, CONTROLLING DENTAL

large baby-boomer population[47] is aging, and—given the rising trend toward cremation—a great proportion of their fillings is on the way to crematories.[48]

Until recently, most people died toothless—or nearly so.[49] Modern dentistry enables more and more people to die with their own teeth; the downside is that these teeth often contain mercury fillings.[50] As cremation rates increase, so does the number of amalgam fillings incinerated in crematories. This is true in the United Kingdom, where the British Dental Association divides the population into three groups: the very old, who generally die with no teeth; those with heavily restored teeth, including amalgam fillings; and "the fluoride toothpaste generation."[51] Experts have predicted that without intervention, cremercury emissions in the United Kingdom would increase by two thirds from 2000 to 2020, before "decreas[ing] back to back to 2000 emission levels around 2055."[52] The United States faces a similar quandary.[53]

The continuing, dramatic expansion of cremation practices in the United States is a major compounding factor in rising cremercury emissions.[54] Cremation is a fast-growing, billion-dollar industry.[55] From 1975 to 2005, the number of crematories increased by more than 450%.[56]

FACILITY DISCHARGES IN WASTEWATER, ALEXANDRIA, VA (1999)).

[46] MERCURY POLICY PROJECT, *supra* note 37, at 3.

[47] The boomer population is approximately seventy-seven million. U.S. CENSUS BUREAU, POPULATION AND HOUSING CHARACTERISTICS OF BABY BOOMERS 26 TO 44 YEARS OLD: 1990 (1996), http://www.census.gov/population/censusdata/cph-l-160h.txt.

[48] *See, e.g.*, JOHN REINDL, MERCURY EMISSIONS FROM CREMATORIA, GREAT LAKES BINATIONAL TOXIC STRATEGY at slide 14 (2005), http://www.epa.gov/bns/reports/stakesdec2005/mercury/Reindl.pdf.

[49] STEPHEN MOORE & JULIAN SIMON, IT'S GETTING BETTER ALL THE TIME: 100 GREATEST TRENDS OF THE LAST 100 YEARS 42 (2001).

[50] *See, e.g.*, Reindl, *supra* note 38, at 5.

[51] U.K. Dep't of Env't, Food, & Rural Affairs, *Mercury Emissions from Crematoria* 8 (2003), http://www.defra.gov.uk/environment/ppc/old-consultations/crematoria/consultation.pdf [hereinafter DEFRA First Consultation].

[52] *Id.*

[53] MERCURY POLICY PROJECT, *supra* note 37, at 5.

[54] *Id.*

[55] MARK HARRIS, GRAVE MATTERS: A JOURNEY THROUGH THE MODERN FUNERAL INDUSTRY TO A NATURAL WAY OF BURIAL 55 (2007) [hereinafter GRAVE MATTERS].

[56] *See* Cremation Ass'n of N. Am., History of Cremation, http://www.cremationassociation.org/html/history.html (last visited Mar. 7, 2008) (stating that there were 425 crematories in 1975); *see also* CREMATION ASS'N OF N. AM., UPDATED 2004 AND 2005 CASES PER CREMATORY BY STATE, http://www.cremationassociation.org/docs/per-crematory.pdf (indicating that there were 1971 crematories in 2005).

In 2004, about 740,695 people, or 31% of the deceased, were cremated.[57] Meanwhile, the rate in Marin County, California, had already reached 80%.[58] By 2030, it is anticipated that more than half of all U.S. residents will be choosing cremation,[59] and this trend is unlikely to reverse course.[60]

Mercury is one component of a complex array of pollutants that may emanate from a particular cremation,[61] and it is a challenging one to quantify.[62] Attempts to measure mercury emissions from cremations have yielded a wide range of results, and disagreement remains as to crematories' share of the global mercury pollution inventory.[63] While consistent crematory mercury emissions measures are scarce, the range has been narrowed using two basic methods.[64] The first is to measure actual emissions from test cremations.[65] The second is a "mass balance" approach that gauges pertinent factors (such as average number of

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[57] CREMATION ASS'N OF N. AM., PROJECTED VS. ACTUAL DEATH AND CREMATION NUMBERS, http://www.cremationassociation.org/docs/crem-data-predict.pdf (last visited Mar. 7, 2007). At an average of $1800 per cremation, GRAVE MATTERS, *supra* note 55, at 67, that would total $1,333,251,000.

[58] Peter Fimrite, *Marin Cemetery: Ashes to Ashes, Dust to Mulch*, S.F. CHRON., Aug. 22, 2004, *available at* http://sfgate.com/cgi-bin/article.cgi?file=/chronicle/archive/2004/08/22/MNGEV8CIGT1.DTL. As of 2005, California's overall percentage was 52%—the tenth-highest rate in the nation—and the state ranked highest nationally in the number of cremations (120,883). CREMATION ASS'N OF N. AM., FINAL 2005 STATISTICS & PROJECTIONS TO THE YEAR 2025, 2006 PRELIMINARY DATA 4 (2007), http://www.cremationassociation.org/docs/CANA-Final06Prelim.pdf.

[59] Cremation Ass'n of N. Am., Deaths & Cremations, United States, 2002-2040, http://www.cremationassociation.org/html/photo-deaths-cremation.html (last visited Mar. 7, 2008).

[60] *See* GRAVE MATTERS, *supra* note 55, at 55 (observing that in countries where cremation has "taken hold," the rate has not diminished).

[61] *See* TERESE GREGG ET AL., UNIV. OF FLA. CREMATION PROJECT, POLLUTANTS, http://www.ees.ufl.edu/homepp/cywu/ENV4121/Project2001/Crematory/Pollutants.htm (last visited Feb. 10, 2008) [hereinafter POLLUTANTS] (listing pollutants such as carbon monoxide, sulphur dioxide, hydrogen chloride, nitrogen oxides, dioxins, mercury, cadmium, lead, and particulate matter).

[62] *See* Chang-Yu Wu, Univ. of Fla., Air Pollution Control, http://www.ees.ufl.edu/homepp/cywu/AirPollutionControl.html (last visited Mar. 7, 2008) ("Mercury is a unique metal in combustion systems. . . ."). However, through the Environmental Technology Verification Program, EPA Region 9 offers qualified agencies the use of a sophisticated device that would enable accurate testing of cremercury emissions. Rothenberg, *supra* note 17; *see generally* U.S. EPA, ENVIRONMENTAL TECHNOLOGY VERIFICATION PROGRAM (2007), http://epa.gov/etv/pubs/600etv07009s.pdf.

[63] SCARMOUTZOS & BOYD, *supra* note 4, at 35 ("The amount of mercury released into the environment from dental amalgams has historically been the most unreliable and underestimated amount included in mercury emissions reports.").

[64] TETRA TECH, POLLUTION PREVENTION CREMATORIA PROJECT FINAL REPORT 5 (2007) (on file with author).

[65] *E.g.*, CAL. AIR RES. BD., EVALUATION TEST ON TWO PROPANE FIRED CREMATORIES AT CAMELLIA MEMORIAL LAWN CEMETERY (1992) (on file with author).

fillings per person, age ranges, and composition of average amalgam fillings) to estimate likely emissions.[66]

Given the difficulty in accounting for numerous, complex variables, the inconsistency of test results is not surprising.[67] Slight variations in the composition of amalgam fillings in different "test corpses" can significantly affect measurements at the top of a chimney.[68] Moreover, depending on the incinerator design, mercury can attach to brick, mortar, or soot on the interior, and thus remain unmeasured.[69] Cremations typically last for several hours, yet some test designs have failed to account for the behavior of the metal at different stages of the process.[70] Other variables that can affect the consistency of measurements include the composition of any containers or vestments accompanying the body into the furnace[71]; the presence of implanted medical devices[72]; the age, weight, and number of amalgam fillings of the test corpse; and—particularly important—the operating temperature of the crematory itself.[73]

These factors demonstrate the inadvisability of holding out the results of any particular test as representative. Yet, EPA appears to have done just that. In 1999, the Cremation Association of North America (CANA) and EPA jointly conducted a test at New York's Woodlawn Crematory ("Woodlawn study").[74] At the time, the facility was the only one in the country fitted with a scrubber filter,[75] and the test aimed, in

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[66] *See, e.g.*, JANE H. LUNDQUIST, BAY AREA AIR QUALITY MGMT. DIST., ESTIMATE OF MERCURY EMISSIONS FROM CREMATORIA IN THE BAY AREA 1 (2000) (on file with author); *see also* TETRA TECH, *supra* note 64, at 5.

[67] LUNDQUIST, *supra* note 66, at 1.

[68] *See, e.g.*, Reindl, *supra* note 38, at 10.

[69] *See, e.g.*, MAXSON, *supra* note 42, at 8.

[70] *See* Reindl, *supra* note 38, at 10 (critiquing the EPA/CANA Woodlawn study).

[71] Roughly 80% of cremated bodies are cremated in special "cremation caskets." CREMATION ASS'N OF N. AM., *supra* note 1, at 17. These are made of materials such as corrugated cardboard to burn readily and with minimal pollution. Otherwise, casket handles, trim, paneling, and padding, which could be made of zinc, plastics, styrofoam, or fiberglass, could cause toxic emissions. *See* GRAVE MATTERS, *supra* note 55, at 57-58.

[72] These may include a "cardiac pacemaker, prostheses, silicon[e] implants, or . . . radioactive seeds used in some cancer therapies." GRAVE MATTERS, *supra* note 55, at 53. Incineration of such items can produce dangerous pollution and can damage cremation units. *Id.*

[73] Reindl, *supra* note 38, at 5-6, 7; *see also* Rothenberg, *supra* note 17.

[74] U.S. EPA, EMISSION TEST EVALUATION OF A CREMATORY AT WOODLAWN CEMETERY BRONX, NY, EPA/R-99-0491999 (1999).

[75] A scrubber filter is a device through which gases exiting the cremation unit are blown. TERESE GREGG ET AL., UNIV. OF FLA., DEVICES (2001), http://www.ees.ufl.edu/homepp/cywu/ENV4121/Project2001/Crematory/Devices.htm#wet [hereinafter DEVICES] ("In the wet scrubber the air is sprayed with water to remove as much air pollutants [sic] as possible from the stream. The droplets containing the pollutants gather at the bottom . . . and are drained out. The water stream is

part, to measure the efficacy of this filtration system.[76] Because the mercury emission results were interpreted as being very low (equivalent to 238 pounds per year nationally,[77] or approximately 0.2g per cremation[78]), the study might be crucial to the industry's continuing avoidance of regulation for controlling mercury.[79]

However, concerns have been raised about the study's accuracy and reliability.[80] John Reindl, who has studied the cremercury issue in depth, writes that

> the lead [consultant who] performed the work notes that the data are subject to interpretation. He goes on to note that the data are averages and recommends that they be multiplied by the total time of the cremation. He also notes that they do not include measurements from the time break during which the measuring instruments were switched from one access port to another, nor any releases from the warm-up

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then taken to a holding tank where the heavy particles settle out. The water can then be reused in the wet scrubber or can be disposed of after referring to the local or state regulations. [These devices] are seldom used in crematoriums because the pollutant removal benefit does not outweigh the cost of the equipment.").

[76] Reindl, *supra* note 38, at 9. *Contra* Paul Rahill, *An Environmental Journey of Ten Years*, MORTUARY SCIENCE, May 2006, *available at* http://www.cremationassociation.org/docs/EnvironmentalJourney.pdf ("One of the reasons Woodlawn was selected was because their cremation equipment was typical to what could be routinely found operating throughout North America."). *But see* Wu, *supra* note 62 (asserting that mercury "is insoluble, making [a] scrubber useless in removing it from flue gas.").

[77] CREMATION ASS'N OF N. AM., MERCURY UPDATE, http://www.cremationassociation.org/docs/mercury-update.pdf (last visited Mar. 7, 2008).

[78] In 1999, 598,721 people were cremated in the United States. CREMATION ASS'N OF N. AM., HISTORICAL CREMATION DATA, http://www.cremationassociation.org/docs/WebHistData.pdf (last visited Mar. 7, 2008). The calculation for the average mercury emission per cremation is the following: 238 pounds divided by 598,721 cremated people equals .00039 pound, or approximately .2 gram per cremation.

[79] *See* e-mail from Mark Harris, to author (Aug. 27, 2007) (on file with author) [hereinafter Mark Harris]. Mr. Harris is the author of GRAVE MATTERS, cited *supra* note 55. *See generally* ROADMAP FOR MERCURY (containing no mention of cremation).

[80] Reindl, *supra* note 38, at 9 (quoting the study's disclaimer: "This report presents the results of a single test program at a single cremation facility. It should not be assumed that these results would characterize emissions at other cremation facilities without further study."). Reindl identifies further reasons for doubting the study's utility. For example: "[Only n]ine cremations were done. . . . [CANA] says that mercury averaged 0.23 grams/hour of operation, but there are no data on mercury emissions varying with temperatures, since, according to the article, it was assumed that mercury emissions would not change with temperature. . . . However, the actual study . . . shows somewhat different data. . . . The report gives no data on the number of teeth nor the number of restorations present. In addition, although it is clear that some mercury was removed by the wet scrubber system, no data are provided on the analysis of the mercury in the water from the scrubber. The ash also does not appear to have been tested for mercury. The report also does not indicate how the cadavers for analysis were selected and whether they are representative of the population being cremated." *Id.* at 9-10.

> and cooldown periods. . . . Thus, there is a significant difference of opinion among two of the principals in the Woodlawn study on how to interpret the data from this study. In addition, the EPA project manager of the study . . . questions the validity of the testing, and notes that mercury levels were sometimes higher after pollution control equipment than before it . . . .[81]

Nonetheless, the Woodlawn study is likely to impede any person, agency, or organization contending that crematory mercury is a concern in the United States.[82] CANA touts the results on its website: "A joint effort by CANA and EPA produced evidence that crematories are capable of low emission[s] without the addition of pollution equipment . . . ."[83]

Other studies show more mercury output from cremation, ranging from 1.6 to 8.5 grams per cremation, with two to four grams as an average.[84] In crafting protocols to reduce cremercury, the United Kingdom's Department for Environment, Food, and Rural Affairs (DEFRA) settled on a three-gram average,[85] and Colorado's Department of Public Health and Environment commissioned a study concluding that the average is 3.2 grams.[86] At this rate, a busy crematory could release as much as twenty-four pounds of mercury vapor annually.[87] EPA itself

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[81] *Id.* at 9.

[82] *See, e.g.*, Mark Harris, *supra* note 79 ("Yes, the EPA ruling was based on studies the Agency did in conjunction with the cremation industry, and, yes, other groups—including the New England Zero Mercury Campaign—say actual mercury emissions are much higher and thus worthy of regulation. . . . But, still, you'll have to deal with the fact of EPA's numbers, which the cremation industry quotes to vouch for the safety of current emissions.").

[83] Cremation Ass'n of N. Am., Emissions Tests Provide Positive Results for Cremation Industry (1999), http://www.cremationassociation.org/html/environment.html (conceding—here, at least—that Woodlawn was "one of the only crematories in North America with additional pollution control equipment"). In terms of avoiding mercury emission controls, the industry could be considered to have an unfair advantage because three quarters of North Americans are unaware that amalgam fillings contain mercury to begin with, and are thus unaware of the impact these fillings may have upon being incinerated. *See* MERCURY POLICY PROJECT, *supra* note 37, at 7. EPA's study, despite the disclaimers, simply provides further cover for the industry. However, the industry faces a different problem of public perception: a significant number of people mistakenly believe that cremation is either forbidden by their religion or cannot be done in conjunction with a traditional funeral or other memorial service. CREMATION ASS'N OF N. AM., CREMATION DATA AND PREDICTIONS: DATA TRENDS (2005), http://www.cremationassociation.org/docs/wirthlin-excerpt.pdf.

[84] Reindl, *supra* note 38, at 1; *see also* OSPAR Comm'n, 2000, *supra* note 5, at 6 (assuming that three grams of mercury are emitted per cremation).

[85] DEFRA First Consultation, *supra* note 51, at 7.

[86] TETRA TECH, *supra* note 64, at ES-1.

[87] Alan Mills, *Cremation Pollution*, N.Y. TIMES, Aug. 21, 1990, *available at* http://query.nytimes.com/gst/fullpage.html?res=9C0CEED8163FF932A1575BC0A966958260.

cites estimates of 130 pounds of cremercury for Wisconsin, Minnesota, and Michigan alone in 1994-95.[88] In 1997, prior to the Woodlawn study, EPA estimated that the nation's crematories emitted 1600 pounds of mercury annually,[89] and a report prepared for EPA in 2006 puts this number at 6528 pounds.[90]

Another impediment arose in 2005, following the low test results from the Woodlawn study (and despite the prior indications of higher actual emissions), when EPA determined that the Clean Air Act rules governing solid waste combustion did not apply to crematories, thereby declining to promulgate any regulations for the time being.[91] However, cremercury has remained on EPA's radar,[92] and some state environmental protection agencies began looking more closely at the issue. Colorado, for instance, received EPA funding to do so.[93]

EPA's *Roadmap for Mercury* ("Roadmap") expresses the agency's intent to collaborate with state, tribal, local, and international governments to reduce mercury pollution:

> As co-regulators with EPA, states have been actively engaged in a range of programs and partnerships to reduce mercury uses, releases, and exposure and to conduct mercury monitoring activities. . . . [S]tates and local governments have been leaders in mercury reduction efforts. EPA will build on these efforts and, where appropriate, help state and local governments replicate successful efforts.[94]

Hence, while current action to curtail cremercury is now occurring only at the state level, EPA has not necessarily closed the door to taking action of its own.

Mills based his calculation on an average of three grams of mercury emitted per cremation. Reindl, *supra* note 38, at 8.

[88] Wisconsin, Minnesota, and Michigan's respective totals were nineteen, seventy-one, and forty pounds. U.S. EPA, Great Lakes Binational Toxics Strategy, http://www.epa.gov/glnpo/bnsdocs/milwaukeehg/appendixa.html (last visited Mar. 7, 2008).

[89] U.S. EPA, LOCATING AND ESTIMATING AIR EMISSIONS FROM SOURCES OF MERCURY AND MERCURY COMPOUNDS § 8.4 (1997), *available at* http://www.epa.gov/ttnchie1/le/mercury.pdf (giving an estimate of 0.80 tons, which is equal to 1600 pounds).

[90] Barr Eng'g & Alexis Cain, Envtl. Scientist, U.S. EPA, Mercury Flow Worksheet (June 2006) (unpublished study, on file with author).

[91] Standards of Performance for New Stationary Sources and Emission Guidelines for Existing Sources: Other Solid Waste Incineration Units, 70 Fed. Reg. 74,881 (proposed Dec. 16, 2005) (codified at 70 C.F.R. pt. 60).

[92] Mark McMillan, *supra* note 34.

[93] *Id.*

[94] ROADMAP FOR MERCURY, *supra* note 8, at 18-19.

IV. CREMERCURY: ADRIFT IN A SEA OF REGULATION

A. RULING OUT FEDERAL REGULATION (FOR NOW)

The federal government heavily regulates mercury as a major criteria pollutant,[95] yet it has no policy addressing cremercury.[96] One reason is that the major industrial emitters, such as petroleum refineries and power plants, emit significantly more mercury pollution than crematories and are simply higher priorities for regulation.[97] However, to the extent that crematories continue to escape regulation, and especially as the cremation industry continues its growth, cremercury will become an ever-greater slice of the emissions pie,[98] potentially triggering new federal or state regulatory imperatives.[99]

The Clean Air Act (CAA)[100] does not currently target cremercury. In 2005, EPA, which is under no explicit mandate to issue standards for every type of incinerator, ruled against regulating crematories as solid waste incinerators under CAA § 129:

> [I]n considering the nature of human crematories, EPA has determined that the human body should not be labeled or considered "solid waste." Therefore, human crematories are not solid waste combustion units, and are not a subcategory of [Other Solid Waste Incineration units] for regulation.[101] [Further, the] CAA is ambiguous regarding

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[95] *See generally* U.S. EPA, Mercury: Laws and Regulations, http://www.epa.gov/mercury/regs.htm (last visited Mar. 7, 2008).

[96] E-mail from Marsha Marsh, Health Scientist, U.S. EPA, to author (Oct. 13, 2007) (on file with author).

[97] *See generally* U.S. EPA, Clean Air Mercury Rule, http://www.epa.gov/air/mercuryrule/ (last visited Mar. 7, 2008).

[98] *See* N.M. ENV'T DEP'T & N.M. DEP'T OF HEALTH, NEW MEXICO MERCURY REDUCTION ACTION PLAN 4 (2006), http://www.nmenv.state.nm.us/Special/MercuryTF-ReportFinal_11_27_06.pdf [hereinafter NEW MEXICO MERCURY REDUCTION ACTION PLAN]; Alexis Cain et al., *Substance Flow Analysis of Mercury Intentionally Used in Products in the United States*, 11 J. INDUS. ECOLOGY 61, 70-71 (2007).

[99] *See, e.g.*, Mark Harris, *supra* note 79.

[100] *See generally* Clean Air Act, 42 U.S.C.A. § 7401 et seq. (Westlaw 2008).

[101] Standards of Performance for New Stationary Sources and Emission Guidelines for Existing Sources: Other Solid Waste Incineration Units, 70 Fed. Reg. 74,881 (proposed Dec. 16, 2005) (codified at 70 C.F.R. pt. 60). Of course, cremation is an ancient practice. While categorizing human remains as "solid waste" might provide for sensible control over disposition (given the ecological needs of modern societies, e.g., to control pollution), to consider cremation as merely a way to deal with waste would be to dramatically rob the practice of its broad cultural values. *Cf.* DAVID ABRAM, THE SPELL OF THE SENSUOUS 15 (1996) ("Some cultures may burn . . . the body in order to more completely return the person, as smoke, to the swirling air, while that which departs as flame is offered to the sun and stars, and that which lingers as ash is fed to the dense earth."); *see*

> what categories of solid waste incineration units must be regulated under section 129(a)(1)(E). After discussing timelines for very specific categories of solid waste incinerators (e.g., large and small municipal waste combustors, commercial and industrial waste incinerators, and hospital and medical waste incinerators), the CAA states only that EPA must publish a schedule for promulgating standards for "other categories of solid waste incineration units."[102]

The regulatory status of crematories under the CAA might change when EPA updates the CAA's Area Source program, by which the agency will address "certain smaller point sources that emit mercury."[103] Cremercury may also become a focus of the Integrated Urban Air Toxics Strategy, which is part of EPA's national air toxics program under the CAA.[104] The strategy offers ways to assess the risks of urban air pollution and to reduce toxic emissions from area sources.[105] It also targets mercury as one of thirty-three hazardous air pollutants (HAPs) "pos[ing] the greatest threat to public health in the largest number of urban areas."[106] EPA has set forth standards for some industrial sources of HAPs while continuing to analyze others.[107]

Ironically, the shrinking contributions of major anthropogenic mercury sources may catalyze cremercury regulation. As New Mexico notes in its 2006 Mercury Reduction Action Plan, "after the full implementation of [EPA's Clean Air Mercury Rule[108]], the relative contribution of mercury from other sources [such as cremation] will increase."[109] Still, cremation's growing share of the national mercury

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also MARY ROACH, STIFF: THE CURIOUS LIVES OF HUMAN CADAVERS 275 (2004) ("The line between solid waste disposal and funerary rituals must be well maintained.").

[102] Standards of Performance for New Stationary Sources and Emission Guidelines for Existing Sources: Other Solid Waste Incineration Units, 70 Fed. Reg. 74,874-75 (proposed Dec. 16, 2005) (codified at 70 C.F.R. pt. 60).

[103] ROADMAP FOR MERCURY, *supra* note 8, at 8 (citation omitted).

[104] *Id.* at 25.

[105] *Id.* Area sources "emit less than 10 tons annually of a single HAP or less than 25 tons annually of a combination of HAP." *Id.* at 31.

[106] *Id.* at 31.

[107] *Id.*

[108] According to EPA, the goal of the Clean Air Mercury Rule is to complement the Clean Air Interstate Rule's significant reductions in mercury emissions from coal-fired power plants, "the largest remaining sources of mercury emissions in the country. When fully implemented, these rules will reduce utility emissions of mercury from 48 tons a year to 15 tons, a reduction of nearly 70 percent." U.S. EPA, *supra* note 97.

[109] NEW MEXICO MERCURY REDUCTION ACTION PLAN, *supra* note 98, at 2. New Mexico estimates that the state's twenty crematories emit forty pounds of mercury annually and notes that Colorado's cremercury reduction initiative may serve as a model for addressing the source. *Id.* at 4. *See also* Alexis Cain et al., *Substance Flow Analysis of Mercury Intentionally Used in Products in*

emissions inventory is not solely attributable to the reduction of other sources.[110] The cremation industry is booming; therefore, actual amounts of cremercury will also continue to rise.[111]

EPA's Toxics Release Inventory (TRI) offers yet another possible route for bringing cremercury under federal or state regulation.[112] The TRI program tracks "disposal or other releases and other waste management activities" for mercury and hundreds of other hazardous substances.[113] In 2000, the TRI dramatically lowered the reporting threshold from 10,000 pounds to ten pounds; consequently, smaller users must now report.[114]

Massachusetts adopted the new reporting threshold in its 2006 revisions to the state's Toxics Use Reduction Act (TURA), targeting mercury as a persistent bioaccumulative toxin.[115] However, the new ten-pound reporting limit applies only to "Large Quantity Toxics Users" who 1) exceed the threshold, 2) are classified in certain industries according to the North American Industrial Classification System (NAICS), and 3) employ ten or more fulltime employees.[116] The NAICS classification for crematories makes them subject to TURA.[117] However, since most crematories are smaller operations,[118] they may remain exempt from reporting requirements in Massachusetts—even though they could be expected to release more than double the threshold amount.[119]

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the United States, 11 J. INDUS. ECOLOGY 61, 71 (2007) ("Atmospheric releases associated with dental amalgam use have remained relatively stable, with reduced releases caused by controls on incineration of infectious waste partially offset by increased releases from cremation of corpses.").

[110] *See, e.g.*, CREMATION ASS'N OF N. AM., *supra* note 57 (demonstrating that cremation rates are likely to keep rising).

[111] Ned Brooks, *supra* note 40.

[112] *See generally* U.S. EPA, Toxics Release Inventory Program, http://www.epa.gov/tri/ (last visited Mar. 3, 2008).

[113] U.S. EPA, 2003 TRI PUBLIC DATA RELEASE EREPORT 1 (2005), http://www.epa.gov/tri/tridata/tri03/pdr/2003eReport.pdf.

[114] ROADMAP FOR MERCURY, *supra* note 8, at 27; *see also* LEOPOLD, *supra* note 14, at 4.

[115] *See* Mass. Dep't of Envtl. Prot., About TURA Reporting & Fees, http://www.mass.gov/dep/toxics/tura/reportsum.htm (last visited Mar. 8, 2008).

[116] *Id.*

[117] N. Am. Indus. Classification Sys., http://www.census.gov/eos/www/naics/htmls/8/812220.htm (listing crematories under Classification 812220).

[118] E-mail from Paul Rahill, Pres., Matthews Cremation (Feb. 7, 2008) (on file with author) (estimating two to five employees each).

[119] *See supra* text accompanying note 87.

B. FIRST NIBBLES AT THE STATE LEVEL

A handful of states have taken a more direct pollution prevention approach. Two legislatures have considered, and rejected, measures directly targeting cremercury, but the issue is not going away.

i. Minnesota

The Minnesota House Finance and Health Policy Committee considered and rejected a measure in 2005 that called for the removal of dental amalgam prior to cremation.[120] The proposal reappeared in 2007 drafts of the Mercury Products Bill.[121] The initial House version called for amalgam removal,[122] but a subsequent revision replaced the removal requirement with a call for the University of Minnesota Mortuary Science Program to conduct a feasibility study of amalgam removal.[123] The final version passed by the legislature and signed by the governor contained neither provision.[124]

Nonetheless, the issue soon resurfaced when Minnesota's Pollution Control Agency set a goal to reduce overall mercury pollution from the currently estimated 3600 pounds annually to 800 pounds annually by 2025.[125] The Agency now estimates that the state's crematories contribute eighty pounds annually, but that this could rise to 120 pounds in ten years if not addressed.[126] Ironically, if the state's overall reduction target is met without cremercury abatement, cremercury's share will have increased from a mere 2.2 % of the emissions inventory to 15%.[127] This is roughly the same level as in the United Kingdom, where the amount is considered high enough that major initiatives are already

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[120] H.F. 661, 84th Leg. Sess. (Minn. 2005) (as introduced), https://www.revisor.leg.state.mn.us/bin/bldbill.php?bill=H0661.0&session=ls84.

[121] H.F. 1316, 85th Leg., Reg. Sess. (Minn. 2007) (first engrossment), http://wdoc.house.leg.state.mn.us/leg/LS85/HF1316.1.pdf.

[122] H.F. 1316, 85th Leg., Reg. Sess. (Minn. 2007) (as introduced), http://wdoc.house.leg.state.mn.us/leg/LS85/HF1316.0.pdf.

[123] H.F. 1316, 85th Leg., Reg. Sess. (Minn. 2007) (first engrossment), http://wdoc.house.leg.state.mn.us/leg/LS85/HF1316.1.pdf.

[124] E-mail from Kate Perushek, Legislative Assistant, Minn. House of Representatives, to author (Oct. 1, 2007) (on file with author).

[125] Ned Brooks, *supra* note 40. The Agency has set an interim reduction goal of 50% by 2018. "How [these goals] will be accomplished is yet to be determined but could include amalgam or tooth removal, chemical cremation or emission controls." E-mail from Ned Brooks, Mercury Reduction Coordinator, Minn. Pollution Control Agency, to author (Mar. 10, 2008) (on file with author).

[126] Ned Brooks, *supra* note 40.

[127] 120 pounds is 15% of the 800 pound target.

underway to tackle cremation-based mercury pollution.[128]

ii. Maine

Maine has also considered targeted cremercury legislation.[129] In 2005, State Senator Scott Cowger introduced a bill that would have given cremators the option of either installing mercury filtration equipment or removing amalgam fillings.[130] Some industry representatives actively opposed both options, and the Maine Senate Natural Resources Committee rejected the bill.[131] No similar measure has resurfaced in the state. Cowger believes that the bill raised awareness of the cremercury problem, and that a bill promoting a voluntary filling-extraction scheme would have gotten more traction.[132] He also believes that a bill delegating filling removal to funeral home operators, instead of to crematory operators who are more constrained in how they can legally "impact" a body, would have faced less opposition.[133]

iii. Colorado

In 2006, the Colorado Department of Public Health and Environment (CDPHE) obtained a $50,000 grant from EPA to launch a "Crematoria Pollution Prevention Initiative" ("Colorado initiative").[134] After reviewing available literature on cremercury, CDPHE's consultant used a mass balance measure to determine with a high level of confidence that the state's crematories were emitting approximately 110 pounds of mercury annually and represented the largest uncontrolled

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[128] BBC News, *Crematoria Warned Over Mercury* (Jan. 10, 2005), http://news.bbc.co.uk/1/hi/health/4160895.stm ("[C]rematoria are responsible for 16% of the UK's mercury pollution.").

[129] Telephone Interview with Matthew Prindiville, Natural Res. Council of Me. (Oct. 14, 2007).

[130] Paul Carrier, *Panel Kills Mercury Bill Aimed at Crematoriums*, PORTLAND PRESS HERALD, May 25, 2005.

[131] *Id.*

[132] E-mail from Scott Cowger, former Me. State Senator, to author (Nov. 17, 2007) (on file with author). *But see infra* text accompanying note 147 ("[A]mong the main objections behind the funeral industry's refusal to continue was that the voluntary approach would be ineffective.").

[133] Carrier, *supra* note 130. Of course, this distinction would be moot when the crematory is operated as part of a funeral home, the essential functions of which involve invasive treatment of bodies. *See, e.g., infra* note 262 (describing embalming).

[134] Mark McMillan, *supra* note 34; *see generally* Mark McMillan, Mgr. Mercury Program, Colo. Dep't of Public Health & Env't, *Mercury Reduction From Crematoria Through Collaboration & the Dev. of Best Mgmt. Practices*, http://www.ecos.org/files/2746_file_Session_2_Mark_McMillan.ppt (last visited Mar. 8, 2008) [hereinafter CDPHE].

source of airborne mercury in the state.[135] CDPHE also estimated that national cremercury emissions totaled roughly thirty times the figure derived from the Woodlawn study.[136]

To guide the initiative, CDPHE convened a group of stakeholders, including regulators, pollution prevention engineers, mercury specialists, dentists, and representatives of the religious community and of the funeral services industry.[137] The team considered three basic options: no action, pollution control, and pollution prevention.[138] Inaction was ruled out because CDPHE had already established that cremations were emitting significant amounts of mercury, and end-of-pipe filtration was rejected as too costly (estimates range from $175,000 to more than $700,000 per crematorium[139]). The team chose instead to study the feasibility of pre-combustion extraction of fillings.[140] However, at least partly because legislatures in Maine and Minnesota had failed to pass regulatory mandates,[141] Colorado decided to investigate a voluntary approach based on an organ donation model, extensive public outreach, and the development of best practices for the parties who would perform the extractions.[142] The stakeholders aimed "to develop . . . voluntary mercury pollution prevention strategies that could be tested and disseminated throughout the state."[143] This goal was based on the belief that informed citizens would agree to pre-cremation extraction of amalgam fillings.[144]

The Colorado stakeholders began a thorough investigation of how fillings could be practically removed in the challenging context of social conventions and mainstream funeral practices. The focal questions included when the fillings should be removed, how the jaw should be opened, how the teeth should be removed, and what should happen after

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[135] TETRA TECH, *supra* note 64, at 5-7.

[136] Mark McMillan, *supra* note 34; *see also* SCARMOUTZOS & BOYD, *supra* note 4, at 35 (estimating that U.S. crematory mercury emissions total three tons annually).

[137] Mark McMillan, *supra* note 34. Colorado's process was similar to "consultations" carried out by the United Kingdom's Department for Environment, Food and Rural Affairs. *See, e.g.*, U.K. Dep't of Env't, Food, & Rural Affairs, *Mercury Emissions from Crematoria, Second Consultation* (2004), www.defra.gov.uk/environment/ppc/old-consultations/crematoria-two/consultation.pdf [hereinafter DEFRA Second Consultation].

[138] CDPHE, *supra* note 134, at slide 9.

[139] *Id.*; *see also* Douglas Crowl, *Funeral-Home Owner Battles Larimer County Over Crematorium*, THE COLORADOAN, Mar. 3, 2008 (citing a potential $500,000 cost for one Colorado crematory operator).

[140] CDPHE, *supra* note 134, at slide 15-17.

[141] TETRA TECH, *supra* note 64, at 12.

[142] Mark McMillan, *supra* note 34.

[143] TETRA TECH, *supra* note 64, at 1.

[144] *Id.*

the amalgam-containing teeth are removed.[145] While the project's final report includes valuable information regarding these challenges—some actual tooth-extraction experiments were conducted—the whole investigation ended prematurely when the industry representatives withdrew and refused to participate further.[146]

Perhaps surprisingly, among the main objections behind the industry representatives' refusal to continue was that the voluntary approach would be ineffective and that "[w]ithout formal regulation or law, tooth extraction will result in little to no participation by Funeral Service Professionals in Colorado."[147] The spokesperson for the industry participants also referred to a cremation industry article that focused on EPA's decision that corpses are not to be regulated under solid waste rules and on the low results of the Woodlawn study.[148]

While it is unclear how Colorado intends to proceed,[149] the state's Crematoria Pollution Prevention Initiative was a bold attempt to tackle the economic, social, and practical hurdles facing the pre-cremation extraction proposal.

iv. Case Study: Cremercury and the San Francisco Bay Area

The cremation rate in the nine counties comprising the Bay Area is well above the national average.[150] Marin County's 80% cremation rate may rank as the nation's highest.[151] In 1997, Bay Area crematories together incinerated as many as 23,662 bodies,[152] and in 2007, there were

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[145] TETRA TECH, *supra* note 64, at 9-11. This study was probably much like the one the University of Minnesota's Mortuary Science Program would have conducted had the Minnesota Legislature enacted its proposed cremercury legislation. *See supra* text accompanying note 123.

[146] TETRA TECH, *supra* note 64, at 12.

[147] TETRA TECH, *supra* note 64, at App. C (reprinting correspondence from Martha Thayer, Dir., Arapahoe Cmty. College Sch. of Mortuary Science, to John Reindl, Recycling Mgr., Dane County, Wis., & Caitlin Rood, Tetra Tech (June 9, 2006)).

[148] *Id.* (reprinting correspondence from Martha Thayer, Dir., Arapahoe Cmty. College Sch. of Mortuary Science, to John Reindl, Recycling Mgr., Dane County, Wis., & Caitlin Rood, Tetra Tech (June 1, 2006)).

[149] *See* DeeDee Correll, *Cremation a Hazard to the Living?,* L.A. TIMES, Dec. 26, 2007 (describing the "stalemate" over cremercury between Colorado state health officials and a crematory operator who wants to relocate his facility).

[150] The rate was roughly 52% as of 1997. LUNDQUIST, *supra* note 66, at 3. As of 2005, California's overall percentage was also 52%—the tenth-highest rate in the nation—and the state ranked highest nationally in the number of cremations (120,883). CREMATION ASSOCIATION OF N. AM., FINAL 2005 STATISTICS AND PROJECTIONS TO THE YEAR 2025, 2006 PRELIMINARY DATA (2007), http://www.cremationassociation.org/docs/CANA-Final06Prelim.pdf.

[151] Fimrite, *supra* note 58.

[152] LUNDQUIST, *supra* note 66, at 3.

approximately fifty Bay Area crematories.[153] Cremation might be the region's third largest source of airborne mercury.[154]

California, and the San Francisco Bay Area in particular, is often seen as a leader in environmental protection.[155] Both the San Francisco Bay Regional Water Quality Control Board and the Bay Area Air Quality Management District (BAAQMD) have regulatory roles in managing mercury pollution, whether by monitoring toxicity levels, regulating existing emitters, or by administering the permits for proposed new sources.[156] While cremercury is getting more attention from some local agencies and nongovernmental organizations,[157] these emissions are too low, by BAAQMD's calculations, to trigger the relevant local regulations.[158] These regulations include a California law, the Air Toxics "Hot Spots" program, as well as BAAQMD's "New Source Review" rules.[159] However, if any official entities are going to act, it will likely be the region's storm water management agencies under mandates from the Clean Water Act.[160]

a. CARB & BAAQMD

The Air Toxics "Hot Spots" Information and Assessment Act ("Hot Spots") was adopted in 1987 to address rising public health concerns about airborne toxics.[161] Through the Hot Spots program, the California

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[153] E-mail from Alicia Gilbreath, Envtl. Analyst, San Francisco Estuary Inst. (Nov. 12, 2007) (on file with author) [hereinafter Alicia Gilbreath].

[154] *Id.* (citing estimates by Sarah Rothenberg, Postdoctoral Fellow, San Francisco Estuary Inst., derived from 2007 Cal. Air Res. Bd. statistics). No one has accurately measured the actual mercury emissions of Bay Area crematories. Rothenberg, *supra* note 17.

[155] OMB Watch, *California Moves to Reinstate Reporting Standards Weakened by Federal EPA* (2007), http://www.ombwatch.org/article/articleview/3810/1/241?TopicID=1; *see also* David R. Baker, *California Fighting Global Warming with Technology, Greenbacks*, S.F. CHRON., Nov. 14, 2007.

[156] *See, e.g.*, San Francisco Bay Reg'l Water Qual. Control Bd., San Francisco Bay Mercury TMDL, http://www.waterboards.ca.gov/sanfranciscobay/TMDL/sfbaymercurytmdl.htm (last visited Mar. 8, 2008); *see also* SAN FRANCISCO BAY AREA AIR QUALITY MGMT. DIST., CREMATORIES: PROCESS DESCRIPTION, PERMIT REQUIREMENTS, SAMPLE EVALUATION, http://www.baaqmd.gov/pmt/handbook/s11c05hd.htm (last visited Mar. 8, 2008).

[157] *See, e.g.*, Mary Spicuzza, *Pulling Teeth*, METRO, June 8, 2000, http://www.metroactive.com/papers/metro/06.08.00/cremations-0023.html.

[158] E-mail from Brian Bateman, Dir. of Eng'g, Bay Area Air Quality Mgmt. Dist., to author (Nov. 16, 2007) (on file with author).

[159] *Id.*

[160] Telephone Interview with Richard Looker, Water Quality Eng'r, San Francisco Bay Reg'l Water Quality Control Bd. (Nov. 5, 2007) [hereinafter Richard Looker].

[161] Cal. Air Res. Bd., Overview of the Air Toxics "Hot Spots" Information and Assessment Act (2005), http://www.arb.ca.gov/ab2588/overview.htm. When the Hot Spots program was enacted,

Air Resources Board (CARB) requires emissions inventories and health risk assessments for designated pollutant sources, including crematories.[162] CARB delegates administration of Hot Spots to the state's air quality management districts, including BAAQMD.[163] Qualifying businesses must quantify emissions, including emissions of mercury.[164] A business that emits high levels of potent chemicals must conduct a risk assessment to gauge the number of people in the vicinity of their facility that may get cancer or other acute or chronic disorders from the emissions.[165] No crematory has yet reported mercury emissions high enough (by BAAQMD's rubric) to trigger a risk assessment under the Hot Spots program.[166]

BAAQMD also keeps tabs on cremercury through its permitting rules for new facilities.[167] An applicant for a new crematory must submit an estimate of the number of cremations it intends to conduct and a projection of pollutant emissions, along with information regarding abatement equipment.[168] The agency then gauges whether the facility will exceed established "toxic risk screen trigger levels."[169] As with the Hot Spots program, no crematory has exceeded the agency's threshold to merit more than the reporting requirements.[170]

For both the Hot Spots program and new source permitting, BAAQMD provides crematory operators the data with which to calculate their projected emissions;[171] therefore, if BAAQMD's number is

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the BAAQMD already had a similar risk management policy in place. Enactment of the state rule required many existing facilities to conduct new emissions inventories and, in some cases, comprehensive risk assessments. Telephone Interview with Jane Lundquist, Eng'r, Bay Area Air Quality Mgmt. Dist. (Nov. 21, 2007).

[162] Telephone Interview with Chris Halm, Air Pollution Specialist, Cal. Air Res. Bd. (Nov. 21, 2007) [hereinafter Halm]; *see also* Cal. Air Res. Bd., *supra* note 161.

[163] Halm, *supra* note 162.

[164] *See* Cal. Air Res. Bd., *supra* note 161; *see also* BAY AREA AIR QUALITY MGMT. DIST., RULES & REGULATIONS, http://www.baaqmd.gov/dst/regulations/index.htm (last visited Mar. 8, 2008).

[165] *See* Cal. Air Res. Bd., *supra* note 161; *see also* BAY AREA AIR QUALITY MGMT. DIST., *supra* note 164.

[166] Telephone Interview with Jane Lundquist, Eng'r, Bay Area Air Quality Mgmt. Dist. (Nov. 21, 2007) [hereinafter Lundquist].

[167] *Id.*; *see also* BAY AREA AIR QUALITY MGMT. DIST., TABLE 2-5-1: TOXIC AIR CONTAMINANT TRIGGER LEVELS, http://www.baaqmd.gov/dst/regulations/rg0205.pdf (last visited Mar. 8, 2008).

[168] *See* SAN FRANCISCO BAY AREA AIR QUALITY MGMT. DIST., CREMATORIES: PROCESS DESCRIPTION, PERMIT REQUIREMENTS, SAMPLE EVALUATION, http://www.baaqmd.gov/pmt/handbook/s11c05hd.htm (last visited Mar. 8, 2008).

[169] Halm, *supra* note 162.

[170] Lundquist, *supra* note 166.

[171] *Id.*

inaccurate, the applicant's calculations will be skewed. In a 2000 report, *Estimate of Mercury Emissions From Crematoria in the Bay Area*, BAAQMD calculated that each cremation produces 1.1 grams of vaporized mercury,[172] a fraction of the more common estimate of two to three grams.[173] Even CARB's emissions factor, based on results from a 1992 cremation test, is higher, at 1.5 grams.[174] BAAQMD's report cites, as a "worst case" scenario (according to figures at the time), regional crematory mercury emissions of 104.3 pounds per year, or 1.9 grams per body.[175] BAAQMD's "most plausible" estimate is 26.8 pounds per year, or .51 gram of mercury per body.[176] Using three grams per body—a figure closer to that used by DEFRA, Colorado, the OSPAR Commission, and others—the emissions of Bay Area crematories would total 156.5 pounds per year. Given that this figure is significantly higher than BAAQMD's "worst case" estimate, and given the apparent inconsistencies within BAAQMD's modeling, the agency should reconsider its baseline calculations.[177]

Projections using estimates of two to three grams per cremation may still be insufficient to exceed the agency's trigger levels, but the gap would close significantly. For example, if a crematory processed 3605 bodies in one year, as did one Bay Area facility,[178] the mercury emissions could be as high as twenty-four pounds.[179] BAAQMD mandates a risk assessment if a facility exceeds the mercury "chronic trigger level" of thirty-nine pounds per year.[180] This Comment does not consider whether the Agency's threshold is appropriate, but this too is an issue warranting further consideration.

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[172] LUNDQUIST, *supra* note 66, at 3.

[173] *See supra* text accompanying note 84.

[174] *See, e.g.*, Reindl, *supra* note 38, at 9 (citing CAL. AIR RES. BD., EVALUATION TEST ON TWO PROPANE-FIRED CREMATORIES AT CAMELLIA MEMORIAL LAWN CEMETERY, TEST REPORT NO. C-90-004. (1992) (on file with author)).

[175] LUNDQUIST, *supra* note 66, at 1.

[176] *Id.*

[177] Through the Environmental Technology Verification Program, EPA Region 9 offers qualified agencies the use of a sophisticated device that would enable accurate testing of cremercury emissions. Rothenberg, *supra* note 17; *see generally* U.S. EPA, ENVIRONMENTAL TECHNOLOGY VERIFICATION PROGRAM (2007), http://epa.gov/etv/pubs/600etv07009s.pdf.

[178] Alicia Gilbreath, *supra* note 153.

[179] At three grams each, 3605 cremations would produce 23.84 pounds of mercury. *See also* Mills, supra note 87 (calculating the annual cremercury output of a busy crematory to be as high as twenty-four pounds). Mills calculated an average of 3 grams of mercury emitted per cremation. Reindl, *supra* note 38, at 8.

[180] BAY AREA AIR QUALITY MGMT. DIST., TABLE 2-5-1: TOXIC AIR CONTAMINANT TRIGGER LEVELS, http://www.baaqmd.gov/dst/regulations/rg0205.pdf (last visited Nov. 24, 2007) (referring to organic mercury and mercury compounds, e.g., methylmercury).

b. Cremercury in the Water

The biologically rich San Francisco Bay receives extensive surface water runoff, including that of two major river systems, laden with sediments and nutrients drawn from vast watersheds.[181] The Bay also collects a dangerous amount of mercury because these watersheds were subject to many decades of mercury-intensive gold mining.[182] This mercury alone profoundly affects the health of the environment, and it is projected to take many decades, if not a century or more, for the gold-mining mercury burden to abate somehow.[183] As part of a general effort to restore and protect the Bay, local agencies have focused on reducing additional new sources of mercury.[184] With roughly fifty crematories in the Bay Area,[185] cremercury is gradually getting more attention, including that of several non-governmental organizations and at least one agency, as a source that can and should be reduced.[186]

The Total Maximum Daily Load (TMDL) Program,[187] which EPA administers pursuant to the federal Clean Water Act, sets "the maximum amount of a pollutant that a waterbody can receive and still safely meet water quality standards."[188] Because EPA lists the San Francisco Bay as "impaired" by mercury,[189] there is a TMDL capping the amount of mercury permissibly emitted to air, land, and water from all sources

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[181] NASA Visible Earth, Sacramento River Delta (2006), http://visibleearth.nasa.gov/view_rec.php?id=17383 ("Between the two of them, the Sacramento and the San Joaquin Rivers drain most of the state of California, collecting and concentrating rainfall and snowmelt [from] the Sierra Nevada and funneling it toward San Francisco Bay.").

[182] Krotz, *supra* note 10.

[183] *See, e.g., id.* ("[I]t takes as long as 50 years for the Bay's mercury concentrations to respond to changes in input.").

[184] Telephone Interview with Geoff Brosseau, Exec. Dir., Bay Area Stormwater Mgmt. Agencies Ass'n (BASMAA) (Nov. 5, 2007) [hereinafter Geoff Brosseau].

[185] Alicia Gilbreath, *supra* note 153. By contrast, there are only six crematoria in the entire state of Maine. Telephone Interview with Scott Cowger, former Me. State Senator, (Oct. 8, 2007).

[186] *See, e.g.*, Spicuzza, *supra* note 157 (quoting a Clean Water Action member as calling cremercury "low hanging fruit").

[187] *See generally* U.S. EPA, National Pollutant Discharge Elimination System (NPDES), http://cfpub.epa.gov/npdes/ (last visited Mar. 8, 2008).

[188] U.S. EPA, Impaired Waters and Total Maximum Daily Loads, http://www.epa.gov/OWOW/tmdl/ (last visited June 28, 2008). A TMDL determination operates in conjunction with the National Pollutant Discharge Elimination System Permit Program regulating point source discharges to surface waters. Geoff Brosseau, *supra* note 184.

[189] U.S. EPA, Section 303(d) List Fact Sheet for Watershed: San Francisco Bay, http://iaspub.epa.gov/tmdl_waters10/huc_rept.control?p_huc=18050004&p_huc_desc=SAN%20FRANCISCO%20BAY&p_cycle=2006 (last visited June 28, 2008).

combined.[190] The Bay Area agencies responsible for controlling surface water discharges (e.g., urban runoff) have set a twenty-year goal of cutting approximately in half the amount of mercury that enters the Bay in this manner annually, from 353 pounds to 181 pounds.[191] In light of ongoing research and pending negotiations with private parties, this goal may yet be revised.[192]

The Bay Area Stormwater Management Agencies Association (BASMAA) is the umbrella organization of the San Francisco Bay's eight municipal storm water programs, which together must meet these reduction targets.[193] BASMAA has considered that crematories may be a significant and potentially abatable source occupying the stormwater agencies' waste load allocation.[194] The Association also needs to consider that the number of crematories in its territory is likely to grow as more people choose cremation over other disposition methods.[195]

Although airborne mercury can drift and may reside for extended periods in the atmosphere,[196] BASMAA considers it prudent to assume that some cremercury deposits locally and is then carried to the Bay in run-off.[197] Supporting this assumption is the fact that crematories have shorter stacks than other emitters such as petroleum refineries.[198] Tests show that mercury levels in the topsoil surrounding a crematory are often elevated.[199] Further, mercury-contaminated surface water presents a

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[190] If a water body is listed as "impaired" by pollution under the Clean Water Act, EPA (or the state in which the body is located) establishes TMDLs, or "waste load allocations," for the pollutants-of-concern for that water body. Local agencies are then responsible for ensuring that discharges of the pollutants do not exceed the TMDL. Geoff Brosseau, *supra* note 184.

[191] Geoff Brosseau, *supra* note 184.

[192] *Id.* In addition, EPA and the states "are modifying surface water discharge permits to incorporate more stringent requirements in mercury discharges, where appropriate." ROADMAP FOR MERCURY, *supra* note 8, at 8-9.

[193] *See* Bay Area Stormwater Mgmt. Agencies Ass'n, About BASMAA, http://basmaa.org/about/ (last visited Mar. 8, 2008).

[194] Geoff Brosseau, *supra* note 184.

[195] *Cf.* CREMATION ASS'N OF N. AM., CREMATION DATA & PREDICTIONS: DATA TRENDS, http://www.cremationassociation.org/docs/crem-data-predict.pdf (last visited Mar. 7, 2008).

[196] *See supra* text accompanying note 19.

[197] Geoff Brosseau, *supra* note 184.

[198] Richard Looker, *supra* note 160.

[199] Reindl, *supra* note 38, at 14-17 (summarizing research on mercury in soils surrounding crematoria). This may be true even though the vast majority of mercury emitted from a crematory is in an inert gaseous form that is unlikely to deposit locally. Rothenberg, *supra* note 17. The remainder is composed of reactive, oxidized mercury and mercury bound to particulate matter. The ratio of these various forms depends on factors such as the operating temperature of the crematory retort. While the inert gaseous mercury takes up what might be a long residence in the atmosphere, the other forms are more readily deposited, although actual figures are elusive. *Id.*

localized threat,[200] and crematories may be located near residences.[201] For these reasons, BASMAA may be the first official entity looking at ways to reduce cremercury in the Bay Area.

Efforts to control mercury air pollution in the San Francisco Bay Area illustrate the myriad complexities of similar efforts elsewhere. Those in charge must make regulatory decisions based on substantial uncertainties due to the variable nature of this particular pollutant. What is certain at this time is that mercury is a potent and persistent toxin that must be effectively controlled. Bay Area agencies should reevaluate baseline assumptions about cremercury to address current emissions and to prepare for the cremation industry's apparently inevitable rise.

V. TOLLING THE BELL FOR CREMERCURY

To the extent that state and local governments are merely following EPA's lead when it comes to cremercury, these governments are missing an important opportunity to reduce a known source of highly toxic pollution. As states like Minnesota, Maine, and Colorado struggle to develop appropriate policies, however, the cremation industry knows that the cremercury issue is not going away.[202] Following the Woodlawn study, an article in *Mortuary Science Magazine* warned the industry to consider next steps to address the problems that "still exist for current and future crematory operations."[203] Sensing that the regulatory climate may change for cremercury, the industry might attempt to head off direct regulation through voluntary measures.[204] Once a feasible regulation has been enacted by some state or region in the U.S., others may follow suit. For example, New Mexico's mercury reduction plan plainly states that it will consider "adoption or adaptation of the best management practices being developed by Colorado."[205]

The question remains: what socially and economically palatable regulation would effectively reduce cremercury emissions? Colorado's study highlighted the two basic options—collecting the fillings or

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[200] Geoff Brosseau, *supra* note 184.

[201] *See* Justin Berton, *Burning Issues: Vocal Sunnyvale Residents Say New Crematorium will be Responsible for the Stink in their City*, METRO, Aug. 30, 2001, *available at* http://www.metroactive.com/papers/metro/08.30.01/crematorium-0135.html.

[202] *See* Rahill, *supra* note 76.

[203] *Id.* (noting that states had begun crafting regulations "without the benefit" of data from the Woodlawn study, and focusing on the (alleged) environmental benefit of operating crematories at lower temperatures).

[204] Mark Harris, *supra* note 79. Such "voluntary" action is not likely to occur unless the regulations are clearly being developed. *See, e.g., supra* text accompanying note 147.

[205] NEW MEXICO MERCURY REDUCTION ACTION PLAN, *supra* note 98, at iii.

capturing the vapors.[206] As that study indicated, filtration technology is so expensive that governments seeking to curb cremercury emissions should instead develop effective pollution prevention protocols for removing the amalgam fillings prior to combustion.[207] Focusing entirely on end-of-pipe solutions to avoid the uncomfortable subject of how cadavers should be treated would be misguided—especially as some within the death services industry allow that a tooth removal system *might* just work.[208]

The development of mandatory cremercury reduction goals might best be achieved by developing best practices for both options and letting market forces drive the decisions. In short: fix the goal, then let the industry choose its path to get there.

A. CREMATION FILTRATION: A COSTLY OPTION OF QUESTIONABLE EFFICIENCY

Several techniques exist to capture mercury from flue gases,[209] but EPA has not yet adopted an official standard, or Maximum Available Control Technology.[210] All of the available techniques are costly. For each crematory furnace in its European member states, the OSPAR Commission cited an annual estimated cost range of to $31,161 to $82,217.[211] A survey conducted for the Colorado Department of Public

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[206] TETRA TECH, *supra* note 64, at ES-1. Other options were considered, including the placement of an as-yet-unknown mercury-stabilizing substance in the mouth of a cadaver prior to sewing it shut; the goal was to avoid problems of disfigurement and timing. *See id.* at app. C (reprinting correspondence from Mark McMillan, Mgr., Mercury Program, Colo. Dep't of Pub. Health & Env't, to Martha Thayer, Dir., Arapahoe Cmty. College Sch. of Mortuary Science, et al. (July 18, 2006)).

[207] *See* TETRA TECH, *supra* note 64, at 8.

[208] TETRA TECH, *supra* note 64, at 11 ("[O]ne funeral professional indicated that he had removed teeth from time to time in response to family requests. This funeral professional indicated that in his experience, tooth removal before cremation, while not standard, was also not an uncommon activity."); telephone Interview with Michael P. LuBrant, Dir., Univ. of Minn. Program of Mortuary Science (Nov. 5, 2007). Mr. LuBrant, however, raised many substantial practical obstacles to such tooth collection. *See infra* text accompanying notes 243-67.

[209] OSPAR Comm'n, *Mercury Emissions from Crematoria and Their Control in the OSPAR Convention Area* 9-11 (2003), http://www.ospar.org/documents/dbase/publications/p00179_Mercury%20emissions%20from%20crematoria.pdf (discussing the following technologies and their respective mercury removal efficiencies: co-flow filters, > 98%; solid bed filters, > 90%; gas scrubbing, which reduces the mercury concentration in the flue gases to approximately 0.1-0.2 mg/m^3; ceramic reactor, efficiency unknown; gold filter, efficiency unknown; honeycomb catalytic adsorber, > 99.9%.). *But see* Wu, *supra* note 62 (calling scrubbers "useless" for this application).

[210] E-mail from Chang-Yu Wu, Professor, Univ. of Fla. (Nov. 12, 2007) (on file with author).

[211] OSPAR Comm'n, *supra* note 209, at 12. These figures represent the lowest estimate (27,270 eruros) for a "cold start" furnace to the highest estimate (75,450 euros) for a "warm start" furnace. *Id.* ("These costs involve technical installation, which includes the cost of additional

Health and Environment found that filtration equipment could cost as much as $690,000.[212] Additionally, there could be ongoing costs associated with transporting, treating, and—depending on the filter type—storing the mercury-laden filter media.[213] Importantly, because mercury will likely be phased out of dentistry altogether,[214] and because the population with amalgam fillings will eventually expire, abatement equipment could be superfluous in a matter of decades. The economic impact of the European Union's cremercury mandate[215] will be instructive, but the United States should meanwhile explore all options.

The expense of effective filtration systems indicates, in part, that the science of mercury vapor capture is highly complex.[216] Except for mercury, "the heavy metals released from waste incinerators have decreased considerably due to improvements in pollution abatement technologies."[217] Temperature controls, wet scrubbers, bag houses, and ambient dust collectors are all useful to control other pollutants[218] but may have only collateral benefits in reducing mercury emissions.[219] Mercury is elusive:

> Mercury is a unique metal in combustion systems. While most other metals are emitted as particulate matters, mercury is mainly emitted as elemental mercury vapor. . . . Therefore, particle control devices are not capable of capturing it. Meanwhile, it is insoluble, making scrubber[s] useless in removing it from flue gas. . . . EPA [once suggested that]

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emission monitors, transport, assembly and civil engineering costs (for renovations)."). In 2003, when the OSPAR Commission report was released, 27,270 euros to 75,450 euros was the rough equivalent of $31,161 to $82,217. European Cent. Bank, Statistical Data Warehouse (2008), http://sdw.ecb.int/ quickview.do?SERIES_KEY=120.EXR.D.USD.EUR.SP00.A. *See also* AEA TECHNOLOGY / NILU-POLSKA, COSTS AND ENVIRONMENTAL EFFECTIVENESS OF OPTIONS FOR REDUCING MERCURY EMISSIONS TO AIR FROM SMALL-SCALE COMBUSTION INSTALLATIONS 49 (2005), http://ec.europa.eu/environment/chemicals/mercury/pdf/sci_final_report.pdf (describing a "nominal additional cost of mercury abatement . . . per cremation . . . .").

[212] Tetra Tech, Control Technologies for Crematoria Hg Emissions 3 (July 18, 2007) (unpublished study, on file with author). It is not clear whether the $690,000 figure includes expenses in addition to procurement and installation.

[213] Telephone Interview with Jim Berlow, Dir., Hazardous Waste Minimization and Mgmt. Div., U.S. EPA Office of Solid Waste (Nov. 5, 2007).

[214] *See generally* MERCURY POLICY PROJECT, *supra* note 37, at 2 (describing results of national survey of dentists, which indicated that "a majority will eventually stop using mercury tooth fillings for 'environmental / waste disposal' reasons . . . .").

[215] BBC News, *supra* note 128 ("The industry has been told mercury filtering equipment must be fitted at crematoria by 2012 to halve emissions.").

[216] *See* Wu, *supra* note 62.

[217] INCINERATION AND HUMAN HEALTH, *supra* note 7, at 11.

[218] DEVICES, *supra* note 75.

[219] *See* Reindl, *supra* note 38, at 10 ("[I]t is clear that some mercury was removed by the wet scrubber system.").

> Activated Carbon [would be] the Maximum Available Control Technology [for major, regulated emitters]. However, it's not an ideal material (e.g., it requires 3 kg of the best carbon to remove 1g of [mercury, the equivalent of only two fillings]).[220]

In addition to activated carbon, sorbant materials such as bauxite or kaolinite may effectively remove heavy metals; but "their effective area is on the surface and hence a high quantity is required to control the heavy metal emission."[221] Further, inconsistencies between crematory facilities (e.g., because of relative age, upkeep, and technique)[222] make elusive the hard data that regulators would need to devise an ideal filtration scheme properly based on reduction targets and fiscal considerations.

Another problem with collecting mercury through the use of filtration technology is that this process results in a much larger bulk of contaminated waste—as much as 3.3 pounds of filter media per filling[223]—to be handled, treated, and/or stored properly.[224] Thus, while control technologies may curtail immediate releases to the air, they "still result in mercury wastes that are potential sources of future emissions . . . ."[225] Collected fillings of a much smaller volume than the filter media would pose a smaller lasting danger.[226]

A thoroughly conceived regulatory policy accounts for not only the economic feasibility of solutions, but the costs of nonregulation as well.[227] With potential cremercury regulations, the equation contains a

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[220] Wu, *supra* note 62. *But see* OSPAR Comm'n, *Recommendation on Controlling the Dispersal of Mercury from Crematoria* 3 (2003) (on file with author) (calling scrubbers effective for reducing mercury concentration in flue gases).

[221] Wu, *supra* note 62.

[222] In the United Kingdom, such inconsistencies led to the conclusion that "to install abatement at all crematoria could lead to significant numbers of crematoria closures." U.K. Dep't of Env't, Food, & Rural Affairs, *Summary of the Responses to the Consultation Paper in July 2004* 3 (2004), http://www.defra.gov.uk/environment/ppc/old-consultations/crematoria-two/responses.pdf.); *see also* DEFRA Second Consultation, *supra* note 137, at 7 ("[R]educing emissions of mercury from crematoria should aim to be achieved without forcing any crematoria closures due to physical constraints such as insufficiency of space or heritage considerations.").

[223] Wu, *supra* note 62 (referring to activated carbon, bauxite, and kaolinite). Accordingly, as much as 16.5 pounds (7500 grams) of media would be required to capture 2.5 grams of mercury from the teeth of a corpse cremated with five fillings.

[224] Disposal of this mercury-contaminated media would then be governed under the Resource Conservation and Recovery Act (RCRA). *See generally* EPA Land Disposal Restrictions Program, 40 C.F.R. § 268 (2005).

[225] U.N. Env't Programme, *supra* note 19, at § 121.

[226] For cost reasons alone, this should be true, since lower expenses for collection, transport, treatment, and/or storage of hazardous materials (because of the lower volume) would encourage proper disposal.

[227] *See* Frank Ackerman & Lisa Heinzerling, *Pricing the Priceless: Cost-Benefit Analysis of*

substantial variable: what is the economic burden of cremercury pollution? The same question arose in the United Kingdom when cremercury controls were first suggested, and DEFRA, the agency in charge, responded, "It is often necessary to take environmental decisions without certain knowledge."[228]

The European Union's proposed mandate raised a number of concerns with a filtration approach: the difficulty of retrofitting some existing facilities, especially those in historic buildings; the possibility that some facilities would have to close because of the great cost; architectural aesthetic impacts; and the unfairness that smaller facilities might have to bear the same burden as large ones.[229] In response to these and other concerns, DEFRA created a "burden sharing" program called the Crematoria Abatement of Mercury Emissions Organisation (CAMEO).[230] In 2006, DEFRA stated that the system was working well:

> Under burden-sharing, crematoria operators can choose whether to fit

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Environmental Protection, 150 U. PA. L. REV. 1553 (2002).

[228] DEFRA Second Consultation, *supra* note 137, at 6. The United Kingdom implemented its cremercury abatement policy under obligations including the OSPAR Recommendation on Mercury from Crematoria, European Union 4th Air Quality Daughter Directive, and the United Nations Protocol on Heavy Metals. *Id.* at 7. As of 2004, cremation rates topped 40% in nine E.U. member states, with four countries exceeding 70%: MAXSON, *supra* note 42, at 17. Other E.U. countries, including Cyprus, Estonia, Greece, Lithuania, and Malta, have no appreciable cremation rate. Overall, the average for the twenty-seven E.U. countries is roughly 33%, or about the same as the U.S. average. *Id.* The European Union has taken bold steps to curtail crematoria mercury emissions. BBC News, *supra* note 128 ("The industry has been told mercury filtering equipment must be fitted at crematoria by 2012 to halve emissions."). *See* Comm'n of the Eur. Communities, *Development of an EU Mercury Strategy, Invitation to Comment* 31 (2004), http://ec.europa.eu/environment/chemicals/mercury/pdf/consultation.pdf (highlighting "the possibility of significant [cremercury] emissions for many years to come in the absence of abatement") (citation omitted). *See also* Doug Hernan, *What Will it Take to Get U.S. Deathcare Professionals to TRULY Adopt a Global View?*, FUNERALWIRE.COM (Apr. 26, 2007), http://www.funeralwire.com/article.php?id=20401 ("European nations are clamping down heavily on air . . . pollution—and those environmental-protection measures 'will have a serious impact' on deathcare professionals in this country . . . perhaps even affecting emission standards for crematories."). Filling-extraction was ruled out as socially unacceptable. OSPAR Comm'n, *OSPAR Recommendation 2003/4 on Controlling the Dispersal of Mercury from Crematoria* 3 (2003); DEFRA Second Consultation, *supra* note 137, at 10. *But see* Mark Macaskill and Toby Macdonald, *Corpses' Teeth May Have to be Pulled*, TIMES ONLINE, Dec. 12, 2004, http://www.timesonline.co.uk/tol/news/uk/scotland/article402237.ece ("'Removing teeth with fillings would be the easiest solution,' said Bill Stanley, a spokesman for the Institute of Cemetery and Crematorium Management in Scotland. 'Pacemakers are routinely removed before a body is cremated as they explode when subjected to high temperatures. The concerns are that the public wouldn't wear it but they don't know about the issue and it needs to be raised. We need to discuss it more fully but it's feasible and members of our organisation wouldn't have any problems carrying out the work.'").

[229] DEFRA Second Consultation, *supra* note 137, at 7-8.

[230] News Release, U.K. Dep't of Env't, Food, & Rural Affairs, Halving Mercury Emissions from Crematoria - Novel "Burden Sharing" Approach to Continue 448/06 (Oct. 19, 2006).

> mercury abatement equipment or contribute to the costs of others doing so. Many operators have joined the CAMEO scheme, which is arranging burden sharing at the national level and provides an umbrella organisation for both running the system and reporting to [DEFRA]. CAMEO will register all burden sharing arrangements, with CAMEO members being free to choose their burden sharing partners. . . . Other operators are making their own arrangements, either by fitting equipment to part of their crematorium, or coming to a private agreement with other crematoria.[231]

One of CAMEO's key functions is enabling the United Kingdom's cremation industry to meet concrete cremercury reduction goals.[232] The U.S. cremation industry consists of small operators, some of which are nonprofits, and corporate chains like the Neptune Society.[233] If concrete goals like those in the European Union are set in the United States, a system akin to CAMEO might be necessary to avoid facility closures and unfair burdens. Large or small, the cost of abatement equipment would likely be passed on to the consumer. According to the OSPAR Commission, this could increase the cost of a cremation in its member countries by 15-20%, depending on the furnace type.[234] Given the average cremation cost in the United States of $1800, this might correspond to an increase of $270 to $360.

Another option would be for federal or state governments to establish a dedicated pollution prevention fund to partially offset the cost; this fund could be funded through assessments on polluters. Even if the extra cost fell entirely on consumers, it could be offset by as-yet-unquantified environmental health benefits, and the total price would still be far less than the average $10,000 tab for a standard funeral.[235] Removing teeth, however, would be even less expensive.

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[231] *Id.*

[232] *Id.*

[233] Telephone Interview with Joe Sehee, Founder, Green Burial Council (Nov. 20, 2007).

[234] OSPAR Comm'n, *Mercury Emissions from Crematoria and Their Control in the OSPAR Convention Area* 12 (2003), http://www.ospar.org/documents/dbase/publications/p00179_Mercury%20emissions%20from%20crematoria.pdf.

[235] GRAVE MATTERS, *supra* note 55, at 56.

B. TOOTH EXTRACTION

i. The Focus on Fillings: Solutions Begin in the Dentist's Office

Thus far, this Comment has focused on one end of one particular mercury waste stream; that is, what happens to mercury in fillings at the end of a person's life. The discussion is not neatly separated from what happens at the initial source of that waste stream: the dentist's office. The dental care industry is a major mercury consumer. According to EPA, in 2001, 14% of the mercury produced for industry in the United States went for use in dental amalgam fillings,[236] which are the primary source of cremercury emissions.[237] One recent study suggests that "the most amenable sources for mercury remediation include the dental office and the crematory."[238]

According to EPA, "[m]any state, tribal, and local governments have been leaders in addressing mercury releases. States have developed innovative mercury release and use reduction laws and regulations that supplement, and in some cases provide a model for, national efforts."[239] One increasingly common trend is to control or ban mercury fillings.[240] EPA's Roadmap notes, "Many states have initiated efforts to reduce mercury in wastewater by focusing on the dental sector. Mercury in dental wastewater [which may result from amalgam installation or removal] can be removed by relatively inexpensive amalgam separators and/or by using other pollution prevention practices."[241] Another increasing trend, albeit wholly based on personal choices and not on any

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[236] ROADMAP FOR MERCURY, *supra* note 8, at 36.

[237] REINDL, *supra* note 48, at slide 2.

[238] SCARMOUTZOS & BOYD, *supra* note 4, at 35 ("Mercury releases from dental amalgam may enter into the environment from three major sources: (1) Interment and cremation (2) Household sewage waste (3) Evacuation and discharge systems at dental offices.").

[239] ROADMAP FOR MERCURY, *supra* note 8, at 29-30 (citing several efforts to reduce the discharge of mercury into the waste stream from such sources as automotive switches and dental offices, but not mentioning any attempts to control cremercury).

[240] *See* Baga, *supra* note 2, at 179 (describing impacts from the use mercury amalgam fillings, including crematory mercury emissions).

[241] ROADMAP FOR MERCURY, *supra* note 8, at 28 ("Amalgam separators currently on the market can capture more than 95 percent of the mercury particles in wastewater."). *Contra* Telephone Interview with Seymour Kurtz, DDS (Oct. 29, 2007) (asserting that the mercury separators required by California regulations to be installed and maintained in dental offices are unduly expensive; that dental offices produce a minuscule amount of mercury waste compared with other sources; and that the expense is especially onerous for dentists who, like Dr. Kurtz, do not install amalgam fillings). Because dentists like Dr. Kurtz treat patients who may already have such fillings, they must comply with the regulations. *Id.*

regulation, is for living people to choose voluntarily to have amalgam fillings replaced with an alternative material.[242]

ii. Filling Extraction in the Context of Mainstream Funeral Practices

As demonstrated by the Colorado initiative, a person with specialized tools can extract teeth from a corpse in short order.[243] Despite Colorado's substantial efforts to test the tooth-extraction waters, however, much more research is necessary before the proposal can be deemed technically feasible.[244]

The difficulties largely reside in other death practices—such as embalming and public viewing—that may occur around the same time as the removal would.[245] Embalming is still mainstream practice in the United States.[246] So, for example, if Ben's family wants Ben's body embalmed for a public viewing and funeral service prior to being cremated, the embalmer will have more work to do if she first has to remove several teeth. Again, the issue is not so much the time involved. Rather, rigor mortis might have set in strongly, and Ben's powerful jaw muscles might have to be forced open.[247] Then the embalmer, probably not operating with the benefit of dental records, has to detect whether there are any amalgam fillings.[248] These are almost always set in molars, so she will have to take a good look inside. Even then, amalgam fillings may lay hidden under dental crowns.[249]

Once she finds Ben's fillings, it will probably not be difficult to pry

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[242] As in-place amalgams are considered to be quite stable in terms of mercury release, it is important that those who would have them removed and replaced consider that the removal process may destabilize the mercury and create a greater exposure hazard. *See, e.g.*, STEPHEN M. KORAL, INT'L ACADEMY OF ORAL MEDICINE & TOXICOLOGY, SAFE REMOVAL OF AMALGAM FILLINGS (2007), www.iaomt.org/articles/files/files288/Safe%20Removal%20of%20Amalgam%20Fillings.pdf. Dentists who perform this procedure should be well trained to capture the mercury. *Id.* Also, dental work is likely to be too expensive for most people to undergo discretionary amalgam removal. For these reasons, it may be safer and more economical for whole teeth to be removed from corpses with fillings intact.

[243] TETRA TECH, *supra* note 64, at 10-11. Note, however, that the mouth of the test corpse was already open. *Id.*

[244] Telephone Interview with Michael P. LuBrant, Dir., Univ. of Minn. Mortuary Science Program (Nov. 5, 2007) [hereinafter LuBrant].

[245] *Id.*

[246] Mark Harris, *supra* note 79; *see generally* AM. ASS'N OF RETIRED PERSONS, FUNERAL AND BURIAL PLANNERS SURVEY (2007), http://assets.aarp.org/rgcenter/consume/funeral_survey.pdf.

[247] Specialized tools exist to help with this task. TETRA TECH, *supra* note 64, at 11. The jaw may be dislocated anyway as part of the embalming process. MITFORD, *supra* note 35, at 48.

[248] *See* Carrier, supra note 130.

[249] LuBrant, *supra* note 244.

them out with specialized tools;[250] however, the tissues surrounding the new gaps may then swell and bruise,[251] making it more challenging to create a scene of peaceful repose.[252] The Colorado team identified other challenges, including "[p]otentially creating points where embalming or other fluids might leak . . . , [d]isturbing the capillaries so that the embalming fluid does not reach all areas of the face, leading to noticeable discoloration during the viewing, [and] [l]eaving spaces in the mouth that cause the cheeks to sink."[253] Alternatively, if the teeth are to be removed following the viewing and service, the remover must contend not only with potential rigor mortis, but also the task of undoing any work that was done to seal the mouth cavity—a common feature of embalming that involves substantial wiring and/or hardware.[254]

It would be far easier for the mortician, at least, if everyone exchanged amalgam fillings for some new substitute while still alive.[255] The next easiest scenario would be to forgo embalming altogether. Indeed, 61% of cremations are "direct," with no embalming and no viewing.[256] Embalming is mandatory only in rare circumstances.[257] In fact, with modern refrigeration technology and the careful use of dry ice[258] embalming is largely unnecessary,[259] although it is difficult to conceive how someone who is severely disfigured in death could otherwise be displayed for mourners.

There is no question, in terms of providing a service that the public generally appreciates and expects to remain available, that the mortuary science of embalming has had—and continues to have—a very large role in the "American way of death."[260] Arguably, this would not be the case

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[250] TETRA TECH, *supra* note 64, at 11.

[251] LuBrant, *supra* note 244.

[252] *Id.*

[253] TETRA TECH, *supra* note 64, at 10.

[254] LuBrant, *supra* note 244.

[255] *But see supra* note 242 (raising safety concerns regarding the removal of amalgams and noting that this procedure is probably too costly for most people).

[256] CREMATION ASS'N OF N. AM., *supra* note 1, at 16; E-mail from Paul Rahill, Pres., Matthews Cremation (Nov. 26, 2007) (on file with author).

[257] Some states have laws that make it illegal to transport an unembalmed body across state lines or to wait longer than a specified time to inter or otherwise dispose of a body without embalming. GRAVE MATTERS, *supra* note 55, at 28.

[258] GRAVE MATTERS, *supra* note 55, at 107 (explaining how one may forgo the use of a funeral home altogether and have a simple, dignified home funeral before final disposition).

[259] *See* U.S. Green Burial Council, http://www.greenburialcouncil.org/faqs.php (last visited Feb. 11, 2008).

[260] *Cf.* AM. ASS'N OF RETIRED PERSONS, FUNERAL AND BURIAL PLANNERS SURVEY 15 (2007), http://assets.aarp.org/rgcenter/consume/funeral_survey.pdf [hereinafter AARP] (reporting survey results showing that 83% of respondents have not considered having a funeral without an

had the public always known what is typically involved in this practice.[261] The invasiveness of extracting several teeth from a body simply pales in comparison to basic embalming practices.[262]

If embalming ceased altogether, an estimated 827,060 gallons per year of embalming fluid[263] would not be buried or get incinerated in crematories.[264] Americans are increasingly interested in ecological death practices,[265] and the top two reasons for choosing cremation are cost and a desire to save land.[266] Therefore, as society becomes more educated about ecological ways of dealing with the dead and remains interested in saving money by choosing direct cremation without embalming, embalming may become an anachronism.[267] To the extent that direct

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open casket and embalming).

[261] In fact, cremation rates began to rise in the 1960s, in part due to Jessica Mitford's best-selling, searing expose of the funeral industry. Richard T. Gill, *Whatever Happened to the American Way of Death?,* THE PUBLIC INTEREST, Spring 1996, *reprinted in* DYING, DEATH, AND BEREAVEMENT 98/99 at 27 (George E. Dickinson et al. eds., 1998).

[262] *See* MITFORD, *supra* note 35, at 45; *see* GRAVE MATTERS, *supra* note 55, at 15. The body is laid out on a table as if ready for surgery. MITFORD, *supra* note 35, at 45; GRAVE MATTERS, *supra* note 55, at 15. Surgical tools and an array of pastes, plasters, powders, sprays, soaps, waxes, mastics, glues, cosmetics, creams, and chemicals are at the ready. MITFORD, *supra* note 35, at 45; GRAVE MATTERS, *supra* note 55, at 15. Orifices are plugged. GRAVE MATTERS, *supra* note 55, at 17. A tube is inserted into a main vein and, under pressure from a pump, the blood is drained and replaced with three to six gallons of dyed, perfumed chemicals including formaldehyde, glycerin, borax, phenol, alcohol, and menthol. *Id.* at 21; MITFORD, *supra* note 35, at 45, 46. Eyelids are kept shut by lifting them over and down onto a spiked eyeball cap that is glued to the eye; the lids are sewn together or glued. The mouth is closed with the help of a needle injector and thread, or pins and wires and drilled holes. GRAVE MATTERS, *supra* note 55, at 19, 20. The jaw may be dislocated to ease this part of the job. MITFORD, *supra* note 35, at 48. Large breasts may be duct taped or sutured together to maintain form, injected with firming embalming fluid, and un-taped or de-sutured. To eliminate the burgeoning mass of bacteria within the chest and abdomen, a long, hollow needle (a "trocar"), which is attached by tube to a suction pump, is repeatedly thrust into the abdomen to pierce and shred and suck everything out. The resulting cavity is filled with chemical cavity fluid. GRAVE MATTERS, *supra* note 55, at 19, 22-23, 24. The head and limbs are reattached, if necessary; the nose and ears are replaced. Bloated tissue is cut away from the inside and stuffed with cotton to restore desired contours, and emaciated tissue is injected with creams. MITFORD, *supra* note 35, at 47, 48.

[263] Glendale Memorial Nature Preserve, Ecologically Sound Burial Alternatives (2007), http://www.glendalenaturepreserve.org/.

[264] In 2005, 61% of cremations were "direct" (without embalming). CREMATION ASS'N OF N. AM., *supra* note 1, at 6; E-mail from Paul Rahill, Pres., Matthews Cremation (Nov. 26, 2007) (on file with author). A recent survey found that almost half of Americans believe that having an open casket service is important, and the vast majority have not considered having an open casket without embalming. AARP, *supra* note 260, at 15-16. One might deduce, then, that the majority of cremations that are not "direct" are of embalmed bodies.

[265] *See* AARP, *supra* note 260, at 15.

[266] CREMATION ASS'N OF N. AM., 2006 DATA & PROJECTIONS TO THE YEAR 2025 19 (2007), *available at* http://www.cremationassociation.org/docs/CANA-Final06Prelim.pdf.

[267] *See* AARP, *supra* note 260, at 17 ("For environmental reasons, the European Union has considered banning formaldehyde [the main ingredient of embalming fluid]. Respondents were asked whether they would support this ban in the United States. Over one-third (36%) reported that

cremations avoid the logistic challenges of embalming and viewing outlined above, a filling-extraction program would be more feasible.

iii. Who Owns the Teeth? Who Pays to Collect Them?

Generally speaking, there is no legally recognized property right in a dead body,[268] and modern laws in the United States regarding the treatment of dead bodies derive from the government's police power to guard public health.[269] Based on its police powers, the state probably could mandate the removal of amalgam fillings from dead bodies to prevent mercury releases to the environment,[270] but a voluntary approach also holds promise. For example, the living could give advance consent to remove teeth with amalgam upon death using an organ-donor model.[271]

A donor model would serve several key purposes. First, it would allow the decision to be made by the living donor and would not leave the bereaved family to make a tough decision in a vulnerable time. Second, not only would it alert funeral and crematory workers to the presence of amalgam fillings, it may even help to locate them.[272] Lastly—and importantly—it would enable filling extractions to comply with the laws of many states that prohibit funeral service professionals

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they would support this ban. . . . If formaldehyde were banned, almost half of respondents (47%) say that they would be most likely to consider cremation as an alternative. Almost one-quarter of respondents (23%) said they would consider a natural or green burial as an alternative.").

[268] *But see* Tanya K. Hernandez, *The Property of Death*, 60 U. PITT. L. REV. 971, 982 (1999) ("[E]ven though probate courts in the United States universally recognize that there is no property in a dead body in a commercial sense, the courts do respect a decedent's right to assert burial preferences and to otherwise dispose of his or her own body by will as part of the freedom of testation. . . . Because personal care of the body of a decedent was traditionally the primary responsibility of the family, the judiciary viewed family members as having a kind of property right to the possession of a deceased family member's body for burial.").

[269] 23 CAL. JUR. 3D *Dead Bodies* § 1 (2006).

[270] Burial is also a pathway for mercury to enter the environment. SCARMOUTZOS & BOYD, *supra* note 4, at 35. For opposition to the state's intrusion into death practices, see Mary L. Clark, *Keep Your Hands Off My (Dead) Body: A Critique of the Ways in Which the State Disrupts the Personhood Interests of the Deceased and His or Her Kin in Disposing of the Dead and Assigning Identity in Death*, 58 RUTGERS L. REV. 45 (2005) (noting that the manner in which kin wish to express concern for the dead may at times "conflict with the needs of the community as a whole").

[271] TETRA TECH, *supra* note 64, at 27. All fifty states have adopted some version of the Uniform Anatomical Gift Act, which "authorizes donations of body parts for transplant or medical research." William Boulier, *Sperm, Spleens, and Other Valuables: The Need to Recognize Property Rights in Human Body Parts*, 23 HOFSTRA L. REV. 693, 712 (1995). *See generally* MARY ROACH, STIFF: THE CURIOUS LIVES OF HUMAN CADAVERS (2003) (presenting fascinating perspectives on organ donation).

[272] Mark McMillan, *supra* note 34.

from possessing any precious dental metal.[273] In other words, if Ben (or his family) gave permission to have his amalgam fillings—which often contain silver—removed, no one will get in trouble for doing the job.

There are various possibilities for distributing the costs of carrying out tooth extractions. For example, a fee could be added to the cost of each mercury amalgam filling, and the fee would be paid to the party extracting the filling at death.[274] This would raise the cost of fillings and encourage the phase-out of these fillings altogether—a goal already established in several states.[275] Alternatively, or in conjunction, insurance companies could be induced to offer coverage for removal-and-replacement of amalgam fillings while the insured is still alive.[276] Another option is to make violators of pollution laws contribute to a dedicated fund.

If the public were more broadly educated about the problem of cremercury, a substantial portion of the public would conceivably be willing to arrange to have their fillings removed upon death. This is especially true among the many who are choosing cremation (and eschewing embalming) for ecological reasons.[277] The donor model might be one effective way to manage the process.

iv. After the Extractions

Collecting small, mercury-contaminated objects is not a novel activity in many states:

> State and local governments have promoted public and private collection programs for both bulk elemental mercury and discarded mercury-containing products. Some businesses are also collecting unwanted mercury or mercury-containing products (e.g., thermostats). . . . Most of this mercury is sent to retorters, and it is likely that the supply of mercury will increase due to successful collection programs and efforts to eliminate mercury from schools,

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[273] *Id.*

[274] This might be administered in a manner similar to California's Electronic Waste Recycling Fee, a point-of-sale tax that covers the recycling costs of certain electronic devices in order to divert harmful pollutants from landfills. *See, e.g.*, State of California Board of Equalization, Special Taxes: Electronic Waste Recycling Fee, http://www.boe.ca.gov/sptaxprog/ewaste.htm (last visited Mar. 30, 2008).

[275] U.S. EPA, Mercury, State Legislation and Regulations (2008), www.epa.gov/epaoswer/hazwaste/mercury/laws.htm (listing bans in Colorado, Maine, and New Hampshire).

[276] *But see supra* note 242 (describing safety concerns when having an amalgam filling removed).

[277] *See, e.g.*, Green Burial Council, Green Burial Council Standards for Funeral Providers, http://www.greenburialcouncil.org/green_funeral_home.php (last visited Nov. 26, 2007).

laboratories, and businesses.[278]

The states, however, may need federal aid to successfully manage such programs. EPA's Roadmap notes that "states do not have the resources or desire to manage surplus mercury for the long term and are looking to the federal government to address this issue."[279] It is especially likely that states will need federal help if Congress enacts a currently proposed mercury export ban[280] and if the fillings collected from cadavers are deemed to be waste mercury as opposed to being suitable for recycling—a determination that may rest solely on socio-cultural concerns.[281] EPA recognizes that:

> [U]ltimately, it will be important to look at ways to permanently "retire" non-federally owned or managed commodity-grade mercury that will eventually have little or even negative economic value. Disposal of commodity-grade mercury would require regulatory changes, as current regulations under the Resource Conservation and Recovery Act (RCRA) require high-concentration mercury wastes to be retorted for mercury recovery and reuse.[282]

Under RCRA, EPA must manage hazardous wastes, from generation to storage, transportation, treatment, and disposal.[283] Thus, the Agency has established pre-disposal treatment and recycling standards for mercury wastes, including emissions limits for the combustion of mercury-laden hazardous waste.[284] RCRA provides a baseline for the states, some of which have designated particular mercury-containing wastes, including dental amalgam, for tougher treatment and disposal

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[278] ROADMAP FOR MERCURY, *supra* note 8, at 44. A "retort" employs a distillation process to isolate mercury. Telephone Interview with Jim Berlow, Dir., Hazardous Waste Minimization and Mgmt. Div., U.S. EPA Office of Solid Waste, (Nov. 5, 2007) [hereinafter Berlow].

[279] ROADMAP FOR MERCURY, *supra* note 8, at 44.

[280] Berlow, *supra* note 278; *see also* Cheryl Hogue, *House Panel Approves Bill To Eliminate U.S. Exports By 2010,* CHEM. & ENG'G NEWS, Nov. 1, 2007, http://pubs.acs.org/cen/news/85/i45/8545news5.html.

[281] If society accepts tooth removal as a way of preventing cremercury pollution, there would probably be little resistance to the careful reprocessing of the mercury into some usable resource. *Cf.* Envtl. Data Interactive Exchange, *Swedish Crematorium Heats Stockholm Housing,* Nov. 8, 2002, *available at* http://www.edie.net/news/news_story.asp?id=6246 (discussing the diversion of heat from crematories to homes in Stockholm: "[A] number of bishops and members of the public have declared the initiative appropriate and environmentally friendly.").

[282] ROADMAP FOR MERCURY, *supra* note 8, at 45.

[283] *See generally* EPA Land Disposal Restrictions Program, RCRA, 40 C.F.R. § 268 (2005).

[284] U.S. EPA, *Mercury: Laws and Regulations*, http://www.epa.gov/mercury/regs.htm (last visited Nov. 4, 2007).

requirements.[285]

If, in a given area, mercury fillings were extracted from cadavers in sufficient quantity to exceed RCRA's small-quantity exemption,[286] and the mercury constituted greater than 260 parts per million of the collected "waste," the material would be sent to one of several "retorters" in the United States to undergo what is essentially a distillation process: the waste would be heated, volatilizing and extracting the mercury, which would then be collected and possibly recycled.[287] The remaining teeth could then be interred in a safe and dignified manner, just as a crematory's collection of metal artificial joints might be.[288]

v. Some Notes About Changing the Culture

Death practices are often deeply embedded within culture; they change slowly—if at all.[289] Throughout history, humans have treated the bodies of deceased persons according to innumerable, seemingly immutable traditions based on particular beliefs about the very nature of death itself.[290] Further, the practices of one culture may be anathema to

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[285] *Id.*

[286] The limit for the small quantity exemption is 100 kg per month (220 lbs. per month). Berlow, *supra* note 278. "[G]iven certain economies of scale, perhaps it may be easier for a large, industrial sort of facility to accumulate some [mercury] before disposal." E-mail from Andrew Helmlinger, Attorney Advisor, U.S. EPA, to author (Mar. 6, 2008) (on file with author).

[287] Berlow, *supra* note 278. The economics of mercury disposal are likely to change if the pending mercury export ban is enacted by Congress. *Id.* For example, the rule might establish a national repository for waste mercury. *Id.* Other economic factors include the market value of recycled mercury and the fact that amalgam fillings contain significant quantities of recoverable silver. *Id.* There might, however, be a conflict with laws in some states that prohibit the possession of precious dental metals (i.e., gold and silver) from deceased persons unless a donor program or similarly protective process were in place. *See also* U.N. Env't Programme, *supra* note 19, at §123 ("The cost of acceptable disposal of mercury waste in some countries is such that many producers now investigate whether alternatives exist in which they would not have to produce and deal with mercury waste. Mercury waste management, as it is most commonly done today, in accordance with national and local regulations, increasingly requires long-term oversight and investment. Proper management of mercury wastes is important to reduce releases to the environment, such as those that occur due to spills (i.e., from broken thermometers and manometers) or releases that occur over time due to leakage from certain uses (e.g., auto switches, dental amalgams). In addition, given that there is a market demand for mercury, collection of mercury-containing products for recycling limits the need for new mercury mining.").

[288] GRAVE MATTERS, *supra* note 55, at 63 (describing how crematory operators must remove such objects before cremains are processed through a crusher and how a crematory operator might then inter the objects).

[289] *Cf.* AARP, *supra* note 260, at 19 (reporting, for example, that 44% of respondents 65 years or older said they were "not at all interested" in a manner of burial that is "more environmentally friendly than a traditional burial with embalming").

[290] *See, e.g.,* Kearl's Guide to the Sociology of Death, Quests for Longevity and Symbolic Immortality, http://www.trinity.edu/~mkearl/death-1.html (last visited Feb. 9, 2008).

another. Cremation, for instance, is forbidden by Orthodox Judaism, and was not approved by the Catholic Church until 1963.[291]

The Parsis of India have an ancient tradition of laying the deceased out in the open to be taken in by vultures.[292] The Parsis face a dreadful dilemma, however: the vultures upon whom they have counted for centuries are now disappearing, largely because of feeding on cattle carcasses so contaminated by an agricultural chemical that the vultures die of renal failure.[293] Some Parsis are switching to cremation, and because access to huge volumes of fuel wood is apparently as difficult as access to gas-fired crematories, a high-tech "solar" crematory has been developed using large, reflective mirrors to focus sunlight into an incineration chamber.[294] The Parsis' ancient method—using vultures—is based on the Zoroastrian religious belief that the dead should not be allowed to contaminate air, water, or earth; therefore, as ecologically friendly as solar cremation might sound, many Parsis feel that it violates their religion by contaminating the air.[295] Still, recognizing that they may no longer rely on the presence of vultures, this ancient culture is shifting to a new practice.

The first modern crematory in America was constructed in 1874.[296] In a relatively short time, domestic cultural death practices have changed dramatically; the ongoing rise of the cremation industry exemplifies such change.[297] Given this context, addressing cremercury pollution by removing teeth should not be ruled out because of perceived public or industry discomfort (or outright repugnance). Mercury pollution rarely presents itself in as stark a manner as a body rotting instead of being swiftly cycled back into nature by vultures. However, intense mercury

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[291] GRAVE MATTERS, *supra* note 55, at 55.

[292] Wired Magazine, *Innovation in the Dead Zone*, Feb. 10, 2003, *available at* http://www.wired.com/culture/lifestyle/news/2003/02/57610.

[293] Paul Peachey, *Rotting Body Row As India Mourns Missing Vultures*, TERRA DAILY, Sept. 2, 2006, *available at* http://www.terradaily.com/reports/Rotting_Body_Row_As_India_Mourns_Missing_Vultures_999.html.

[294] Wired Magazine, *supra* note 292.

[295] *Id.*

[296] MARY ROACH, STIFF: THE CURIOUS LIVES OF HUMAN CADAVERS 258 (2003). Although ancient Egyptians are often considered the first embalmers, embalming as mainstream practice in the United States only dates back to the Civil War, when the long-distance shipping of soldiers' bodies fueled the development of tissue preservation methods. Jason Goodman, *Arsenic and Old Graves*, WATER & WASTEWATER PRODUCTS, Vol. 6, No. 5 (2006), http://www.wwn-online.com/articles/51584/; Adam Gopnik, *In the Mourning Store, Burying the Civil War Dead*, THE NEW YORKER, Jan. 21, 2008, *available at* http://www.newyorker.com/arts/critics/books/2008/01/21/080121crbo_books_gopnik.

[297] Gill, *supra* note 261, at 27.

pollution is every bit as gruesome,[298] and to the extent that cremercury is released because society is unwilling to curb it, this toxin will continue to accumulate and to threaten public health and the global environment.

The public health laws that regulate the disposition of dead bodies in the United States necessarily aim to complement widely held religious and cultural beliefs,[299] but neither the laws nor the beliefs are static. In the late nineteenth century, when most people considered burial to be more adherent to religious custom,[300] a vigorous "cremationist" movement lauded cremation as spiritually beneficial.[301] Further, as increasingly crowded urban conditions broadened public health concerns, cremationists touted cremation's sanitary advantages over burials, which were commonly believed to issue pathogenic miasmas.[302] Cremation eventually became more acceptable, but well into the twentieth century, it remained curiously free from regulation.[303] This has changed, and crematories are now subject to myriad regulations that vary widely across the country.[304] These laws, like others targeting professional death services generally, effectively address some aspects of public health but are largely aimed at preserving the dignity of the dead and at preventing unscrupulous business practices by morticians.[305]

While these are all worthy goals, current regulations fail to address the full range of issues raised by disposition practices in the United States.[306] Cremercury emissions, which are largely unregulated, can—

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[298] *See, e.g.*, Masazumi Harada, Minamata Disease and the Mercury Pollution of the Globe, http://www.einap.org/envdis/Minamata.html; Heart Spring, Symptoms of Mercury Poisoning, http://heartspring.net/mercury_poison_symptoms.html (last visited Aug 30, 2008).

[299] Curiously, in California, this includes punishment for a funeral services professional who uses foul language in the presence of a corpse. CAL. BUS. & PROF. CODE § 7700 (Westlaw 2007).

[300] *See, e.g.*, GRAVE MATTERS, *supra* note 55, at 55 ("The practice [of cremation] was slow to take hold in the mostly Christian nation of the time . . . .").

[301] STEPHEN PROTHERO, PURIFIED BY FIRE: A HISTORY OF CREMATION IN AMERICA 17 (2001).

[302] *See* ROACH, *supra* note 296, at 258 (citing STEPHEN PROTHERO, PURIFIED BY FIRE: A HISTORY OF CREMATION IN AMERICA (2001)).

[303] *See* PROTHERO, *supra* note 301, at 130 (suggesting that the general lack of governmental endorsement of cremation substantially hindered the growth of the cremation industry in the U.S.).

[304] Keith E. Horton, Note, *Who's Watching the Cryptkeeper?: The Need for Regulation and Oversight in the Crematory Industry*, 11 ELDER L. J. 425, 427 (2003) ("States regulate the crematory industry via a patchwork of various laws with enforcement responsibilities spread across multiple state agencies, commissions, and boards. Surprisingly, some states allow crematories to operate without a license or inspections.").

[305] *See, e.g.*, MITFORD, *supra* note 35, at 176-77.

[306] "Currently, the crematory industry is largely underregulated." Horton, *supra* note 304, at 426. Industry representatives may strongly disagree. *Cf. id.* at n.6 (citing Robert M. Fells, External Chief Operating Officer and Gen. Counsel, Int'l Cemetery and Funeral Ass'n, Letter to the Editor, U.S. NEWS & WORLD REP., Mar. 5, 2002), *available at* http://www.icfa.org/usnwr_letter.htm).

and should be—curtailed. Similarly, why should someone who has died of cancer be pumped full of carcinogenic formaldehyde[307] only to contaminate the soil and groundwater through burial or to toxify the air by cremation? While the bereaved may find comfort in American death rituals, evidence of this "collateral damage" challenges the notion that mainstream practices actually dignify or pay homage to the dead. As long as medical study depends on the availability of corpses,[308] and as long as coroners must hold a body pending identification or autopsy,[309] there will probably be a need for corpse preservation. The law can continue to provide for the rare, actual need for toxic embalming.[310] Similarly, cremation may be a vital tool for disposing of bodies where, for example, there is an outbreak of lethal contagion or another instance of mass death.[311]

The time for a greener way of death has arrived; the most important way to "green" cremation is to eliminate cremercury. Better yet, why not embrace alternatives that may readily avoid cremation's other impacts as well?

C. ALTERNATIVES TO CREMATION

This Comment primarily attempts to demonstrate the significant danger of cremercury and to suggest ways to mitigate this danger. Mercury emissions are the main environmental problem with cremation, but they are certainly not the only one. In the past, crematories were notorious for visible emissions.[312] These have generally been addressed, but even if mercury fillings were now removed, cremations would still

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[307] Nat'l Cancer Inst., Formaldehyde and Cancer: Questions and Answers, http://www.cancer.gov/cancertopics/factsheet/Risk/formaldehyde (last visited Nov. 25, 2007).

[308] *See generally* ROACH, *supra* note 296.

[309] *Cf.* 22A AM. JUR. 2D *Dead Bodies* § 13 (2007).

[310] *See supra* note 257.

[311] For example, the first publicly operated crematory opened on Swinburne Island, New York, in 1889 and was operated to dispose of the bodies of immigrants who had died from infectious disease. PROTHERO, *supra* note 301, at 57. *But see* WORLD HEALTH ORG., TSUNAMI AFFECTED AREAS, 2005 COMMUNICABLE DISEASE RISKS AND INTERVENTIONS 5 (2005), http://www.who.int/infectious-disease-news/IDdocs/whocds200534.pdf ("Human remains do not pose a risk of communicable disease epidemics after natural disasters. . . . Burial is preferable to cremation in mass casualties and where identification of victims is not possible. The mass management of human remains is often based on the false belief that they represent an epidemic hazard if not buried or burned immediately."); *see also* MITFORD, *supra* note 35, at 63 (quoting a Canadian health minister's view that embalming "serves no useful purpose in preventing the transmission of communicable disease").

[312] Lundquist, *supra* note 166.

emit an array of pollutants and toxins.[313] While the Woodlawn study demonstrated that lowering the operating temperatures could lower some of these pollutants,[314] this would actually *increase* the release of dioxin,[315] which is one of the most potent toxins known.[316] Further, as much as 356 cubic feet of natural gas may be required to complete a single cremation.[317] Combustion of natural gas, a non-renewable fossil fuel, produces carbon dioxide, a greenhouse gas that exacerbates climate change.[318] Cremations also produce sulphur dioxide and nitrogen oxide, which contribute to the formation of acid rain.[319]

For these reasons, in addition to greening cremation by eliminating cremercury, existing alternatives to cremation, such as green burial,[320] should be made widely known and accessible, and new alternatives, like "promession,"[321] should be developed.[322] Demand for such services, tailored specially to accommodate the country's huge population, should be encouraged, in part, as a market incentive for crematories to adopt "greener" practices. For example, if promession can gain a foothold in the United States, it stands to ecologically revolutionize the death care

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[313] POLLUTANTS, *supra* note 61 (listing carbon monoxide, sulphur dioxide, hydrogen chloride, nitrogen oxides, dioxins, mercury, cadmium, lead, and particulate matter).

[314] *See* Rahill, supra note 76.

[315] Telephone Interview with Jane Lundquist, Eng'r, Bay Area Air Quality Mgmt. Dist. (Nov. 21, 2007). Dioxins are released from burning plastics and from burning chlorine compounds normally found in cadavers. POLLUTANTS, *supra* note 61.

[316] World Health Org., Dioxins and Their Effects on Human Health (2007), http://www.who.int/mediacentre/factsheets/fs225/en/index.html.

[317] DAVID L. RUSSELL, How much energy (natural gas) is consumed to burn a body in a crematorium? (Nov. 28, 2006), ALL EXPERTS, http://en.allexperts.com/q/Environmental-Science-1471/Cremation-energy-used.htm.

[318] NAT'L ENERGY INFO. CTR., GREENHOUSE GASES, CLIMATE CHANGE, AND ENERGY (2004), *available at* http://www.eia.doe.gov/oiaf/1605/ggccebro/chapter1.html.

[319] POLLUTANTS, *supra* note 61.

[320] *See generally* Green Burial Council, http://greenburialcouncil.org/ (last visited June 25, 2008). The Green Burial Council has a range of standards for ecological burial practices and is currently devising certification standards for cremation that will "mitigate for mercury pollution." Green Burial Council, Standards, http://greenburialcouncil.org/standards.htm (last visited June 25, 2008).

[321] *See generally* Promessa Organic, http://www.promessa.se/index_en.asp (last visited June 25, 2008). Using liquid nitrogen to freeze-dry bodies, promession mimics natural, biological processes that cycle the vital nutrients of deceased organisms back into the environment to sustain new life. *See generally id.* Mercury removal is an important part of the process. Telephone Interview with Susanne Wiigh-Masak, Founder, Promessa Found. (Aug. 30, 2007). In a short time, promession has caught fire in the European Union and elsewhere. *Id.* (describing inquiries from the United States, Korea, Canada, and South Africa). "[Wiigh-Masak] appears to be doing, in a matter of years, what took the cremationists a century." ROACH, *supra* note 296, at 261.

[322] A full discussion of such alternatives is beyond the scope of this Comment.

industry, and crematories are likely to be its main competitor.[323] Morticians are already losing massive market share to crematories.[324] With their experience in handling deceased persons, they might be able to regain their economic vitality by embracing this promising, thoroughly well-conceived method.

VI. SUMMARY & CONCLUSION

The polluting effects of cremation (and other common funerary practices) are not the most severe problem facing the environment. They are, however, richly emblematic of society's collective miscalculation—or denial—when it comes to a fundamental equation of biological existence: without death, there can be no life.

Under this rubric, it makes no sense to burn a corpse with mercury fillings. Legislation is needed to advance public health goals by mandating stringent standards to reduce or eliminate cremercury. This would necessarily require additional research to craft practical, economical filtration and/or filling extraction practices. A comprehensive approach would also effectively educate the public about the danger of cremercury and about ways to avoid it, including alternatives like green burial and promession. In driving such change, the law can help to satisfy the growing demand for ecological disposition and to boost the economy. In turn, this would encourage the culture—broadly speaking—to look beyond adherence to tradition and to acknowledge our direct connection to the earth that sustains us.

*PHILIP DONALD BATCHELDER**

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[323] Seventy percent of Swedes are cremated, and one of the primary goals of promession's inventor was to develop a viable, ecological alternative to cremation. Telephone Interview with Susanne Wiigh-Masak, Founder, Promessa Found. (Aug. 30, 2007).

[324] Gill, supra note 261, at 27.

* 2009 J.D. Candidate, Golden Gate University School of Law, San Francisco, California. I am grateful to the many people who helped to inform and improve this Comment, including the students and faculty at Golden Gate University who supported my efforts. Special thanks to my courageous and lovely companion, Ms. Mary Mack. I dedicate this Comment to those people who are breaking taboos about death practices to encourage a shift to more sensible and ecological methods. In case anyone is wondering: I want to be freeze-dried and scattered in the leaves under a California buckeye tree. But not yet.