STATE OF CALIFORNIA — DEPARTMENT OF FINANCE

ECONOMIC AND FISCAL IMPACT STATEMENT Preliminary

(REGULATIONS AND ORDERS)

STD. 399 (REV. 12/2008)

See SAM Section 6601 - 6616 for Instructions and Code Citations

DEPARTMENT NAME	CONTACT PERSON	TELEPHONE NUMBER
Department of Toxic Substances Control	Larry Yurk	(916) 445-5640
DESCRIPTIVE TITLE FROM NOTICE REGISTER OR FORM 400		**NOTICE FILE NUMBER**
Mercury Thermostats Collection and Performance Requirements		Z

ECONOMIC IMPACT STATEMENT

A. ESTIMATED PRIVATE SECTOR COST IMPACTS (Include calculations and assumptions in the rulemaking record.)

1. Check the appropriate box(es) below to indicate whether this regulation:

- [x] a. Impacts businesses and/or employees
- [ ] b. Impacts small businesses
- [ ] c. Impacts jobs or occupations
- [ ] d. Impacts California competitiveness
- [ ] e. Imposes reporting requirements
- [ ] f. Imposes prescriptive instead of performance
- [ ] g. Impacts individuals
- [ ] h. None of the above (Explain below. Complete the Fiscal Impact Statement as appropriate.)

h. (cont.) _____

(If any box in Items 1 a through g is checked, complete this Economic Impact Statement.)

2. Enter the total number of businesses impacted: 30 Describe the types of businesses (Include nonprofits.): _____

The regulation impacts any thermostat manufacturer operating a collection program in California.

Enter the number or percentage of total businesses impacted that are small businesses: None

3. Enter the number of businesses that will be created: None eliminated: None

Explain: This regulation does not mandate the use of specific technologies , equipment or specify transportation procedures.

4. Indicate the geographic extent of impacts: [x] Statewide [ ] Local or regional (List areas.): _____

5. Enter the number of jobs created: None or eliminated: None Describe the types of jobs or occupations impacted: _____

6. Will the regulation affect the ability of California businesses to compete with other states by making it more costly to produce goods or services here?

[ ] Yes [x] No If yes, explain briefly: _____

B. ESTIMATED COSTS (Include calculations and assumptions in the rulemaking record.)

1. What are the total statewide dollar costs that businesses and individuals may incur to comply with this regulation over its lifetime? $ 2,916,638

a. Initial costs for a small business: $ None Annual ongoing costs: $ None Years: 10

b. Initial costs for a typical business: $ None Annual ongoing costs: $ None Years: 10

c. Initial costs for an individual: $ None Annual ongoing costs: $ None Years: 10

d. Describe other economic costs that may occur: Thermostat manufacturers will have an initial annual cost of $ 154,287

The cost for operating 10 years is estimated to be $2,916,638

ECONOMIC AND FISCAL IMPACT STATEMENT cont. (STD. 399, Rev. 12/2008)

2. If multiple industries are impacted, enter the share of total costs for each industry: No other industries are impacted.

3. If the regulation imposes reporting requirements, enter the annual costs a typical business may incur to comply with these requirements. (Include the dollar costs to do programming, record keeping, reporting, and other paperwork, whether or not the paperwork must be submitted.): $ _____

4. Will this regulation directly impact housing costs? ☐ Yes ☑ No If yes, enter the annual dollar cost per housing unit: _____ and the number of units: _____

5. Are there comparable Federal regulations? ☐ Yes ☑ No Explain the need for State regulation given the existence or absence of Federal regulations: _____

Enter any additional costs to businesses and/or individuals that may be due to State - Federal differences: $ _____

C. ESTIMATED BENEFITS (Estimation of the dollar value of benefits is not specifically required by rulemaking law, but encouraged.)

1. Briefly summarize the benefits that may result from this regulation and who will benefit: The proposed regulation assists in the reduction of mercury pollution with the aim of protecting public health and the environment.

2. Are the benefits the result of: ☐ specific statutory requirements, or ☐ goals developed by the agency based on broad statutory authority?

Explain: _____

3. What are the total statewide benefits from this regulation over its lifetime? $ None

D. ALTERNATIVES TO THE REGULATION (Include calculations and assumptions in the rulemaking record. Estimation of the dollar value of benefits is not specifically required by rulemaking law, but encouraged.)

1. List alternatives considered and describe them below. If no alternatives were considered, explain why not: Health and Safety Code section 25214.8.17 requires DTSC to establish performance requirements for collection of thermostats. Other alternatives were considered but least cost alternative would continue to expose the state to more mercury pollution and not meet the law.

2. Summarize the total statewide costs and benefits from this regulation and each alternative considered:

Regulation:	Benefit: $ Not Quantified	Cost: $ 2,916,638
Alternative 1:	Benefit: $	Cost: $
Alternative 2:	Benefit: $	Cost: $

3. Briefly discuss any quantification issues that are relevant to a comparison of estimated costs and benefits for this regulation or alternatives: _____

4. Rulemaking law requires agencies to consider performance standards as an alternative, if a regulation mandates the use of specific technologies or equipment, or prescribes specific actions or procedures. Were performance standards considered to lower compliance costs? ☑ Yes ☐ No

Explain: The regulations require thermostat manufacturers meet collection performance requirements establish by DTSC. The law mandates DTSC set these the performance requirements. The law does not require the use of specific technologies or equipment.

E. MAJOR REGULATIONS (Include calculations and assumptions in the rulemaking record.) Cal/EPA boards, offices, and departments are subject to the following additional requirements per Health and Safety Code section 57005.

ECONOMIC AND FISCAL IMPACT STATEMENT cont. (STD. 399, Rev. 12/2008)

1. Will the estimated costs of this regulation to California business enterprises exceed $10 million ? ☐ Yes ☑ No (If No, skip the rest of this section.)

2. Briefly describe each equally as an effective alternative, or combination of alternatives, for which a cost-effectiveness analysis was performed:

Alternative 1: _____

Alternative 2: _____

3. For the regulation, and each alternative just described, enter the estimated total cost and overall cost-effectiveness ratio:

Regulation: $ _____ Cost-effectiveness ratio: $ _____

Alternative 1: $ _____ Cost-effectiveness ratio: $ _____

Alternative 2: $ _____ Cost-effectiveness ratio: $ _____

FISCAL IMPACT STATEMENT

A. FISCAL EFFECT ON LOCAL GOVERNMENT (Indicate appropriate boxes1 through 6 and attach calculations and assumptions of fiscal impact for the current year and two subsequent Fiscal Years.)

☐ 1. Additional expenditures of approximately $ _____ in the current State Fiscal Year which are reimbursable by the State pursuant to Section 6 of Article XIII B of the California Constitution and Sections 17500 et seq. of the Government Code. Funding for this reimbursement:

☐ a. is provided in _____, Budget Act of _____ or Chapter _____, Statutes of _____

☐ b. will be requested in the _____ (FISCAL YEAR) Governor's Budget for appropriation in Budget Act of _____

☐ 2. Additional expenditures of approximately $ _____ in the current State Fiscal Year which are not reimbursable by the State pursuant to Section 6 of Article XIII B of the California Constitution and Sections 17500 et seq. of the Government Code because this regulation:

☐ a. implements the Federal mandate contained in _____

☐ b. implements the court mandate set forth by the _____

court in the case of _____ vs. _____

☐ c. implements a mandate of the people of this State expressed in their approval of Proposition No. _____ at the _____ (DATE) election;

☐ d. is issued only in response to a specific request from the _____

_____, which is/are the only local entity(s) affected;

☐ e. will be fully financed from the _____ (FEES, REVENUE, ETC.) authorized by Section

_____ of the _____ Code;

☐ f. provides for savings to each affected unit of local government which will, at a minimum, offset any additional costs to each such unit;

☐ g. creates, eliminates, or changes the penalty for a new crime or infraction contained in _____

☐ 3. Savings of approximately $ _____ annually.

☐ 4. No additional costs or savings because this regulation makes only technical, non-substantive or clarifying changes to current law regulations.

ECONOMIC AND FISCAL IMPACT STATEMENT cont. (STD. 399, Rev. 12/2008)

☑ 5. No fiscal impact exists because this regulation does not affect any local entity or program.

☐ 6. Other.

B. FISCAL EFFECT ON STATE GOVERNMENT (Indicate appropriate boxes 1 through 4 and attach calculations and assumptions of fiscal impact for the current year and two subsequent Fiscal Years.)

☐ 1. Additional expenditures of approximately $ _____ in the current State Fiscal Year. It is anticipated that State agencies will:

☐ a. be able to absorb these additional costs within their existing budgets and resources.

☐ b. request an increase in the currently authorized budget level for the _____ fiscal year.

☐ 2. Savings of approximately $ _____ in the current State Fiscal Year.

☑ 3. No fiscal impact exists because this regulation does not affect any State agency or program.

☐ 4. Other.

C. FISCAL EFFECT ON FEDERAL FUNDING OF STATE PROGRAMS (Indicate appropriate boxes1 through 4 and attach calculations and assumptions of fiscal impact for the current year and two subsequent Fiscal Years.)

☐ 1. Additional expenditures of approximately $ _____ in the current State Fiscal Year.

☐ 2. Savings of of approximately $ _____ in the current State Fiscal Year.

☑ 3. No fiscal impact exists because this regulation does not affect any federally funded State agency or program.

☐ 4. Other.

FISCAL OFFICER SIGNATURE		DATE 8-7-12
AGENCY SECRETARY [1] APPROVAL/CONCURRENCE	for MA	DATE 8-7-12
DEPARTMENT OF FINANCE [2] APPROVAL/CONCURRENCE	PROGRAM BUDGET MANAGER	DATE

1. *The signature attests that the agency has completed the STD.399 according to the instructions in SAM sections 6601-6616, and understands the impacts of the proposed rulemaking. State boards, offices, or department not under an Agency Secretary must have the form signed by the highest ranking official in the organization.*

2. *Finance approval and signature is required when SAM sections 6601-6616 require completion of Fiscal Impact Statement in the STD.399.*

Economic and Fiscal Impact Analysis:
Mercury Thermostat Collection and Performance Requirements
Department of Toxic Substances Control Reference Number R-2010-03

INTRODUCTION

Economic analyses of new regulations related to hazardous wastes generally examine the impacts of a rulemaking by comparing the difference between how wastes are managed before the proposed rule and how they are to be managed after the proposed regulations are adopted. In the case of mercury-added thermostat collection, this analysis is somewhat complicated because the management of mercury-added thermostat waste is currently addressed under existing universal waste regulations (California Code of Regulations title 22, chapter 23). In addition, the Mercury Thermostat Collection Act of 2008 (HSC section 25214.8.10 et seq) requires manufacturers, who sold mercury-added thermostats in California prior to January 1, 2006, to establish a thermostat collection program, pay the costs of transporting and recycling mercury thermostats, and conduct education and outreach on the law's requirements. The law also imposed new requirements on contractors and wholesalers. It required heating, ventilation and air conditioning (HVAC) and demolition contractors to transport thermostats to a collection site and required HVAC wholesalers to act as a collection site and to pay up to $25 each for thermostat collection bins. None of these costs result from the current rulemaking.

Health and Safety Code section 25214.8.17 directs the Department of Toxic Substances Control (DTSC) to adopt regulations that develop performance requirements to specify collection rates for out-of-service mercury-added thermostats and establish a methodology for calculating the number of out-of-service mercury-added thermostats becoming waste annually. Hence, the proposed regulations focus on the method for determining the number of out-of-service mercury-added thermostats that become waste annually and the annual performance requirement for the collection of mercury-added thermostats by manufacturers. To provide an accurate estimate of the economic and fiscal impacts over the long-term, this analysis assumes the baseline to be the current legislative and regulatory framework that exists if these proposed regulations are not adopted. To be clear,

1) The proposed regulations will not require anyone to handle an out-of-service mercury-added thermostat that is not already required to do so by statue. Nor do they change the requirements for universal waste handlers, transporters or destination facilities.
2) None of the 30 former manufacturers of mercury-added thermostats manufactures its products in California

The proposed regulations only establish performance requirements for activities in which these persons are already engaged.

This document presents estimates of the cost to comply with the proposed rules, including an estimate of the potential costs that manufacturers may incur to meet the performance requirements in these regulations for collecting out-of-service mercury-added thermostats. This document also includes an analysis of impacts on small businesses as required pursuant to Government Code 11346.5.

MERCURY THERMOSTAT COLLECTION RATE AND PERFORMANCE REQUIREMENTS

The regulations establish performance requirements that specify annual collection rates for manufacturers to meet or exceed. DTSC elected to establish a methodology for determining the number of out-of-service mercury-added thermostats becoming waste each year based on a report submitted to DTSC by the Thermostat Recycling Corporation (TRC). The report, *Study to Meet Requirements for State of California Thermostat Recycling Legislation. Mercury-Contaning Thermostats: Estimating Inventory and Flow from Existing Residential & Commercial Buildings* (SERA Report), summarizes the results of a statistically-valid survey of households and businesses across California, and was prepared by Skumatz Economic Research Associates (SERA) on behalf of the manufacturers of mercury-added thermostats, as required by section 25214.8.18 of the Health and Safety Code.

ENTITIES SUBJECT TO MERCURY THERMOSTAT COLLECTION RATE AND PERFORMANCE REQUIREMENTS

Approximately 30 manufacturers produced mercury-added thermostats and sold them in California prior to January 1, 2006. Nearly all of these manufacturers are represented by the Thermostat Recycling Corporation (TRC), a non-profit organization voluntarily founded by thermostat manufacturers in 1985 for the purpose of collecting and properly disposing of mercury-containing thermostats.

There are approximately 11,000 licensed C-20 heating, ventilation, and air conditioning (HVAC) contractors in California, as defined in section 832.20 of title 16 of the California Code of Regulations, and approximately 1,600 licensed C-21 demolition contractors in California, as defined in section 832.21 of title 16 of the California Code of Regulations. All of these businesses are potential handlers of out-of-service mercury-added thermostats and could be subject to these regulations. These contractors must already manage waste thermostats in accordance with the universal waste regulations adopted by DTSC pursuant to Chapter 6.5 of the California Health and Safety Code, which require delivery of waste mercury-containing thermostats to proper collection locations. Because the Health and Safety Code already requires contractors who remove out-of-service mercury-added thermostats to bring them to a collection location operating in compliance with DTSC's (existing) regulations the requirements on these contractors will not materially change as a result of the adoption of these proposed regulations. Because they do not impose new requirements on C-20 and C-21 contractors, these proposed regulations will have no economic impact on these businesses.

METHODOLOGY FOR ECONOMIC AND FISCAL IMPACT ANALYSIS

A) Estimating the Quantity of Mercury-Added Thermostats and Out-of-Service Mercury-Added Thermostats

Prior to 2008 neither the quantity of mercury-added thermostats in use, nor the number being replaced in California annually was well-characterized. As described earlier, section 25214.8.18 of

the Health and Safety Code required manufacturers to present to DTSC a survey plan and methodology for a survey to provide statistically valid data on the number of mercury-added thermostats that become waste annually in California. In 2009, the SERA report was completed and estimated the anticipated flow of mercury-containing thermostats each year for 25 years, starting with 2010. The "high" estimates assume that 100 percent of analog thermostats contain mercury (i.e., that all thermostats except digital models contain mercury). The "low" estimates are based on a small validation study, in which SERA visited 30 locations that had responded to the survey in order to validate their responses. Based on the survey and subsequent validation study, the SERA report estimated between 22 and 46 percent of thermostats currently installed in commercial buildings and between 27 and 47 percent of thermostats in residences contain mercury. There are about 1.4 million mercury-containing thermostats in the commercial sector (taking the midpoint of the high and low ranges) and about 5.8 million mercury-containing thermostats in California households, for a total of about 7.2 million (estimated range 5.1 - 9.3 million) statewide.

DTSC is adopting the "low" estimates of the SERA report as its methodology for calculating the number of mercury-added thermostats becoming waste each calendar year in the proposed regulations.

B) Estimating the Annual Collection Rate

The SERA report estimates that within twenty-five years of 2010, 82% of the estimated 5 to 9 million mercury-added thermostats will reach their expected useful service life, estimated at 27.5 years. Performance requirements in the proposed regulations are specified, incrementally, for the first five years: 2013 through 2017. The performance requirements for subsequent years through 2022 are set at a rate of 75 percent. Performance requirements beyond 2022 will be established in a future rulemaking and will be determined based on the manufacturers' success in meeting the first seven years' requirements.

The first five years' requirements are based on historical collections by the Thermostat Recycling Corporation (TRC) in a number of other states. In 2010, TRC programs in several small states collected more than 500 mercury thermostats per 100,000 population (500/100,000 = 0.005). If the manufacturers were able to achieve a comparable per capita collection rate in California in a given year, it would correspond to 0.005 x 37,000,000 = 185,000 thermostats (in 2010 the population in the state was 37 million). The performance requirements specified in proposed regulations are considerably more modest. The table below shows the absolute number of thermostats that the manufacturers would be required to collect in 2013 through 2022 and the number of thermostats per 100,000 population.

Performance Requirement for
Number of Thermostats Per 100,000

Year	Percent goal	Number of thermostats	Thermostats per 100,000 population
2013	30%	65,100	173
2014	45%	95,400	253
2015	55%	113,850	302
2016	65%	131,300	348
2017	75%	147,750	392
2018	75%	144,750	384
2019	75%	140,250	370
2020	75%	135,750	360
2021	75%	130,500	346
2022	75%	126,000	334

C) Assessing the Cost of Compliance with the Proposed Regulation

As described in the introduction, it is difficult to separate the cost of compliance only with the regulation from the costs associated with existing requirements for the management, collection and disposal of mercury-added thermostats. The number of thermostats that would become a waste in any given year is estimated, as seen in the SERA Report. The performance goals included in the proposed regulations are based on a these estimates beginning with a small percentage of the estimate and growing to a larger percentage as the collection programs' effectiveness improves gradually over time.

DTSC recognizes that manufacturers may incur some increased costs associated with meeting the specified performance requirements. A conservative estimate of the cost of compliance with the proposed regulation assumes that 100% of the mercury-added thermostats reflected in the performance goals result from the regulation and would not otherwise become wastes in the absence of regulation. DTSC can estimate the cost per thermostat of operating the collection program to derive this conservative calculation.

The cost for the California program has been estimated from the known costs of the national program activities after removing those costs not applicable to California activities. The TRC reports annual national program costs and three years of costs are depicted in the following table. As shown, although the costs of operating the program has increased over time, the number of thermostats collected has also increased, resulting in a lower cost per thermostat.

TRC 3-YR NATIONAL PROGRAM COST

	Activities	2009	2010	2011
Direct Costs	TRC - Staff and Administration	$248,066.00	$231,757.00	$255,617.00
	Recycling Costs	$222,755.00	$300,096.00	$299,877.00
	Insurance	$18,706.00	$17,771.00	$13,945.00
	New Collection Containers	$18,130.00	$18,219.00	$18,859.00
	Marketing & Outreach	$96,867.00	$76,696.00	$123,221.00
Other	Travel	$16,105.00	$28,809.00	$28,108.00
	Legal	No-Report Cost	No-Report Cost	$93,272.00
	Statutory Incentive Payments (not in CA)	$27,496.00	$40,380.00	$37,860.00
Number of Thermostat Collected		155,733	200,064	300,000
Totals		**$648,125.00**	**$713,728.00**	**$870,759.00**

Staff and administration are personnel requirements to run the national program. Recycling costs are those costs associated with disposal of the collected thermostats. Insurance is identified as pollution insurance for incidents. New collection containers are for replacement of damaged bins and to fill any additional requests for collection bins. The statutory incentive payment does not apply in California. DTSC assumes direct costs are those activities necessary to operate a program in California, namely, staff and administration, recycling costs, insurance, new collection containers, and marketing and outreach. All other costs are not included in the calculation of costs in California.

ESTIMATES OF DIRECT COST PER THERMOSTAT

	2009	2010	2011
Direct Costs (staff & administration, recycling costs, insurance, new collection containers, and marketing & outreach)	$604,524.00	$644,539.00	$711,519.00
TRC Annual Thermostat Collection	155,733	200,064	300,000
Direct Cost per Thermostat	**$3.88**	**$3.22**	**$2.37**

The following table provides an estimated range of cost for manufacturers to operate a California only mercury-added thermostat collection program for the next ten years, applying an estimated cost per thermostat to the annual performance requirements identified in these regulations. The actual costs will be determined by TRC as they implement their program to meet the annual performance requirements. It is important to note that these costs are likely to be an overstatement of the actual cost of the proposed regulation since they assume that 100% of the thermostat collection activity is attributable to the regulation.

ESTIMATES OF MERCURY-ADDED THERMOSTAT WASTE COLLECTION QUANTITIES AND COST

Year	Annual Performance Goals: "T"= Number of Thermostats Collected	Estimated Annual Costs per "T" Recycled	Estimated Annual California Collection Program Costs
2013 (1)	65,100	$2.37	$154,287
2014 (2)	95,400	$2.37	$226,098
2015 (3)	113,850	$2.37	$269,824
2016 (4)	131,300	$2.37	$311,181
2017 (5)	147,750	$2.37	$350,167
2018 (6)	144,750	$2.37	$343,057
2019 (7)	140,250	$2.37	$332,392
2020 (8)	135,750	$2.37	$321,727
2021 (9)	130,500	$2.37	$309,285
2022 (10)	126,000	$2.37	$298,620
Totals	1,230,650		$2,916,638

ESTIMATES FOR THE 399 FORM

A. Economic Impact: Statewide Cost Impacts On Businesses

As described earlier, existing statute already requires the manufacturers to operate a collection program and existing universal waste requirements already establish handling requirements for mercury-added thermostats. Because the performance requirements specified in the proposed regulation are based on estimates from the manufacturers of the amounts of mercury-added thermostats likely to become waste, the impact of the regulation on businesses in the state is likely to be small or negligible. DTSC estimates that the number of businesses affected will be approximately 30 manufacturers that have identified themselves as manufacturers that sold mercury-added thermostats in California prior to January 1, 2006. DTSC does not anticipate the creation of new businesses or jobs or the elimination of business or jobs. These regulations will not affect the ability of California businesses to compete with other states.

B. Economic Impact: Estimated Costs

These regulations establish a performance requirement that the manufacturers must meet, so manufacturers will need to work with handlers of waste mercury-added thermostats to achieve these goals. However, these performance requirements are based on proven performance by the manufacturers in other states, so DTSC anticipates the goal are reasonable. These regulations do not impose any additional governmental fees, charges or assessments on mercury-added thermostat manufacturers. Existing law requires the manufacturer to establish a collection program and these regulations establish the performance requirement for that program. There are no required

specifications for how the manufacturers will accomplish the performance requirements, so there are no mandated additional requirements for new equipment, additional staff, consultants, testing laboratory costs, or other professional services. These regulations require no additional costs associated with maintaining shipping, receiving and recordkeeping costs for the mercury-added thermostat manufacturers existing requirements of the Mercury Thermostat Collection Act of 2008.

These regulations do not generally affect the activities of heating, ventilation, and air-conditioning (HVAC) contractors or demolition contractors. The activities of these contractors are subject to existing laws and regulations.

C. Economic Impact: Estimated Benefits

As seen in the TRC national program cost data for 2009 through 2011, the cost per thermostat may decline as the number of thermostats collected increases. Some of this per unit cost decrease may be attributed to economies of scale and may apply to program costs in California as the annual percentage performance requirements increase over time. In addition, as the TRC implements the thermostat program in California, it may identify opportunities to reduce indirect and other costs associated with the national program, resulting in greater national efficiency and reduced national costs.

D. Economic Impact: Alternatives to These Regulations

DTSC has identified the following alternatives. DTSC has chosen the first of the three alternatives presented below

1. Manufacturer sponsored survey study and performance requirements: DTSC used the results of a manufacturer-sponsored study as the basis for its methodology for estimating the number of thermostats becoming waste annually. The study determined the anticipated flow rate of mercury-containing thermostats by year for 25 years starting in year 2010. The study used random and stratified samples; and indicated that there are approximately 1.4 million mercury-containing thermostats in the commercial sector and approximately 5.8 million mercury-containing thermostats in California households, for a total of approximately 7.2 million mercury-containing thermostats statewide (taking the mid-point of low and high estimates). The contractor performed a small-scale validation study consisting of 30 site visits to validate the accuracy of the survey responses. To develop the estimated numbers of thermostats becoming waste in each calendar year, SERA used a statistical “cumulative distribution and expected lifetime model, along with survey data on the distribution of ages of installed thermostats. SERA develop the estimate of the total market that would flow out in a given year. These results are tabulated in Table 1.5 of the SERA provides three sets of estimates of the number of thermostats becoming waste each year:

- A low estimate, which is based on data from a small-scale validation study by SERA
- A middle estimate, which that does not take the results of the validation study into account ; and

- A high estimate, which applies a 13.5 percent factor ("validation premium") to the middle estimate values, to account for the undercounting of thermostats by survey respondents seen in the validation study mentioned previously.

DTSC has determined that SERA's study was well-conducted and provided statistically valid data on the number of thermostats becoming waste annually. Therefore, DTSC is adopting the results of the study, as summarized in Table 1.5 of the SERA, as the methodology for these regulations. Due to the relatively small sample size in SERA's validation study and its geographical limitations (all site visits were in the San Francisco Bay area), DTSC has chosen to use SERA's low estimate, described above, in its methodology. While this conservative approach may underestimate the true number of out-of-service mercury-added thermostats becoming waste annually, DTSC has concluded that this approach is rigorous and defensible.. The annual collection rates for the manufacturers to collect mercury-added thermostats are expressed as percentages of thermostats collected based on these annual flow rate numbers. Performance requirements set in these regulations are based on proven performance in other states. After starting with very modest rates, subsequent years' performance requirements rise to eventually approximate performance rates in top performing states.

2. **Do Nothing:** DTSC rejected this option because HSC section 25214.8.17 requires DTSC to adopt regulations to establish collection rates and a methodology for determining the number of out-of-service mercury-added thermostats becoming waste annually. Mercury-added thermostats are a universal waste and doing nothing would limit DTSC's ability to achieve compliance with the universal waste requirements. To do nothing could potentially place Californians in jeopardy of increased exposure to mercury.

3. **Contractor Reporting Requirements**: This alternative was rejected because it placed the primary burden of the regulation on thousands of individual contractors, imposing a new contractor reporting requirement that would have represented a potentially sizeable financial burden on small businesses in California. Compliance rates would likely have been low, error rates would likely have been high, and the resources required of DTSC to effectively enforce a new administrative requirement on such a large number of individual businesses would have been considerable. Furthermore, this alternative contradicts the intent of the legislature in adopting an extended producer responsibility (EPR) law: that the responsibility and costs for collecting and properly managing out-of-service mercury-added thermostats should fall primarily to the manufacturers.

E. Economic Impact: Major Regulations

The proposed regulation is not considered to be a major regulation because it will not have an economic impact of more than $10,000,000 on California businesses.

Fiscal Effect on Local Governments

These regulations do not require local entities to undertake a new program or to provide an increased level of service in an existing program and therefore not state reimbursable.

Fiscal Impact on State Government
These regulations do not require state agencies to undertake a new program or to provide an increased level of service in an existing program. The cost to DTSC attributed to monitoring extended producer responsibility is absorbed as part of the current costs under the universal waste management program.

Fiscal Impact on Federal Funding of State Programs
These regulations do not implement federal mandates. Federal funding of state programs will not increase or decrease as the result of these regulations.

Conclusion

DTSC anticipates the proposed regulations will have an economic impact on a limited number of businesses—the manufacturers. While the manufacturers already fund TRC's efforts to collect out-of-service mercury-added thermostats in California and a number of other states, DTSC believes that TRC will be required to invest some additional resources in order to meet the collection rate goals established in these regulations. The proposed regulations will have a modest economic impact on approximately 30 manufacturers whose mercury thermostats were formerly sold in California. Nevertheless, DTSC has determined that the proposed regulation will not have a significant statewide adverse economic impact directly affecting businesses, including the ability to compete with businesses in other states, many of which have mercury thermostat collection requirements similar to California's.

1300 North 17th Street • Suite 1752 • Arlington, VA 22209

Thermostat Recycling Corporation

www.thermostat-recycle.org

April 1, 2012

VIA EMAIL

Ms. Debbie Raphael, Director
Department of Toxic Substances Control
10001 I Street
Sacramento, CA 95814

Subject: Thermostat Recycling Corporation's 2011 Annual Report for California

Dear Ms. Raphael:

Attached is TRC's annual collection report for calendar year 2011. TRC has made its best effort to provide a comprehensive report on its efforts to promote the collection program in California and improve the program's environmental outcomes. A copy of this report may be found on TRC's website at: http://www.thermostat-recycle.org/media/index.

While results are encouraging, much work remains. The program built upon 2010's growth and increased the number of thermostats recovered from California collection locations by nearly 50%.

TRC continues to aggressively market its program in California and the attached report describes a number of modifications to the program in an effort to increase the number of mercury switch thermostats recovered from California in 2012.

Sincere Regards,

Mark Tibbetts
Executive Director

Cc: TRC Member Representatives

Collection Data

Table 1: 2011 California Collections by Brand

	Thermostats	Switches	Lbs Mercury
Honeywell	13,732	28,465	176.48
White Rogers	1,994	2,717	16.85
GE	116	318	1.97
Bard	79	250	1.55
Burnham	9	19	0.12
Carrier	955	3,174	19.68
Chromalox	6	20	0.12
ClimateMaster	24	72	0.45
Crane	-	-	-
Empire Comfort	3	3	0.02
Goodman	33	75	0.47
WW Grainger	5	10	0.06
Hunter	3	3	0.02
Invensys	377	448	2.78
ITT	102	109	0.68
Lear Siegler	4	6	0.04
Lennox	166	346	2.15
Lux	336	410	2.54
Marley-Wylain	2	3	0.02
McQuay	33	99	0.61
Nordyne	27	76	0.47
PSG	23	53	0.33
Rheem	122	367	2.28
Sears	32	36	0.22
Taco	-	-	-
Thomas & Betts	1	2	0.01
TPI	3	6	0.04
Trane	247	788	4.89
Uponor	-	-	-
Valliant	-	-	-
York / JCI	90	275	1.71
Noms (orphans)	173	419	2.60
Whole Thermsotat Total	18,697	38,569	239
Switches (removed)		2,534	15.71
Switches		**41,103**	**254.84**
Total Thermostats			**19,927**

From California collection locations TRC recovered 255.84 pounds of mercury from 18,697 intact mercury thermostats and 2,534 mercury switches removed from thermostats.

Based upon 201l returns, TRC estimates there are 2.05 switches per thermostat recovered from California. The 2,534 switches likely represent an additional 1,230 thermostats.

TRC recovered 16,529 thermostats from HVAC wholesale distributor collection locations, 1,403 from HVAC contractors and 765 from HHW locations in California. TRC received no thermostats from California retail locations in 2011.

Waste Mercury-Added Thermostat Management

Bins with waste mercury-switch thermostats are received at the fulfillment/processing center in Golden Valley, Minnesota. The facility is owned and operated by Honeywell International under contract with TRC.

Bins are received at the loading dock and sent to the TRC processing area. The bin and plastic liner are opened and the contents are identified, sorted, and tallied. The following data is recorded for each bin returned and processed: bin number, business name (location name), city, state, zip code, date returned, number of thermostats and

mercury switches by manufacturer and any non-conforming material. The bin is returned to the location that sent it in with a new pre-paid address label within 72 hours of receipt. The thermostats are stored and staged in a plastic lined carton in a storage area for final processing. The containers are dated and processed in order received, first in-first out.

The containers are returned from the storage area to the TRC processing area to have the mercury switches removed from the plastic housing. Universal Waste Regulations require the disposal of waste within 12 months of generation. TRC's processor requires that the disposal occur within 6 months of generation and TRC follows the more stringent requirement. Small quantities of thermostats are removed from the container, which is then closed again, and placed at the switch removal workstation on a tray that contains any potential mercury spillage. The switches are removed from the thermostats and placed into a 2 quart container at the work station. In the event that a switch breaks and mercury spills the work area is designed to contain the spillage and the operators are trained in the clean-up and disposal of mercury. TRC processing area is equipped with special mercury vacuum cleaners and the work area is vacuumed at the end of the work day to assure that any spillage is cleaned up and not left to evaporate.

The 2 quart container is emptied into a special 55 gallon drum which is labeled and dated according to regulations. The drum is sealed with a band and is only opened when contents are being added to it. Special negative pressure venting assures any fumes are drawn away and vented when the drum is opened.

The 55 gallon drum is then shipped to Bethlehem Apparatus Corporation in Hellertown, Pennsylvania for final processing of the mercury switches. Bethlehem Apparatus meets or exceeds all local, state, federal regulations for the management of the product. Bethlehem's approvals for mercury recovery/recycling include:

- EPA - identification No. PAD002390961 (Bethlehem Apparatus Co., Inc.)
- EPA BDAT Requirement - satisfied by all recovery operations
- CERCLA (Comprehensive Environmental Response Compensation and Liability Act)
- Pennsylvania Department of Environmental Protection

The facilities' processing follows all EPA guidelines and regulations. TRC has a facility license from Hennepin County Minnesota for the operation of the TRC. Honeywell, Inc. has a Hazardous Waste Generator license from Hennepin County. All persons who handle mercury thermostats as part of the TRC operation receive training in the handling of Hazardous Waste and Universal Waste.

Program Education and Outreach

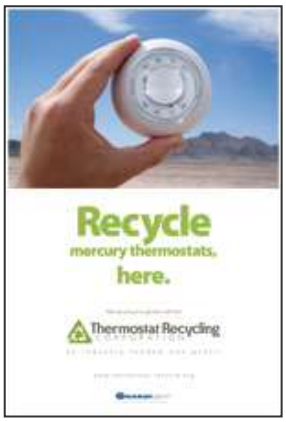
TRC marketing and promotion efforts targeted key audiences in California. TRC's objectives are to raise awareness of California's mercury thermostat law and to encourage the recycling of waste mercury thermostats. Below is a summary of many of the activities and the channels TRC utilized to support of this effort.

Development of Written Materials and Signage for Collection Points and Key stakeholders—TRC maintains on its website (www.thermostat-recycle.org) a Promotional

Toolkit which contains templates of a number of items for collection points to download and reproduce. In 2011 TRC **added three new** items to the toolkit. The new items include two posters and two versions of a point-of-sale card.

Exhibit 1: Examples of Toolkit Items

Poster



Advertisement

In addition to the templates on TRC's website, TRC placed the new window cling (ideal for the entrances of collection locations) into inventory along with the two new 11 x 17 posters and a postcard. TRC provided the cling and a copy of the "law" poster (or previous versions) to all California locations that ordered a new or additional bin in 2011. TRC actively promotes the availability of these items and will provide these materials to any participating collection location or HVAC contractor. These items are also distributed at trade shows. Finally, TRC provided copies of these materials to DTSC staff in support of the Department's educational efforts.

Exhibit 2: Examples of New Print Collateral

Poster (law version)

Window Cling

Wholesaler Recruitment/Engagement—All HVAC wholesale distributors with physical locations in California are required to act as a collection point for waste mercury thermostats and promote the availability of thermostat recycling at their location(s).

In an effort to increase the level of participation among California distributors TRC employed the following tactics:

- Direct engagement: TRC determined the most efficient and effective means of engaging distributors is not at the branch location level. TRC staff specifically targeted decision makers of distributors with multiple California locations in 2011. The primary message was it is the law and the Department is taking steps to enforce. TRC used industry meetings, member contacts, and other tactics to identify and contact decision makers at distributors.
- Creating competitive pressure: The distribution business is highly competitive and TRC used that to engage competitors. Marketing and media efforts highlighted certain distributors' participation in an effort to engage their competitors. Placing the logos of distributors on TRC's website is one of the best examples of this effort.
- Pushing contractors to collection locations: Paid and earned media emphasized to contractors to ask their distributors to collect; if distributors' customers request the service it is more likely they will offer it.

The following summarizes a few key projects conducted in 2011 targeting distributors.

- In partnership with Heating Airconditioning Refrigeration Distributors International (HARDI), TRC launched the inaugural *Mercury Thermostat Recycling Awards* in **May.** The awards were intended to incent participation in the program by recognizing the distributor(s) that recovered the most mercury thermostats and/or developed innovative strategies to promote the program at its location(s). The program was widely promoted by HARDI to its members and within the industry trade press. TRC also developed custom promotional materials for HARDI members and templates of those materials are available on TRC's website. The awards were presented at HARDI's annual meeting in **October.** California distributors **USACD** and **Baker Distributing** were among the winners.
- TRC placed a 5x7full-color insert in *HVACR Business* magazine (for greater detail see the advertising section below). TRC included the logos of several California distributors that have supported the program beyond the minimums in the law. California distributors **USACD, Baker Distributing, Goodman Distribution, and RE Michel** provided art to TRC.
- Following the Department's recommendation that TRC "pull" bins from collection locations, TRC sent correspondence (see Appendix A and B) to all California collection locations in **July** that had 1) never returned the bin or 2) had not returned the bin within the last 12 months.[1] TRC included a copy of its window cling sticker in the mailing to promote the availability of materials to participating collection locations.
- TRC added a scrolling bar with the logo of "collection partners" to its website. Several California distributors agreed to provide art to TRC.

[1] The impact of the mailing was significant as evidenced by the spike in returns in August.

Retailer Engagement— TRC continued to encourage large national retailers to participate in the program. During the implementation of San Louis Obispo County's retail ordinance, TRC again availed the program to large retailers.

Summary of Additional Education and Outreach by Channel

TRC conducted an array of activities intended to raise awareness of California's mercury thermostat disposal ban, mandatory HVAC contractor recycling, and the ease of compliance through TRC's collection program.

Website—TRC's maintains www.thermostat-recycle.org. The website contains participation forms, the previously mentioned outreach toolkit, safety and shipping information, media releases, and reports. The website includes a location search utility that provides for an easy search by zip-code of locations that have ordered TRC collection containers. TRC also promotes its national collection partners by scrolling their corporate logos on the homepage. In **September** TRC completed a *search engine optimization* (SEO) of its website. The objective of the SEO was to increase website traffic by making TRC easier to find on the internet. For instance if a person searches on the term "mercury thermostat recycling" or "thermostat recycling" the first search result in Google is TRC's website. The optimization nearly doubled TRC's monthly website traffic and also markedly shifted the manner in which the site is found, as a higher percentage are now finding TRC through "organic search."

Earned Media— TRC generated considerable positive media attention in 2011. TRC made a concerted effort in 2011 to generate stories on the program. Most notable was the four-page article in *The Air Conditioning, Heating, and Refrigeration News* (*The News*) which included a TRC provided table on mercury thermostat laws. *The News* is one of the leading industry publications.

Publication/Website	Month	Coverage	Readership/Reach
Air Conditioning, Heating & Refrigeration News	January	Article on thermostat recycling and TRC	111,000
RSES Journal	January	TRC & HARDI partnership	18,000
HVACR Business	April	Guest Column thermostat recycling	33,000
Indoor Comfort News	June		25,000
Air Conditioning Today	June	2010 TRC annual report	n/a
ACCA-Hot Air! Blog	July	TRC program	n/a
Wholesale Observations (HARDI)	July	TRC program	n/a
Demolition Magazine	July/August	Proper management of mercury	n/a
Indoor Comfort News	July	2010 TRC annual report	25,000
1800recycling.com	September	Recycling old thermostats	N/A
Contracting Business	October	Thermostat recycling awards	29,000
Indoor Comfort News	October	USACD thermostat recycling	n/a
Supply House Times	October	Thermostat recycling awards	12,800

The National Demolition Association (NDA) also ran a multi-page article authored by TRC's executive director on the proper management of mercury containing products found in residential and commercial structures in the **June/July** issue of *Demolition Magazine*. Select reprints of

these articles may be found on TRC's website at http://www.thermostat-recycle.org/media/index and have also been included in the Appendix.

Paid Advertising

ACCA Sponsorship—TRC sponsored the Air Conditioning Contractors of America (ACCA) 2011 Contracting Week in Nashville, Tennessee, **October** 18-21. The sponsorship included TRC's logo on attendee bags, the inclusion of TRC promotional materials in the bag, and TRC's logo on ACCA's website and signage at the event.

Trade channel web-based advertising— TRC developed new rotating banner advertisements and ran them (Exhibit 3) on the websites contractingbusiness.com (160x600 skyscraper) and hvac-talk.com (300x250 medium rectangle) during the months of **April, May, September** and **October**. Together, the websites average 1.8 million pages views and 280,000 unique visitors per month. HVAC-Talk.com, an online discussion community, boasts 122,000 registered users.

TRC strategically placed ads to coincide with the spring and fall HVAC business cycles. While the ads were featured, 701,528 impressions were delivered and 522 clicks on the advertisements were recorded. In September and October, clicks from HVAC-Talk.com ads accounted for 3% of TRC's website traffic.

Exhibit 3: Web Banner Advertisement (300 x 250 version)

Facebook and Google— TRC developed and deployed a Social Media strategy that leveraged the power of Google and the popularity of Facebook. The campaign, which ran from **September** through **December,** geo-targeted contractors and consumers in California and other states with mercury thermostat disposal bans in an effort to create awareness and increase thermostat collections.

Ads (See Exhibit 4) were developed with variable messages targeting both audiences. Advertisements appeared on Google search results pages after an individual searched terms related to TRC's mission (E.g. thermostat replacement, contracting recycling regulations, mercury thermostat recycling, programmable thermostats, etc.). Similarly, the Facebook

campaign targeted users over 18 who "like" industry-relevant topics or organizations (i.e. renovating, renovators, HVAC, HVAC Technicians, home repair, etc.)

The campaign resulted in over **340,000 impressions** on Google and **8.1 million impressions** on Facebook.

Exhibit 4: Examples of Google and Facebook Advertisements

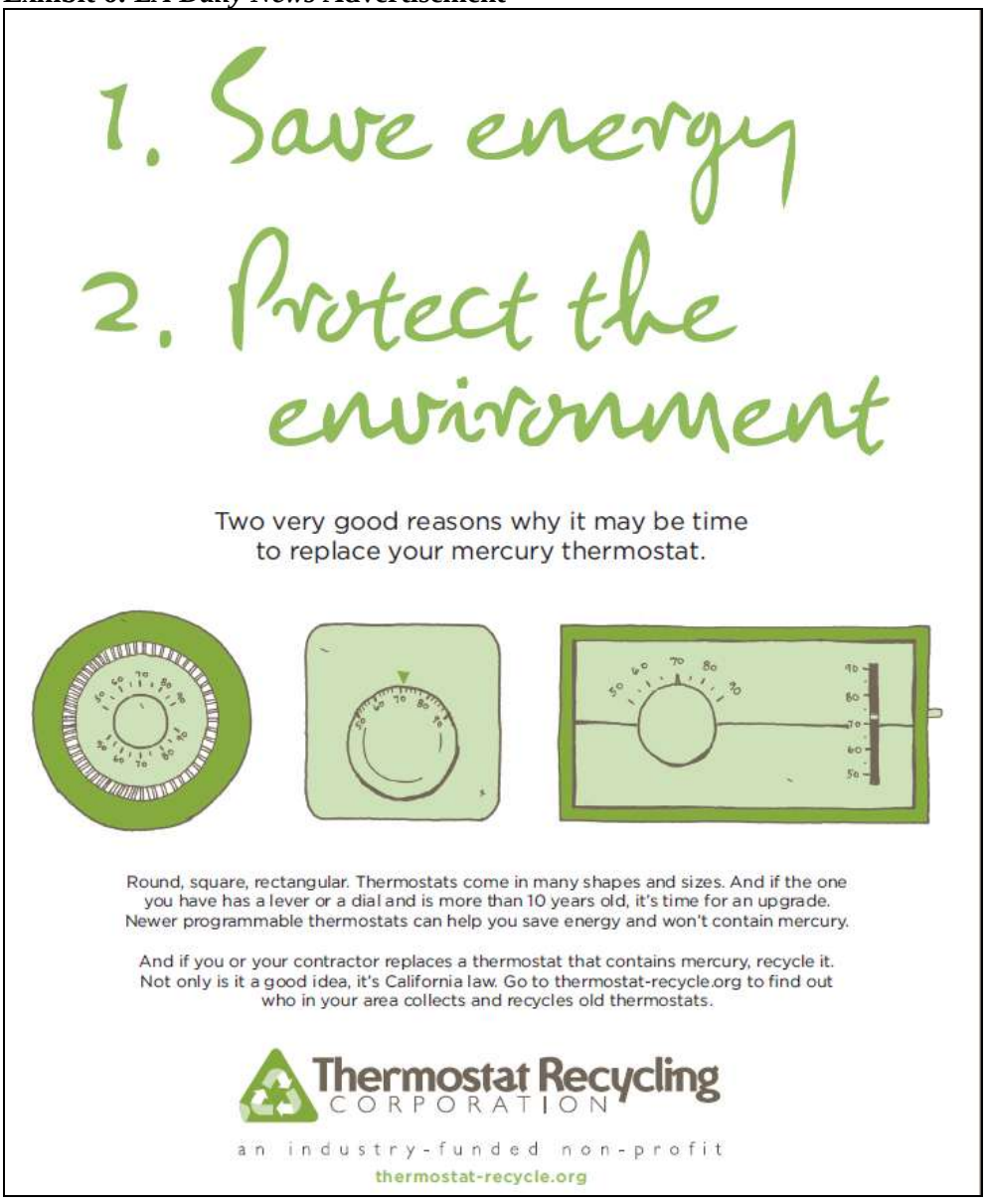
Tip-In Insert in HVAC Trade Press—TRC placed a 5x7 color insert in the **April** and **October** issues of *HVACR Business* (see Exhibit 5). The insert was included in issues received by approximately 12,000 subscribers in states with mercury thermostat disposal bans (including California). This enabled TRC to incorporate the message, "It's something you gotta do, because it's the law."

Exhibit 5: *HVACR Business* Insert

Additionally, as mentioned previously, TRC incorporated the logos of larger HVAC wholesale distributors on the backside of the card enabling contractors to quickly identify collection locations.

2011 IHACI Summer Energy Savings Guide, *Los Angeles Daily News*—TRC ran a full-page color advertisement in the guide (Exhibit 6). The guide reached over 400,000 readers of the *Daily News* and featured editorial and emphasis on quality installation practices, utility programs, and energy savings.

Exhibit 6: *LA Daily News* Advertisement



***Indoor Comfort News* Advertising—**TRC placed a quarter-page advertisement in the April, August, and November issues. *Indoor Comfort News* (*ICN*) has been published by the Institute of Heating and Air Conditioning Industries, Inc. (IHACI) since 1955 as a tool for attaining the trade association's goal of educating and promoting HVACR industry. *ICN's* audience includes

contractors, distributors, and manufacturers. Total circulation is 25,000 with a readership estimated over 100,000. **California circulation is approximately 17,000.**

Exhibit 7: *ICN* Advertisement

Tradeshows—TRC attended and exhibited at the following trade shows:

January 31-February 2: AHRExpo. Las Vegas. AHRExpo is the largest national trade show for the HVACR industry. TRC staff exhibited and promoted the program to HVAC contractors, manufacturers and distributors. The show had a total registered attendance of over 53,000.

February 15–17: Air Conditioning Contractors of America Indoor Air Expo, San Antonio, Texas. Representatives from over 200 HVAC contracting businesses attended the show.

March 1: Plumbing, Heating Cooling Contractors of Greater **Los Angles, California**. The "Flow Expo" was held at the Long Beach Convention Center and was attended by over 5,000 industry professionals.

May 22-26: Oil and Energy Service Professionals. Hershey, PA. This was OESP's annual convention and trade show. Nearly 2,700 HVAC professionals attended this show, which targeted service managers for HVAC firms that install and repair oil fired furnaces. TRC sponsored this event and its logo was displayed on event signage and website.

September 27-29: North American Hazardous Materials Management Association (NAHMMA), Portland, Oregon. This was NAHMMA's annual meeting. TRC exhibited and co-presented with a HARDI representative.

October 23-26: Heating Airconditioning and Refrigeration Distributors International (HARDI). Maui, Hawaii. TRC exhibited and participated in the "Booth Program," which provides for 1-on-1 sessions with senior executive staff from HARDI member companies. This event targeted representatives of approximately 80% of the wholesale market for HVACR products. TRC also presented the inaugural Thermostat Recycling Award to three HVACR distributors recognizing their support of the program.

November 16: Institute of Heating and Air Conditioning Industries, Inc. (IHACI) **Pasadena, California**. IHACI's trade show is attended by over 5,000 HVAC professionals; this show is the largest annual California trade show for the industry.

Public Service Announcement— TRC developed a new 30 second public service announcement in 2011 reflecting changes to the Energy Star program.

California

Did you know that by turning down your thermostat by ten to fifteen degrees for eight hours a day you could save ten percent a year on energy bills? That's according to The US Department of Energy. Installing a programmable thermostat makes this easy.

But remember many older thermostats contain mercury, and if you replace one, you must recycle it--it's California law. The good news is there are recycling locations all over the state. Go to thermostat dash recycle dot O R G to know more.

In **August** TRC requested (See Appendix D) radio stations serving the California market air the PSA. TRC monitored the airtime of the PSA through **December**. While the monitoring doesn't cover all stations within California, it does provide data on the frequency and audience for the PSA, particularly in larger markets.

Exhibit 8: PSA Summary:

Market	Stations	Audience Total
Bakersfield	KRAB, KDFO	5,600
Los Angles	KFRG	9,300
San Fransco	KLIV	74,400
San Deigo	KGB, KHTS, KIOZ, KMYI, KUSS	268,300
Fresno	KJZN	59,500
	Total	**417,100**

Stakeholder Outreach— TRC sent correspondence followed by a direct appeal via telephone (See Appendix E) to over **40** California trade groups in **August and September.** TRC targeted the California chapters of **Plumbing Heating Cooling Contractors Association** and **Sheet Metal and Air Conditioning Contractors' National Association.** TRC sent similar correspondence to the **Northern CA Mechanical Contractors Association** and the

Airconditioning, Refrigeration and Mechanical Contractors Association of Southern California. The California chapters of the **National Association of Residential Property Managers, Building Owners and Managers Association,** and **California Apartment Association** also received correspondence. Attached to the correspondence was a simple media release for use in association publications.

Operational Enhancements

TRC made a number of enhancements to its operations in 2011. Some enhancements include:

- To facilitate compliance with the one-year accumulation regulation and speed bin returns, TRC began including an adhesive label to record the accumulation start date in each container. TRC modified the label on the exterior of the bin to include the admonition to return bin within one year of receipt. TRC also updated instructions provided with every new and returned recycling container to explicitly require locations to record the accumulation start date and return the container within one year that date

- To improve customer service TRC began to directly handle customer service calls at program's HQ and included the new toll-free number and email address on instructions provided in each bin. This toll-free number was also provided in all correspondence to California distributors. The new number and email helpline was added to the footer and contact us page on TRC's website. TRC's goal is to return all calls and emails within one business day. TRC is also maintaining a log of all calls to ensure quality of service and that issues are resolved appropriately and in a timely manner.

- TRC updated the participation forms to capture more information from the collection location at the time the bin is ordered. **TRC is also now accepting orders via email and fax,** in an effort to both ease and speed up the order process. TRC also began explicitly offering to invoice bin fees. TRC found this is particularly helpful to larger distributors ordering multiple bins.

- Implemented a new data management system that provides for timely updates to collection location information on the website. TRC also modified the bin order process. **All orders are now initially processed by TRC staff at the corporate office.** This change results in faster processing of orders and fewer errors in processing and data entry.

- Engaged directly with several wholesale distributors with multiple locations in California to **update location information in the program's location database**. Maintaining accurate listings is an on-going and continual process.

- Updated its compliance assistance effort. As collections have increased, the frequency of bins with non-compliant materials has grown. **A new monitoring system was implemented increasing the frequency of contact to collection locations.** This effort has the additional benefit of pushing collateral to locations and updating location information.

Program Expenses

TRC is a national voluntary program that is also operating nine mandatory programs on behalf of its manufacturer members. As most promotional activities are run concurrently in multiple states, tracking and isolating expenses specifically to California is not possible. Below is a summary of TRC's national program expenses for 2011. A copy of TRC's 2010 IRS Form 990 is attached in the Appendix.

Exhibit 8: 2011 Program Administrative Expenses

TRC Staff and Administration	$	255,617
Recycling Costs	$	299,877
Insurance	$	13,945
Statutory Incentive Payments	$	37,860
New Collection Containers	$	18,859
Travel	$	28,108
Legal	$	93,272
Direct Expenses for Marketing & Outreach	$	123,221
Total	$	870,760

TRC expenses include:

- TRC Staff and Administration: Includes staff and consultants, general office expenses, telecommunications, and other administrative expenses. Includes staff labor costs to implement California program.
- Insurance: Pollution and liability insurance.
- Travel: All travel in 2011 includes travel to trade shows to promote program.
- Recycling Costs: All costs (including labor) associated with transporting, processing, and properly managing waste thermostats. Also includes cost associated with fulfilling new bin orders and data management.
- New Collection Containers: Direct cost for new containers ordered in 2011.
- Marketing/Outreach & Printing: Includes direct costs to develop and print program collateral; direct mail, national and state advertising, sponsorships, marketing consultants, some web and IT consulting, and other outreach activities. Marketing/Outreach does not include any TRC labor costs.

Comments/Recommendations/Modifications

California's mandatory collection program will shortly be entering its third year of operation. Using 2008 as the base year, the cumulative increase in collections is 167%[2].

[2] Comparison uses whole thermostats recovered, actual growth higher if the totals include switches removed from thermostats.

While these results are encouraging, TRC recognizes significant work remains. There are also a number of challenges. Some more significant challenges include:

- Wholesale distributor participation remains problematic. As an example, TRC staff visited approximately 20 wholesale distributor collection locations in the Los Angeles area in **November.** Not surprisingly, several were still not collecting (even if TRC had record of a bin order for that location). Surprisingly, many of the locations not collecting had also been visited by DTSC staff, and were still not collecting. TRC speculates that the issue with wholesaler compliance is not awareness of the law's requirements within the channel, but rather it simply may not be considered a priority by some.

  However, in the months following, the perceived threat of enforcement has had an impact. The channel is aware that the Department is conducting inspections and risk of substantial fines for non-compliance is now making this program a priority. Both bin orders and requests for materials spiked in the last several months.

- Maintaining accurate information on collection locations. Staff turnover at distributors is high and location information quickly becomes dated. Additionally, locations rarely inform TRC if they move, close, or lose a bin. If anything occurs, locations simply order a new bin. Moreover, typically after the initial bin order the only contact with the collection location is the return of a full bin. The return address information on the pre-printed label from Federal Express is limited and does not allow us to update contact information such as name or phone number[3].

- Contractor and/or technician compliance with the disposal ban remain below desired levels. However, we are certain the level of awareness of California law is high within the channel.

- Compliance with TRC storage and shipping policies. TRC's policies are intended to protect the health and safety of program participants in compliance with state and federal regulations. The return of items other than whole mercury thermostats is a continual issue and as collection rates increase, the amount of time and effort now devoted to compliance assistance is significant.

In response, TRC will among other things make the following modifications to its program in 2012:

- Expand and modify aspects of its marketing efforts to the trade channel in California. TRC will **mail over 32,000** postcards to California HVAC contractors in 2012. TRC is also expanding its advertising buy in *Indoor Comfort News* and will run a full-color 5x7 insert in 3 consecutive issues of the magazine. The buy will reach **17,000 California subscribers per issue.**
- **Test a consumer-facing web-based advertising** campaign in California. Noteworthy, the campaign's primary objective will not target consumers' recycling behavior; rather it will attempt to get consumers to affect their HVAC contractors' behavior.

[3] Many locations do not even complete the return label. Additionally, locations may provide a main phone number or it may be a direct line to the staff person that ordered the bin(s).

- Develop a postcard reminder encouraging collection locations to ship TRC collection containers within a year of the accumulation date and contact the program with address changes. **TRC's goal is to "touch" collection locations more frequently** and this is one of several tactics that will be employed and/or tested in 2012.
- TRC's new database and changes to its participation forms and bin order processing will assist in the accuracy of collection location information forms moving forward. However, 10 years of legacy data remains a problem. **Cleaning TRC's database** will be one of several projects for the program's summer intern.
- TRC does not see value in conducting site visits to all, or even a substantial minority of locations. Efforts in other states have merely proven what is known; many are not actively collecting. Site visits have not yielded growth in location participation, as staff at the location generally does not have the authority to order bins. Rather, TRC will continue with its strategy of engaging decision makers at the corporate offices of wholesale distributors. Efforts are underway (dependent on the voluntary participation of the distributor) to engage certain distributors with a significant market presence in California on cooperative marketing efforts. Working with HARDI, TRC is also modifying the Thermostat Recycling Awards program to **incent the active promotion of the program** by collection locations.
- Develop additional collateral to **assist HVAC contractors** in promoting their support of the program and incent their participation.
- **Develop two short training videos.** One will be for use by HVAC training instructors to show prior to HVAC training classes. The other will be for wholesale distributors to train staff on the program and TRC's storage and shipping policies (e.g. compliance with universal waste regulations.)

Appendix A: Sample of Correspondence to HVAC Wholesale Distributor locations in California

1300 North 17th Street • Suite 1752 • Arlington, VA 22209

Thermostat Recycling Corporation

www.thermostat-recycle.org

July 29, 2011

COPY

[redacted]
SAN JOSE, CA 95112-0000

Dear [redacted]

Legislation passed in 2008 requires all HVAC wholesale distributors with facilities in California to act as a collection point for waste mercury-switch thermostats. Thermostat Recycling Corporation thanks you for participating in its program and acting as a collection site for waste mercury thermostats.

According to our records, your location has not returned a bin within the last 12 months. I want to remind you that California universal waste regulations require that wastes such as mercury thermostats be stored for no longer than 12 months from the start date of accumulations. If you have thermostats in the container, please ship it to us promptly. We have included an extra pre-paid shipping label in case you misplaced the one provided with the container. If you have questions about the program, please contact us using the information provided below.

Additionally, TRC recently updated the promotional materials available to collection sites. TRC has both printed cling stickers and posters available at no cost. Templates of materials are available on TRC's website at thermostat-recycle.org. We have included a window cling as an example. Please consider using this collateral as it serves to promote the program while showcasing your business as an environmental steward.

Please feel free to contact me with any questions about the law or TRC's program. Call 888-266-0550 or email us at trc@thermostat-recycle.org

Regards,

Neisha Johnson

Appendix B: Sample of Correspondence to HVAC Wholesale Distributors in California

1200 North 17th Street - Suite 1702 - Arlington, VA 22209

Thermostat Recycling Corporation

www.thermostat-recycle.org

August 1, 2011

[redacted]
SAN DIEGO, CA 92110

Dear [redacted]

Legislation passed in 2008 requires all HVAC wholesale distributors with facilities in California to act as a collection point for waste mercury-switch thermostats. I want to remind you that California universal waste regulations require that wastes such as mercury thermostats be stored for no longer than 12 months from the start date of accumulations.

According to our records, your location received container(s) in order to comply with California law. However, to date, our records indicate we have never received any waste mercury thermostats from this location. It has come to our attention that the California Department of Toxic Substances Control (DTSC) has been conducting inspections of HVAC wholesalers and has begun enforcement of this regulation. If you have thermostats in the container, please ship it to us promptly.

If you no longer have a container or if you need another pre-paid shipping label, please contact Neisha Johnson immediately at 888-266-0550 or by email at trc@thermostat-recycle.org.

Regards,

Mark Tibbetts
Executive Director

Appendix C: NDA Article

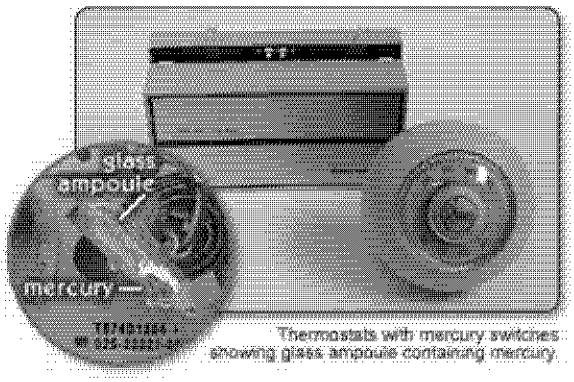
ENVIRONMENTAL **UPDATE**

SAFE HANDLING & DISPOSAL OF MERCURY-CONTAINING THERMOSTATS

Additional Regulations Affect Demolition Industry: Pre-Demolition Removal of Mercury-containing devices from Residential and Commercial Facilities

By MARK TIBBETTS
Executive Director
Thermostat Recycling Corporation
Arlington, VA

Mercury can be found in various devices in residential and commercial structures. If not managed properly at the end-of-life, these devices can break, releasing mercury into the environment. Prior to demolition, facilities should be inspected and these devices should be removed to ensure proper disposal.



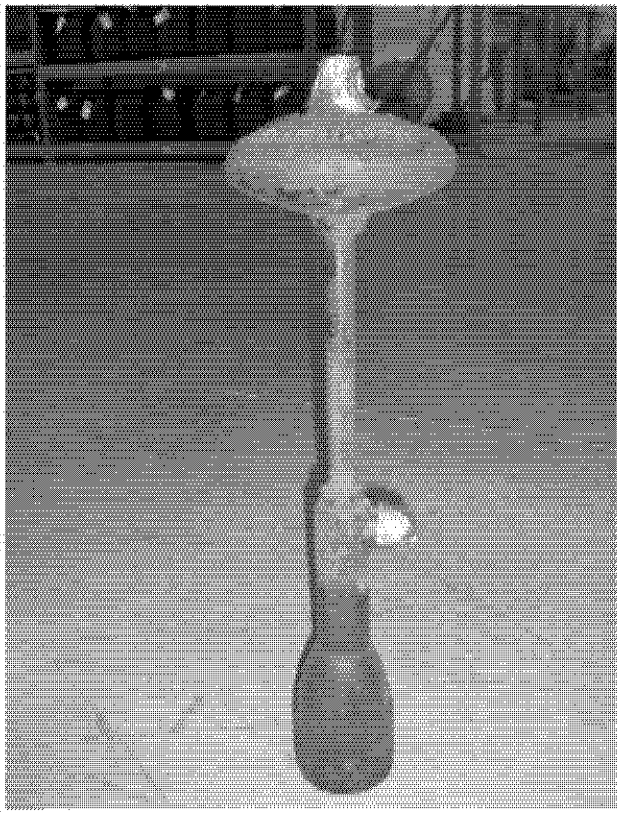
Thermostats with mercury switches showing glass ampoule containing mercury.

Mercury releases can present a serious environmental and health problem. Inhaling mercury vapors – which are colorless and odorless – can cause irreversible damage to the brain and kidneys. Even very small amounts of mercury (less than a gram) may cause adverse health effects.

The central nervous system, eyes and respiratory system can also be affected by mercury. Developing fetuses and children are the most sensitive to mercury exposure. Inhalation of mercury vapor is the most harmful means of exposure. Mercury can also enter the body through contact with the skin or by swallowing.

If released, mercury can pose a danger to people if not properly cleaned up and removed. It can easily spread by walking (tracking), sweeping or vacuuming, thereby presenting a potential health threat to others. Tracking throughout a building or into automobiles has spread mercury contamination to many other locations in many instances.

Health impacts will increase over time if the mercury is not properly removed. Mercury vapors are heavier than air and tend to remain near the floor or mercury source, but can get into the ventilation system and be spread throughout a house or business. Indoors, mercury vapors will accumulate in the air. Children five years of age and younger are considered to be particularly sensitive to the effects of mercury on the nervous



Mercury Seal Generator

system since their central nervous system is still developing. When pregnant women are exposed to mercury, the mercury can pass from the mother's body to the developing fetus; it can also be passed to a nursing infant through breast milk.

CLEANING UP MERCURY SPILLS

If released, clean-up costs are significant. It is not unusual for costs to range from $5,000 up to $300,000 for a single incident. Typical response to mercury releases in homes has consisted of relocating the residents and providing temporary housing, gathering visible mercury with a special vacuum, and heating and ventilating the house to drive off the harmful mercury vapors. In some instances, walls, carpeting and floors of houses have had to be removed because they were grossly contaminated. Personal possessions have also been discarded if they became contaminated and the mercury could not be removed. Contaminated materials are likely to be treated as hazardous waste and sent to a special landfill or a mercury retort facility. In a worst case scenario mercury is spread from the original release location into vehicles and other homes via shoes or clothing; spreading contamination and the scope of clean-up.

DEVICES THAT CONTAIN MERCURY

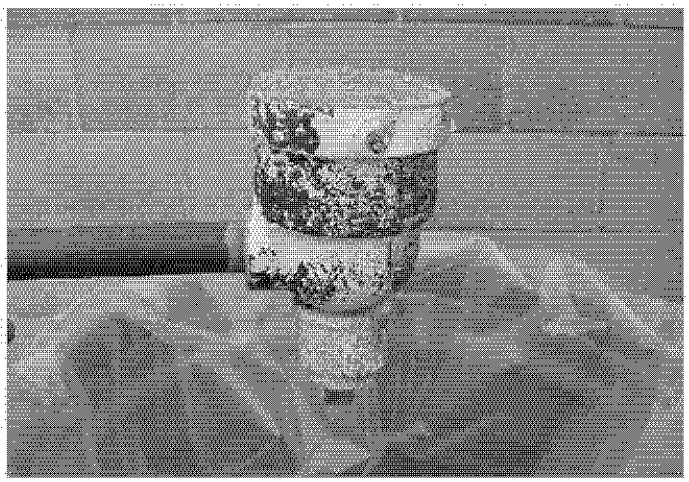
The three most common devices with significant amounts of mercury in them are mercury-switch thermostats, gas pressure regulators, and mercury pressure switches.

Facilities that were built prior to 1968 may have a mercury-containing gas pressure regulator adjacent to the gas meter. Most of these devices were manufactured and installed in the 1940s and 1950s. These devices contain approximately two teaspoons of mercury. Mercury spills have sometimes occurred during improper removal of these devices, causing a potentially significant health risk and resulting in costly cleanups.

Some older boiler heating systems have a mercury seal generator or mercury pressure switch(s). These devices may be found near the boiler or near a radiator on an upper floor. They can contain up to several fluid ounces of mercury. Mercury spills can occur as a result of improper removal of these devices. A spill can require a significant cleanup effort. In April 2011, EPA responded to a mercury spill at a home where an old 1920s boiler had been improperly removed, resulting in a spill of about four fluid ounces of mercury.

The most commonly found mercury-containing devices are mercury-switch thermostats. While it its more likely to find them in residential structures (single and multi-family), mercury-switch thermostats may also be

found in commercial and light-industrial facilities. Each thermostat contains up to 12 grams of elemental mercury and is one of the largest remaining reservoirs of mercury in residential buildings today.



Mercury Gas Regulator
(Courtesy of American Gas Association)

LEGAL ISSUES GOVERNING MANAGEMENT

The management of mercury-containing devices is regulated by both state and federal authorities.

The Superfund Law (Section 104 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 as amended, 42 U.S.C. Sec. 9604) provides the US Environmental Protection Agency (EPA) the legal authority to respond to mercury releases. The Superfund law also gives EPA the authority to identify the party responsible for the release, order those who improperly handle mercury to take appropriate response, and/or compel them to pay for a cleanup.

CERCLA also requires that any release amount above the quantity of one pound – one pound of mercury is approximately two tablespoons – must be reported to the National Response Center.

The Emergency Planning and Community Right-to-Know Act requires that any release of mercury greater than one pound be reported to the local emergency planning committee, state emergency response commission, or local response personnel by the owner/operator.

Disposal of these devices may also be regulated by federal law.

Additionally, many states also regulate the disposal of mercury-containing products. Twelve states specifically ban the disposal of mercury-containing products in solid waste. Additionally, some states, most notably California and Illinois, require demolition contractors to remove and properly manage all mercury-containing thermostats prior to a building's demolition.

PROPER MANAGEMENT

Facilities need to be inspected, and if mercury is present, these devices need to be removed and disposed of properly prior to a building's demolition. In the instance of mercury-containing gas pressure regulators, the removal needs to be coordinated with the gas utility.

In the case of mercury-switch thermostats, they can be managed as a universal waste, reducing costs associated with transport and disposal. In fact, the manufacturers of mercury-switch thermostats established a national program in which assumes all costs associated with the transport and disposal of whole mercury-switch thermostats. For more information on the management of waste mercury thermostats visit www.thermostat-recycle.org.

Appendix D: PSA cover letter

1200 North 17th Street • Suite 1752 • Arlington, VA 22209

Thermostat Recycling Corporation

www.thermostat-recycle.org

July 29, 2011

COPY

Dear Public Service Director,

The Thermostat Recycling Corporation (TRC) is a not-for-profit organization that facilitates the collection and proper disposal of mercury-containing thermostats. Voluntarily founded by thermostat manufacturers, TRC's mission is to promote the safe collection and proper disposal of mercury-containing thermostats.

Mercury is a potent neurotoxin and by properly disposing mercury thermostats by recycling them is the best means of keeping it from the environment. Many people are replacing their old thermostats to save energy and it is important for them to know that many old thermostats contain mercury and should be recycled.

We would appreciate any support you can give us, within your community, by running this Radio PSA, giving your audience a chance to help protect California's environment.

Thank You for your time and consideration,

Mark Tibbetts
Executive Director

Appendix E: Stakeholder Correspondence

1300 North 17th Street · Suite 1752 · Arlington, VA 22209

Thermostat Recycling Corporation

www.thermostat-recycle.org

September 19, 2011

COPY

Gary Schwenk
SMACNA
7677 Oakport St., #1100
Oakland, CA 94621

SUBJECT: IMPORTANT INFORMATION ON CALIFORNIA'S MERCURY THERMOSTAT DISPOSAL ACT

Dear Mr. Schwenk:

This letter is to remind you of a legal obligation in California that affects your members. The Mercury Thermostat Act, which went into effect in 2008, requires HVAC contractors to recycle all mercury-switch thermostats they removed from service. The law prohibits them from leaving them at the customer's premise.

The good news is that this law is very easy to comply with. Manufacturers must provide a no-cost recycling program in the state of California and every HVAC wholesale distributor in California is required to collect waste mercury thermostats. All contractors need to do is have their technicians hang-on to the mercury thermostats they remove from service and make arrangements to drop-off the waste thermostats at any HVAC wholesale distributor free-of-charge.

Thirty manufacturers are supporting the non-profit Thermostat Recycling Corporation (TRC) which is implementing and promoting the collection program in California and other states.

We are interested in working with your organization to increase awareness about the legal obligations of the HVAC industry and TRC's program. Currently less than 50% of all waste mercury thermostats are being recycled in California and it is critical for the HVAC industry to increase the number being recycled. The better this program performs decreases the likelihood of more onerous regulations on the HVAC industry. One has to look no further than the current rule-making by the Department of Toxic Substances Control's (DTSC) to see the risk to the HVAC industry in California.

We attached information on the program and we encourage you to share it with your members. We plan to follow-up with you to discuss ideas on further promoting the program and increasing HVAC contractor's participation in this program.

For more information, please call 703-841-3243 or email Neisha.johnson@nema.org. Additional information is also available at TRC's website at www.thermostat-recycle.org.

Sincerely,

Mark Tibbetts
Executive Director

1300 North 17th Street - Suite 1752 - Arlington, VA 22209

Thermostat Recycling Corporation

www.thermostat-recycle.org

September 19, 2011

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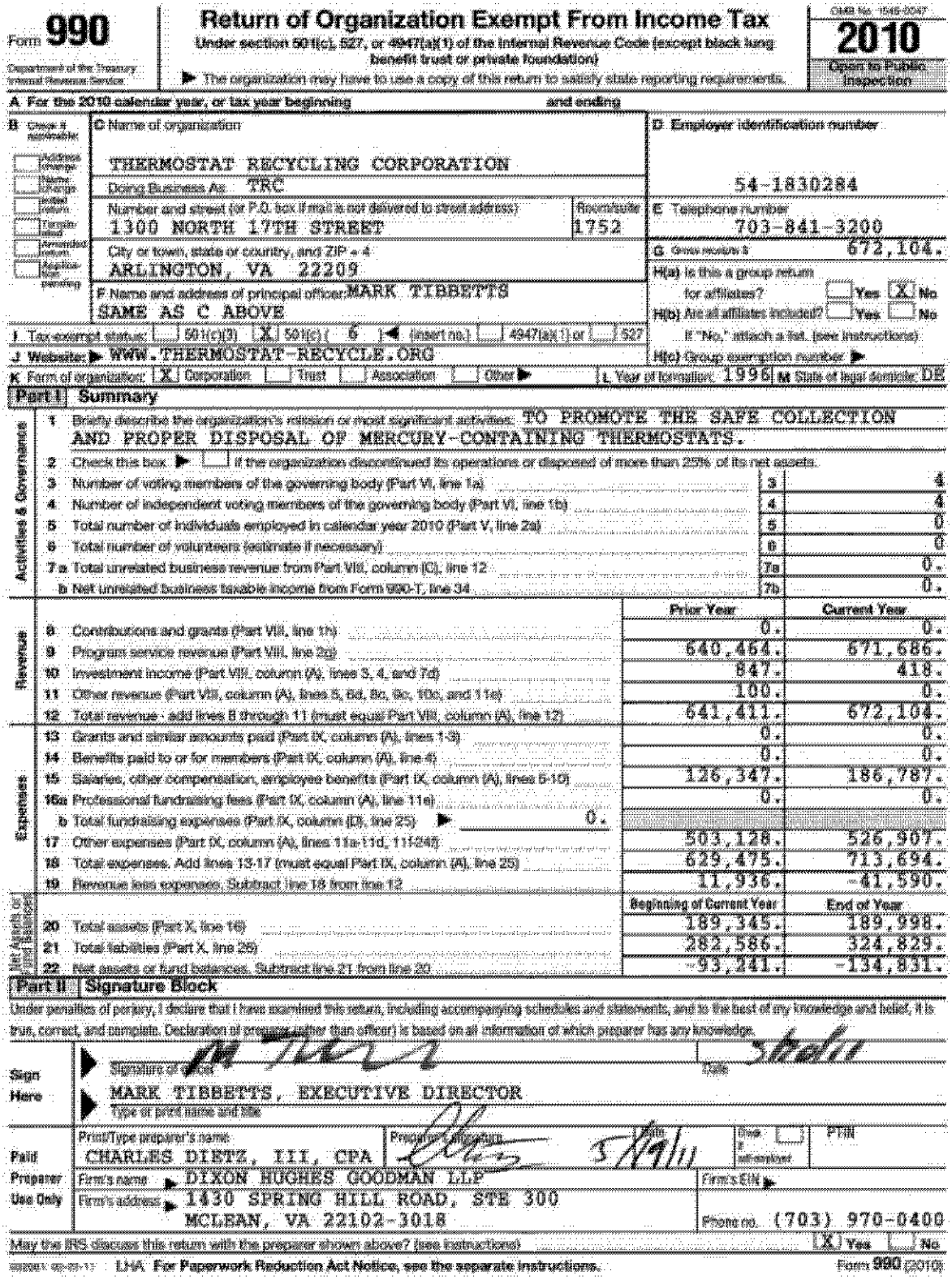
Sincerely,

Mark Tibbetts
Executive Director

This is printed on recycled paper

Appendix F: 990



Form **990** — Department of the Treasury, Internal Revenue Service

Return of Organization Exempt From Income Tax

Under section 501(c), 527, or 4947(a)(1) of the Internal Revenue Code (except black lung benefit trust or private foundation)

▶ The organization may have to use a copy of this return to satisfy state reporting requirements.

OMB No. 1545-0047

2010

Open to Public Inspection

A For the 2010 calendar year, or tax year beginning and ending

B Check if applicable: Address change; Name change; Initial return; Terminated; Amended return; Application pending

C Name of organization: THERMOSTAT RECYCLING CORPORATION

Doing Business As: TRC

Number and street (or P.O. box if mail is not delivered to street address): 1300 NORTH 17TH STREET

Room/suite: 1752

City or town, state or country, and ZIP + 4: ARLINGTON, VA 22209

D Employer identification number: 54-1830284

E Telephone number: 703-841-3200

G Gross receipts $: 672,104.

F Name and address of principal officer: MARK TIBBETTS SAME AS C ABOVE

H(a) Is this a group return for affiliates? Yes [X] No

H(b) Are all affiliates included? Yes [ ] No

If "No," attach a list. (see instructions)

H(c) Group exemption number ▶

I Tax-exempt status: [ ] 501(c)(3) [X] 501(c) (6) ◀ (insert no.) [ ] 4947(a)(1) or [ ] 527

J Website: ▶ WWW.THERMOSTAT-RECYCLE.ORG

K Form of organization: [X] Corporation [ ] Trust [ ] Association [ ] Other ▶

L Year of formation: 1996

M State of legal domicile: DE

Part I Summary

1 Briefly describe the organization's mission or most significant activities: TO PROMOTE THE SAFE COLLECTION AND PROPER DISPOSAL OF MERCURY-CONTAINING THERMOSTATS.

2 Check this box ▶ [ ] if the organization discontinued its operations or disposed of more than 25% of its net assets.

3 Number of voting members of the governing body (Part VI, line 1a)	3	4
4 Number of independent voting members of the governing body (Part VI, line 1b)	4	4
5 Total number of individuals employed in calendar year 2010 (Part V, line 2a)	5	0
6 Total number of volunteers (estimate if necessary)	6	0
7a Total unrelated business revenue from Part VIII, column (C), line 12	7a	0.
b Net unrelated business taxable income from Form 990-T, line 34	7b	0.

	Prior Year	Current Year
8 Contributions and grants (Part VIII, line 1h)	0.	0.
9 Program service revenue (Part VIII, line 2g)	640,464.	671,686.
10 Investment income (Part VIII, column (A), lines 3, 4, and 7d)	847.	418.
11 Other revenue (Part VIII, column (A), lines 5, 6d, 8c, 9c, 10c, and 11e)	100.	0.
12 Total revenue - add lines 8 through 11 (must equal Part VIII, column (A), line 12)	641,411.	672,104.
13 Grants and similar amounts paid (Part IX, column (A), lines 1-3)	0.	0.
14 Benefits paid to or for members (Part IX, column (A), line 4)	0.	0.
15 Salaries, other compensation, employee benefits (Part IX, column (A), lines 5-10)	126,347.	186,787.
16a Professional fundraising fees (Part IX, column (A), line 11e)	0.	0.
b Total fundraising expenses (Part IX, column (D), line 25) ▶ 0.		
17 Other expenses (Part IX, column (A), lines 11a-11d, 11f-24f)	503,128.	526,907.
18 Total expenses. Add lines 13-17 (must equal Part IX, column (A), line 25)	629,475.	713,694.
19 Revenue less expenses. Subtract line 18 from line 12	11,936.	-41,590.

	Beginning of Current Year	End of Year
20 Total assets (Part X, line 16)	189,345.	189,998.
21 Total liabilities (Part X, line 26)	282,586.	324,829.
22 Net assets or fund balances. Subtract line 21 from line 20	-93,241.	-134,831.

Part II Signature Block

Under penalties of perjury, I declare that I have examined this return, including accompanying schedules and statements, and to the best of my knowledge and belief, it is true, correct, and complete. Declaration of preparer (other than officer) is based on all information of which preparer has any knowledge.

Sign Here

Signature of officer — Date

MARK TIBBETTS, EXECUTIVE DIRECTOR

Type or print name and title

Paid Preparer Use Only

Print/Type preparer's name: CHARLES DIETZ, III, CPA — Preparer's signature — Date 5/9/11 — Check [ ] if self-employed — PTIN

Firm's name ▶ DIXON HUGHES GOODMAN LLP — Firm's EIN ▶

Firm's address ▶ 1430 SPRING HILL ROAD, STE 300 MCLEAN, VA 22102-3018 — Phone no. (703) 970-0400

May the IRS discuss this return with the preparer shown above? (see instructions) [X] Yes [ ] No

923001 09-09-10 LHA For Paperwork Reduction Act Notice, see the separate instructions. Form 990 (2010)

Form 990 (2010) THERMOSTAT RECYCLING CORPORATION 54-1830284 Page 2

Part III Statement of Program Service Accomplishments

Check if Schedule O contains a response to any question in this Part III ☐

1 Briefly describe the organization's mission:
NONE

2 Did the organization undertake any significant program services during the year which were not listed on the prior Form 990 or 990-EZ? ☐ Yes ☒ No
If "Yes," describe these new services on Schedule O.

3 Did the organization cease conducting, or make significant changes in how it conducts, any program services? ☐ Yes ☒ No
If "Yes," describe these changes on Schedule O.

4 Describe the exempt purpose achievements for each of the organization's three largest program services by expenses. Section 501(c)(3) and 501(c)(4) organizations and section 4947(a)(1) trusts are required to report the amount of grants and allocations to others, the total expenses, and revenue, if any, for each program service reported.

4a (Code:) (Expenses $ 620,299. including grants of $) (Revenue $)
TRC FACILITATES THE PROPER MANAGEMENT OF WASTE MERCURY THERMOSTATS BY PROVIDING RECYCLING CONTAINERS FOR THE COLLECTION AND TRANSPORT OF WASTE MERCURY THERMOSTATS TO ELIGIBLE COLLECTION SITES IN ALL US STATES, EXCEPT ALASKA AND HAWAII. TRC ALSO CONDUCTS AN EDUCATIONAL CAMPAIGN PROMOTING THE PROPER MANAGEMENT OF WASTE MERCURY THERMOSTATS. DURING 2010, TRC HAS COLLECTED OVER 200,000 MERCURY-CONTAINING THERMOSTATS. THIS TRANSLATES TO ALMOST 1,900 POUNDS OF MERCURY REMOVED OUT OF THE WASTE STREAM.

4b (Code:) (Expenses $ including grants of $) (Revenue $)

4c (Code:) (Expenses $ including grants of $) (Revenue $)

4d Other program services. (Describe in Schedule O.)
(Expenses $ including grants of $) (Revenue $)

4e **Total program service expenses** ▶ 620,299.

Form **990** (2010)

052002
12-21-10

Form 990 (2010) THERMOSTAT RECYCLING CORPORATION 54-1830284 Page 3

Part IV Checklist of Required Schedules

			Yes	No
1	Is the organization described in section 501(c)(3) or 4947(a)(1) (other than a private foundation)? *If "Yes," complete Schedule A*	1		X
2	Is the organization required to complete Schedule B, Schedule of Contributors?	2		X
3	Did the organization engage in direct or indirect political campaign activities on behalf of or in opposition to candidates for public office? *If "Yes," complete Schedule C, Part I*	3		X
4	**Section 501(c)(3) organizations.** Did the organization engage in lobbying activities, or have a section 501(h) election in effect during the tax year? *If "Yes," complete Schedule C, Part II*	4		
5	Is the organization a section 501(c)(4), 501(c)(5), or 501(c)(6) organization that receives membership dues, assessments, or similar amounts as defined in Revenue Procedure 98-19? *If "Yes," complete Schedule C, Part III*	5	X	
6	Did the organization maintain any donor advised funds or any similar funds or accounts where donors have the right to provide advice on the distribution or investment of amounts in such funds or accounts? *If "Yes," complete Schedule D, Part I*	6		X
7	Did the organization receive or hold a conservation easement, including easements to preserve open space, the environment, historic land areas, or historic structures? *If "Yes," complete Schedule D, Part II*	7		X
8	Did the organization maintain collections of works of art, historical treasures, or other similar assets? *If "Yes," complete Schedule D, Part III*	8		X
9	Did the organization report an amount in Part X, line 21; serve as a custodian for amounts not listed in Part X; or provide credit counseling, debt management, credit repair, or debt negotiation services? *If "Yes," complete Schedule D, Part IV*	9		X
10	Did the organization, directly or through a related organization, hold assets in term, permanent, or quasi-endowments? *If "Yes," complete Schedule D, Part V*	10		X
11	If the organization's answer to any of the following questions is "Yes," then complete Schedule D, Parts VI, VII, VIII, IX, or X as applicable.			
a	Did the organization report an amount for land, buildings, and equipment in Part X, line 10? *If "Yes," complete Schedule D, Part VI*	11a		X
b	Did the organization report an amount for investments - other securities in Part X, line 12 that is 5% or more of its total assets reported in Part X, line 16? *If "Yes," complete Schedule D, Part VII*	11b		X
c	Did the organization report an amount for investments - program related in Part X, line 13 that is 5% or more of its total assets reported in Part X, line 16? *If "Yes," complete Schedule D, Part VIII*	11c		X
d	Did the organization report an amount for other assets in Part X, line 15 that is 5% or more of its total assets reported in Part X, line 16? *If "Yes," complete Schedule D, Part IX*	11d		X
e	Did the organization report an amount for other liabilities in Part X, line 25? *If "Yes," complete Schedule D, Part X*	11e		X
f	Did the organization's separate or consolidated financial statements for the tax year include a footnote that addresses the organization's liability for uncertain tax positions under FIN 48 (ASC 740)? *If "Yes," complete Schedule D, Part X*	11f		X
12a	Did the organization obtain separate, independent audited financial statements for the tax year? *If "Yes," complete Schedule D, Parts XI, XII, and XIII*	12a		X
b	Was the organization included in consolidated, independent audited financial statements for the tax year? *If "Yes," and if the organization answered "No" to line 12a, then completing Schedule D, Parts XI, XII, and XIII is optional*	12b		X
13	Is the organization a school described in section 170(b)(1)(A)(ii)? *If "Yes," complete Schedule E*	13		X
14a	Did the organization maintain an office, employees, or agents outside of the United States?	14a		X
b	Did the organization have aggregate revenues or expenses of more than $10,000 from grantmaking, fundraising, business, and program service activities outside the United States? *If "Yes," complete Schedule F, Parts I and IV*	14b		X
15	Did the organization report on Part IX, column (A), line 3, more than $5,000 of grants or assistance to any organization or entity located outside the United States? *If "Yes," complete Schedule F, Parts II and IV*	15		X
16	Did the organization report on Part IX, column (A), line 3, more than $5,000 of aggregate grants or assistance to individuals located outside the United States? *If "Yes," complete Schedule F, Parts III and IV*	16		X
17	Did the organization report a total of more than $15,000 of expenses for professional fundraising services on Part IX, column (A), lines 6 and 11e? *If "Yes," complete Schedule G, Part I*	17		X
18	Did the organization report more than $15,000 total of fundraising event gross income and contributions on Part VIII, lines 1c and 8a? *If "Yes," complete Schedule G, Part II*	18		X
19	Did the organization report more than $15,000 of gross income from gaming activities on Part VIII, line 9a? *If "Yes," complete Schedule G, Part III*	19		X
20a	Did the organization operate one or more hospitals? *If "Yes," complete Schedule H*	20a		X
b	If "Yes" to line 20a, did the organization attach its audited financial statements to this return? **Note.** Some Form 990 filers that operate one or more hospitals must attach audited financial statements (see instructions)	20b		

Form **990** (2010)

932003
12-21-10

Form 990 (2010) THERMOSTAT RECYCLING CORPORATION 54-1830284 Page 4

Part IV Checklist of Required Schedules *(continued)*

			Yes	No
21	Did the organization report more than $5,000 of grants and other assistance to governments and organizations in the United States on Part IX, column (A), line 1? *If "Yes," complete Schedule I, Parts I and II*	21		X
22	Did the organization report more than $5,000 of grants and other assistance to individuals in the United States on Part IX, column (A), line 2? *If "Yes," complete Schedule I, Parts I and III*	22		X
23	Did the organization answer "Yes" to Part VII, Section A, line 3, 4, or 5 about compensation of the organization's current and former officers, directors, trustees, key employees, and highest compensated employees? *If "Yes," complete Schedule J*	23		X
24a	Did the organization have a tax-exempt bond issue with an outstanding principal amount of more than $100,000 as of the last day of the year, that was issued after December 31, 2002? *If "Yes," answer lines 24b through 24d and complete Schedule K. If "No", go to line 25*	24a		X
b	Did the organization invest any proceeds of tax-exempt bonds beyond a temporary period exception?	24b		
c	Did the organization maintain an escrow account other than a refunding escrow at any time during the year to defease any tax-exempt bonds?	24c		
d	Did the organization act as an "on behalf of" issuer for bonds outstanding at any time during the year?	24d		
25a	**Section 501(c)(3) and 501(c)(4) organizations.** Did the organization engage in an excess benefit transaction with a disqualified person during the year? *If "Yes," complete Schedule L, Part I*	25a		
b	Is the organization aware that it engaged in an excess benefit transaction with a disqualified person in a prior year, and that the transaction has not been reported on any of the organization's prior Forms 990 or 990-EZ? *If "Yes," complete Schedule L, Part I*	25b		
26	Was a loan to or by a current or former officer, director, trustee, key employee, highly compensated employee, or disqualified person outstanding as of the end of the organization's tax year? *If "Yes," complete Schedule L, Part II*	26		X
27	Did the organization provide a grant or other assistance to an officer, director, trustee, key employee, substantial contributor, or a grant selection committee member, or to a person related to such an individual? *If "Yes," complete Schedule L, Part III*	27		X
28	Was the organization a party to a business transaction with one of the following parties (see Schedule L, Part IV instructions for applicable filing thresholds, conditions, and exceptions):			
a	A current or former officer, director, trustee, or key employee? *If "Yes," complete Schedule L, Part IV*	28a		X
b	A family member of a current or former officer, director, trustee, or key employee? *If "Yes," complete Schedule L, Part IV*	28b		X
c	An entity of which a current or former officer, director, trustee, or key employee (or a family member thereof) was an officer, director, trustee, or direct or indirect owner? *If "Yes," complete Schedule L, Part IV*	28c		X
29	Did the organization receive more than $25,000 in non-cash contributions? *If "Yes," complete Schedule M*	29		X
30	Did the organization receive contributions of art, historical treasures, or other similar assets, or qualified conservation contributions? *If "Yes," complete Schedule M*	30		X
31	Did the organization liquidate, terminate, or dissolve and cease operations? *If "Yes," complete Schedule N, Part I*	31		X
32	Did the organization sell, exchange, dispose of, or transfer more than 25% of its net assets? *If "Yes," complete Schedule N, Part II*	32		X
33	Did the organization own 100% of an entity disregarded as separate from the organization under Regulations sections 301.7701-2 and 301.7701-3? *If "Yes," complete Schedule R, Part I*	33		X
34	Was the organization related to any tax-exempt or taxable entity? *If "Yes," complete Schedule R, Parts II, III, IV, and V, line 1*	34		X
35	Is any related organization a controlled entity within the meaning of section 512(b)(13)?	35		X
a	Did the organization receive any payment from or engage in any transaction with a controlled entity within the meaning of section 512(b)(13)? *If "Yes," complete Schedule R, Part V, line 2* ☐ Yes ☒ No			
36	**Section 501(c)(3) organizations.** Did the organization make any transfers to an exempt non-charitable related organization? *If "Yes," complete Schedule R, Part V, line 2*	36		
37	Did the organization conduct more than 5% of its activities through an entity that is not a related organization and that is treated as a partnership for federal income tax purposes? *If "Yes," complete Schedule R, Part VI*	37		X
38	Did the organization complete Schedule O and provide explanations in Schedule O for Part VI, lines 11 and 19? **Note.** All Form 990 filers are required to complete Schedule O	38	X	

Form 990 (2010)

032004
12-21-10

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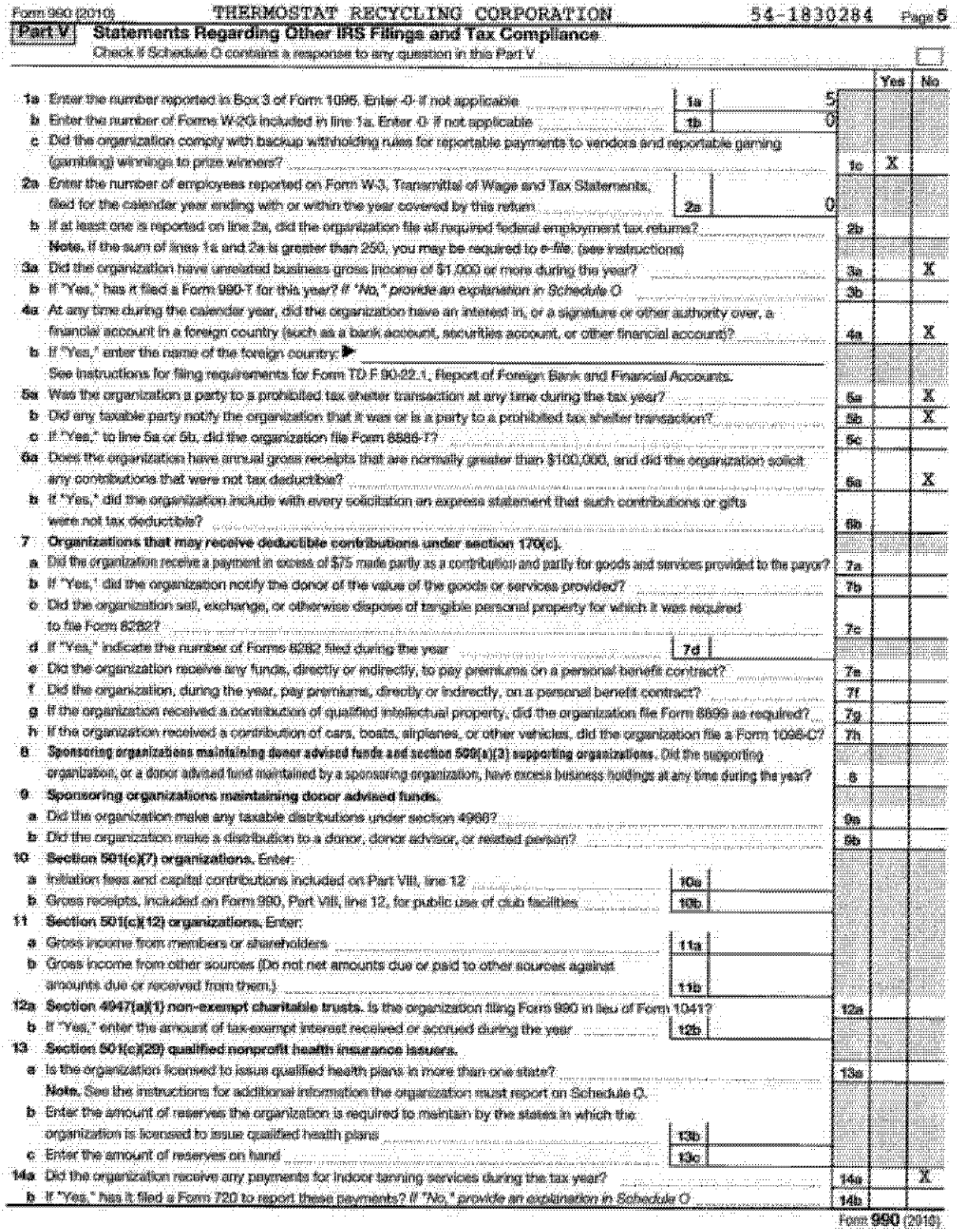

Form 990 (2010) THERMOSTAT RECYCLING CORPORATION 54-1830284 Page 5

Part V **Statements Regarding Other IRS Filings and Tax Compliance**

Check if Schedule O contains a response to any question in this Part V ☐

				Yes	No
1a	Enter the number reported in Box 3 of Form 1096. Enter -0- if not applicable	1a	5		
b	Enter the number of Forms W-2G included in line 1a. Enter -0- if not applicable	1b	0		
c	Did the organization comply with backup withholding rules for reportable payments to vendors and reportable gaming (gambling) winnings to prize winners?		1c	X	
2a	Enter the number of employees reported on Form W-3, Transmittal of Wage and Tax Statements, filed for the calendar year ending with or within the year covered by this return	2a	0		
b	If at least one is reported on line 2a, did the organization file all required federal employment tax returns?		2b		
	Note. If the sum of lines 1a and 2a is greater than 250, you may be required to e-file. (see instructions)				
3a	Did the organization have unrelated business gross income of $1,000 or more during the year?		3a		X
b	If "Yes," has it filed a Form 990-T for this year? *If "No," provide an explanation in Schedule O*		3b		
4a	At any time during the calendar year, did the organization have an interest in, or a signature or other authority over, a financial account in a foreign country (such as a bank account, securities account, or other financial account)?		4a		X
b	If "Yes," enter the name of the foreign country: ▶				
	See instructions for filing requirements for Form TD F 90-22.1, Report of Foreign Bank and Financial Accounts.				
5a	Was the organization a party to a prohibited tax shelter transaction at any time during the tax year?		5a		X
b	Did any taxable party notify the organization that it was or is a party to a prohibited tax shelter transaction?		5b		X
c	If "Yes," to line 5a or 5b, did the organization file Form 8886-T?		5c		
6a	Does the organization have annual gross receipts that are normally greater than $100,000, and did the organization solicit any contributions that were not tax deductible?		6a		X
b	If "Yes," did the organization include with every solicitation an express statement that such contributions or gifts were not tax deductible?		6b		
7	**Organizations that may receive deductible contributions under section 170(c).**				
a	Did the organization receive a payment in excess of $75 made partly as a contribution and partly for goods and services provided to the payor?		7a		
b	If "Yes," did the organization notify the donor of the value of the goods or services provided?		7b		
c	Did the organization sell, exchange, or otherwise dispose of tangible personal property for which it was required to file Form 8282?		7c		
d	If "Yes," indicate the number of Forms 8282 filed during the year	7d			
e	Did the organization receive any funds, directly or indirectly, to pay premiums on a personal benefit contract?		7e		
f	Did the organization, during the year, pay premiums, directly or indirectly, on a personal benefit contract?		7f		
g	If the organization received a contribution of qualified intellectual property, did the organization file Form 8899 as required?		7g		
h	If the organization received a contribution of cars, boats, airplanes, or other vehicles, did the organization file a Form 1098-C?		7h		
8	**Sponsoring organizations maintaining donor advised funds and section 509(a)(3) supporting organizations.** Did the supporting organization, or a donor advised fund maintained by a sponsoring organization, have excess business holdings at any time during the year?		8		
9	**Sponsoring organizations maintaining donor advised funds.**				
a	Did the organization make any taxable distributions under section 4966?		9a		
b	Did the organization make a distribution to a donor, donor advisor, or related person?		9b		
10	**Section 501(c)(7) organizations.** Enter:				
a	Initiation fees and capital contributions included on Part VIII, line 12	10a			
b	Gross receipts, included on Form 990, Part VIII, line 12, for public use of club facilities	10b			
11	**Section 501(c)(12) organizations.** Enter:				
a	Gross income from members or shareholders	11a			
b	Gross income from other sources (Do not net amounts due or paid to other sources against amounts due or received from them.)	11b			
12a	**Section 4947(a)(1) non-exempt charitable trusts.** Is the organization filing Form 990 in lieu of Form 1041?		12a		
b	If "Yes," enter the amount of tax-exempt interest received or accrued during the year	12b			
13	**Section 501(c)(29) qualified nonprofit health insurance issuers.**				
a	Is the organization licensed to issue qualified health plans in more than one state?		13a		
	Note. See the instructions for additional information the organization must report on Schedule O.				
b	Enter the amount of reserves the organization is required to maintain by the states in which the organization is licensed to issue qualified health plans	13b			
c	Enter the amount of reserves on hand	13c			
14a	Did the organization receive any payments for indoor tanning services during the tax year?		14a		X
b	If "Yes," has it filed a Form 720 to report these payments? *If "No," provide an explanation in Schedule O*		14b		

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Part VI Governance, Management, and Disclosure *For each "Yes" response to lines 2 through 7b below, and for a "No" response to line 8a, 8b, or 10b below, describe the circumstances, processes, or changes in Schedule O. See instructions.*

Check if Schedule O contains a response to any question in this Part VI ☒

Section A. Governing Body and Management

			Yes	No
1a	Enter the number of voting members of the governing body at the end of the tax year	1a 4		
b	Enter the number of voting members included in line 1a, above, who are independent	1b 4		
2	Did any officer, director, trustee, or key employee have a family relationship or a business relationship with any other officer, director, trustee, or key employee?	2		X
3	Did the organization delegate control over management duties customarily performed by or under the direct supervision of officers, directors or trustees, or key employees to a management company or other person?	3		X
4	Did the organization make any significant changes to its governing documents since the prior Form 990 was filed?	4		X
5	Did the organization become aware during the year of a significant diversion of the organization's assets?	5		X
6	Does the organization have members or stockholders?	6	X	
7a	Does the organization have members, stockholders, or other persons who may elect one or more members of the governing body?	7a	X	
b	Are any decisions of the governing body subject to approval by members, stockholders, or other persons?	7b		X
8	Did the organization contemporaneously document the meetings held or written actions undertaken during the year by the following:			
a	The governing body?	8a	X	
b	Each committee with authority to act on behalf of the governing body?	8b	X	
9	Is there any officer, director, trustee, or key employee listed in Part VII, Section A, who cannot be reached at the organization's mailing address? *If "Yes," provide the names and addresses in Schedule O*	9		X

Section B. Policies *(This Section B requests information about policies not required by the Internal Revenue Code.)*

			Yes	No
10a	Does the organization have local chapters, branches, or affiliates?	10a		X
b	If "Yes," does the organization have written policies and procedures governing the activities of such chapters, affiliates, and branches to ensure their operations are consistent with those of the organization?	10b		
11a	Has the organization provided a copy of this Form 990 to all members of its governing body before filing the form?	11a	X	
b	Describe in Schedule O the process, if any, used by the organization to review this Form 990.			
12a	Does the organization have a written conflict of interest policy? *If "No," go to line 13*	12a	X	
b	Are officers, directors or trustees, and key employees required to disclose annually interests that could give rise to conflicts?	12b		X
c	Does the organization regularly and consistently monitor and enforce compliance with the policy? *If "Yes," describe in Schedule O how this is done*	12c		X
13	Does the organization have a written whistleblower policy?	13	X	
14	Does the organization have a written document retention and destruction policy?	14	X	
15	Did the process for determining compensation of the following persons include a review and approval by independent persons, comparability data, and contemporaneous substantiation of the deliberation and decision?			
a	The organization's CEO, Executive Director, or top management official	15a	X	
b	Other officers or key employees of the organization	15b	X	
	If "Yes" to line 15a or 15b, describe the process in Schedule O. (See instructions.)			
16a	Did the organization invest in, contribute assets to, or participate in a joint venture or similar arrangement with a taxable entity during the year?	16a		X
b	If "Yes," has the organization adopted a written policy or procedure requiring the organization to evaluate its participation in joint venture arrangements under applicable federal tax law, and taken steps to safeguard the organization's exempt status with respect to such arrangements?	16b		

Section C. Disclosure

17 List the states with which a copy of this Form 990 is required to be filed ▶ CA , MT

18 Section 6104 requires an organization to make its Forms 1023 (or 1024 if applicable), 990, and 990-T (501(c)(3)s only) available for public inspection. Indicate how you make these available. Check all that apply.

☐ Own website ☐ Another's website ☒ Upon request

19 Describe in Schedule O whether (and if so, how), the organization makes its governing documents, conflict of interest policy, and financial statements available to the public.

20 State the name, physical address, and telephone number of the person who possesses the books and records of the organization. ▶

MARK TIBBETTS - 703-841-3200

1300 NORTH 17TH STREET, NO. 1752, ARLINGTON, VA 22209

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Part VII Compensation of Officers, Directors, Trustees, Key Employees, Highest Compensated Employees, and Independent Contractors

Check if Schedule O contains a response to any question in this Part VII ☐

Section A. Officers, Directors, Trustees, Key Employees, and Highest Compensated Employees

1a Complete this table for all persons required to be listed. Report compensation for the calendar year ending with or within the organization's tax year.

- List all of the organization's **current** officers, directors, trustees (whether individuals or organizations), regardless of amount of compensation. Enter -0- in columns (D), (E), and (F) if no compensation was paid.
- List all of the organization's **current** key employees, if any. See instructions for definition of "key employee."
- List the organization's five **current** highest compensated employees (other than an officer, director, trustee, or key employee) who received reportable compensation (Box 5 of Form W-2 and/or Box 7 of Form 1099-MISC) of more than $100,000 from the organization and any related organizations.
- List all of the organization's **former** officers, key employees, and highest compensated employees who received more than $100,000 of reportable compensation from the organization and any related organizations.
- List all of the organization's **former directors or trustees** that received, in the capacity as a former director or trustee of the organization, more than $10,000 of reportable compensation from the organization and any related organizations.

List persons in the following order: individual trustees or directors; institutional trustees; officers; key employees; highest compensated employees; and former such persons.

☐ Check this box if neither the organization nor any related organization compensated any current officer, director, or trustee.

(A) Name and Title	(B) Average hours per week (describe hours for related organizations in Schedule O)	(C) Position (check all that apply)						(D) Reportable compensation from the organization (W-2/1099-MISC)	(E) Reportable compensation from related organizations (W-2/1099-MISC)	(F) Estimated amount of other compensation from the organization and related organizations
		Individual trustee or director	Institutional trustee	Officer	Key employee	Highest compensated employee	Former			
DAN O'DOWNELL CHAIR	2.50	X		X				0.	0.	0.
JOHN SARTAIN VICE CHAIR/TREASURER	2.50	X		X				0.	0.	0.
ANDREW GRAHAM SECRETARY	2.50	X		X				0.	0.	0.
ROBERT JOHNSON DIRECTOR	2.50	X						0.	0.	0.
MARK TIBBETTS EXECUTIVE DIRECTOR	35.00			X				110,109.	0.	30,779.

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Part VII Section A. Officers, Directors, Trustees, Key Employees, and Highest Compensated Employees *(continued)*

(A) Name and title	(B) Average hours per week (describe hours for related organizations in Schedule O)	(C) Position (check all that apply)						(D) Reportable compensation from the organization (W-2/1099-MISC)	(E) Reportable compensation from related organizations (W-2/1099-MISC)	(F) Estimated amount of other compensation from the organization and related organizations
		Individual trustee or director	Institutional trustee	Officer	Key employee	Highest compensated employee	Former			
1b Sub-total ▶								110,109.	0.	30,779.
c Total from continuation sheets to Part VII, Section A ▶								0.	0.	0.
d Total (add lines 1b and 1c.) ▶								110,109.	0.	30,779.

2 Total number of individuals (including but not limited to those listed above) who received more than $100,000 in reportable compensation from the organization ▶ 1

		Yes	No
3	Did the organization list any former officer, director or trustee, key employee, or highest compensated employee on line 1a? If "Yes," complete Schedule J for such individual		X
4	For any individual listed on line 1a, is the sum of reportable compensation and other compensation from the organization and related organizations greater than $150,000? If "Yes," complete Schedule J for such individual		X
5	Did any person listed on line 1a receive or accrue compensation from any unrelated organization or individual for services rendered to the organization? If "Yes," complete Schedule J for such person		X

Section B. Independent Contractors

1 Complete this table for your five highest compensated independent contractors that received more than $100,000 of compensation from the organization.

(A) Name and business address	(B) Description of services	(C) Compensation
HONEYWELL INTERNATIONAL, 1985 DOUGLAS DRIVE, GOLDEN VALLEY, MN 55422-3992	ADMINISTRATIVE AND RECYCLING SERVICES	240,974.

2 Total number of independent contractors (including but not limited to those listed above) who received more than $100,000 in compensation from the organization ▶ 1

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Part VIII Statement of Revenue

			(A) Total revenue	(B) Related or exempt function revenue	(C) Unrelated business revenue	(D) Revenue excluded from tax under sections 512, 513, or 514
Contributions, gifts, grants and other similar amounts	1a Federated campaigns	1a				
	b Membership dues	1b				
	c Fundraising events	1c				
	d Related organizations	1d				
	e Government grants (contributions)	1e				
	f All other contributions, gifts, grants, and similar amounts not included above	1f				
	g Noncash contributions included in lines 1a-1f: $					
	h Total. Add lines 1a-1f	▶				
Program Service Revenue		Business Code				
	2a MEMBERSHIP DUES	900099	655,186.	655,186.		
	b SITE PARTICIPATION FEE	900099	16,500.	16,500.		
	c					
	d					
	e					
	f All other program service revenue					
	g Total. Add lines 2a-2f	▶	671,686.			
	3 Investment income (including dividends, interest, and other similar amounts)	▶	418.			418.
	4 Income from investment of tax-exempt bond proceeds	▶				
	5 Royalties	▶				
		(i) Real	(ii) Personal			
	6a Gross Rents					
	b Less: rental expenses					
	c Rental income or (loss)					
	d Net rental income or (loss)	▶				
		(i) Securities	(ii) Other			
	7a Gross amount from sales of assets other than inventory					
	b Less: cost or other basis and sales expenses					
	c Gain or (loss)					
	d Net gain or (loss)	▶				
	8a Gross income from fundraising events (not including $ ____ of contributions reported on line 1c). See Part IV, line 18	a				
	b Less: direct expenses	b				
	c Net income or (loss) from fundraising events	▶				
	9a Gross income from gaming activities. See Part IV, line 19	a				
	b Less: direct expenses	b				
	c Net income or (loss) from gaming activities	▶				
	10a Gross sales of inventory, less returns and allowances	a				
	b Less: cost of goods sold	b				
	c Net income or (loss) from sales of inventory	▶				
	Miscellaneous Revenue	Business Code				
	11a					
	b					
	c					
	d All other revenue					
	e Total. Add lines 11a-11d	▶				
	12 Total revenue. See instructions.	▶	672,104.	671,686.	0.	418.

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Part IX Statement of Functional Expenses

Section 501(c)(3) and 501(c)(4) organizations must complete all columns.
All other organizations must complete column (A) but are not required to complete columns (B), (C), and (D).

Do not include amounts reported on lines 6b, 7b, 8b, 9b, and 10b of Part VIII.	(A) Total expenses	(B) Program service expenses	(C) Management and general expenses	(D) Fundraising expenses
1 Grants and other assistance to governments and organizations in the U.S. See Part IV, line 21				
2 Grants and other assistance to individuals in the U.S. See Part IV, line 22				
3 Grants and other assistance to governments, organizations, and individuals outside the U.S. See Part IV, lines 15 and 16				
4 Benefits paid to or for members				
5 Compensation of current officers, directors, trustees, and key employees	140,888.			
6 Compensation not included above, to disqualified persons (as defined under section 4958(f)(1)) and persons described in section 4958(c)(3)(B)				
7 Other salaries and wages	45,899.			
8 Pension plan contributions (include section 401(k) and section 403(b) employer contributions)				
9 Other employee benefits				
10 Payroll taxes				
11 Fees for services (non-employees):				
a Management				
b Legal	7,349.			
c Accounting	9,845.			
d Lobbying				
e Professional fundraising services. See Part IV, line 17				
f Investment management fees				
g Other	4,981.			
12 Advertising and promotion	36,034.			
13 Office expenses	40,164.			
14 Information technology	19,107.			
15 Royalties				
16 Occupancy				
17 Travel	28,809.			
18 Payments of travel or entertainment expenses for any federal, state, or local public officials				
19 Conferences, conventions, and meetings				
20 Interest				
21 Payments to affiliates				
22 Depreciation, depletion, and amortization				
23 Insurance	17,771.			
24 Other expenses. Itemize expenses not covered above. (List miscellaneous expenses in line 24f. If line 24f amount exceeds 10% of line 25, column (A) amount, list line 24f expenses on Schedule O.)				
a HONEYWELL REIMBURSEMENT	300,096.			
b INCENTIVE PAYMENTS	40,380.			
c BINS EXPENSE	18,219.			
d SPONSORSHIP AND MEMBERS	4,152.			
e				
f All other expenses				
25 Total functional expenses. Add lines 1 through 24f	713,694.			
26 Joint costs. Check here ▶ ☐ if following SOP 98-2 (ASC 958-720). Complete this line only if the organization reported in column (B) joint costs from a combined educational campaign and fundraising solicitation				

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Part X Balance Sheet

			(A) Beginning of year		(B) End of year
Assets	1	Cash - non-interest-bearing	88,347.	1	66,595.
	2	Savings and temporary cash investments	100,673.	2	100,905.
	3	Pledges and grants receivable, net		3	
	4	Accounts receivable, net	325.	4	16,000.
	5	Receivables from current and former officers, directors, trustees, key employees, and highest compensated employees. Complete Part II of Schedule L		5	
	6	Receivables from other disqualified persons (as defined under section 4958(f)(1)), persons described in section 4958(c)(3)(B), and contributing employers and sponsoring organizations of section 501(c)(9) voluntary employees' beneficiary organizations (see instructions)		6	
	7	Notes and loans receivable, net		7	
	8	Inventories for sale or use		8	
	9	Prepaid expenses and deferred charges		9	6,498.
	10a	Land, buildings, and equipment: cost or other basis. Complete Part VI of Schedule D — 10a			
	b	Less: accumulated depreciation — 10b		10c	
	11	Investments - publicly traded securities		11	
	12	Investments - other securities. See Part IV, line 11		12	
	13	Investments - program-related. See Part IV, line 11		13	
	14	Intangible assets		14	
	15	Other assets. See Part IV, line 11		15	
	16	**Total assets.** Add lines 1 through 15 (must equal line 34)	189,345.	16	189,998.
Liabilities	17	Accounts payable and accrued expenses	282,586.	17	324,829.
	18	Grants payable		18	
	19	Deferred revenue		19	
	20	Tax-exempt bond liabilities		20	
	21	Escrow or custodial account liability. Complete Part IV of Schedule D		21	
	22	Payables to current and former officers, directors, trustees, key employees, highest compensated employees, and disqualified persons. Complete Part II of Schedule L		22	
	23	Secured mortgages and notes payable to unrelated third parties		23	
	24	Unsecured notes and loans payable to unrelated third parties		24	
	25	Other liabilities. Complete Part X of Schedule D		25	
	26	**Total liabilities.** Add lines 17 through 25	282,586.	26	324,829.
Net Assets or Fund Balances		**Organizations that follow SFAS 117, check here ▶ [X] and complete lines 27 through 29, and lines 33 and 34.**			
	27	Unrestricted net assets	-93,241.	27	-134,831.
	28	Temporarily restricted net assets		28	
	29	Permanently restricted net assets		29	
		Organizations that do not follow SFAS 117, check here ▶ [ ] and complete lines 30 through 34.			
	30	Capital stock or trust principal, or current funds		30	
	31	Paid-in or capital surplus, or land, building, or equipment fund		31	
	32	Retained earnings, endowment, accumulated income, or other funds		32	
	33	Total net assets or fund balances	-93,241.	33	-134,831.
	34	Total liabilities and net assets/fund balances	189,345.	34	189,998.

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Part XI Reconciliation of Net Assets

Check if Schedule O contains a response to any question in this Part XI ☐

1	Total revenue (must equal Part VIII, column (A), line 12)	1	672,104.
2	Total expenses (must equal Part IX, column (A), line 25)	2	713,694.
3	Revenue less expenses. Subtract line 2 from line 1	3	-41,590.
4	Net assets or fund balances at beginning of year (must equal Part X, line 33, column (A))	4	-93,241.
5	Other changes in net assets or fund balances (explain in Schedule O)	5	
6	Net assets or fund balances at end of year. Combine lines 3, 4, and 5 (must equal Part X, line 33, column (B))	6	-134,831.

Part XII Financial Statements and Reporting

Check if Schedule O contains a response to any question in this Part XII ☒

			Yes	No
1	Accounting method used to prepare the Form 990: ☐ Cash ☒ Accrual ☐ Other _____ If the organization changed its method of accounting from a prior year or checked "Other," explain in Schedule O.			
2a	Were the organization's financial statements compiled or reviewed by an independent accountant?	2a	X	
b	Were the organization's financial statements audited by an independent accountant?	2b		X
c	If "Yes" to line 2a or 2b, does the organization have a committee that assumes responsibility for oversight of the audit, review, or compilation of its financial statements and selection of an independent accountant? If the organization changed either its oversight process or selection process during the tax year, explain in Schedule O.	2c	X	
d	If "Yes" to line 2a or 2b, check a box below to indicate whether the financial statements for the year were issued on a separate basis, consolidated basis, or both: ☒ Separate basis ☐ Consolidated basis ☐ Both consolidated and separate basis			
3a	As a result of a federal award, was the organization required to undergo an audit or audits as set forth in the Single Audit Act and OMB Circular A-133?	3a		X
b	If "Yes," did the organization undergo the required audit or audits? If the organization did not undergo the required audit or audits, explain why in Schedule O and describe any steps taken to undergo such audits.	3b		

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SCHEDULE C (Form 990 or 990-EZ)

Department of the Treasury
Internal Revenue Service

Political Campaign and Lobbying Activities

For Organizations Exempt From Income Tax Under section 501(c) and section 527

▶ Complete if the organization is described below. ▶ Attach to Form 990 or Form 990-EZ.
▶ See separate instructions.

OMB No. 1545-0047

2010

Open to Public Inspection

If the organization answered "Yes," to Form 990, Part IV, line 3, or Form 990-EZ, Part V, line 46 (Political Campaign Activities), then

- Section 501(c)(3) organizations: Complete Parts I-A and B. Do not complete Part I-C.
- Section 501(c) (other than section 501(c)(3)) organizations: Complete Parts I-A and C below. Do not complete Part I-B.
- Section 527 organizations: Complete Part I-A only.

If the organization answered "Yes," to Form 990, Part IV, line 4, or Form 990-EZ, Part VI, line 47 (Lobbying Activities), then

- Section 501(c)(3) organizations that have filed Form 5768 (election under section 501(h)): Complete Part II-A. Do not complete Part II-B.
- Section 501(c)(3) organizations that have NOT filed Form 5768 (election under section 501(h)): Complete Part II-B. Do not complete Part II-A.

If the organization answered "Yes," to Form 990, Part IV, line 5 (Proxy Tax), or Form 990-EZ, Part V, line 35a (Proxy Tax), then

- Section 501(c)(4), (5), or (6) organizations: Complete Part III.

Name of organization	Employer identification number
THERMOSTAT RECYCLING CORPORATION	54-1830284

Part I-A Complete if the organization is exempt under section 501(c) or is a section 527 organization.

1 Provide a description of the organization's direct and indirect political campaign activities in Part IV.
2 Political expenditures ▶ $
3 Volunteer hours

Part I-B Complete if the organization is exempt under section 501(c)(3).

1 Enter the amount of any excise tax incurred by the organization under section 4955 ▶ $
2 Enter the amount of any excise tax incurred by organization managers under section 4955 ▶ $
3 If the organization incurred a section 4955 tax, did it file Form 4720 for this year? ☐ Yes ☐ No
4a Was a correction made? ☐ Yes ☐ No
b If "Yes," describe in Part IV.

Part I-C Complete if the organization is exempt under section 501(c), except section 501(c)(3).

1 Enter the amount directly expended by the filing organization for section 527 exempt function activities ▶ $
2 Enter the amount of the filing organization's funds contributed to other organizations for section 527 exempt function activities ▶ $
3 Total exempt function expenditures. Add lines 1 and 2. Enter here and on Form 1120-POL, line 17b ▶ $
4 Did the filing organization file Form 1120-POL for this year? ☐ Yes ☐ No
5 Enter the names, addresses and employer identification number (EIN) of all section 527 political organizations to which the filing organization made payments. For each organization listed, enter the amount paid from the filing organization's funds. Also enter the amount of political contributions received that were promptly and directly delivered to a separate political organization, such as a separate segregated fund or a political action committee (PAC). If additional space is needed, provide information in Part IV.

(a) Name	(b) Address	(c) EIN	(d) Amount paid from filing organization's funds. If none, enter -0-.	(e) Amount of political contributions received and promptly and directly delivered to a separate political organization. If none, enter -0-.

For Paperwork Reduction Act Notice, see the instructions for Form 990 or 990-EZ. Schedule C (Form 990 or 990-EZ) 2010
LHA

Schedule C (Form 990 or 990-EZ) 2010 THERMOSTAT RECYCLING CORPORATION 54-1830284 Page 2

Part II-A Complete if the organization is exempt under section 501(c)(3) and filed Form 5768 (election under section 501(h)).

A Check ▶ ☐ if the filing organization belongs to an affiliated group.

B Check ▶ ☐ if the filing organization checked box A and "limited control" provisions apply.

Limits on Lobbying Expenditures (The term "expenditures" means amounts paid or incurred.)	(a) Filing organization's totals	(b) Affiliated group totals
1a Total lobbying expenditures to influence public opinion (grass roots lobbying)		
b Total lobbying expenditures to influence a legislative body (direct lobbying)		
c Total lobbying expenditures (add lines 1a and 1b)		
d Other exempt purpose expenditures		
e Total exempt purpose expenditures (add lines 1c and 1d)		
f Lobbying nontaxable amount. Enter the amount from the following table in both columns.		

If the amount on line 1e, column (a) or (b) is:	The lobbying nontaxable amount is:
Not over $500,000	20% of the amount on line 1e.
Over $500,000 but not over $1,000,000	$100,000 plus 15% of the excess over $500,000.
Over $1,000,000 but not over $1,500,000	$175,000 plus 10% of the excess over $1,000,000.
Over $1,500,000 but not over $17,000,000	$225,000 plus 5% of the excess over $1,500,000.
Over $17,000,000	$1,000,000.

g Grassroots nontaxable amount (enter 25% of line 1f)		
h Subtract line 1g from line 1a. If zero or less, enter -0-		
i Subtract line 1f from line 1c. If zero or less, enter -0-		

j If there is an amount other than zero on either line 1h or line 1i, did the organization file Form 4720 reporting section 4911 tax for this year? ☐ Yes ☐ No

4-Year Averaging Period Under Section 501(h)

(Some organizations that made a section 501(h) election do not have to complete all of the five columns below. See the instructions for lines 2a through 2f on page 4.)

Lobbying Expenditures During 4-Year Averaging Period

Calendar year (or fiscal year beginning in)	(a) 2007	(b) 2008	(c) 2009	(d) 2010	(e) Total
2a Lobbying nontaxable amount					
b Lobbying ceiling amount (150% of line 2a, column(e))					
c Total lobbying expenditures					
d Grassroots nontaxable amount					
e Grassroots ceiling amount (150% of line 2d, column (e))					
f Grassroots lobbying expenditures					

Schedule C (Form 990 or 990-EZ) 2010

932042 09-02-11

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Schedule C (Form 990 or 990-EZ) 2010 THERMOSTAT RECYCLING CORPORATION 54-1830284 Page 3

Part II-B **Complete if the organization is exempt under section 501(c)(3) and has NOT filed Form 5768 (election under section 501(h)).**

		(a) Yes	(a) No	(b) Amount
1	During the year, did the filing organization attempt to influence foreign, national, state or local legislation, including any attempt to influence public opinion on a legislative matter or referendum, through the use of:			
a	Volunteers?			
b	Paid staff or management (include compensation in expenses reported on lines 1c through 1i)?			
c	Media advertisements?			
d	Mailings to members, legislators, or the public?			
e	Publications, or published or broadcast statements?			
f	Grants to other organizations for lobbying purposes?			
g	Direct contact with legislators, their staffs, government officials, or a legislative body?			
h	Rallies, demonstrations, seminars, conventions, speeches, lectures, or any similar means?			
i	Other activities? If "Yes," describe in Part IV			
j	Total. Add lines 1c through 1i			
2a	Did the activities in line 1 cause the organization to be not described in section 501(c)(3)?			
b	If "Yes," enter the amount of any tax incurred under section 4912			
c	If "Yes," enter the amount of any tax incurred by organization managers under section 4912			
d	If the filing organization incurred a section 4912 tax, did it file Form 4720 for this year?			

Part III-A **Complete if the organization is exempt under section 501(c)(4), section 501(c)(5), or section 501(c)(6).**

			Yes	No
1	Were substantially all (90% or more) dues received nondeductible by members?	1		X
2	Did the organization make only in-house lobbying expenditures of $2,000 or less?	2	X	
3	Did the organization agree to carryover lobbying and political expenditures from the prior year?	3		X

Part III-B ***Complete if the organization is exempt under section 501(c)(4), section 501(c)(5), or section 501(c)(6) if BOTH Part III-A, lines 1 and 2 are answered "No" OR if Part III-A, line 3 is answered "Yes."***

1	Dues, assessments and similar amounts from members	1	
2	Section 162(e) nondeductible lobbying and political expenditures (do not include amounts of political expenses for which the section 527(f) tax was paid).		
a	Current year	2a	
b	Carryover from last year	2b	
c	Total	2c	
3	Aggregate amount reported in section 6033(e)(1)(A) notices of nondeductible section 162(e) dues	3	
4	If notices were sent and the amount on line 2c exceeds the amount on line 3, what portion of the excess does the organization agree to carryover to the reasonable estimate of nondeductible lobbying and political expenditure next year?	4	
5	Taxable amount of lobbying and political expenditures (see instructions)	5	

Part IV **Supplemental Information**

Complete this part to provide the descriptions required for Part I-A, line 1; Part I-B, line 4; Part I-C, line 5; and Part II-B, line 1. Also, complete this part for any additional information.

Schedule C (Form 990 or 990-EZ) 2010

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SCHEDULE O (Form 990 or 990-EZ)
Department of the Treasury
Internal Revenue Service

Supplemental Information to Form 990 or 990-EZ

Complete to provide information for responses to specific questions on Form 990 or 990-EZ or to provide any additional information.
▶ Attach to Form 990 or 990-EZ.

OMB No. 1545-0047
2010
Open to Public Inspection

Name of the organization: THERMOSTAT RECYCLING CORPORATION

Employer identification number: 54-1830284

FORM 990, PART VI, SECTION A, LINE 6: THE INITIAL MEMBERS OF THIS CORPORATION SHALL BE GENERAL ELECTRIC CORPORATION, WHITE-RODGERS CORPORATION, AND HONEYWELL INC. EACH SUCH CORPORATION SHALL BE DEEMED AN ORIGINAL MEMBER OF THE CORPORATION, AND ALL THREE CORPORATIONS MAY BE REFERRED TO COLLECTIVELY IN THE BY-LAWS AS THE ORIGINAL MEMBERS.

FROM TIME TO TIME, THE BOARD OF DIRECTORS MAY INVITE OTHER THERMOSTAT MANUFACTURERS TO PARTICIPATE AS MEMBERS IN THE CORPORATION. SUCH A CORPORATION SHALL BECOME A MEMBER ONLY UPON PAYMENT OF FEES AS PROVIDED UNDER ARTICLE VII OF THE BY-LAWS.

FORM 990, PART VI, SECTION A, LINE 7A: THERE SHALL BE A NOMINATING COMMITTEE OF THE BOARD OF DIRECTORS, WHICH SHALL CONSIST OF THREE DIRECTORS, ALL OF WHOM ARE EMPLOYED BY ORIGINAL MEMBERS. ONE MONTH PRIOR TO THE ANNUAL MEETING OF THE CORPORATION, THE NOMINATING COMMITTEE SHALL APPROVE A SLATE OF NOMINEES MEETING THE QUALIFICATIONS SET FORTH IN SECTION 2 TO BE SUBMITTED TO THE MEMBERS FOR ELECTION AT THE ANNUAL MEETING.

FORM 990, PART VI, SECTION B, LINE 11: A COPY OF FORM 990 IS PROVIDED TO ALL GOVERNING MEMBERS BEFORE IT IS FILED. A REASONABLE AMOUNT OF TIME IS ALLOWED FOR THE GOVERNING MEMBERS TO REVIEW THE FORM 990 AND PROVIDE COMMENTS.

FORM 990, PART VI, SECTION B, LINE 15: COMPENSATION IS ESTABLISHED BY THE NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA). NEMA UTILIZES INDEPENDENT CONSULTANTS AND COMPARABILITY DATA, AMONG OTHER METHODS, TO

Name of the organization: THERMOSTAT RECYCLING CORPORATION | Employer identification number: 54-1830284

DETERMINE THE COMPENSATION OF THE ORGANIZATION'S EXECUTIVE DIRECTOR.

FORM 990, PART VI, SECTION C, LINE 19: TRC MAKES ITS GOVERNING DOCUMENTS, CONFLICT OF INTEREST POLICY, AND FINANCIAL STATEMENTS AVAILABLE TO THE PUBLIC UPON REQUEST (VIA E-MAIL OR MAIL).

PART XII, LINE 2C - THIS PROCESS HAS REMAINED UNCHANGED FROM THE PRIOR YEAR.

Form **8868** (Rev. January 2011)
Department of the Treasury
Internal Revenue Service

Application for Extension of Time To File an Exempt Organization Return

▶ File a separate application for each return.

OMB No. 1545-1709

- If you are filing for an **Automatic 3-Month Extension, complete only Part I** and check this box ▶ [X]
- If you are filing for an **Additional (Not Automatic) 3-Month Extension, complete only Part II** (on page 2 of this form).

Do not complete Part II unless you have already been granted an automatic 3-month extension on a previously filed Form 8868.

Electronic filing (e-file). You can electronically file Form 8868 if you need a 3-month automatic extension of time to file (6 months for a corporation required to file Form 990-T), or an additional (not automatic) 3-month extension of time. You can electronically file Form 8868 to request an extension of time to file any of the forms listed in Part I or Part II with the exception of Form 8870, Information Return for Transfers Associated With Certain Personal Benefit Contracts, which must be sent to the IRS in paper format (see instructions). For more details on the electronic filing of this form, visit *www.irs.gov/efile* and click on *e-file for Charities & Nonprofits*.

Part I **Automatic 3-Month Extension of Time.** Only submit original (no copies needed).

A corporation required to file Form 990-T and requesting an automatic 6-month extension - check this box and complete Part I only ▶ [ ]

All other corporations (including 1120-C filers), partnerships, REMICs, and trusts must use Form 7004 to request an extension of time to file income tax returns.

Type or print	Name of exempt organization	Employer identification number
File by the due date for filing your return. See instructions.	THERMOSTAT RECYCLING CORPORATION	54-1830284
	Number, street, and room or suite no. If a P.O. box, see instructions. 1300 NORTH 17TH STREET, NO. 1752	
	City, town or post office, state, and ZIP code. For a foreign address, see instructions. ARLINGTON, VA 22209	

Enter the Return code for the return that this application is for (file a separate application for each return) [0 1]

Application Is For	Return Code	Application Is For	Return Code
Form 990	01	Form 990-T (corporation)	07
Form 990-BL	02	Form 1041-A	08
Form 990-EZ	03	Form 4720	09
Form 990-PF	04	Form 5227	10
Form 990-T (sec. 401(a) or 408(a) trust)	05	Form 6069	11
Form 990-T (trust other than above)	06	Form 8870	12

- The books are in the care of ▶ MARK TIBBETTS 1300 NORTH 17TH STREET, NO. 1752 - ARLINGTON, VA 22209
  Telephone No. ▶ 703-841-3200 FAX No. ▶
- If the organization does not have an office or place of business in the United States, check this box ▶ [ ]
- If this is for a Group Return, enter the organization's four digit Group Exemption Number (GEN) _____. If this is for the whole group, check this box ▶ [ ], If it is for part of the group, check this box ▶ [ ] and attach a list with the names and EINs of all members the extension is for.

1 I request an automatic 3-month (6 months for a corporation required to file Form 990-T) extension of time until AUGUST 15, 2011, to file the exempt organization return for the organization named above. The extension is for the organization's return for:
▶ [X] calendar year 2010 or
▶ [ ] tax year beginning _____, and ending _____.

2 If the tax year entered in line 1 is for less than 12 months, check reason: [ ] Initial return [ ] Final return [ ] Change in accounting period

3a	If this application is for Form 990-BL, 990-PF, 990-T, 4720, or 6069, enter the tentative tax, less any nonrefundable credits. See instructions.	3a	$ 0.
b	If this application is for Form 990-PF, 990-T, 4720, or 6069, enter any refundable credits and estimated tax payments made. Include any prior year overpayment allowed as a credit.	3b	$ 0.
c	**Balance due.** Subtract line 3b from line 3a. Include your payment with this form, if required, by using EFTPS (Electronic Federal Tax Payment System). See instructions.	3c	$ 0.

Caution. If you are going to make an electronic fund withdrawal with this Form 8868, see Form 8453-EO and Form 8879-EO for payment instructions.

LHA **For Paperwork Reduction Act Notice, see instructions.** Form **8868** (Rev. 1-2011)

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APPENDIX F: Locations Requesting Bins from TRC

Customer Type	Business Name	Address	City	ZIPCODE	Total
CONTRACTOR	A-1 GUARANTEED	1768 BROADWAY	VALLEJO	94589	1
	BUCKLEY PARNELL HEAT & AIR	5990 DEVECCHI AVE	CITRUS HEIGHTS	95621	1
	CHIMNEY KRAFT	700 NORTHCREST DRIVE	CRESCENT CITY	95531	1
	GOODCENTS	1322 DUPONT COURT	MANTECA	95336	6
	MAKI HEATING & AIR CONDITIONING, INC.	105 GUM LANE	AUBURN	95603	1
	MATRIX HG, INC.	2355 WHITMAN RD. SUITE A	CONCORDIA	94518	2
	MCCLELLAND Air CONDITIONING	801 MARAUDER STREET	CHICO	95973	2
	RICHARD HEATH & ASSOCIATES, INC	9480 TELSTAR AVENUE SUITE 2	El Monte	91731-0000	2
	YUBA-SUTTER HHW FACILITY	3001 N LEVEE ROAD	MARYSVILLE	95901	1
	BONNEY PLUMBING, HEATING & AIR	3906 KRISTI COURT	SACRAMENTO	95827	1
	BILL HOWE HEATING & AIR	1364 MORENA BLVD #A	SAN DIEGO	92110	1
	ONE HOUR HEATING & A/C	415 20TH STREET	BAKERSFIELD	93301	1
HHW FACILITY	ALAMEDA COUNTY HOUSEHOLD HAZ. WASTE PROGRAM	2091 W WINTON AVE	HAYWARD	94545	5
		2091 W. WINTON AVE.	HAYWARD	94545	1
	AMADOR COUNTY WASTE MANAGEMENT DEPT.	810 COURT STREET	JACKSON	95642	5
	BAY COUNTIES WASTE SERVICES	301 CARL ROAD	SUNNYVALE	94089-0000	2
	BUENA VISTA HHW FACILITY	150 ROUNDTREE LANE	WATSONVILLE	95076-0000	3
	BUTTE REGIONAL HHW COLLECTION FACILITY	1101 MARADER ST.	CHICO	95973-0000	3
	CASTRO VALLEY SANITARY DISTRICT	21040 MARSHALL STREET	CASTRO VALLEY	94546	2
	Chicago Grade Landfill HHW	HWY 41	Atascadero	93422	1
	CITY OF FREMONT PHHWCF	41149 BOYCE ROAD	FREMONT	94538	1
	CITY OF HIGHLAND	27215 BASELINE STREET	HIGHLAND	92346	1
	CITY OF MADERA PUBLIC WORKS	1030 S. GATEWAY DRIVE	MADERA	93637	1
	CITY OF SACRAMENTO PHHWCF	8491 FRUITRIDGE ROAD	SACRAMENTO	95826	1
	CITY OF SAN DIEGO, MIRAMAR HHWCF	5161 CONVOY STREET	SAN DIEGO	92111-0000	1
	CITY OF SANTA MARIA HHW FACILITY	2065 E. MAIN STREET	SANTA MARIA	93454	2
	Cold Canyon Landfill HHW	HWY 227	SAN LUIS OBISPO	93401-0000	1

COLUSA COUNTY HHW PROGRAM	1215 MARKET STREET	COLUSA	95932-0000	2
COUNTY OF MARIPOSA	5593 HWY 49 NORTH	MARIPOSA	95338	6
COUNTY OF SAN DIEGO HHW	324 MAPLE STREET	RAMONA	92065	1
COUNTY OF SANTA CLARA	1555 BERGER DR SUITE 300	SAN JOSE	95112	2
COUNTY OF TUOLUMNE SOLID WASTE DIVISION	2 SOUTH GREEN ST.	SONORA	95370	3
COUNTY OF VENTURA-	800 SOUTH VICTORIA AVE	VENTURA	93009-1650	2
CV STRATEGIES	42600 CAROLINE COURT SUITE 102	PALM DESERT	92211	1
CYPRESS CITY HALL	5275 ORANGE AVENUE	CYPRESS	90630	4
DEL NORTE COUNTY TRANSFER STATION	1700 STATE STREET	CRESCENT CITY	95531	1
DELTA HHW COLLECTION FACILITY	2550 PITTSBURG-ANTIOCH HWY	Pittsburg	94509-1373	1
EL DORADO COUNTY ENVIRONMENTAL MGMT. DEPT.	2850 FOURLANE COURT	PLACERVILLE	95667	1
GLEN COUNTY HOUSEHOLD HAZARDOUS WASTE FACILITY	5700 COUNTY ROAD 33	ARTOIS	95913-0000	2
HUMBOLDT WASTE MANAGEMENT AUTHORITY	1059 W. HAWTHORNE ST.	EUREKA	95501-0000	1
KERN COUNTY SPECIAL WASTE FACILITY	17035 FINNIN AVE. #2	MOJAVE	93501	1
	3301 BOWMAN ROAD	RIDGECREST	93555	1
	4951 STANDARD ST.	BAKERSFIELD	93308-4531	1
LUCIA MAR UNIFIED SCHOOL DISTRICT	222 STANLEY AVE	ARROYO GRANDE	93420	1
MADERA COUNTY HHW COLLECTION FACILITY	21739 ROAD 19	CHOWCHILLA	93610	2
MADERA COUNTY HHW COLLECTION FACILITY	2037 W. CLEVELAND AVE	MADERA	93637	2
MARIN COUNTY HOUSEHOLD HAZARDOUS WASTE FACILITY	565 JACOBY STREET	SAN RAFAEL	94901	2
MENDOCINO SOLID WASTE MANAGEMENT AUTHORITY	298A PLANT ROAD	UKIAH	95482	1
MERCED COUNTY HHW	260 E 15TH ST.	MERCED	95341-6216	1
	6040 N. HIGHWAY 59	MERCED	95340	1
Morro Bay/Cayucos Waste Water Plant	160 Atascadero Road	Morro Bay	93442	1
NEVADA COUNTY H.H.W. FACILITY	14741 WOLF MTN. RD.	GRASS VALLEY	95949	4
Nipomo Household Hazardous Waste Drop-Off	509 Southland	Nipomo	93444	1
ORO LOMA SANITARY DISTRICT	2600 GRANT AVE	SAN LORENZO	94580-1838	2
Palo Alto Public Works Dept	2501 Embarcadero Way	Palo Alto	94303	1
Paso Robles Landfill HHW	Hwy 46 East	Paso Robles	93446	1
PERMANENT HHW COLLECTION FACILITY	50 NATOMA ST.	FOLSOM	95630	2

	PARC ENVIRONMENTAL	2706 S RAILROAD AVE	FRESNO	93725	2
	RAHAC HTG & COOLING INC.	1326 BLOSSOM STREET	GLENDALE	91201-0000	1
				91201-2305	1
	SALINAS VALLEY SOLID WASTE HHWCF	139 SUN STREET	SALINAS	93901	1
	SAN BERNADINO COUNTY HHW	2824 EAST W STREET, BLDG 302	SAN BERNADINO	92408-0000	2
	SAN JOAQUIN COUNTY HHW	7850 R.A. BRIDGEFORD STREET	STOCKTON	95206	3
	SAN LUIS OBISPO COUNTY IWA	870 OSOS STREET	SAN LUIS OBISPO	93401-0000	2
	SAN MATEO COUNTY HHW FACILITY	32 TOWER ROAD	SAN MATEO	94402	1
	SOUTH TAHOE REFUSE TRANSFER STATION	2140 Ruth AVE.	SOUTH LAKE TAHOE	96150	2
	TEHAMA COUNTY/RED BLUFF LANDFILL	19995 PLYMIRE ROAD	RED BLUFF	96080	4
	VENTURA HOUSEHOLD HAZARDOUS WASTE FACILITY	336 SAN JON ROAD	VENTURA	93002	2
	WEST CONTRA COSTA PERMANENT HHW	101 PITTSBURG AVENUE	RICHMOND	94801-0000	2
	YOLO COUNTY CENTRAL LANDFILL	44090 COUNTY ROAD 28H	WOODLAND	95776	2
		44090 COUNTY RD 28 H	WOODLAND	95776	1
	CLEAN HARBORS EVS	500 MECHAM ROAD	PETALUMA	94952	1
	WESTERN PLACER WASTE MANAGEMENT AUTHORITY	NORTECH WASTE 3195 ATHENS AVE	LINCOLN	95648	2
	CITY OF REDDING SOLID WASTE	2255 ABERNATHY LANE	REDDING	96003	1
	CITY OF CARPINTERIA	5775 CARPINTERIA AVE.	CARPINTERIA	93013	2
	CITY OF SAN DIEGO, HHW	5161 CONVOY STREET	SAN DIEGO	92111	1
	AAA AIR & HEATING	5644 E. WESTOVER	FRESNO	93727	1
	EDH FIRE STATION #86	3670 BASS LAKE ROAD	EL DORADO HILLS	95762	2
	RDC EM BUILDING C	2850 FAIRLANE COURT, BUILDING C	PLACERVILLE	95667	1
	CTY OF TUOLUMNE, CA SIERRA TRANSFER STATION	11111 SCOFIELD ST	BIG OAK FLAT	95305	1
	REGIONAL WATER QUALITY CONTROL PLANT	2501 EMBARCADERO WAY	Palo Alto	94303	1
	KERN COUNTY WASTE MANAGEMENT	4951 STANDARD ST.	BAKERSFIELD	93308	2
RETAIL	ANTIOCH ACE HARDWARE	501 SUNSET DRIVE	ANTIOCH	94509-0000	1
	BERKELEY ACE HARDWARE	2145 UNIVERSITY AVENUE	BERKELEY	94704-0000	1
	BILL'S ACE HARDWARE	3503 PACHECO BLVD.	MARTINEZ	94553-0000	2
	BRENTWOOD ACE HARDWARE	8900 BRENTWOOD BLVD, STE J	BRENTWOOD	94513-0000	1
	LAUREL ACE HARDWARE	4024 MACARTHUR BLVD	OAKLAND	94619	1

	OAKLEY ACE HARDWARE	305 4TH STREET	OAKLEY	94561-0000	1
	PITTSBURG ACE HARDWARE	125 E. LELAND ROAD	Pittsburg	94565-0000	1
	Orchard Supply Hardware	825 Oak Park Blvd	Pismo Beach	93449	1
		2005 Theatre Drive	Paso Robles	93446	1
	Miners (N)	553 W. Tefft	Nipomo	93444	1
	Cambria Hardware	2345 Village Ln.	Cambria	93428	1
	SAN LUIS OBISPOS COUNTY IWMA	870 OSOS STREET	SAN LUIS OBISPO	93401-0000	7
	Miner's Ace Hardware (LO)	1080 Los Osos Valley Rd.	Los Osos	93402	1
	Pismo Beach True Value Hardware	930 Price St.	Pismo Beach	93449	1
	Lowes	2445 Golden Hills Rd.	Paso Robles	93446	1
	Miner's Ace Hardware (MB)	510 Atascadero Rd.	Morro Bay	93442	1
	Home Depot	905 El Camino Real	Atascadero	93422	1
		1551 Froom Ranch Wy	SAN LUIS OBISPO	93405	1
	Miner's Ace Hardware (AT)	9370 El Camino Real	Atascadero	93422	1
	KMart	3980 El Camino Real	Atascadero	93422	1
		1570 W. Branch St.	ARROYO GRANDE	93420	1
	Costco	1540 Froom Ranch Rd.	SAN LUIS OBISPO	93405	1
	Miners (SLO) formerly Pac. Home & Garden	2034 Santa Barbara	SAN LUIS OBISPO	93401	1
	Brisco's True Value Hardware	1005 El Camino Real	ARROYO GRANDE	93420	1
	Decou Lumber & Ace Hardware (AT)	8965 El Camino Real	Atascadero	93422	1
	Hewitt Hardware	428 Main St.	TEMPLETON	93465	1
	Miner's Ace Hardware (AG)	186 Station Way	Arroyo Grande	93420	1
	Miner's Ace Hardware (GB)	1056 Grand Ave.	Grover Beach	93433	1
	Blake's True Value Home Center	1701 Riverside Ave.	Paso Robles	93446	1
Wholesaler/Dist	AIR COLD SUPPLY	206 COMMERCIAL STREET	SAN JOSE	95112	1
		640 AVON AVE	AZUSA	91702-2044	2
	AIR COLD-A FERGUSON ENTERPRISE	11244 PLAYA COURT BRANCH 1048	CULVER CITY	90230	1
		1144 WEST AVENUE, L-12 BRANCH 1053	LANCASTER	93534	1
		1224 NORTH MARSHALL BRANCH 1581	EL CAJON	92020	2
		12841 PRODUCTION PLACE BRANCH 1055	VICTORVILLE	92395	1

	1346 SOUTH CLAUDINA STREET BRANCH 692	ANAHEIM	92805-6234	1
	13500 SATICOY STREET	VAN NUYS	91402	1
	149 B GRANADA DRIVE BRANCH 1894	SAN LUIS OBISPO	93401-7316	1
	2750 SOUTH TOWNE AVENUE BRANCH 1183	POMONA	91766	1
	2751 DURAHART STREET BRANCH 570	RIVERSIDE	92507	1
	289 NORTH MCARTHUR WAY BRANCH 1081	UPLAND	91786	1
	3550 LA CRUZ WAY BRANCH 1893	Paso Robles	93446	1
	429 MADERA STREET BRANCH 1059	SAN GABRIEL	91776	1
	887 LAWRENCE DRIVE BRANCH 1056	NEWBURY PARK	91320	1
ALLIED REFRIGERATION	1211 EAST EDINGER AVENUE	TUSTIN	92780-0000	1
	1375 EAST 15TH STREET	LOS ANGELES	90021-0000	1
	15558 CABRITO ROAD	VAN NUYS	91406-0000	1
	1928 DON LEE PLACE	ESCONDIDO	92029-0000	1
	199 SOUTH MARSHALL STREET	EL CAJON	92020-0000	1
	2170 COMMERCE AVENUE, UNIT U	CONCORD	94520-0000	1
	2175 ADAMS AVENUE	SAN LEANDRO	94577-0000	1
	2300 EAST 28TH STREET	SIGNAL HILL	90755-0000	1
	306 SOUTH NINTH AVENUE	CITY OF INDUSTRY	91746-0000	1
	34660 DATE PALM DRIVE	CATHEDRAL CITY	92234-0000	1
	404 S. I STREET	SAN BERNADINO	92410-0000	1
	702 EAST GISH ROAD	SAN JOSE	95112-0000	1
	7823 OSTROW STREET	SAN DIEGO	92111-0000	1
	8480 HIGUERA STREET	CULVER CITY	90232-0000	1
	1256 PRICE AVE.	POMONA	91767-5840	1
AMERICAN REFRIGERATION SUPPLIES INC.	1086 KRAEMER PL.	ANAHEIM	92806-0000	1
	1405-2 GRANITE LN.	MODESTO	95351-0000	1
	145 11TH ST.	SAN FRANCISCO	94103-0000	1
	1501 POMONA RD. STE. 102	CORONA	92880-0000	1
	245 SUTTON PL.	SANTA ROSA	95407-0000	1
	2703 5TH ST. STE 7	SACRAMENTO	95818-0000	1

	325 5TH ST.	OAKLAND	94607-0000	1
	399 S. ARROWHEAD AVE.	SAN BERNARDINO	92408-0000	1
	444 LITTLEFIELD	S SAN FRANCISCO	94080-0000	1
	6110 VALLEY VIEW AVE.	BUENA PARK	90620-0000	1
	740 E. HAZELTON AVE.	STOCKTON	95203-0000	1
	7874 RONSON RD.	SAN DIEGO	92111-0000	1
	910 JUSTIN AVE.	GLENDALE	91201-0000	1
ATWATER SUPPLY	1903 FRIENDSHIP DRIVE	EL CAJUN	92020	1
	42655 RIO NEDO	TEMECALA	92590	1
	518 EAST BALL ROAD	ANAHEIM	92805	1
Baker Distributing Co.	1295 EMERALD AVE. SUITE D	MODESTO	95351-0000	1
	1351 OLD BAYSHORE	SAN JOSE	95112-0000	1
	1501 MINNESOTA ST.	SAN FRANCISCO	94107-0000	1
	2375 DAVIS ST.	SAN LEANDRO	94577-2205	1
	300 WEST ROBLES BLDG J.	SANTA ROSA	95407-0000	1
	849 WEST 8TH ST.	CHICO	95926-0000	1
	5449 EAST LAMONA AVE.	FRESNO	93703-0000	1
	6800 SIERRA COURT, SUITE N	DUBLIN	94568-0000	1
	2138 ZANKER ROAD	SAN JOSE	95131-2108	1
	428 NORTH CANAL ST.	SAN FRANCISCO	94107-0000	1
	3020 SOUTH KILSON DRIVE	SANTA ANA	92707-0000	1
	149 UNION AVENUE	BAKERSFIELD	93307-0000	1
	25978 BUSINESS CENTER DRIVE	Redlands	92374-0000	1
	575 CARDIFF STREET	CORONA	92879-0000	1
	9355 REMICK AVENUE	PACOMIA	91331-0000	1
	16253 OMELAS STREET	IRWINDALE	91706-0000	1
	9610 DESOTO AVENUE	CHATSWORTH	91311-0000	1
	849 WEST 8TH STREET	CHICO	95928	1
	180 HEGENBERGER LOOP, STE A & B	OAKLAND	94621-0000	1
Baker Distributing Company	5474 Complex Street Suite 502	SAN DIEGO	92123	1

	16253 ORNELAS ST	IRWINDALE	91706	1
BURKE ENGINEERING COMPANY	1225 NORTH FIFTH STREET	SAN JOSE	95112-0000	1
	1312 ALLEC ST.	ANAHEIM	92805-0000	1
	155 W. VICTORIA ST.	LONG BEACH	90805-0000	1
	3190 ORANGE GROVE AVE. A	NORTH HIGHLANDS	95660	1
	3190 ORANGE GROVE AVENUE	NORTH HIGHLANDS	95660-0000	2
	3190-A ORANGE GROVE AVE.	N. HIGHLANDS	95660-5706	1
	4250 PEPSI DR # D	SAN DIEGO	92111-0000	1
	6605 ODESSA AVENUE	VAN NUYS	91406-0000	1
	7303 EDGEWATER DRIVE, #A	OAKLAND	94621-3016	1
	74488 VILLAGE DR	CHINO	90708-0000	1
	9700 FACTORIAL WAY	El Monte	91733-1799	8
	1790 IOWA AVENUE	RIVERSIDE	92507	1
	1225 N. 5TH STREET	SAN JOSE	95112	1
	1225 N. FIFTH STREET	SAN JOSE	95112	1
CALIFORNIA COOLING	1922 FRIENDSHIP DRIVE	EL CAJON	92020-0000	1
	239 W. ORANGE AVE	EL CENTRO	92243-0000	2
	622 S. VINEWOOD ST.	ESCONDIDO	92029-0000	1
CALIFORNIA COOLING SUPPLY	14718 RAYMER ST. SUITE C	VAN NUYS	91405	1
CALIFORNIA REFRIGERATION SUPPLY INC	1718 FAIRWAY DR	SAN LEANDRO	94577-0000	1
CASS, INC	2730 PERALTA STREET	OAKLAND	94607	1
CFM EQUIPMENT DIST.	1644 MAIN AVE. SUITE 1	SACRAMENTO	95838-0000	1
CONTROLCO	15375 BARRANCA PKWY, I - 104	IRVINE	92618	1
	210 VAN NESS	FRESNO	93721-0000	1
	251 OPPORTUNITY STREET, B	SACRAMENTO	95838	1
	320 KENTUCKY STREET	BAKERSFIELD	93305	1
	35 DORMAN, #2	SAN FRANCISCO	94124	1
	5600 IMHOTT DRIVE, SUITE G	CONCORD	94520	1
	840 66TH AVENUE	OAKLAND	96421	1
DAN GOETZ WHOLESALE OUTLET INC	335 O'HAIR COURT, SUITE A	SANTA ROSA	95407	1

DIAL ONE -- SERVICE EXPERTS	4670 PACIFIC STREET, STE. 100	ROCKLIN	95677-0000	1
FACSCO	1528 N. THESTA STREET	FRESNO	93703-0000	2
FERGUSON HEATING & COOLING	605 EAST CERRITOS AVENUE	ANAHEIM	92805	1
	640 AYON AVENUE BRANCH 1050	AZUSA	91702	1
	903 NORTH MARKET BOULEVARD	SACRAMENTO	95834	1
	9349 OSO AVENUE BRANCH 1049	CHATSWORTH	91702	1
	81925 INDUSTRIAL PLACE	INDIO	92201	1
FIX AIR AUTHORIZED Trane PARTS	890 SERVICE ST., UNIT A	SAN JOSE	95112-0000	1
GEARY PACIFIC SUPPLY	1161 W. BRADLEY AVE.	EL CAJON	92030-1503	1
	1162 W. BRADLEY AVE.	EL CAJON	92030-1503	1
	1200 E. CERRITOS AVENUE	ANAHEIM	92805-0000	1
	31050 HUNTWOOD AVENUE	HAYWARD	94544-0000	2
	333 S. TEILMAN AVE.	FRESNO	93706-0000	2
	333 S. TEILMAN AVENUE	FRESNO	93706-0000	1
	3443 NIKI WAY	RIVERSIDE	92507-6812	1
	4365 JETWAY COURT	NORTH HIGHLANDS	95660-5701	2
	6421 BOX SPRINGS BLVD.	RIVERSIDE	92507-0000	2
	6918 VALJEAN AVENUE	VAN NUYS	91406-0000	2
	8711 AIRPORT ROAD	REDDING	96002-9223	1
GENIE AIR CONDITIONING & HEATING, INC	15041 CALVERT ST.	VAN NUYS	91411	1
GEORGE T. HALL	1257 GOODRICH BLVD	LOS ANGELES	90022	1
	15915 ARMINTA ST	VAN NUYS	91406	1
	1605 GENE AUTRY WAY	ANAHEIM	95805	1
	4289 TAYLOR STREET	SAN DIEGO	92110	1
HOWARD INDUSTRIES	8855 WASHINGTON BLVD	CULVER CITY	90232-0000	6
INVENSYS CLIMATE CONTROLS, NORTH AMERICA	151 SOUTH PROMENADE AVENUE	CORONA	92879-0000	4
JOHNSTONE SUPPLY	1661 MARKET ST	CORONA	92880	1
JOHNSTONE SUPPLY #098	200 TALMADGE DRIVE	SANTA ROSA	95407	1
JOHNSTONE SUPPLY #140	1335 DAYTON ST. SUITE A	SALINAS	93901	1
JOHNSTONE SUPPLY #328	870 PIPER AVE	MERCED	95341	1

JOHNSTONE SUPPLY #329	1000 N. BURKE	VISALIA	93292	1
JOHNSTONE SUPPLY CO	1070 COMMERCIAL ST, STE 104	SAN JOSE	95112-1408	1
	13211 SPRING STREET	BALDWIN PARK	91706-2289	2
	1385 N. MAGNOLIA AVE	EL CAJON	92020-0000	1
	1445 SAN MATEO AVENUE	SOUTH SAN FRANCISCO	94080-0000	2
	2132 AVIATION DRIVE	UPLAND	91786-5720	2
	23211 DEL LAGO DRIVE	LAGUNA HILLS	92653-1307	1
	2331 COMMERCE AVE #E	CONCORD	94520-0000	1
	3015 S. KILSON DRIVE	SANTA ANA	92707-0000	1
	333 MARKET ST	OAKLAND	94607-0000	1
	42342 10TH ST WEST SUITE A	LANCASTER	93534	1
	4320 PACIFIC HWY	SAN DIEGO	92110	1 1
	477 QUILLCO CT	SANTA ROSA	95407-0000	2
	5658 E. CLINTON AVE.	FRESNO	93727-0000	2
	900 S. ANDREASEN DR.	ESCONDIDO	92029-1914	1
JOHNSTONE SUPPLY OF LONE BEACH	2810 TEMPLE AVE.	LONG BEACH	90806-2213	1
JOHNSTONE SUPPLY OF REDDING	940 WALL STREET	REDDING	96002	1
JOHNSTONE SUPPLY UPLAND	2132 AVIATION DRIVE	UPLAND	91786-5720	1
JOHNSTONE SUPPLY-ANAHEIM	518 E BALL ROAD	ANAHEIM	92805-0000	1
JOHNSTONE-COMMERCE	8040 SLAUSON AVENUE	MONTEBELLO	90640	1
JOHNSTONE-SANTA BARBARA	220 WEST GUTIERREZ STREET	SANTA BARBARA	93101	1
JOHNSTONE-THOUSAND OAKS	2645 TOWNSGATE ROAD # 600	THOUSAND OAKS	91361	1
JOHNSTONE-VENTURA	5960 VALENTINE ROAD # 3	VENTURA	93003	1
Lennox Industries Inc.	1021 STRIKER AVENUE	SACRAMENTO	95835-0000	2
	1059 VINE STREET, SUITE 108	SACRAMENTO	95814-0321	2
	12775 RESERVOIR STREET	CHINO	91710-2943	2
	2500 E. FRANCIS STREET	ONTARIO	91761-0000	1
	3410 SAN FERNANDO ROAD, UNIT 5	LOS ANGELES	90065-0000	2
	7670 TRADE STREET, STE. A - D	SAN DIEGO	92121-0000	2

	4000 HAMNER AVE.	MIRA LOMA	91752	1
MSI HVAC	11700 INDUSTRY	FONTANA	92337	1
	2344 MEYERS AVE	ESCONDIDO	92029	1
	23456 SOUTH POINTE #B	LAGUNA HILLS	92653	1
NORTHAIRE SUPPLY CO INC	1359 OAKLAND ROAD	SAN JOSE	95112-0000	1
PACIFIC HEATING & COOLING SUPPLY, INC,	3720 LA CRUZ WAY	TEMPLETON	93465-0000	1
R.E. MICHEL COMPANY, INC	1922 FRIENDSHIP DRIVE	EL CAJON	92020-00	1
	14718 RAYMER ST. UNIT A	VAN NUYS	91405-1262	1
R.S.D.	3355 McMAUDE PL	SANTA ROSA	95407	1
RAHAC HTG & COOLING INC.	1326 BLOSSOM STREET	GLENDALE	91201	1
REFRIGERATION SUPPLIES DISTRIBUTOR	43300 BUSINESS PARK DR.	TEMECULA	92590	1
	43300 BUSINESS PARK DR. # A102	TEMECULA	92590	1
RSD	10170 CROYDON WAY SUITE 1	SACRAMENTO	95827-2104	3
	1050 COMMERCIAL STREET, #105	SAN JOSE	95112-0000	1
	110 EAST MAIN STREET	EL CENTRO	92243-2589	2
	1121 LONE PALM AVENUE, #A	MODESTO	95351-0000	2
	1201 MONTEREY PASS ROAD	MONTEREY PARK	91754-3616	1
	1376 STEALTH STREET	LIVERMORE	94551-0000	4
	14766 RAYMER STREET	VAN NUYS	91405-0000	1
	14901 RAYMER ST	VAN NUYS	91405-0000	1
	1670 INDUSTRIAL BLVD.	CHULA VISTA	91911-0000	2
	1721 LOGAN AVENUE	SAN DIEGO	92113-1006	2
	1833 EAST MAIN STREET	VISALIA	93292-6768	2
	1933 S VINEYARD AVE	ONTARIO	91761-0000	2
	2100 E. WILSHIRE AVE	SANTA ANA	92705-0000	1
	2100 WILSHIRE AVENUE, UNIT A	SANTA ANA	92705-0000	1
	21727 NORDHOFF STREET	CHATSWORTH	91311	2
	2208 EAST MCKINLEY AVENUE	FRESNO	93703-3005	2
	2350 LEXINGTON STREET	SACRAMENTO	95815-3216	2
	2601 ATLANTIC OCEAN DR.	LAKE FOREST	92630	1

	26021 ATLANTIC OCEAN DRIVE	LAKE FOREST	92630-0000	1
	285 LAWRENCE AVENUE	SOUTH SAN FRANCISCO	94080-6818	2
	2882 TEEPEE DRIVE	STOCKTON	95205-0000	3
	2890 E CORONADO ST	ANAHEIM	92806-2503	1
	2890 E. CORONADO ST.	ANAHEIM	92806-2503	1
	3355 MCMAUDE PLACE	SANTA ROSA	95407-0000	2
	4131 LATHAM STREET	RIVERSIDE	92501-0000	2
	436 HESTER STREET	SAN LEANDRO	94577-1024	2
	527 BRUNKEN AVENUE	SALINAS	93901-0000	2
	5910 BOWCROFT STREET	LOS ANGELES	90016-0000	2
	621 EAST 21ST STREET	BAKERSFIELD	93305-5109	2
	6391 ORANGETHORPE AVENUE	BUENA PARK	90620-0000	1
	640 COMMERCE DRIVE, #200	ROSEVILLE	95678-0000	2
	680 UNION AVE	POMONA	91766	1
			91768-0000	1
	702 WEST 190TH STREET	GARDENA	90248-0000	2
	715 SOUTH FLOWER STREET	BURBANK	91502-2014	1
	915 INDOSLAT AVE	REDDING	96001-0000	1
	915 INDUSTRIAL AVENUE, STE 101	REDDING	96002-0000	1
	2551 S. TOWNWELL DRIVE	CONCORD	94520-0000	2
	915 INDUSTRIAL ST	REDDING	96002-1369	1
	640 COMMERCE DRIVE	ROSEVILLE	95678-0000	2
RSD-48	702 W. 190TH STREET	GARDENA	90248-0000	1
RSD-MONTEREY PARK	1201 MONTEREY PASS ROAD	MONTEREY PARK	91754-3616	1
RSD-TOTAL CONTROL	221 PANORAMA DRIVE	BENICIA	94510-0000	2
SIGLER INC	20680 NORDHOFF ST	CHATSWORTH	91311	1
	2301 ARNOLD INDUSTRIAL WAY	CONCORD	94520	2
SIGLERS	17745 E. VALLEY BLVD.	CITY OF INDUSTRY	91744	1
	20680 NORDHOFF ST	CHATSWORTH	91311	1
SLAKEY BROTHERS	1001 OATES COURT	MODESTO	95352	1

		111 MADRONE	SANTA CRUZ	95060	1
		1190 WESTERN STREET	FAIRFIELD	94533	1
		1200 INDUSTRIAL STREET	REDDING	96002	1
		12277 LOMA RICA DRIVE SUITE E	GRASS VALLEY	95945	1
		2201 EAST BRUNDAGE LANE	BAKERSFIELD	93307	1
		2215 KAUSEN STE 1	ELK GROVE	95758	1
		2301 PARK AVENUE	CHICO	95927	1
		2460 BATES AVENUE	CONCORD	94520	1
		2540 TEEPEE DRIVE	STOCKTON	95208	1
		26534 DANTI CT	HAYWARD	91520	1
		2845 DUKE COURT	SANTA ROSA	95407	2
		30 STEIN AM RHEIN CT STE F	REDWOOD CITY	94063	1
		3201 ORANGE GROVE AVENUE	NORTH HIGHLANDS	95660	1
		321 ORANGE AVENUE	SAND CITY	93955	1
		4333 NORTH EFFIE STREET	FRESNO	93755	1
		545 BOYD STREET	YUBA CITY	95992	1
		601 WORK STREET	SALINAS	93901	1
		863 SAVAKER AVE	SAN JOSE	95126-0000	1
		863 SAVAKER STREET	SAN JOSE	95126	2
		111 MADRANOE STREET	SANTA CRUZ	95060	1
	SLAKEY BROTHERS/BAKERSFIELD	2201 EAST BRUNDAGE LANE	BAKERSFIELD	93307	1
	SLAKEY BROTHERS/CHICO	2301 PARK AVENUE	CHICO	95927	1
	SLAKEY BROTHERS/ELK GROVE	2215 KAUSEN STE 1	ELD GROVE	95758	1
	SLAKEY BROTHERS/FAIRFIELD	1190 WESTERN STREET	FAIRFIELD	94533	1
	SLAKEY BROTHERS/FRESNO	4333 NORTH EFFIE STREET	FRESNO	93755	1
	SLAKEY BROTHERS/GRASS VALLEY	12277 LOMA RICA DRIVE, STE E	GRASS VALLEY	94945	1
	SLAKEY BROTHERS/JACKSON	1400 SOUTH HIGHWAY 49	JACKSON	95642	1
	SLAKEY BROTHERS/MODESTO	1001 OATES COURT	MODESTO	95352	1
	SLAKEY BROTHERS/NORTH HIGHLANDS	3201 ORANGE GROVE AVENUE	NORTH HIGHLANDS	95660	1
	SLAKEY BROTHERS/REDDING	1200 INDUSTRIAL STREET	REDDING	96049	1

SLAKEY BROTHERS/REDWOOD CITY	30 STEIN AM RHEIN COURT STE F	REDWOOD CITY	94063	1
SLAKEY BROTHERS/S. SAN FRANCISCO	328 ROEBLING ROAD	S. SAN FRANCISCO	94080	1
SLAKEY BROTHERS/SALINAS	601 WORK STREET	SALINAS	93901	1
SLAKEY BROTHERS/SAN JOSE	863 SAVAKER STREET	SAN JOSE	95126	1
SLAKEY BROTHERS/SAND CITY	321 ORANGE AVENUE	SAND CITY	93955	1
SLAKEY BROTHERS/SANTA CRUZ	111 MADRONE	SANTA CRUZ	95060	1
SLAKEY BROTHERS/SANTA ROSA	2845 DUKE COURT	SANTA ROSA	95407-7844	1
SLAKEY BROTHERS/SONORA	19450 INDUSTRIAL DRIVE	SONORA	95370	1
SLAKEY BROTHERS/STOCKTON	2540 TEEPEE DRIVE	STOCKTON	95208	1
SLAKEY BROTHERS/YUBA CITY	545 BOYD STREET	YUBA CITY	95991	1
SOUTHERN CALIFORNIA AIR CON APPL	1000 N. JOHNSON AVE.	EL CAJON	92020	1
SPECIALTY AC	5250 EAST SECOND STREET	BENICIA	94510-0000	3
T & A SUPPLY, INC.	1045 NORTH 10TH STREET	SAN JOSE	95112	1
THRIFTY SUPPLY	8541 23RD AVE.	SACRAMENTO	95826	1
	8541 23RD AVENUE	SACRAMENTO	95826-0000	1
TOTALINE OF CALIFORNIA	1070 COMMERCIAL STREET, SUITE 106	SAN JOSE	95112	1
	1090 E. COOLEY AVENUE	SAN BERNARDINO	92408	2
	12819 TELEGRAPH RD.	SANTA FE SPRINGS	90670	2
	18791 RANCHO WAY, UNIT A	RANCHO DOMINGUEZ	90220	1
	20191 WINDROW DR. UNIT B	LAKE FOREST	92630	2
	205 S. PUENTE ST	BREA	92821	2
	2301 ARNOLD INDUSTRIAL WAY	CONCORD	94520	1
	2345 LOS ANGELES STREET	FRESNO	92721	2
	2425 AUTO PKWY SUITE 200	ESCONDIDO	92029	1
	2641 LINDSAY PRIVADO DR.	ONTARIO	91761	1
	41710 REAGAN WAY	MURRIETA	92562	2
	421 S. LOMBARD ST.	OXNARD	93030	2
	4517 STANDARD STREET	BAKERSFIELD	93308	2
	4863 SHAWLINE STREET	SAN DIEGO	92111	1
	615 W. GROVE AVE.	ORANGE	92865	2

	6450 SYCAMORE CANYON BLVD.	RIVERSIDE	92507	2
	6650 TOP GUN ST.	SAN DIEGO	92121	2
	7615 N. SAN FERNANDO RD.	BURBANK	91352	2
	78-305 DINAH SHORE, BLDG 1200	PALM DESERT	92211	2
	8615 23RD AVENUE	SACRAMENTO	95826	1
	99 SOUTHHILL DRIVE SUITE B	BRISBANE	94005	2
TRANE	5595 N GOLDEN STATE BLVD	FRESNO	93722	1
TRANE PARTS CENTER	4145 DEL MAR AVENUE	ROCKLIN	95677-0000	1
UNITED REFRIGERATION	1134 E. DOMINGUEZ STREET	CARSON	90746-3518	1
	1265 WEST MCCOY LANE, STE. C	SANTA MARIA	93455-1058	1
	1413 GRANITE LANE	MODESTO	95351-1121	1
	1736 JANELLI COURT	VISALIA	93292-6644	1
	1848 EAST GRIFFITH WAY	FRESNO	93726-4819	1
	1920 EAST MCFADDEN AVENUE	SANTA ANA	92705-4705	1
	2225 AUTO PARK WAY	ESCONDIDO	92029-1348	1
	230 EAST 21ST STREET	BAKERSFIELD	93305-5115	1
	2405 VERNA COURT	SAN LEANDRO	94577-4222	1
	2626 SOUTHPORT WAY, STE. G	NATIONAL CITY	91950-8752	1
	3120 PASEO MERCADO, STE. 101	OXNARD	93036-8916	1
	4060 EAST AIRPORT DRIVE	ONTARIO	91761-1566	2
	41573 CHERRY STREET	MURRIETA	92562-9193	1
	510 EAST RANCHO VISTA BLVD.	PALMDALE	93550-3005	1
	5345 THIRD STREET	IRWINDALE	91706-2085	1
	6150 VALLEY VIEW STREET	BUENA PARK	90620-1030	1
	625 LINCOLN AVENUE	SAN BERNADINO	92408-2230	1
	77-670 SPRINGFIELD LANE, STE #5A	PALM DESERT	92211-0474	1
	8835 COMPLEX DRIVE	SAN DIEGO	92123-1403	1
	904 COMMERCIAL STREET	SAN JOSE	95112-1435	1
	933 WASHINGTON STREET	SAN CARLOS	94070-5316	1
	134 NOPALITAS WAY	SANTA BARBARA	93103-3629	1

US AIR CONDITIONING DISTRIBUTORS	4770 RUFFNER STREET	SAN DIEGO	92111-1520	1
USACD	1002 INDUSTRY WAY	EL CENTRO	92243	1
	1238-A SIMPSON WAY	ESCONDIDO	92029-0000	1
	1250 NORTH MARSHALL AVENUE	EL CAJON	92020-0000	1
	1304 S, CLAUDINA STREET	ANAHEIM	92805-0000	1
	16900 CHESTNUT STREET	CITY OF INDUSTRY	91748	1
			91748-0000	1
	17615 CATALPA STREET	HESPERIA	92345-0000	1
	1951 FAIRWAY DRIVE	SAN LEANDRO	94577-0000	1
	27470 COLT COURT	TEMECULA	92590-0000	1
	2751 TEMPLE AVE	SIGNAL HILL	90755-2210	1
	3035 CROSSROADS DRIVE	REDDING	96003	1
	3333 ORANGE GROVE	NORTH HIGHLANDS	95660-0000	1
	495 MARQUITA AVENUE	Paso Robles	93446	1
	720 WILLIAMS STREET	BAKERSFIELD	93305-0000	1
	9250 OWENSMOUTH AVENUE	CHATSWORTH	91311-0000	1
	2670 E. BYRD AVE	FRESNO	93706	1
	8620 HAYDEN PL.	CULVER CITY	90232	1
	3826 TEEPEE DRIVE SUITE 103	STOCKTON	95205	1
WESTERN NEVADA SUPPLY	10990 INDUSTRIAL WAY	TRUCKEE	96161-0000	1
	200 BELLA WAY	SUSANVILLE	96130-9166	1
	515 SOUTH MAIN STREET	BISHOP	93514-0000	1
RDS-BURBANK	715 SOUTH FLOWER STREET	BURBANK	91502-2014	1
RSD 25	7332 CONVOY COURT, STE A	SAN DIEGO	92111-1110	2
RDS-SAN JOSE	1050 COMMERCIAL STREET, #105	SAN JOSE	95112-0000	1
JOHNSTONE SUPPLY # 33	8639 TAMARACK AVE	SUN VALLEY	91352-2505	1
R.E. MICHEL CO. INC. #381	1922 FRIENDSHIP DRIVE	EL CAJON	92020-0000	1
RSD-22	915 INDUSTRIAL AVENUE, STE 101	REDDING	96002-0000	1
UNITED REFRIGERATION # D5	3421 N. SAN FERNANDO RD. # E & F	LOS ANGELES	90065	1
UNITED REFRIGERATION # P1	4248 ROSEVILLE ROAD	NORTH HIGHLANDS	95660-5710	1

UNITED REFRIGERATION # C4	16606 Schoenborn St	North Hills	91343	1
US AIRCONDITIONING DIST.	2100 CHICAGO AVENUE	RIVERSIDE	92507-0000	1
MOUNTAIN AIR	14441 SPURLOCK LANE	PINE GROVE	95665	1
AIR COLD SUPPLY # 1057	26470 SUMMIT CIRCLE	SANTA CLARITA	91350-2991	1
RUSSELL SIGLER INC.	17745 E. VALLEY BLVD.	CITY OF INDUSTRY	91744	1
	2425 AUTO PKWY SUITE 200	ESCONDIDO	92029	1
	19801 RANCHO WAY UNIT A	COMPTON	90220	1
SIGLER-ONTARIO	2641 LINDSAY PRIVADO DR.	ONTARIO	91761	1
RUSSELL SIGLER	4863 SHAWLINE STREET	SAN DIEGO	92111	1
SIGLER	1070 COMMERCIAL STREET, SUITE 106	SAN JOSE	95112	1
GOODMAN DISTRIBUTION, INC.	1070 COMMERCIAL STREET STE 103	SAN JOSE	95112	1
	1900 Compton Ave Suite 102	CORONA	92881	1
	315 Cloverleaf Drive	BALDWIN PARK	91706	1
	525 Park Avenue Suite A	San Fernando	91340	1
	3562 Ruffin Road	SAN DIEGO	92123	1
	1225 N. Kraemer Blvd.	ANAHEIM	92806	1
	3648 Industry Avenue	LAKEWOOD	90712	1
	1972 Essex Ct	Redlands	92373	1
	30720 Gunther Street	Palm Springs	92276	1
	300 N. Graves Avenue, Unit C	OXNARD	93030	1
	15024 Anacapa Road	VICTORVILLE	92392	1
	41670 Reagan Way	MURRIETA	92562	1
	40222a LaQuinta Lane, Suite 101	PALMDALE	93551	1
	3633 Lenawee Ave. Ste 180	LOS ANGELES	90016	1
	3334 San Fernando Rd #102	LOS ANGELES	90065	1
	9621 Oates Dr	SACRAMENTO	95827	1
	4020 Nelson Ave. Suite 100	CONCORD	94520	1
	2601 Teepee Dr.	STOCKTON	95205	1
	8825 WASHINGTON BLVD. STE 400	ROSEVILLE	95678-5935	1
	2364 W Winton Ave	HAYWARD	94545	1

	1070 Commercial Street, Suite 103	SAN JOSE	95112	1
	840 N. 10th Street, Suite J	SACRAMENTO	95811	1
	2823 Gibson Street	BAKERSFIELD	93308	1
	2620 East Byrd Avenue	FRESNO	93706	1
	1101 Oates Court Ste 100	MODESTO	95358	1
	1150 McCullom Street	EL CENTRO	92243	1
GOODMAN DIST. # 706	5160 RICHTON ST. "A"	MONTCLAIR	91763	1
STANDARD SUPPLY USA	1820 "S" STREET	SACRAMENTO	95811	2
COAST APPLIANCE PARTS	1404 29TH STREET	BAKERSFIELD	93301-0000	1
	6909 SOUTH WESTERN AVENUE	LOS ANGELES	90047-0000	1
	2606 LEE AVENUE	SOUTH EL MONTE	91733-0000	1
	948 COLTON AVENUE	COLTON	92324-0000	1
	4408 TWAIN AVENUE	SAN DIEGO	92120-0000	1
	9515 KESTER AVENUE	VAN NUYS	91411-0000	1
	3260 EAST MCKINLEY	FRESNO	93703-0000	1
	1702 SOUTH LYON STREET	SANTA ANA	92705-0000	1
	312 EAST TULARE STREET	VISALIA	93277-0000	1
	6250 CHERRY AVENUE	LONG BEACH	90805-0000	1
	15700 SOUTH BROADWAY	GARDENA	90248-0000	1
	12503 VENICE BLVD.	CULVER CITY	90066-0000	1
GLOBAL HVAC	900 SPRECKLES AVENUE	MANTECA	95336	2
Lennox Parts Plus	299 GODDARD	IRVINE	92618	1
CATHEDRAL CITY #7	68713 PEREZ RD. BLDG. B-7	CATHEDRAL CITY	92234	1
GOODMAN DISTRIBUTION, INC #764	18085 EUCLID STREET	FOUNTAIN VALLEY	92708	1
SO. CAL A/C SUPPLY CO. INC	1000 NORTH JOHNSON AVENUE	EL CAJON	92020	1
GOODMAN DISTRIBUTION INC. # 768	16300 STAGG STREET	VAN NUYS	91406	1
HEATING & COOLING LLC #811	3970 HOME AVENUE	SAN DIEGO	92105	1
HEATING & COOLING LLC #813	629 ALPINE WAY	ESCONDID0	92029	1
HEATING & COOLING LLC #815	2350 MULBERRY STREET	RIVERSIDE	92501	1
HEATING & COOLING LLC #812	11661 RIVERSIDE DRIVE STE. 185	LAKESIDE	92040	1

HEATING & COOLING LLC #817	72110 CORPORATE WAY	THOUSAND PALMS	92276	1
HEATING & COOLING LLC #831	6510 SIERRA COURT	DUBLIN	94568	1
HEATING & COOLING LLC #832	5357 EAST HOME AVENUE	FRESNO	93727	1
HEATING & COOLING LLC #834	301 S. 9TH STREET-BLDG. C	MODESTO	95351	1
HEATING & COOLING LLC #833	3324 LANDCO DRIVE	BAKERSFIELD	93308	1
HEATING & COOLING LLC #835	7321 ROSEVILLE RD., SUITE 1	SACRAMENTO	95842	1
HEATING & COOLING LLC #821	685 N. POPLAR STREET	ORANGE	92868	1
HEATING & COOLING LLC #822	910 CANAL PLACE	CITY OF INDUSTRY	91746	1
HEATING & COOLING LLC #823	2650 N. INDUSTRY DRIVE	LAKEWOOD	90712	1
HEATING & COOLING LLC #824	14742 RAYMER STREET	VAN NUYS	91405	1
HEATING & COOLING LLC #826	320 LAMBERT STREET #8	OXNARD	93036	1
HEATING & COOLING LLC #825	9714 DEERING AVENUE	CHATSWORTH	91311	1
CFM EQUIPMENT	1744 SOUTH PEARL ST.	FRESNO	93721	1
BAKER DISTRIBUTING COMPANY #982	929 SEABOARD COURT	UPLAND	91786	1
LENNOX	30575 HILL ST.	THOUSAND PALMS	92276	1
ARCTIC SUPPLY	213 CIVIC CENTER DRIVE	NATIONAL CITY	91950	1
INDIO COOLING & HEATING SUPPLY	45-100 GOLF CENTER PARKWAY SUITE C	INDIO	92201	1
J W WOOD CO., INC/ALL AIR SUPPLY	224 MEYERS STREET	CHICO	95928	1
	3676 OLD HWY 44 DRIVE	REDDING	96004	1
TRANE PARTS - SOUTH SACRAMENTO	5440 FLORIN PERKINS RD	SACRAMENTO	95826	1
TRANE - LONG BEACH 549	1930 E CARSON ST #101	LONG BEACH	90810	1
TRANE - TUSTIN 544	1451 EDINGER AVE STE E	TUSTIN	92780	1
INGERSOLL RAND / TRANE	3565 CORPORATE CT	SAN DIEGO	92123	1
Trane INDUSTRY SITE 547	17760 ROWLAND ST.	CITY OF INDUSTRY	91748	1
MSI HVAC 08	75220 MERLE DR.	PALM DESERT	92211	1
MSI HVAC 01	11700 INDUSTRY AVE.	FONTANA	92337	1
Trane RIVERSIDE	2222 KANSAS AVE. SUITE C	RIVERSIDE	92507	1
Trane COMPANY GLENDALE	3631 SAN FERNANDO ROAD	GLENDALE	91204	1

APPENDIX G: Returns by location

Bin Number	Customer Name	City	Zip	Data	Grand Total
M10992	GEARY PACIFIC SUPPLY	REDDING	96002-9223	Sum of Total Stats Sum of Total lbs mercury	30 0.3596
M11059	FIX AIR AUTHORIZED Trane PARTS	SAN JOSE	95112-0000	Sum of Total Stats Sum of Total lbs mercury	45 0.5828
M11070	HOWARD INDUSTRIES	CULVER CITY	90232-0000	Sum of Total Stats Sum of Total lbs mercury	115 1.7732
M11071	HOWARD INDUSTRIES	CULVER CITY	90232-0000	Sum of Total Stats Sum of Total lbs mercury	66 0.8308
M11072	HOWARD INDUSTRIES	CULVER CITY	90232-0000	Sum of Total Stats Sum of Total lbs mercury	104 1.4322
M11150	JOHNSTONE SUPPLY CO	UPLAND	91786-5720	Sum of Total Stats Sum of Total lbs mercury	83 0.8742
M11262	RSD-MONTEREY PARK	MONTEREY PARK	91754-3616	Sum of Total Stats Sum of Total lbs mercury	51 0.6634
M11263	RSD	MONTEREY PARK	91754-	Sum of Total Stats	25

			3616	Sum of Total lbs mercury	0.31
M11273	RSD	FRESNO	93703-3005	Sum of Total Stats	74
				Sum of Total lbs mercury	1.3268
M11274	RSD	ANAHEIM	92806	Sum of Total Stats	76
				Sum of Total lbs mercury	1.1966
			92806-2503	Sum of Total Stats	147
				Sum of Total lbs mercury	2.511
M11275	RSD	ANAHEIM	92806-1760	Sum of Total Stats	61
				Sum of Total lbs mercury	1.1842
			92806-2503	Sum of Total Stats	126
				Sum of Total lbs mercury	1.8662
M11278	RSD	SAN LEANDRO	94577-1024	Sum of Total Stats	102
				Sum of Total lbs mercury	1.7794
M11279	RSD	SAN LEANDRO	94577-1024	Sum of Total Stats	63
				Sum of Total lbs mercury	1.1408
M11299	RSD	SAN JOSE	95112-0000	Sum of Total Stats	43
				Sum of Total lbs mercury	0.806

	RDS-SAN JOSE	SAN JOSE	95112-0000	Sum of Total Stats Sum of Total lbs mercury	52 0.8742
M11302	RSD	CONCORD	94520-0000	Sum of Total Stats Sum of Total lbs mercury	73 1.55
M11303	RSD	CONCORD	94520-0000	Sum of Total Stats Sum of Total lbs mercury	121 2.356
	RSD CONCORD	CONCORD	94520-0000	Sum of Total Stats Sum of Total lbs mercury	51 0.7688
M11305	RSD	VAN NUYS	91405-0000	Sum of Total Stats Sum of Total lbs mercury	166 1.86
M11312	RSD	POMONA	91768-0000	Sum of Total Stats Sum of Total lbs mercury	108 1.1656
M11313	RSD	POMONA	91766	Sum of Total Stats Sum of Total lbs mercury	109 1.7794
M11315	RSD	GARDENA	90248	Sum of Total Stats Sum of Total lbs mercury	41 0.713
M11318	RSD	SANTA ANA	92705-0000	Sum of Total Stats Sum of Total lbs mercury	78 1.302

M11321	RSD	SAN JOSE	95112-0000	Sum of Total Stats Sum of Total lbs mercury	212 3.596
M11719	RSD	ONTARIO	91761-0000	Sum of Total Stats Sum of Total lbs mercury	45 0.8432
M11720	RSD	ONTARIO	91761-0000	Sum of Total Stats Sum of Total lbs mercury	51 0.7502
M11944	JOHNSTONE SUPPLY-ANAHEIM	ANAHEIM	92805-0000	Sum of Total Stats Sum of Total lbs mercury	239 2.6846
M11945	JOHNSTONE SUPPLY CO	ESCONDIDO	92029-0000	Sum of Total Stats Sum of Total lbs mercury	166 1.5562
			92029-1914	Sum of Total Stats Sum of Total lbs mercury	146 2.1886
M12427	JOHNSTONE SUPPLY CO	SAN JOSE	95112-1408	Sum of Total Stats Sum of Total lbs mercury	107 1.8166
M12428	JOHNSTONE SUPPLY CO	OAKLAND	94607-0000	Sum of Total Stats Sum of Total lbs mercury	39 0.372
M12430	UNITED REFRIGERATION	BUENA PARK	90620-1030	Sum of Total Stats	181

				Sum of Total lbs mercury	2.5916
M12445	JOHNSTONE SUPPLY # 33	SUN VALLEY	91352-0000	Sum of Total Stats	183
				Sum of Total lbs mercury	1.7422
			91352-2505	Sum of Total Stats	42
				Sum of Total lbs mercury	0.5518
	JOHNSTONE SUPPLY CO	SUN VALLEY	91352-0000	Sum of Total Stats	185
				Sum of Total lbs mercury	1.6554
M12494	JOHNSTONE SUPPLY CO	FRESNO	93727-0000	Sum of Total Stats	43
				Sum of Total lbs mercury	0.6572
M12584	UNITED REFRIGERATION	LOS ANGELES	90065	Sum of Total Stats	38
				Sum of Total lbs mercury	0.4464
	UNITED REFRIGERATION # D5	LOS ANGELES	90065	Sum of Total Stats	50
				Sum of Total lbs mercury	0.6138
M12664	R.E. MICHEL CO. INC. #381	EL CAJON	92020-0000	Sum of Total Stats	44
				Sum of Total lbs mercury	0.5952
M13148	BURKE ENGINEERING COMPANY	ANAHEIM	92805-0000	Sum of Total Stats	46
				Sum of Total lbs mercury	0.6386
M13156	BURKE ENGINEERING COMPANY	VAN NUYS	91406-0000	Sum of Total Stats	33

				Sum of Total lbs mercury	0.3162
M13158	BURKE ENGINEERING COMPANY	NORTH HIGHLANDS	95660	Sum of Total Stats	18
				Sum of Total lbs mercury	0.1798
M13159	BURKE ENGINEERING COMPANY	RIVERSIDE	92507	Sum of Total Stats	228
				Sum of Total lbs mercury	2.0336
M13160	BURKE ENGINEERING COMPANY	LONG BEACH	90805-0000	Sum of Total Stats	36
				Sum of Total lbs mercury	0.62
M13163	BURKE ENGINEERING COMPANY	SAN JOSE	95112	Sum of Total Stats	47
				Sum of Total lbs mercury	0.558
M13698	CITY OF FREMONT PHHWCF	FREMONT	94538	Sum of Total Stats	48
				Sum of Total lbs mercury	0.4278
M13747	RSD	LIVERMORE	94551-0000	Sum of Total Stats	29
				Sum of Total lbs mercury	0.4154
M13749	RSD	LIVERMORE	94551-0000	Sum of Total Stats	77
				Sum of Total lbs mercury	1.147
M14118	SAN BERNADINO COUNTY HHW	SAN BERNADINO	92408-0000	Sum of Total Stats	76
				Sum of Total lbs mercury	0.775
M14178	MSI HVAC	ESCONDIDO	92029	Sum of Total Stats	75
				Sum of Total lbs mercury	1.6678

M14180	MSI HVAC	LAGUNA HILLS	92653	Sum of Total Stats Sum of Total lbs mercury	145 1.55
M14194	A-1 GUARANTEED	VALLEJO	94589	Sum of Total Stats Sum of Total lbs mercury	103 2.3312
M14380	UNITED REFRIGERATION	SANTA BARBARA	93103-3629	Sum of Total Stats Sum of Total lbs mercury	90 1.3888
M14461	BAY COUNTIES WASTE SERVICES	SUNNYVALE	94089-0000	Sum of Total Stats Sum of Total lbs mercury	15 0.1054
M14469	JOHNSTONE SUPPLY	LAGUNA HILLS	92653-1307	Sum of Total Stats Sum of Total lbs mercury	47 0.4588
	JOHNSTONE SUPPLY CO	LAGUNA HILLS	92653-1307	Sum of Total Stats Sum of Total lbs mercury	47 0.4402
M14495	USACD	ANAHEIM	92805-0000	Sum of Total Stats Sum of Total lbs mercury	191 2.9264
M14496	USACD	BAKERSFIELD	93305-0000	Sum of Total Stats Sum of Total lbs mercury	8 0.0806
M14497	USACD	CHATSWORTH	91311	Sum of Total Stats Sum of Total lbs mercury	60 0.682
			91311-	Sum of Total Stats	607

			0000	Sum of Total lbs mercury	6.8634
M14498	USACD	EL CAJON	92020-0000	Sum of Total Stats	96
				Sum of Total lbs mercury	1.3454
M14499	USACD	CITY OF INDUSTRY	91748-0000	Sum of Total Stats	1377
				Sum of Total lbs mercury	18.1722
M14500	USACD	RIVERSIDE	92507-0000	Sum of Total Stats	176
				Sum of Total lbs mercury	1.7918
	US AIRCONDITIONING DIST.	RIVERSIDE	92507-0000	Sum of Total Stats	90
				Sum of Total lbs mercury	0.9858
M14501	US AIR CONDITIONING DISTRIBUTORS	SAN DIEGO	92111-1520	Sum of Total Stats	41
				Sum of Total lbs mercury	0.5208
	USACD	SAN DIEGO	92111-0000	Sum of Total Stats	95
				Sum of Total lbs mercury	1.5748
			92111-1520	Sum of Total Stats	115
				Sum of Total lbs mercury	1.9344
	US AIRCONDITIONING DIST.	SAN DIEGO	92111-1520	Sum of Total Stats	184
				Sum of Total lbs	2.9636

				mercury	
M14502	USACD	SIGNAL HILL	90755-2210	Sum of Total Stats Sum of Total lbs mercury	380 5.2266
M14503	USACD	NORTH HIGHLANDS	95660-0000	Sum of Total Stats Sum of Total lbs mercury	35 0.4402
M14504	USACD	SAN LEANDRO	94577-0000	Sum of Total Stats Sum of Total lbs mercury	125 1.0168
M14522	GOODCENTS	MANTECA	95336	Sum of Total Stats Sum of Total lbs mercury	96 1.085
M14523	GOODCENTS	MANTECA	95336	Sum of Total Stats Sum of Total lbs mercury	83 0.9982
			95336-0000	Sum of Total Stats Sum of Total lbs mercury	46 0.4588
M14530	AMERICAN REFRIGERATION SUPPLIES INC.	SAN FRANCISCO	94103-0000	Sum of Total Stats Sum of Total lbs mercury	76 1.1098
M14538	SAN BERNADINO COUNTY HHW	SAN BERNADINO	92408-0000	Sum of Total Stats Sum of Total lbs mercury	66 0.5146
M14544	SLAKEY BROTHERS	SAN JOSE	95126-0000	Sum of Total Stats Sum of Total lbs	35 0.2914

				mercury	
M14545	USACD	ESCONDIDO	92029-0000	Sum of Total Stats Sum of Total lbs mercury	108 1.55
M14572	USACD	REDDING	96003	Sum of Total Stats Sum of Total lbs mercury	25 0.2852
M14582	MOUNTAIN AIR	PINE GROVE	95665	Sum of Total Stats Sum of Total lbs mercury	47 0.5952
M14593	SLAKEY BROTHERS	SAN JOSE	95126	Sum of Total Stats Sum of Total lbs mercury	101 1.4818
		SOUTH SAN FRANCISCO	94080	Sum of Total Stats Sum of Total lbs mercury	32 0.3472
M14600	AIR COLD-A FERGUSON ENTERPRISE	NEWBURY PARK	91320	Sum of Total Stats Sum of Total lbs mercury	207 2.0274
M14602	AIR COLD-A FERGUSON ENTERPRISE	SAN GABRIEL	91776	Sum of Total Stats Sum of Total lbs mercury	243 2.3312
M14607	AIR COLD-A FERGUSON ENTERPRISE	SAN LUIS OBISPO	93401-7316	Sum of Total Stats Sum of Total lbs mercury	39 0.3286
M14645	USACD	HESPERIA	92345-0000	Sum of Total Stats Sum of Total lbs mercury	58 1.5872
M14659	ALLIED REFRIGERATION	SIGNAL HILL	90755-	Sum of Total Stats	73

			0000	Sum of Total lbs mercury	1.0106
M14661	ALLIED REFRIGERATION	TUSTIN	92780-0000	Sum of Total Stats Sum of Total lbs mercury	37 0.6386
M14664	ALLIED REFRIGERATION	POMONA	91767-5840	Sum of Total Stats Sum of Total lbs mercury	130 2.108
M14666	ALLIED REFRIGERATION	SAN JOSE	95112-0000	Sum of Total Stats Sum of Total lbs mercury	86 1.705
M14668	ALLIED REFRIGERATION	VAN NUYS	91406-0000	Sum of Total Stats Sum of Total lbs mercury	37 0.3782
M14679	USACD	TEMECULA	92590-0000	Sum of Total Stats Sum of Total lbs mercury	60 1.0168
M14781	TOTALINE OF CALIFORNIA	ORANGE	92865	Sum of Total Stats Sum of Total lbs mercury	33 1.9158
M14799	SIGLER	SAN JOSE	95112	Sum of Total Stats Sum of Total lbs mercury	42 0.527
M14918	SLAKEY BROTHERS	GRASS VALLEY	95945	Sum of Total Stats Sum of Total lbs mercury	30 0.3596
M14952	SLAKEY BROTHERS/SAN JOSE	SAN JOSE	95126	Sum of Total Stats	47

				Sum of Total lbs mercury	0.6076
M14954	SLAKEY BROTHERS/SANTA ROSA	SANTA ROSA	95407-7844	Sum of Total Stats	33
				Sum of Total lbs mercury	0.3534
M15004	GOODCENTS	MANTECA	95336	Sum of Total Stats	294
				Sum of Total lbs mercury	3.4782
M15005	GOODCENTS	MANTECA	95336	Sum of Total Stats	219
				Sum of Total lbs mercury	2.4862
M15006	GOODCENTS	MANTECA	95336	Sum of Total Stats	132
				Sum of Total lbs mercury	1.5748
M15007	GOODCENTS	MANTECA	95336	Sum of Total Stats	287
				Sum of Total lbs mercury	3.2054
M15065	CITY OF SAN DIEGO, MIRAMAR HHWCF	SAN DIEGO	92111-0000	Sum of Total Stats	53
				Sum of Total lbs mercury	0.5642
M15068	JOHNSTONE SUPPLY UPLAND	UPLAND	91786-5720	Sum of Total Stats	103
				Sum of Total lbs mercury	1.1346
M15074	USACD	EL CENTRO	92243	Sum of Total Stats	133
				Sum of Total lbs mercury	1.2338
M15124	RSD	CHATSWORTH	91311	Sum of Total Stats	83
				Sum of Total lbs mercury	1.3578
M15143	JOHNSTONE SUPPLY OF LONE BEACH	LONG BEACH	90806-	Sum of Total Stats	60

			2213	Sum of Total lbs mercury	0.7874
M15462	RAHAC HTG & COOLING INC.	GLENDALE	91201	Sum of Total Stats	13
				Sum of Total lbs mercury	0.1364
M15645	USACD	CITY OF INDUSTRY	91748	Sum of Total Stats	1265
				Sum of Total lbs mercury	18.7302
M13164	BURKE ENGINEERING COMPANY	SAN JOSE	95112	Sum of Total Stats	40
				Sum of Total lbs mercury	0.7068
		EL MONTE	91733-1799	Sum of Total Stats	63
				Sum of Total lbs mercury	0.6138
M15034	THRIFTY SUPPLY	SACRAMENTO	95826	Sum of Total Stats	30
				Sum of Total lbs mercury	0.2728
M13153	BURKE ENGINEERING COMPANY	SAN DIEGO	92111	Sum of Total Stats	30
				Sum of Total lbs mercury	0.372
			92111-0000	Sum of Total Stats	32
				Sum of Total lbs mercury	0.4216
M14601	AIR COLD SUPPLY # 1057	SANTA CLARITA	91350-2991	Sum of Total Stats	57
				Sum of Total lbs mercury	0.5952
M12703	RSD	SACRAMENTO	95827-2104	Sum of Total Stats	70
				Sum of Total lbs	1.2524

				mercury	
M11268	RSD	RIVERSIDE	92501-0000	Sum of Total Stats Sum of Total lbs mercury	50 0.6634
M14919	NEVADA COUNTY H.H.W. FACILITY	GRASS VALLEY	95949	Sum of Total Stats Sum of Total lbs mercury	43 0.4588
M14922	NEVADA COUNTY H.H.W. FACILITY	GRASS VALLEY	95949	Sum of Total Stats Sum of Total lbs mercury	59 0.6324
M14614	AIR COLD-A FERGUSON ENTERPRISE	CULVER CITY	90230	Sum of Total Stats Sum of Total lbs mercury	48 0.4402
M15057	WESTERN NEVADA SUPPLY	TRUCKEE	96161-0000	Sum of Total Stats Sum of Total lbs mercury	51 0.4402
M14947	SLAKEY BROTHERS/NORTH HIGHLANDS	NORTH HIGHLANDS	95660	Sum of Total Stats Sum of Total lbs mercury	51 0.4712
M14798	TOTALINE OF CALIFORNIA	SAN JOSE	95112	Sum of Total Stats Sum of Total lbs mercury	20 0.217
M14795	TOTALINE OF CALIFORNIA	SAN DIEGO	92111	Sum of Total Stats Sum of Total lbs mercury	40 0.5394
M15668	USACD	PASO ROBLES	93446	Sum of Total Stats Sum of Total lbs mercury	62 0.6758
M13135	GEARY PACIFIC SUPPLY	RIVERSIDE	92507-0000	Sum of Total Stats Sum of Total lbs	39 0.3224

				mercury	
M14510	GEARY PACIFIC SUPPLY	RIVERSIDE	92507-0000	Sum of Total Stats Sum of Total lbs mercury	39 0.3534
M14567	JOHNSTONE SUPPLY #140	SALINAS	93901	Sum of Total Stats Sum of Total lbs mercury	53 0.7192
M15600	RAHAC HTG & COOLING INC.	GLENDALE	91201-0000	Sum of Total Stats Sum of Total lbs mercury	38 0.2852
M14766	SIGLERS	CITY OF INDUSTRY	91744	Sum of Total Stats Sum of Total lbs mercury	15 0.2046
M14585	SLAKEY BROTHERS	REDDING	96002	Sum of Total Stats Sum of Total lbs mercury	46 0.465
M10125	RSD-48	GARDENA	90248-0000	Sum of Total Stats Sum of Total lbs mercury	85 1.4012
M11316	RSD	BUENA PARK	90620-0000	Sum of Total Stats Sum of Total lbs mercury	133 2.1576
M14592	SLAKEY BROTHERS	SANTA CRUZ	95060	Sum of Total Stats Sum of Total lbs mercury	56 0.4154
M11947	JOHNSTONE SUPPLY CO	SAN DIEGO	92110	Sum of Total Stats Sum of Total lbs mercury	129 1.674
			92110-	Sum of Total Stats	28

			0000	Sum of Total lbs mercury	0.4526
M12669	R.E. MICHEL COMPANY, INC	EL CAJON	92020-00	Sum of Total Stats Sum of Total lbs mercury	95 1.3764
M12429	JOHNSTONE SUPPLY CO	CONCORD	94520-0000	Sum of Total Stats Sum of Total lbs mercury	58 0.6324
M11074	HOWARD INDUSTRIES	CULVER CITY	90232-0000	Sum of Total Stats Sum of Total lbs mercury	103 2.6474
M12704	BURKE ENGINEERING COMPANY	SAN JOSE	95112-0000	Sum of Total Stats Sum of Total lbs mercury	48 0.5332
M13748	RSD	LIVERMORE	94551-0000	Sum of Total Stats Sum of Total lbs mercury	50 1.0478
M14917	ALAMEDA COUNTY HHW	HAYWARD	94545	Sum of Total Stats Sum of Total lbs mercury	15 0.2542
M13475	CLEAN HARBORS EVS	PETALUMA	94952	Sum of Total Stats Sum of Total lbs mercury	66 0.589
M12864	COUNTY OF TUOLUMNE	SONORA	95370	Sum of Total Stats Sum of Total lbs mercury	7 0.062
M14789	TOTALINE OF CALIFORNIA	RIVERSIDE	92507	Sum of Total Stats Sum of Total lbs	13 0.1612

				mercury	
M12887	RSD-22	REDDING	96002-0000	Sum of Total Stats Sum of Total lbs mercury	44 0.7812
M14531	AMERICAN REFRIGERATION SUPPLIES INC.	OAKLAND	94607-0000	Sum of Total Stats Sum of Total lbs mercury	18 0.2914
M16044	Baker Distributing Co.	CHICO	95928	Sum of Total Stats Sum of Total lbs mercury	77 0.8618
M14779	SIGLER-ONTARIO	ONTARIO	91761	Sum of Total Stats Sum of Total lbs mercury	15 0.1054
M16454	RSD	ROSEVILLE	95678-0000	Sum of Total Stats Sum of Total lbs mercury	59 0.9982
M16453	RSD	ROSEVILLE	95678-0000	Sum of Total Stats Sum of Total lbs mercury	132 2.3002
M11281	RDS-BURBANK	BURBANK	91502-2014	Sum of Total Stats Sum of Total lbs mercury	31 0.3596
M11410	LENNOX INDUSTRIES INC.	CHINO	91710-2943	Sum of Total Stats Sum of Total lbs mercury	42 0.5208
M13339	LENNOX INDUSTRIES INC.	ONTARIO	91761-0000	Sum of Total Stats Sum of Total lbs	36 0.4588

				mercury	
		MIRA LOMA	91752	Sum of Total Stats Sum of Total lbs mercury	19 0.2356
M15872	GOODMAN DISTRIBUTION, INC.	Montclair	91763	Sum of Total Stats Sum of Total lbs mercury	23 0.3782
	GOODMAN DIST. # 706	Montclair	91763	Sum of Total Stats Sum of Total lbs mercury	29 0.2666
M14374	UNITED REFRIGERATION	SAN BERNADINO	92408-2230	Sum of Total Stats Sum of Total lbs mercury	51 0.6882
M13146	BURKE ENGINEERING COMPANY	EL MONTE	91733-1799	Sum of Total Stats Sum of Total lbs mercury	53 0.6386
M14382	UNITED REFRIGERATION # C4	North Hills	91343	Sum of Total Stats Sum of Total lbs mercury	41 0.403
M16705	USACD	CITY OF INDUSTRY	91748	Sum of Total Stats Sum of Total lbs mercury	133 1.5004
M16706	USACD	CITY OF INDUSTRY	91748	Sum of Total Stats Sum of Total lbs mercury	79 0.9424
M16704	USACD	CITY OF INDUSTRY	91748	Sum of Total Stats Sum of Total lbs mercury	74 0.9362
M16703	USACD	CITY OF INDUSTRY	91748	Sum of Total Stats Sum of Total lbs mercury	109 1.4136

M16702	USACD	CITY OF INDUSTRY	91748	Sum of Total Stats Sum of Total lbs mercury	69 1.0106
		CULVER CITY	90232	Sum of Total Stats Sum of Total lbs mercury	41 2.1266
M16700	USACD	CITY OF INDUSTRY	91748	Sum of Total Stats Sum of Total lbs mercury	147 1.984
M16701	USACD	CITY OF INDUSTRY	91748	Sum of Total Stats Sum of Total lbs mercury	80 0.992
	CATHEDRAL CITY #7	CATHEDRAL CITY	92234	Sum of Total Stats Sum of Total lbs mercury	85 3.7138
M14958	SLAKEY BROTHERS/YUBA CITY	YUBA CITY	95991	Sum of Total Stats Sum of Total lbs mercury	33 0.3162
M14915	ALAMEDA COUNTY HHW	HAYWARD	94545	Sum of Total Stats Sum of Total lbs mercury	41 0.3348
M16234	USACD	FRESNO	93706	Sum of Total Stats Sum of Total lbs mercury	47 0.434
M14913	ALAMEDA COUNTY HHW	OAKLAND	94602	Sum of Total Stats Sum of Total lbs mercury	44 0.403
M14794	RUSSELL SIGLER	SAN DIEGO	92111	Sum of Total Stats Sum of Total lbs mercury	53 0.6076
M14162	SPECIALTY AC	BENICIA	94510-0000	Sum of Total Stats Sum of Total lbs	14 0.2728

				mercury	
M14634	R.E. MICHEL COMPANY, INC	VAN NUYS	91406	Sum of Total Stats Sum of Total lbs mercury	33 0.3472
			91405-1262	Sum of Total Stats Sum of Total lbs mercury	17 0.1736
M11149	JOHNSTONE SUPPLY CO	BALDWIN PARK	91706-2289	Sum of Total Stats Sum of Total lbs mercury	65 0.6076
M14787	RUSSELL SIGLER INC.	COMPTON	90220	Sum of Total Stats Sum of Total lbs mercury	30 0.3286
M12817	MCCLELLAND Air CONDITIONING	CHICO	95973	Sum of Total Stats Sum of Total lbs mercury	23 0.31
M14767	RUSSELL SIGLER INC.	CITY OF INDUSTRY	91744	Sum of Total Stats Sum of Total lbs mercury	4 0.062
M14518	CFM EQUIPMENT DIST.	SACRAMENTO	95838-0000	Sum of Total Stats Sum of Total lbs mercury	22 0.217
M14366	UNITED REFRIGERATION	MURRIETA	92562-9193	Sum of Total Stats Sum of Total lbs mercury	11 0.1426
M11075	HOWARD INDUSTRIES	CULVER CITY	90232-0000	Sum of Total Stats Sum of Total lbs mercury	14 0.217

M14770	RUSSELL SIGLER INC.	ESCONDIDO	92029	Sum of Total Stats Sum of Total lbs mercury	15 0.248
M14583	SLAKEY BROTHERS	MODESTO	95352	Sum of Total Stats Sum of Total lbs mercury	10 0.1054
M14372	UNITED REFRIGERATION	PALM DESERT	92211-0474	Sum of Total Stats Sum of Total lbs mercury	53 0.496
M14464	FACSCO	FRESNO	93703-0000	Sum of Total Stats Sum of Total lbs mercury	86 1.3144
M11073	HOWARD INDUSTRIES	CULVER CITY	90232-0000	Sum of Total Stats Sum of Total lbs mercury	46 0.3844
M15187	BUCKLEY PARNELL HEAT & AIR	CITRUS HEIGHTS	95621	Sum of Total Stats Sum of Total lbs mercury	20 0.2356
M13877	CHIMNEY KRAFT	CRESCENT CITY	95531	Sum of Total Stats Sum of Total lbs mercury	26 0.372
M14381	UNITED REFRIGERATION	SANTA MARIA	93455-1058	Sum of Total Stats Sum of Total lbs mercury	37 0.434
M11725	RSD	SACRAMENTO	95827-2104	Sum of Total Stats Sum of Total lbs mercury	63 1.0292
M15198	MATRIX HG, INC.	CONCORDIA	94518	Sum of Total Stats	24

				Sum of Total lbs mercury	0.4154
M14663	ALLIED REFRIGERATION	SAN BERNADINO	92410-0000	Sum of Total Stats	44
				Sum of Total lbs mercury	0.434
M14605	AIR COLD-A FERGUSON ENTERPRISE	EL CAJON	92020	Sum of Total Stats	41
				Sum of Total lbs mercury	0.4278
M12770	DAN GOETZ WHOLESALE OUTLET INC	SANTA ROSA	95407	Sum of Total Stats	59
				Sum of Total lbs mercury	0.7812
M14371	UNITED REFRIGERATION	OXNARD	93036-8916	Sum of Total Stats	11
				Sum of Total lbs mercury	0.1488
M14341	KERN COUNTY SPECIAL WASTE FACILITY	BAKERSFIELD	93308-4531	Sum of Total Stats	50
				Sum of Total lbs mercury	0.3286
M14571	GEARY PACIFIC SUPPLY	NORTH HIGHLANDS	95660-5701	Sum of Total Stats	72
				Sum of Total lbs mercury	1.4632
M14286	COUNTY OF VENTURA-	VENTURA	93009-1650	Sum of Total Stats	6
				Sum of Total lbs mercury	0.0372
M15948	BILL HOWE HEATING & AIR	SAN DIEGO	92110	Sum of Total Stats	26
				Sum of Total lbs mercury	0.2666
M16222	AAA AIR & HEATING	FRESNO	93727	Sum of Total Stats	55
				Sum of Total lbs mercury	0.4464

M15041	MAKI HEATING & AIR CONDITIONING, INC.	AUBURN	95603	Sum of Total Stats Sum of Total lbs mercury	24 0.2046
M16041	Baker Distributing Co.	PACOMIA	91331-0000	Sum of Total Stats Sum of Total lbs mercury	35 0.5828
M11276	RSD	SACRAMENTO	95815-3216	Sum of Total Stats Sum of Total lbs mercury	45 0.682
M16043	Baker Distributing Co.	CHATSWORTH	91311-0000	Sum of Total Stats Sum of Total lbs mercury	24 0.2232
M14379	UNITED REFRIGERATION	SANTA ANA	92705-4705	Sum of Total Stats Sum of Total lbs mercury	25 0.3472
M14086	D & D PLUMBING HEATING & COOLING	VACAVILLE	95687	Sum of Total Stats Sum of Total lbs mercury	1 0.0062
M14375	UNITED REFRIGERATION	SAN CARLOS	94070-5316	Sum of Total Stats Sum of Total lbs mercury	121 2.4986
M16771	Baker Distributing Company	IRWINDALE	91706	Sum of Total Stats Sum of Total lbs mercury	63 0.7006
M15189	GENIE AIR CONDITIONING & HEATING, INC	VAN NUYS	91411	Sum of Total Stats Sum of Total lbs mercury	9 0.248
M14587	SLAKEY BROTHERS	SALINAS	93901	Sum of Total Stats	9

				Sum of Total lbs mercury	0.0682
M12660	Baker Distributing Co.	SAN JOSE	95131-2108	Sum of Total Stats	52
				Sum of Total lbs mercury	0.837
M14575	SLAKEY BROTHERS	CHICO	95927	Sum of Total Stats	62
				Sum of Total lbs mercury	0.5952
M14468	JOHNSTONE SUPPLY CO	SANTA ANA	92707-0000	Sum of Total Stats	79
				Sum of Total lbs mercury	1.1594
M14921	NEVADA COUNTY H.H.W. FACILITY	GRASS VALLEY	95949	Sum of Total Stats	74
				Sum of Total lbs mercury	0.8246
M12655	Baker Distributing Co.	SANTA ROSA	95407-0000	Sum of Total Stats	26
				Sum of Total lbs mercury	0.2852
M11288	RSD	SAN DIEGO	92111-1110	Sum of Total Stats	42
				Sum of Total lbs mercury	0.8432
	RSD 25	SAN DIEGO	92111-1110	Sum of Total Stats	35
				Sum of Total lbs mercury	0.6882
M11289	RSD	SAN DIEGO	92111-1110	Sum of Total Stats	37
				Sum of Total lbs mercury	0.6758
	RSD 25	SAN DIEGO	92111-1110	Sum of Total Stats	26

				Sum of Total lbs mercury	0.5022
M13190	TRANE PARTS CENTER	ROCKLIN	95677-0000	Sum of Total Stats Sum of Total lbs mercury	39 0.6262
M14376	UNITED REFRIGERATION	SAN DIEGO	92123-1403	Sum of Total Stats Sum of Total lbs mercury	23 0.3596
M15599	RAHAC HTG & COOLING INC.	GLENDALE	91201-2305	Sum of Total Stats Sum of Total lbs mercury	9 0.0682
M14529	AMERICAN REFRIGERATION SUPPLIES INC.	CORONA	92880-0000	Sum of Total Stats Sum of Total lbs mercury	40 0.4526
M14608	FERGUSON HEATING & COOLING	AZUSA	91702	Sum of Total Stats Sum of Total lbs mercury	28 0.2852
M12545	UNITED REFRIGERATION	IRWINDALE	91706-2085	Sum of Total Stats Sum of Total lbs mercury	14 0.124
M11362	RSD	REDDING	96002-1369	Sum of Total Stats Sum of Total lbs mercury	56 1.4756
M12495	JOHNSTONE SUPPLY CO	FRESNO	93727-0000	Sum of Total Stats Sum of Total lbs mercury	35 0.3596
M15894	GOODMAN DISTRIBUTION, INC.	ROSEVILLE	95678-	Sum of Total Stats	53

			5935	Sum of Total lbs mercury	0.5704
M14633	CALIFORNIA COOLING SUPPLY	VAN NUYS	91405	Sum of Total Stats	34
				Sum of Total lbs mercury	0.4216
Total Sum of Total Stats					18697
Total Sum of Total lbs mercury					254.8386

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Mercury-Containing Thermostats: Estimating Inventory and Flow from Existing Residential & Commercial Buildings

A Study to Meet Requirements for State of California Thermostat Recycling Legislation

prepared for:
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December 28, 2009

ORGANIZATION OF THE REPORT

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1. Project Background and Executive Summary

The State of California will develop regulations establishing collection rates for waste mercury-containing thermostats. As part of the planning process, the State mandated that thermostat manufacturers develop a "statistically valid" estimate of the mercury-containing thermostats that annually become waste in California.

To develop the required estimates, the Thermostat Recycling Corporation, acting on behalf of 28 manufacturers that historically sold mercury-containing thermostats, contracted with Skumatz Economic Research Associates (SERA) of Superior Colorado, experts in energy- and recycling-related surveys, statistics, and estimation of measure lifetimes and "decay curves". The project's activities included:

- Developed technical approach for the project for review by the State and Stakeholders that could fulfill the mandates of being methodologically defensible
- Discussed the technical approach at a meeting in Sacramento, and responded to questions
- Developed a web survey including the key questions needed to develop estimates required by the legislation
- Designed appropriate sampling designs to "represent" the desired population, and purchased lists of random households, and stratified random sample of businesses, across the State
- Prepared tailored postcards inviting the residential and commercial samples to complete the survey on-line (phone number also provided for those wishing to complete via phone)
- Mailed a second postcard and conducted pro-active telephone surveys with the commercial sector to improve the statistical properties and increase the response count
- Analyzed the data gathered from the survey;
- Conducted two validation survey efforts – on-sites to 30 respondent premises to verify accuracy of the survey responses on thermostat type and to provide indicative information on the presence of mercury in ambiguous thermostat types (round, square, etc.). We also sent disposable cameras to 44 respondents to provide an additional opportunity to verify the accuracy and consistency of responses regarding reporting of thermostat "counts" and types.
- Prepared a draft report (and final report incorporating comments), to be completed by the end of December 2009.

The analysis shows that there are an average of 5.6 total thermostats in the average business premise (businesses, not buildings, were the unit of measure). The average household in the State of California has 1.2 thermostats. Although we cannot accurately project the share of these total thermostats that are mercury-containing (the study's focus was inventory and flow), it was possible to develop a range. The "high" end of the range derives from an assumption that 100% of any thermostat type that *can* contain mercury *does* contain mercury. The outcome of this assumption is that all thermostats except digital models are assumed to contain mercury – an obvious overestimate, but the estimate provides a "bound". The "lower" estimate derives from a small sample of site visits, during which an inspector popped the lid off all except digital thermostats. A significant number of potentially-mercury-containing thermostats instead used bimetal strips or were otherwise non-mercury versions of the models. The use of this figure reduces the mercury-containing shares for square and round models to 17% and 70%,

respectively. Using these sources, the computed range for the share of thermostats that contain mercury varies between 22-46% for commercial and 27-47% for residential models currently in-the-field.

Tables 1.1- 1.5 summarize the results of the study. Our research indicates that:

- There are about 1.4 million mercury-containing thermostats in the commercial sector (taking the midpoint of the high / low ranges); and about 5.8 million mercury-containing thermostats in California households, for a total of about 7.2 million (5.1-9.3 million) mercury-containing thermostats statewide.
- Our mid-point estimate is that there are 0.4 mercury-containing thermostats per household (1.2 total thermostats), and 1.9 mercury-continuing thermostats per business (of 5.6 total thermostats per business.
- The penetration of digital thermostats in the State is about 53-54% in both the commercial and residential sectors.

Validation Analysis: Although not part of the legislative requirements, we conducted two small-scale validation efforts to provide indicative data on the reliability of self-report data for a study of this nature. We conducted 30 site visits centered around the Bay Area, and in a separate effort, we mailed out 44 disposable cameras to a random sample of respondents state-wide. A detailed description of the results and methods is found in Section 4.1 of this report. The camera validation work was still in progress at the time this report was prepared, so fewer replies from that approach are available (12 returns).

The combination of these two validation efforts finds that self-reports were correct in the majority of cases. There were a total of five errors in the reported totals of thermostats on the premise from the 42 validated sites (12% had errors); the errors in "total count" were 4% from the residential side, and 15% from the commercial side. Using these figures, we find a total estimated weighted correction factor (given the total thermostats reported from the residential vs. commercial sectors) of about 13.5% undercounting of thermostats using self-reported figures. The validation work also examined the accuracy in the report of types of thermostats present in the home or business. No errors were detected in the photo sample; four residents and no businesses reported incorrect types based on the on-site validation work (3% error in types compared to the total thermostats inspected). These results are included in Table 1.6.

Survey Feedback – "Drivers" and Intervention Points

Finally, we gathered information on the drivers, or possible intervention points for capturing the mercury thermostats.

- Business Thermostat Replacement Drivers and Disposal Practices:
    - The number two reason for replacing the thermostat is proactive switch-out for a programmable model. The other drivers for business replacement / removal of thermostats are renovations / replacement of the heating system, and a thermostat that stops functioning. Some heating / cooling system upgrades do take place without replacing the thermostats, but these are a minority (about 1/3 as often as replacing the thermostats).
    - The single most important influencing factor for removing the wall thermostat was to replace it with a model or system that would allow better and more even temperature control, followed closely by a move to a more efficient heating system.

- Most businesses have taken little responsibility for the disposal of removed wall thermostats. The vast majority said they "didn't know" what happened to them, or the contractor disposed of it and the business didn't know where. A small minority said they were disposed in trash and about the same number indicated it went to a recycling facility.
- Note that about 5% of the responding businesses indicated there is a small cache of removed and used thermostats awaiting discard or recycling at their facility. These would be likely to be brought forward in the initial years of any convenient thermostat recycling program that might be established.

- Residential Thermostat Replacement Drivers and Disposal Practices:
  - Households show similar patterns in drivers for replacement of thermostats: upgrades of the heating / cooling system, followed with a very close second of a desire to install programmable thermostat.
  - In the residential sector, the existing thermostats were retained after a heating / cooling system upgrade only about one-fifth of the time.
  - Influencing factors for replacement included the desire for a more even temperature in the home, and an upgrade to a more energy efficient heating system. Utility energy programs and rebates were an important, but lower tier, driver (about half as important as the system's efficiency). The utility incentives were about equal in importance with high heating / cooling bills and the addition of new space in the home as a driver.
  - The vast majority of households say the contractor disposed of the removed thermostat equipment and they do not know what was done with them; many others don't know at all what happened to the removed equipment, or said they threw them in the trash. Another 5% said they still have old ones in storage (which may result in a small surge at start-up of a new program), and a similar number said they were delivered to a recycling center.
  - The level of planned remodels in businesses or homes that may potentially affect thermostats is fairly low over the next three years, presumably due in part to the economy.

Beyond the "count" information provided in Tables 1.1-1.5, the key lessons learned from this research are:

- Nearly half the respondents (47% of households, 40% commercial) were completely unaware that older thermostats could contain mercury. Neither households nor businesses think at all about recycling or potentially proper disposal of thermostats.[1] Contractors were the leading reported destination for removed residential and commercial thermostats. *The vast majority of thermostats can be recovered by acting on the primary contractors who are responsible for the majority of retrofits for both the residential and commercial sectors*. *"Do it yourself" efforts seem a relatively small part of the market and cause of thermostat disposal.*
- The low response to our first round of postcards requesting participation in the survey *demonstrated a relative disinterest in mercury thermostats as a special disposal issue.*

[1] Two-thirds of households with a thermostat replacement said the contractor disposed of the thermostat and they didn't know where, or they just didn't know where the removed thermostat(s) went. Only about 5% reported sending them to an appropriate facility. Commercial respondents were even less likely to know where the thermostats went and relied on contractors. Contractors were 3-4 times more commonly-cited as a thermostat destination than any other listed (hazardous waste site, trash, used in other locations, etc.).

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When we sent the second email, we portrayed the survey as one addressing general recycling and "hard-to-recycle" items (and we added a few general questions to draw them in before hitting them with our thermostat queries). Residents and businesses are not tuned into thermostats.

The remainder of this report focuses solely on methods and the estimation work. There are no additional results related to the central goal of the project are included in the remainder of the report.

Table 1.1: Summary of Key Results on the Inventory and Flows of Mercury-Containing Thermostats in Businesses and Households in the State of California (source: project survey, or directly-resulting computations, unless otherwise noted)

Average (and 95% confidence interval)	Commercial	Residential	Weighted Average
Avg Thermostats per business, Household, est.	5.6[2] (-0.22-11.39)	1.17[3] (1.1-1.2)	1.5 (.44-2.6)
Total Thermostat shares, California, estimated	21%	79%	100%
Total Thermostats in California, estimated	4.1 million	15.7 million	19.8 million
Share that are mercury-containing, lower, est.*	22%	27%	26%
Share that are mercury-containing, high, est.*	46%	47%	47%
Total Mercury-containing, Lower, est.	0.9 million	4.2 million	5.1 million
Total Mercury-containing, high, est., (parentheses incorporate higher estimate adding 13.5% for possible underreporting identified in validation	1.9 million (2.2 million)	7.4 million (8.4 million)	9.3 million (10.5 million)
Average Age in years, all	15.7 (14.9-16.4)	11.7 (10.9-12.5)	12.56 (12.0-13.1)
Average Age in years, square	21.9 (20.8-23.0)	21.4 (19.2-23.6)	21.6 (20.3-22.8)
Average Age in years, round	29.4 (25.5-33.3)	30.9 (27.0-34.8)	30.5 (27.8-33.2)
Average Age in years, digital	8.5 (7.9-9.1)	6.3 (5.9-6.8)	6.8 (6.4-7.1)
Average Age in years, snap	18.8 (15.2-22.4)	11.7 (8.3-15.1)	12.4 (9.8-15.0)
Average Age in years, lever	31.2 (28.5-33.8)	14.2 (9.8-18.7)	17.5 (14.4-20.7)
Average Age in years, other	12.1 (6.1-18.1)	25.0 (15.4-34.7)	20.4 (15.9-25.0)
Est. Number of households and businesses in California (Source: Census 2006, 2008)	723,900[4]	13.4 million	14.1 million

Note(*): "lower estimate" for mercury-containing thermostats derived from very small (30 observations) on-site validation survey. "High estimate" derived from "worst case assumptions" where only digital thermostats are assumed to lack mercury. The actual share of mercury models will be less than worst case, but may be higher or lower than "lower" estimate.

[2] This translates to an average of approximately 0.3 thermostats per paid employee in California. 90% confidence band presented for the commercial mean (smaller sample); pr>t at 95%=0.16. The figures presented are weighted by business size (employment categories, commercial) and housing units (by single-family detached, attached, and categories of multi-family sizes for residential).

[3] The average percent reported to be "working" was 94% in commercial business, and 93% in homes.

[4] These are 723,880 businesses listed under "all firms" with employees from "US Census Bureau Statistics of US Businesses 2006: All Industries, CA". There are apparently a high number of non-employee businesses in the State. Census bureau "Quick Facts" shows "all firms" to be 2.9 million in California in 2002, and private non-farm firms as 892,000 ("establishments" in Census "US Businesses" is 878.128). "All firms" would imply figures almost exactly four times as high in the commercial sector; scaling to "establishments" would increase commercial figures by 20%. We sampled from businesses with 1 or more employees.

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Table 1.2: Percent of Thermostats by Type

Percent of thermostats by type, estimated from survey; mean (95% confidence band)	Commercial	Residential	Weighted Average
Square	25.5% (19.6-31.5%)	20.7% (17.6-23.8%)	21.0% (18.4-23.7%)
Round	9.1% (5.4-12.9%)	8.7% (6.8-10.7%)	8.7% (7.0-10.4%)
Digital	53.6% (46.9-60.4%)	53.4% (49.6-57.2%)	53.4% (50.0-56.7%)
Snap	3.8% (1.8-5.7%)	9.2% (7.2%-11.3%)	8.8% (7.1-10.6%)
Lever	5.6% (2.5-8.5%)	5.3% (3.8-6.8%)	5.3% (4.0-6.7%)
Other	2.4% (0.6-6.8%)	2.6% (1.9-3.4%)	2.6% (1.9-3.3%)
Total	100%	100%	100%

Table 1.3: Average Age of Thermostats by Type

Average Age of Thermostats, in years. Average (95% confidence interval)	Commercial	Single Family	Weighted Average
Square	21.9 (20.8-23.0)	21.4 (19.2-23.6)	21.6 (20.3-22.8)
Round	29.4 (25.5-33.3)	30.9 (27.0-34.8)	30.5 (27.8-33.2)
Digital	8.5 (7.9-8.1)	6.3 (5.9-6.8)	6.7 (6.4-7.1)
Snap	18.8 (15.2-22.4)	11.7 (8.3-15.1)	12.4 (9.8-15.0)
Lever	31.2 (28.5-33.8)	14.2 (9.8-18.7)	17.5 (14.3-20.7)
Other	12.1 (6.1-18.0)	25.0 (15.4-34.7)	20.4 (15.9-25.0)
Overall	15.7 (14.9-16.4)	11.7 (10.9-12.5)	12.7 (12.0-13.1)

Table 1.4: Percent of Models Containing Mercury, by Type – "Worst" Case vs. Validation Percentages[5]

Range for Percent with Mercury, by type, estimated	Lower (Source: site visit)	High ("Worst" Case)
Square	17%	100%
Round	70%	100%
Digital	0%	0%
Snap	100%	100%
Lever	100%	100%
Other	100%	100%
"Worst case" assumes any thermostat type that CAN have mercury, contains mercury. Low case based on Validation survey. Note Site visit includes only 30 on-sites / small sample.		

[5] Note that these figures were not derived from the survey respondents, as they were only asked to identify broad "types" as listed below. The percent mercury figures were from a small-sample audit / site visit of 30 respondents (column1) and "worst case" assignments of model visual "types" that, at an early generation of manufacture and internal design, could ever have contained mercury.

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Table 1.5: Anticipated Flow of Mercury-Containing Thermostats by Year (using Low and High Mercury Model Saturations from Table 1.4 and Decay model described in Section 4.5)[6]

Year	Annual Flow of Mercury-Containing Thermostats - Low Estimate (5.1 million total Hg Thermostats), estimated.	Annual Flow of Mercury-Containing Thermostats - High estimate (9.3 million total Hg Thermostats), estimated.	Annual Flow of Mercury-Containing Thermostats - High estimate (10.5 million total Hg Thermostats), adding 13.5% validation premium
1	237,000	432,000	490,000
2	233,000	425,000	482,000
3	222,000	405,000	460,000
4	217,000	396,000	449,000
5	212,000	387,000	439,000
6	207,000	377,500	428,000
7	202,000	368,000	418,000
8	197,000	360,000	409,000
9	193,000	351,000	398,000
10	187,000	340,000	386,000
11	181,000	329,000	373,000
12	174,000	318,000	361,000
13	168,000	308,000	350,000
14	162,000	298,000	338,000
15	156,000	288,000	327,000
16	150,000	279,000	317,000
17	144,000	270,000	306,000
18	137,000	261,000	296,000
19	131,000	253,000	287,000
20	129,000	235,000	267,000
21	127,000	232,000	263,000
22	113,000	207,000	235,000
23	103,000	187,000	212,000
24	94,000	172,000	195,000
25	99,000	181,000	205,000
Total estimated mercury thermostat flows during 25 years	4,175,000	7,659,500	8,694,000
Total to be recovered (installed in CA)	5,100,000	9,300,000	10,556,000
Total for first 25 years as share of total to be recovered (assumes no new mercury thermostats may be installed)	82%	82%	82%

[6] To represent a "high" high estimate, the estimates could be further adjusted using confidence intervals from Appendix B.

Table 1.6: Response Totals and Validation Study Visits

	Commercial	Residential	Total
Survey Responses			
Number of survey responses	267	595	862
Number of thermostats covered	4386	690	5076
On-site Validation			
Validation visits (and percent of survey responses)	5 (1.9%)	25 (4.2%)	30 (3.5%)
Reported Thermostats covered by validation (and percent)	45 (1.0%)	36 (5.2%)	81 (1.6%)
Validation Thermostats count (validated & pct diff)	53 (18% extra)	37 (2.8% extra)	90 (11% extra)
Camera Validation			
Cameras Sent Out	7	37	44
Returns (as of 12/28/09)	3	9	12
Reported Thermostats covered by validation	14	11	25
Validated Thermostat count (validated & percent diff)	15 (7% extra)	12 (9% extra)	27 (8% extra)
Overall Thermostat "Count" Correction Factor (Based on Total Validation Responses) (raw, and weighted for total)	68 (15% extra)	49 (4% extra)	117 (10% extra) (13.5% extra weighted avg)
Overall error in thermostat "Type" reporting	0%	8%	3.4% of all thermostats inspected

2. Introduction to the Project

A number of states are passing mandatory mercury thermostat collection laws and associated collection goals. However, the goals are imperfectly set, as information on the number of mercury thermostats, in either commercial or residential buildings, is largely unknown. Developing targets, planning for handling and diversion/ disposal, and investing in the design of programs are all improved with more reliable information on the inventory of mercury thermostat, their removal rates and practices, and the actors involved.

With the exception of one statistical study (King County, commercial sector) most of the goals were set using "rules of thumb" or very crude assumptions. For example, the State of Iowa asserts an assumption that each home has 1.25 thermostats for its draft goal-setting computations.

The State of California requires delivery of a "study" that provides estimates of the number of thermostats potentially available for disposal / recycling / management. This chapter describes the approach we used to produce high quality, defensible estimates of:

- The inventory or "count" of thermostats in place in California households and businesses; and
- The annual "flow" of this equipment out of the buildings, potentially subject to capture through a thermostat recycling program.

Our approach used a large-scale web survey to identify the "saturation" of mercury thermostats, and we used statistical analysis methods to estimate the decay function for thermostats. Our approach adapted and streamlined some of the King County methods, and incorporated energy efficiency estimation approaches to provide reliable estimates of the following information:

- Number of mercury thermostats in place in residential buildings and separately in commercial buildings - useful for an inventory and to predict the lifetime flows of equipment;
- Number of annual removals of mercury thermostats from residential and commercial buildings (separately) – useful for setting annual goals;
- Practices in removing thermostats (and destinations), actors involved in decision-making and removal, and factors influencing removal rates in commercial vs. residential buildings – useful for identifying intervention points, possible program / capture designs to most effective (and cost-effectively) redirect the equipment to proper disposal, etc.

3. Collecting the Data: The Residential / Commercial Thermostat Survey

There are four key elements to strong survey data collection, each of which is addressed in the paragraphs below.

- A sampling frame that well-represents the population (i.e. a good sample source),
- Good sample design that incorporates a prior information about possible patterns in responses and data,
- Responses from a random set of the selected sample, and
- Accurate and thorough data from the respondents.

3.1 Selecting the Samples

Surveys are useful methods for gathering data representative of populations. In our case, the populations were defined as California businesses and households. Statistics make it clear that it is not necessary to interview or visit every building in order to get accurate estimates of the number of thermostats in these buildings. Instead, once data from a certain threshold number of respondents are reached, there are significantly diminishing returns from additional data, allowing affordable data collection.

Sample Source: We used one of the most highly-respected firms from which to purchase the necessary contact data – InfoUSA. This firm is the source for data for Gallup-type polls, as well as thousands of universities and research firms across the nation. They were the source for both our residential and commercial data, and we have used the firm for many previous research projects.

Sampling design: We used both simple random and stratified random sampling designs to develop our samples, using the lists purchased from InfoUSA. The approaches for the residential and commercial sectors are presented below.

- **Residential**: We used a simple random selection process to select the sampled home addresses from our purchased sample. The project's design was to households in California in its entirety, so there was not stratification used by geography, age of home, or home type (single-family vs. multi-family).

- **Commercial**: The best stratification methods for the commercial sector almost always include size (square footage or employment).[7] We used employment as the stratification variable for this survey, largely because employment categories are well-reported in census, allowing us to compare response proportions to that independent source to identify whether troublesome non-random patterns in responses occurred in our survey. Distributions of businesses (or buildings) by size are far from even. There are many more small firms / buildings than large ones, but energy use and square footage covered (and in a related

[7] The remainder of this discussion assumes that the commercial survey entity is a business, not a building. If we can identify a source for "building" addresses with an associated respondent firm, we can substitute that if desired.

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manner, the number of thermostats[8]) would be disproportionately higher in (the fewer number of) large firms. Generally, if there is any reason to believe that there are differences in the responses from large vs. small buildings (in thermostats, in response rates, in decision-making or other topics of our analysis, or if we want to be able to present information separately by size or building) it is important to assure there are reasonable response numbers from these large buildings. Thus, we used a "stratified random" design, and we sent out a larger proportion (but not necessarily larger total number) of postcards to this group. This stratification technique can improve the quality and robustness of the database. Because small buildings or businesses tend to be more homogeneous, a smaller percent (although still large number) of respondents can be included in the sample. This kind of stratification increases the response from large businesses (and presumably larger buildings) which would likely include more thermostats and increase the explanatory power for estimating the number of thermostats across the State.

Sample Size: It is natural to assume that that sample size is directly related to "coverage" of the survey – that is, one might think many more surveys would be needed to represent a State as opposed to representing a city. Actually, that is not true, and is illustrated in the table below. The number of responses needed to represent a city of 10,000 and a state of 10,000,000 at +/- 5% accuracy with 95% confidence[9] is not very different (on the order of 380 responses). No matter how big the total households (within a fairly large band), the sample sizes needed are similar.[10] Regarding the question of how many surveys it takes to achieve higher levels of accuracy, statistical sample sizes are far from proportional; double the accuracy requires more than twice the sample (almost four times – increasing from 96 to 384).

Table 3.1: Computation of Sample Sizes and resulting accuracy / confidence levels

IF the population (homes or comm'l bldgs) is…	95% confidence		90% confidence	
Computed responses needed for accuracy of…	+/-5%	+/-10%[11]	+/-5%	+/-10%
100	79	49	73	40
1,000	278	88	213	63
10,000	370	95	263	67
100,000	383	96	270	68
1,000,000	384	96	271	68
10,000,000	384	96	271	68

Our mailings were designed to obtain between 270 and 380 responses for each of the residential and commercial sector. Given there are about 724,000 businesses and more than 13 million households in California, these figures would provide confidence in certain survey data at levels of +/-5% at the 90% and 95% confidence levels, respectively. To achieve these responses we selected samples of 12,000 businesses and 10,000 residences (businesses have a lower response rate). Our commercial sample oversampled among the larger business sizes. Our final responses reached or exceeded goals (594 residential, 267 commercial, Table 4.1).

[8] Although the information from the King County study indicates otherwise – they did not find significantly more thermostats in large buildings; however, it is important to identify whether this finding is corroborated.

[9] The statement of confidence level is standard practice; however, it is simplified and slightly misleading. It states the accuracy with which you would predict a 50% response (e.g. male / female, yes/no) given random responses totaling the number given from the sample, compared to the answer from the population. It does not predict the accuracy of an answer of, say, "9" from among a number of categories, etc. However, it serves as a benchmark for higher vs. lower accuracy sample sizes.

[10] This is why Nielsen television ratings or Gallup election polls can use nationwide samples of 1200 and get accuracy nationwide.

[11] Also approximately equal to +/- 7% at 90% confidence.

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3.2 Contacting the Sample

Postcard outreach to web survey: We issued quarter-page size postcards[12] to samples of the residential (single- and multi-family combined) and commercial sectors; providing a link to a web survey and requesting their participation. We also let them know that filling out the survey entered the respondent into a lottery to win one of several MP3 players[13] or gift certificates. We posted the survey link on a neutral website ("www.garbageandrecyclingsurveys.org" , which SERA owns) Participants navigated to the website and clicked on the labeled button to launch the survey.

To allow flexibility, we also provided a toll-free number on the postcard and administered the survey via phone to anyone preferring that option. To increase response and reduce bias, we used a two-stage method, sending an initial postcard, and then several weeks later, a reminder postcard.[14] In an unusual result, we received significantly higher responses rates to the second postcard, as it eliminated the focus on thermostats and portrayed the survey as soliciting feedback on "Recycling and Hard-to-Recycle" programs. As one final adjustment, to make sure we had strong response from large businesses (who potentially had large numbers of thermostats), we called these sample elements and conducted phone interviews with more than 30 of these businesses and incorporated them into the database.

3.3 The Questionnaire

SERA has conducted more than 100 large-scale surveys for both residential and commercial energy-related equipment inventories and similar studies. Over time, our techniques have evolved. Originally we used paper surveys, then phone surveys, and most recently, we have found that web surveys are a very effective and efficient strategy, especially for a project with an aggressive time line and one that needs photographs, like this one. A web survey provides several advantages.

- Inexpensive and very speedy data collection
- Respondents can fill out the survey night or day – at their convenience – which turns out to be especially convenient for businesses;
- Skip patterns are automatic - so errors do not arise and the survey can be shorter or longer based on specific responses;
- Drawings / pictures can be incorporated for clarification of issues –this was very important for this survey, as we needed to incorporate photographs of various thermostat types;
- Data is automatically entered into the computer – no separate keypunch entry costs (and errors).

On-going data checking – we can look at responses after the first few and make adjustments to the survey to correct for anything that seems unclear or to probe on issues. The data can be analyzed in "real time" and the survey "left active" and analyzed again when more responses have been received

[12] The first round of postcards was black print on colored card stock; the follow-up postcard was colored on white card-stock.
[13] We have found this prize works amazingly well for both the residential and commercial sector. The cost of even several dozen MP3 players is still many times less than the cost of a large scale phone survey (other options include gift certificates, checks, and other options). We have gotten strong response rates from this approach, and the bias from web access may not be dramatically different from problems introduced in phone surveys from unlisted numbers and cell phone only households.
[14] An adaptation of the "Dillman" method for reducing survey bias.

We used skip patterns embedded in the survey so questions appropriate for single family residential vs. multi-family residential vs. commercial respondents can answer appropriate questions.

Questionnaire content: The survey was designed to gather data on 1) key analytical data of interest, and 2) demographics or "firm-o-graphics" that allow us to identify whether there is potentially bias in responses. This supporting data must be asked in a way that allows us to match response proportions against the initial sampling frame database or against published "census" or other data. The following question topics were included in our web survey.

- Whether there are any thermostats in building
- Type of thermostat: We included photos of various types, and asked respondents to classify thermostats into square, round, digital, snap, other digital, others with levers or similar, or other (their description). These were the key types provided by the Thermostat Recycling Corporation and their members (along with photos), and could be used to help classify thermostats into mercury-containing or not, since it was decided not to have survey respondents pull the covers from thermostats to identify whether they contained mercury.[15]
- How many thermostats in building of the type(s) of interest; whether each is still functioning (&)[16]
- Year built (*); year thermostats installed (&)
- Year remodeled (*); year remodeled that removed / involved thermostat (&); reason for removal for any thermostats removed (&);; Expected timing of next remodel / next remodel involving thermostat
- Square feet(*)
- Predominate use of the building(*)
- Heating fuel type(s)
- Who removed the thermostat; destination of removed thermostats, actors involved in decision-making and removal
- Factors influencing remodeling and thermostat removal rates (in commercial buildings especially)
- Other information useful for identifying intervention points, possible program / capture designs to most effectively (and cost-effectively) redirect the equipment to proper disposal, etc.
- Demographic data: type of home (SF detached, attached, MF, etc.); number of residents, square footage, number of bed and bath rooms (predictor for square footage); education of head of household and/or income; zip code[17], and County;
- Firmographic data: type of business, main activity at the site; single firm or chain / central decision-making, square footage, number of employees, single or multiple occupants in building, other.

[15] These extra efforts might also have negatively affected survey response rates.

[16] The group of 4 features marked with asterisks (*) were identified as strong explanatory factors for the King County work. The group of data collection elements marked with ampersands (&) represents potentially useful data related to measure retention / removal / decision-making analyses.

[17] Zip codes and / or counties provide the opportunity to check for geographic bias in the results (by comparing to census data to check for representativeness of the responses). Weights based on county responses and on within sector responses were used to improve the representation, and were used in the derivation of results for this study.

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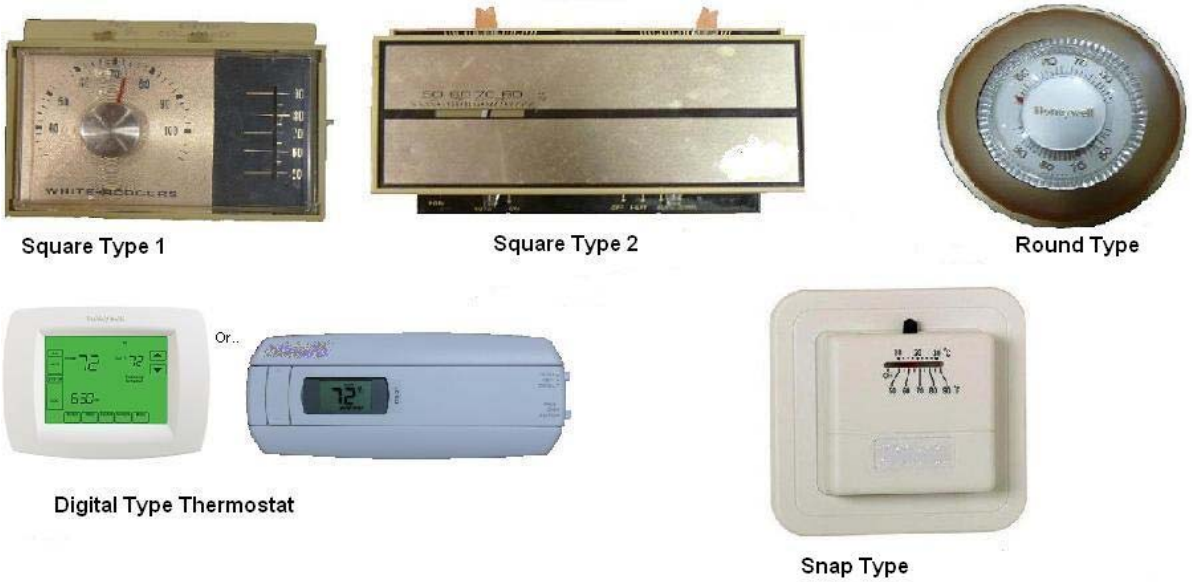
We prepared draft and revised residential and commercial postcards, and draft and revised surveys for review. We also reviewed the survey responses after about a dozen surveys to make sure key data were being reported in ways that would be useful for the analysis.

The photographs used to help respondents identify the key thermostat types are reproduced here; the thermostat survey questions are included in Appendix C at the end of the report.

Figure 3.1 Major Thermostat Types Provided in Photo Form within Web Questionnaire



4. Analyzing the Data: Bias Reduction and Estimations

4.1 The Validation Survey

Two validation efforts were undertaken. We conducted on-site validation survey of 30 respondents in the San Francisco Bay Area. In addition, late in the survey we selected 44 random respondents and sent them disposable cameras, incentive gift certificates to encourage return of the cameras, and a pre-paid postage return envelope. A letter included with the camera asked the respondents to photograph each thermostat in their dwelling or business. Preliminary results from this second validation effort were available for this report.

Validation Efforts: The validation efforts were undertaken to provide indications of the accuracy of self-reported data to support this study.

- **On-Site Validation**: A total of 30 site visits were conducted to inspect the accuracy of survey / self-reported thermostat counts and types. Site visits were conducted at 5 commercial businesses, 4 apartment units, and 21 single family residents across 8 counties in the State, covering a total of 96 thermostats. The inspections were conducted in Alameda, Contra Costa, Marin, Monterey, San Francisco, San Mateo, Santa Clara, and Sonoma Counties. The key results of the validation work are presented in Table 1.6 in Chapter 1. The inspections found three respondents (10%) mis-reported the number of thermostats, under-representing the number of thermostats in the market by 15% (one resident missed one thermostat, two larger commercial respondents missed more). Of the thermostats reported, four residents mixed up the types (three reported actual digitals as round or square types, and one reported a round as a digital) and no commercial respondents were incorrect in types reported (5% total error). Of a total of 14 thermostats missed in the count, half were new types not reported by the respondent (one square, one snap, three rounds, and two other). All but one of these was in one larger commercial establishment with an inaccurate count. While 30 site visits and 96 thermostats inspected is not a large sample, the number provides indicative data useful for helping providing bounds for the results of the analysis.[18]

- **Camera Validation**: In a second validation effort, we mailed disposable cameras to a sample of 44 businesses and households selected randomly from our respondents across the state. The sample was asked to take photographs of each thermostat in their home and return the camera in the pre-paid envelope, which would validate both count and types.[19] This method does not allow us to validate the percent that contain mercury,

[18] A random validation survey of 30 on-sites with 95 thermostats would provide +/-10% at 95% confidence on the thermostat data. Our validation survey was geographically clustered, so these are indicative percentages only. The randomly-scattered responses from the camera validation improve these properties. Cameras were sent to randomly-selected respondent locations in Los Angeles, Culver City, Beverly Hills, Yorba Linda, San Diego, Santa Maria, Stockton, Laguna Niguel, Oxnard, Jamul, Madera, Irvine, Redding, and many others.

[19] We provided a gift certificate to encourage return of the cameras.

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except for the knowledge that digital thermostats do not contain mercury.[20] The responses have only just started to arrive; we have 12 replies in the first two days of responses that have been incorporated into this report. The results showed that of 9 residential respondents, accounting for a "reported" 11 thermostats, we had one error; there were actually 12 thermostats in place. On the commercial side, the 3 businesses were supposed to have a total of 14 thermostats, but there were 15 in total in the photographs. There were no errors in the reported thermostat "types". These results are also included in Table 1.6.

The combination of these two validation efforts finds that self-reports were correct in the majority of cases. There were five errors in "count" from the 42 validated sites (12% had errors); the errors in number were 4% from the residential side, and 15% from the commercial side. Using these figures, we find a total estimated weighted correction factor (given the total thermostats reported from the residential vs. commercial sectors) of about 13.5% undercounting of thermostats using self-reported figures. A total of 3.4% of the inspected thermostats were reported as the wrong type (all errors in the residential sector).

4.2 Responses and Patterns

Thanks to two rounds of postcards notifying of the survey, revisions to the second round to broaden interest in the survey (from just "thermostats" to "recycling and hard to recycle items", and pro-active calls by SERA staff to large businesses, we achieved our goal responses (270-380). About 85% responded to key questions related to the number and types of thermostats and similar data. Thus, our effective response rates were a bit lower, but still strong (see Table 4.1)

Table 4.1: Number of Respondents to the Thermostat Survey and Associated Confidence Levels

	Commercial	Residential	Total
Number of businesses and households in California (census 2006, 2008 estimates)	723,900[21]	13.4 million	14.1 million
Number of survey responses and associated confidence levels	267 +/-6% at 95% confid. +/-5% at 90% confid.	595 +.-3.3% at 95% and 90% confidence	862 +/-3.3% at 95% confid. +/-2.8% at 90% confid.
Number of responses responding to key thermostat questions, and associated confidence levels	195 +/- 7% at 95% confid. +/-5.9% at 90% confid.	549 +/-3.5% at both 90% and 95% confidence	744 +/-3.6% at 95% confid. +/-3% at 90% confid.

[20] Note that if "type" is enough, this validation method is quite fast and much less expensive than field-work / on-site visits, and would suit validation studies applied to large, easily distinguished or unique equipment (hot water heaters, solar installations, and many other types.).

[21] These are 723,900 businesses with employees from "US Census Bureau Statistics of US Businesses 2006: All Industries, CA". There are apparently a high number of non-employee businesses in the State. Census bureau "Quick Facts" shows "all firms" to be 2.9 million in California in 2002, and private non-farm firms as 892,000 ("establishments" in US All Industries is 878,128). We sampled from businesses with 1 or more employees. The splits used in this table are from the sampling frame provided by InfoUSA, our sample population. Splits from census are within a few percentage points of these figures.

4.3 Bias Reduction Analysis

Bias Reduction: Before we conducted any analyses, we reviewed the data for evidence of bias. There are two types of bias, each addressed below.

- **Response bias, unreturned surveys:** Systematic non-random patterns in returns or responses to surveys are a source of bias. For example, our sampling plan may have been designed to achieve 20% of our responses from small buildings, but we find we are only getting 10% from them, or patterns of data disproportionately for newer vs. older buildings (compared to the purchased sample or to data from national or regional studies). To check for basic patterns of non-representative responses, we examined two main variables: geographic patterns (we examined county), and responses by housing type and business size. The business size factor was especially important because we used a stratified random, not purely random sample for the business sector. In the commercial case, we sent out the surveys in a non-representative pattern (we oversampled large buildings so we could have greater accuracy for the businesses responsible for the bulk of thermostats in the State). Therefore, corrections (using "weights") for business size (reflected in employment category) were anticipated (for example, see Table 4.2, which shows 6% of responses from employment category 250+ and the census population is only 1%). The commercial and residential responses were assigned "weights" based on business size and housing unit type to provide better representation of the State's residential and commercial sectors.[22] We found that there were patterns in both the commercial and residential survey (Table 4.5, single vs. multi-family responses), and we applied weights that compensated for these patterns.[23] Graphs illustrating deviations by County for the residential and commercial sector are provided in Appendix A.

Table 4.2: Table of Completions and Ratios for Commercial Sector Respondents

	Responses	Response Percent	Census Count, CA	Census Percent	Ratio (related to weight)	Pop/SurveyN/1000
Commercial Businesses, all	267 (*)		891,987			3.5
Employees 1-4	45	17%	491,641	55%	3.2	10.9
Employees 5-9	17	7%	161,647	18%	2.8	9.5
Employees 10-19	38	15%	111,298	12%	0.8	2.9
Employees 20-49	46	18%	79,682	9%	0.5	1.7
Employees 50-99	15	6%	27,268	3%	0.5	1.8
Employees 100-249	11	4%	14,836	2%	0.4	1.3
Employees 250+	15	6%	5,615	1%	0.1	0.4

(*)258 answered question on employees

[22] To illustrate the correction method in a simplified way, if we got perfect responses from all categories, but twice as many from the elderly, their responses might be weighted as ½ each and then used in the database for computing less biased means, etc.
[23] Computed weights also varied by question based on responses to that question.

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Table 4.3: Table of Completions and Ratios for Residential Sector Respondents

	Responses	Response Percent	Census, California	Census Percent	Ratio incl MF	Pop/Survey N/1000
Households, all	594		12,183,304[24]			20.5
Single family home, detached	455	77%	6,883,493	56%	0.74	15.1
Single family, attached / town home	55	9%	931,873	8%	0.83	16.9
Apartment 2-4	25	4%	1,024,803	8%	2.00	41.0
Apartment 5 or more	47	8%	2,804,712	23%	2.91	59.7
Manufactured home / mobile home	12	2%	538,423	4%	2.19	44.9

Not all identified home type; omitted minor census categories for residential

- **Patterns in Missing data from within surveys**: Another source of error results from missing data within a survey. For example, younger households may not know when the home was remodeled for a thermostat replacement, and a higher percent leave this answer blank. If this is systematic, it can lead to problems estimating models. Correction methods can be applied to address this issue, and are especially reliable in cases where there are responses from others that are "similar" or where explanatory variables can be used to fill in these missing data.[25] Our most critical data was the number of thermostats in the home or business. The number of non-responses was illustrated in Table 4.1. The main pattern we identified was that very large facilities (specifically an airport, a university campus), stated the number of thermostats in responses like "we have thousands". We had limited other "similar" facilities to use to estimate the total number of thermostats in these facilities, and we used a low end value for these facilities. We addressed the general issue of non-response to the key questions using weighting, rather than other (imputation-type) methods. The potential undercounting of thermostats in these large facilities may be an issue in general; however, the flow or disposal of mercury thermostats from these types of facilities is likely to be addressed in a responsible way. In addition, future studies may find it productive to conduct site visits of a small sample of these types of facilities, as it may not be practical to expect these facility managers to 1) know the count of thermostats, or 2) have the time available to conduct such a count.

4.4 Analysis of the Number of Thermostats

We conducted two key types of analysis: 1) estimating the total and average number of thermostats in businesses and households across California, and 2) examining the lifetimes of thermostats to identify the annual "flow" of the inventory of thermostats in the State that may be available for recycling (and hopefully avoided disposal).

Estimating the "Count" of Thermostats in place: We used the survey responses on 'number of wall thermostats in the place in your space' from the survey to estimate the count of

[24] The latest total of 13.4 million households was used to compute the total thermostats. This table was prepared using the previous household count, but the ratios between single and multifamily households, for weighting purposes, are the only difference and are relatively small.

[25] We have often used "hot deck" (see article by Ong, Holt, Barnes, and Skumatz in *"The Energy Journal"*, 1989) imputation methods to "impute" or put in replacement data – but drawing from our sample in doing so. To implement the "hot deck" method, one needs responses from sets of "similar" households (same age group, region, house type, etc.) and their responses are used to assign or fill in the response from a randomly-selected "similar" household. It is similar to "predicting" the response and filling that value in, but it has better statistical properties. This was not applied to this thermostat study.

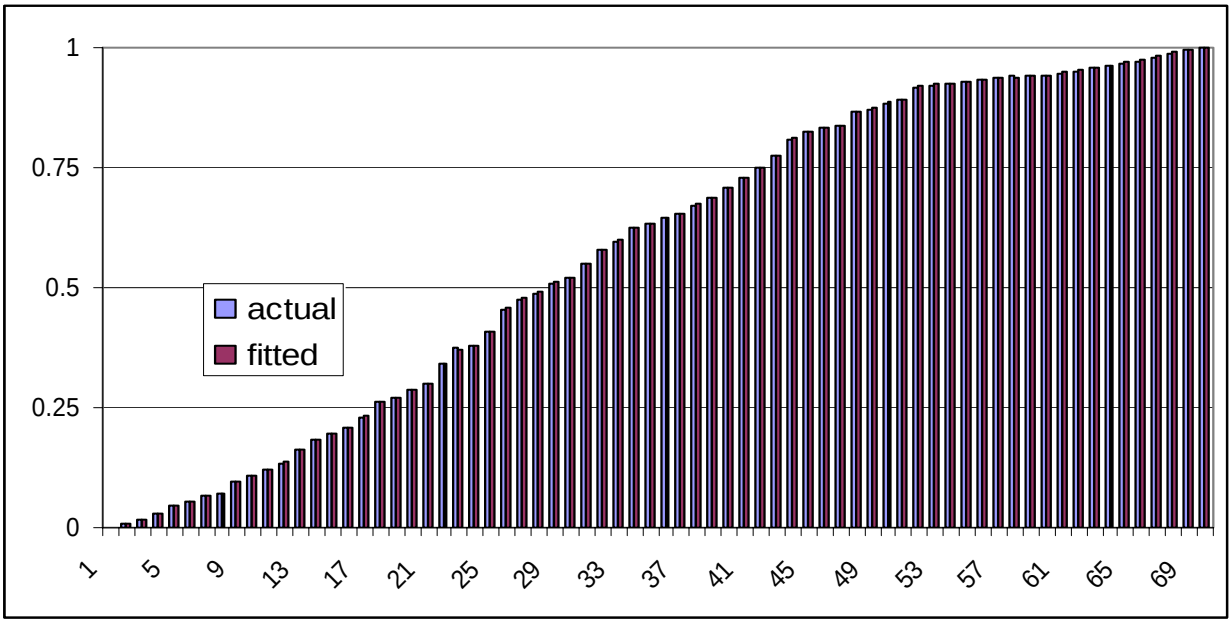
thermostats from survey responses, using weighted data to represent the population mean. The results of this analysis are included in Table 1.1.

4.5 Lifetimes / Annual Flow of Thermostats into the Market

Predict lifetime and annual "flow" of thermostats out of buildings: We used two methods to derive this estimate.[26] We graphed the actual lifetimes of thermostats, along with the results of a fitted model. These data are presented in Figure 4.1. The horizontal axis represents "years in place", and the vertical axis represents cumulative percent of the thermostats that age or younger. Note that this estimate demonstrates that about 50% of thermostats are still in place after 27.5 years. "Measure lifetime" literature in the energy efficiency field defines this "median value" as an "expected useful lifetime" or EUL. However, note that, within our sample, all the thermostats are not removed until about 70 years in place (technically, 68.5 years in our sample). The graph shows a flattening after about 50 years, at which the removal rate slows. This slowing at advanced ages is common in measure lifetimes (as well as humans!).

Figure 4.1: Cumulative Distribution - Approximate Actual and Fitted Measure Lifetime Curve Using Censored and Uncensored Data (gamma distribution as best fit, survey data)[27]

Cumulative Percent *Graph approximates function, not as smooth*



Years Installed

[26] Note that the data used for this analysis is necessarily imperfect. It is based on recall of current occupants, some of whom have been in the location a long time, and some were newer. However, the credibility of the data is bolstered by two results. The estimated EUL is about 25 years, which is very close to the EUL estimated by the CPUC and the DEER database, which is used Statewide by energy efficiency program planners and evaluators. Second, the measures last as long as 70 years, which is credible, as it corresponds to the types of age distributions we see for heating systems in the field (which are associated with thermostats).

[27] Uneven-ness in the graph is due to the author graphing estimates for "whole years", requiring interpolations between other numbers when whole-year lifetimes are not available; in addition, the graph is complicated by the "clusters" of data on certain points (e.g. many observations recalled at 10 years; fewer at 9 and 11, etc.). If graphed by formula, the "fitted" version would be smoother.

We used statistical modeling to develop projections of the measure lifetimes, taking into account both the thermostats that were in place, but removed (and for which we have data on estimated installation and removal years); and those that are still in place (and representing a variety of ages in the field). The former are "uncensored failures", and the latter are "right-censored" values. The censored values have not yet failed, and the statistical model works with both sets of data to develop the best projection of the decay curve / hazard function,[28] median value (estimated or expected useful lifetime - EUL) and various quartile values (See Table 4.4).[29] The approach represents best practices methods for measure lifetime analysis[30] for energy efficiency equipment.

Although these types of models are commonly used to estimate expected useful lifetimes, the model provides much more information. The cumulative percentage values can be used to predict the proportion of thermostats in place that would be expected to flow out of buildings each year into the future. The method uses the lifetimes of measures that have already been removed and the age of those still in place to predict how long the remaining equipment will last, and the model gives us an annual flow of removals in percentage terms. Although energy efficiency work focuses on the median or EUL, the proportions of projected failures / removals per year are of particular interest for this study of mercury thermostat flows.

In general terms, we then multiplied the inventory or "count" of thermostat equipment still in place (identified from the averages, or inventory step of the analyses, Table 1.1) times the annual flow rates from this model to compute the actual number expected to be removed each year from the residential vs. the commercial sectors (Figure 4.1).[31] The result is presented in Table 1.5.

These estimates can also be adjusted using the confidence intervals for the hazard function (Appendix B) and adjustments based on the validation survey, including adjustments to provide ranges in the "count" and types (and associated mercury-containing percent). The results and implications are included in the Executive Summary, Chapter 1 of this report.

Table 4.4: Quartile and Other Values for Fitted Thermostat "Flow" Model
(note confidence intervals are provided in the Table in Appendix B)

	10%	25%	50% (EUL)	75%	90%
Years in Place, overall	10	17.5	27.5	41.5	51.5

[28] The "decay" or "hazard" function approach comes from the health field, explaining deaths and illnesses, which we have applied to functional "deaths" of equipment.

[29] We tested other models, including residential vs. commercial, and omitting digital models. The quartile points varied by no more than 10% or 15%. Generally, the distribution for the residential sector extended longer (to 68.5 years) than the commercial sector (which was truncated at 49.5 years, likely because of recall issues, more than actual field differences). The median lifetime estimates varied by only 10-15% overall value presented in the Appendix. Thus, we opted for the "overall" model, preserving maximum data. Experimental analysis of differences for digital vs. non-digital models differences in the same range. The gamma distribution also had the best "fit" statistics (log likelihood and chi-square) of the five alternative distributions tested.

[30] Similar to the California Public Utilities Commission (CPUC) "Protocols" for estimating Effective Useful Lifetimes (EULs). For details on this approach, see Skumatz, "Best Practices in Measure Retention and Lifetime Studies: Standards for Reliable Measure Retention Methodology Derived from Extensive Review", Proceedings of the IEPEC Evaluation Conference, 2005, Brooklyn NY., and numerous similar studies by Skumatz (and others).

[31] Using statistical models, we tested different decay functions (log, exponential, gamma, etc.) to identify the best "fit". The performance of the alternative statistical models can be compared on the basis of a number of statistical "fit" measures, specifically Log-likelihood and chi-square probabilities. We presented the model with the best fit (gamma distribution), and the figures for "fit" compared to actual values are presented in the appendix..

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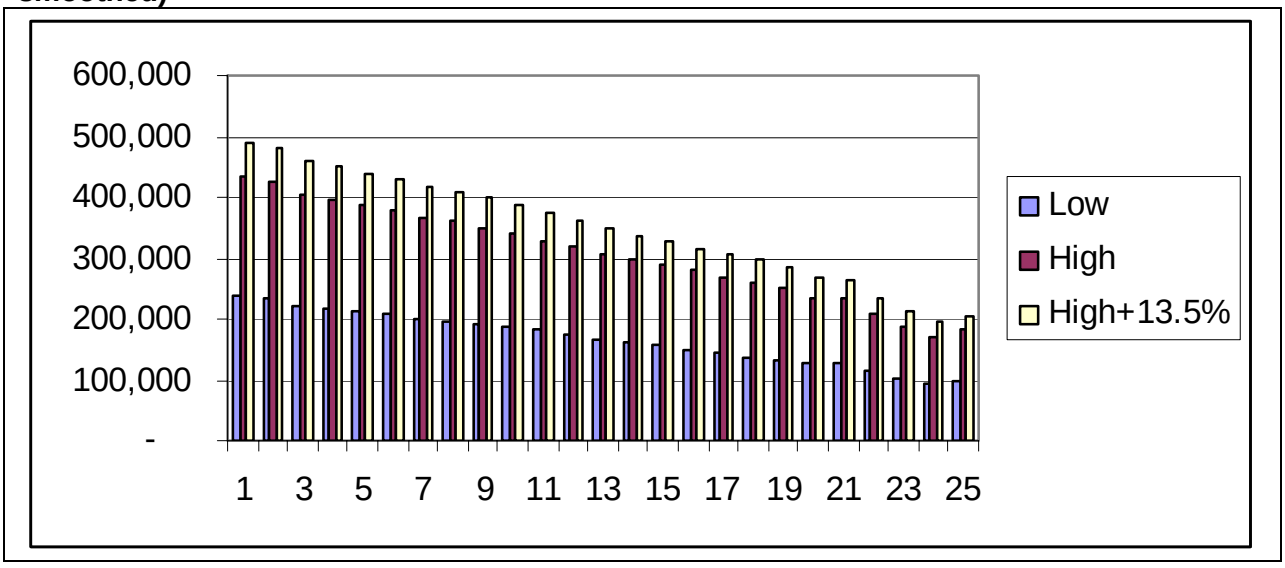
The actual computation of annual flows of mercury-containing thermostats from California homes and businesses, given the fact that all the thermostats in the marketplace were not installed at one time, is somewhat complicated. To develop the estimate, we used the cumulative distribution and expected lifetime model, along with survey data on the distribution of ages of installed thermostats. First, we deleted all digital thermostats (non-mercury) from the distribution, and second, we removed all thermostats with ages less than 3 (since mercury models were banned in 2006). Then we divided the total inventory of existing thermostats into quartiles, ranked by age of the thermostats currently installed.[32] We found 5% of the market had thermostats with ages of 6.5 years or less (5% incremental); 10% were 8.5 years or less (5% incremental); 25% were 13 years or less (an incremental 15%); 50% were 22 years or less (an incremental 25%); 75% were 34 years (an incremental 25%), and 90% had thermostats of 44 years or less, and we used that figure for the remaining 25% of the market.[33] Using the measure lifetime / cumulative distribution curve, we started at the years of life already expended, and adjusted the annual disposal streams for each cohort to conform with expecting 100% of the models to expire at about 70 years. Several of the cohorts were completely collected in the 25 years we show on the table (the cohort with 44 year old equipment or higher). We summed up the cohorts to develop the estimate of the total market that would flow out in a given year.[34] The estimated results are presented in Table 1.5 and are shown graphically below.[35]

Figure 4.2: Estimated Annual Flow of Mercury Thermostats into Market (first 25 Years, smoothed)



[32] We excluded digital thermostats because 1) they do not contain mercury, and 2) they are newer and would have skewed the quartiles toward "newer" equipment, and biased the flows downward. Mercury containing thermostats tend to be older equipment and may be expected to flow out at a faster rate than we would estimate if digital models were left in the computations.

[33] The number of cohorts was selected because statistical programs easily produce these quartile figures. More cohorts would not change the numbers substantially.

[34] based on lifetime expectations, not including adjustments for the poor near-term economy

[35] The excel approximation to the estimated model formula made slight waves in the data, which were smoothed somewhat with simple procedures.

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Appendix A: Comparison of County Shares

Figure A.1. Deviations in Responses by County –Total Residential Housing Units

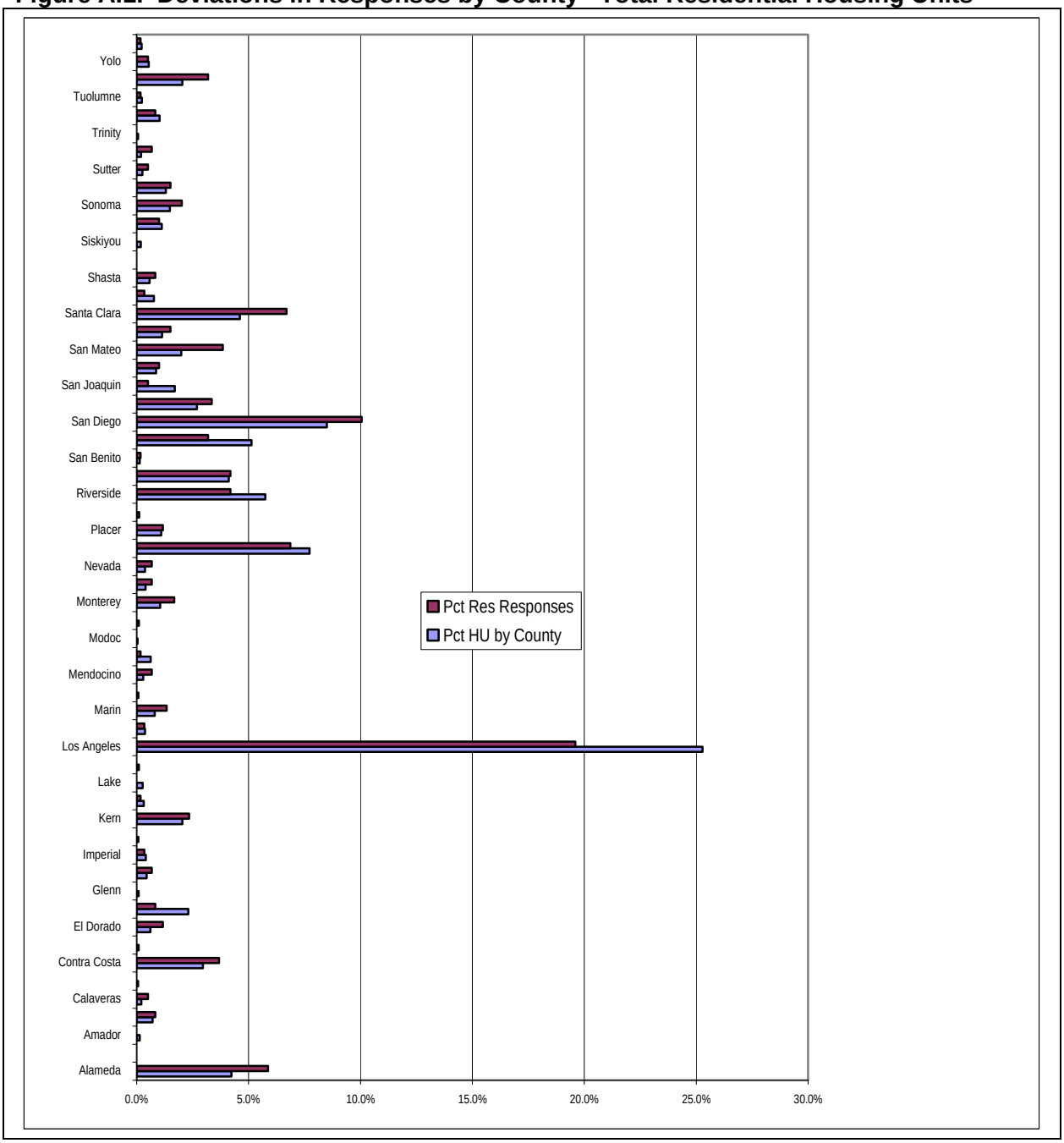
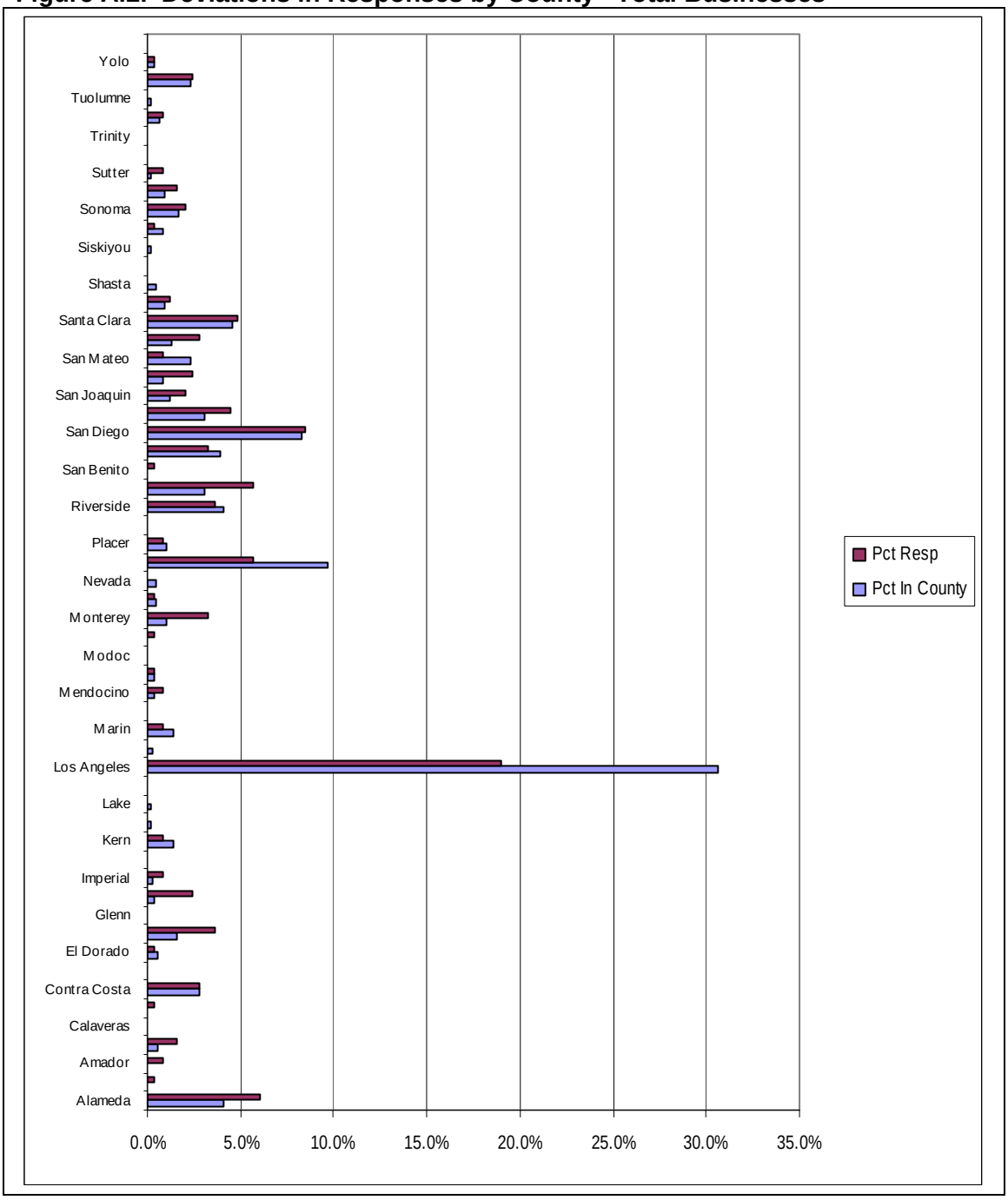


Figure A.2. Deviations in Responses by County –Total Businesses[36]



[36] Weighted averages presented in this report are based on business size (employment categories) and housing units in Single and multi-family dwellings. Using county response corrections as the weighting criteria were 1.2 for the residential mean (same as weighted; unweighted was 1.2), and 23.6 for the commercial mean (employment-weighted was 5.7, unweighted 23.9) because of the oversampling of large businesses. Combined weights were not considered because of the small cell counts that would be created in the business sector.

Appendix B: Values and Confidence Intervals for Fitted Measure Lifetime Curve

Cumulative actual probability and
Kaplan Meier Estimates and Confidence Intervals –
Thermostat Lifetimes based on censored and uncensored data
Cumulative Probability Estimates (approximately graphed in Figure 4.1)

		Simultaneous 95% Confidence Limits			
Lifetime	Cumulative Probability	Lower	Upper	Kaplan-Meier Estimate	Kaplan-Meier Standard Error
2	0.0007	0.0014	0.0014	0.0014	0.0000
2	0.0021	0.0028	0.0028	0.0028	0.0000
2	0.0035	0.0042	0.0042	0.0042	0.0000
2	0.0049	0.0056	0.0056	0.0056	0.0000
2	0.0063	0.0070	0.0070	0.0070	0.0000
2	0.0077	0.0083	0.0084	0.0084	0.0000
2	0.0091	0.0097	0.0098	0.0098	0.0000
2	0.0105	0.0111	0.0112	0.0111	0.0000
2	0.0118	0.0125	0.0126	0.0125	0.0000
2	0.0132	0.0139	0.0140	0.0139	0.0000
2	0.0149	0.0159	0.0159	0.0159	0.0000
2	0.0169	0.0178	0.0179	0.0179	0.0000
4	0.0189	0.0200	0.0200	0.0200	0.0000
4	0.0207	0.0214	0.0215	0.0215	0.0000
4	0.0222	0.0229	0.0230	0.0230	0.0000
4	0.0237	0.0244	0.0245	0.0245	0.0000
4	0.0252	0.0259	0.0260	0.0260	0.0000
4	0.0267	0.0274	0.0275	0.0274	0.0000
4	0.0282	0.0289	0.0290	0.0289	0.0000
4	0.0297	0.0304	0.0305	0.0304	0.0000
4	0.0315	0.0325	0.0326	0.0325	0.0000
4	0.0333	0.0340	0.0341	0.0340	0.0000
4	0.0348	0.0355	0.0356	0.0355	0.0000
4	0.0363	0.0370	0.0371	0.0370	0.0000
4	0.0378	0.0385	0.0386	0.0385	0.0000
4	0.0393	0.0400	0.0400	0.0400	0.0000
5	0.0408	0.0416	0.0417	0.0416	0.0000
5	0.0428	0.0439	0.0440	0.0439	0.0000
5	0.0451	0.0462	0.0462	0.0462	0.0000
5	0.0474	0.0485	0.0485	0.0485	0.0000
5	0.0493	0.0501	0.0502	0.0501	0.0000
6	0.0509	0.0517	0.0518	0.0517	0.0000
6	0.0525	0.0533	0.0534	0.0534	0.0000
6	0.0535	0.0536	0.0537	0.0537	0.0000
6	0.0538	0.0539	0.0540	0.0540	0.0000
6	0.0541	0.0543	0.0543	0.0543	0.0000
6	0.0544	0.0546	0.0546	0.0546	0.0000
6	0.0554	0.0562	0.0563	0.0562	0.0000
6	0.0570	0.0578	0.0579	0.0578	0.0000
6.5	0.0587	0.0594	0.0595	0.0595	0.0000
6.5	0.0603	0.0610	0.0611	0.0611	0.0000

7	0.0619	0.0628	0.0629	0.0628	0.0000
7	0.0637	0.0645	0.0646	0.0645	0.0000
7	0.0654	0.0662	0.0663	0.0663	0.0000
7	0.0671	0.0679	0.0680	0.0680	0.0000
8	0.0689	0.0697	0.0698	0.0697	0.0000
8	0.0706	0.0714	0.0715	0.0714	0.0000
8	0.0717	0.0718	0.0719	0.0719	0.0000
8	0.0727	0.0735	0.0736	0.0736	0.0000
8	0.0738	0.0740	0.0740	0.0740	0.0000
8	0.0749	0.0757	0.0758	0.0757	0.0000
8.5	0.0759	0.0761	0.0762	0.0761	0.0000
8.5	0.0770	0.0778	0.0779	0.0779	0.0000
8.5	0.0787	0.0795	0.0796	0.0796	0.0000
8.5	0.0798	0.0800	0.0801	0.0800	0.0000
8.5	0.0802	0.0804	0.0805	0.0804	0.0000
8.5	0.0806	0.0808	0.0809	0.0808	0.0000
8.5	0.0817	0.0825	0.0826	0.0826	0.0001
8.5	0.0834	0.0843	0.0844	0.0843	0.0001
8.5	0.0852	0.0860	0.0861	0.0860	0.0001
8.5	0.0869	0.0877	0.0878	0.0878	0.0001
8.5	0.0886	0.0894	0.0895	0.0895	0.0001
8.5	0.0903	0.0912	0.0913	0.0912	0.0001
8.5	0.0921	0.0929	0.0930	0.0929	0.0001
8.5	0.0938	0.0946	0.0947	0.0947	0.0001
9	0.0956	0.0964	0.0965	0.0965	0.0001
9	0.0974	0.0982	0.0983	0.0983	0.0001
10	0.0992	0.1001	0.1002	0.1001	0.0001
10	0.1010	0.1019	0.1020	0.1019	0.0001
10	0.1021	0.1023	0.1024	0.1024	0.0001
10	0.1026	0.1027	0.1029	0.1028	0.0001
10	0.1030	0.1032	0.1033	0.1032	0.0001
10	0.1035	0.1036	0.1037	0.1037	0.0001
10	0.1039	0.1041	0.1042	0.1041	0.0001
10	0.1043	0.1045	0.1046	0.1046	0.0001
10	0.1048	0.1049	0.1051	0.1050	0.0001
10	0.1052	0.1054	0.1055	0.1054	0.0001
10	0.1057	0.1058	0.1059	0.1059	0.0001
10	0.1061	0.1063	0.1064	0.1063	0.0001
10	0.1065	0.1067	0.1068	0.1067	0.0001
10	0.1070	0.1071	0.1072	0.1072	0.0001
10	0.1074	0.1076	0.1077	0.1076	0.0001
10	0.1078	0.1080	0.1081	0.1081	0.0001
10	0.1083	0.1084	0.1086	0.1085	0.0001
10	0.1087	0.1089	0.1090	0.1089	0.0001
10	0.1092	0.1093	0.1094	0.1094	0.0001
10	0.1096	0.1098	0.1099	0.1098	0.0001
10	0.1100	0.1102	0.1103	0.1103	0.0001
10	0.1105	0.1106	0.1108	0.1107	0.0001
10	0.1109	0.1111	0.1112	0.1111	0.0001
10	0.1114	0.1115	0.1116	0.1116	0.0001
10	0.1118	0.1120	0.1121	0.1120	0.0001
10	0.1122	0.1124	0.1125	0.1124	0.0001
10	0.1127	0.1128	0.1129	0.1129	0.0001
10	0.1131	0.1133	0.1134	0.1133	0.0001
10	0.1135	0.1137	0.1138	0.1138	0.0001
10	0.1140	0.1141	0.1143	0.1142	0.0001

10	0.1144	0.1146	0.1147	0.1146	0.0001
10	0.1149	0.1150	0.1151	0.1151	0.0001
10	0.1153	0.1155	0.1156	0.1155	0.0001
10.5	0.1164	0.1173	0.1174	0.1173	0.0001
10.5	0.1182	0.1191	0.1192	0.1191	0.0001
11.5	0.1201	0.1210	0.1211	0.1210	0.0001
11.5	0.1220	0.1229	0.1230	0.1229	0.0001
11.5	0.1239	0.1247	0.1249	0.1248	0.0001
11.5	0.1257	0.1266	0.1267	0.1267	0.0001
11.5	0.1276	0.1285	0.1286	0.1286	0.0001
11.5	0.1295	0.1304	0.1305	0.1305	0.0001
12	0.1314	0.1323	0.1324	0.1323	0.0001
12	0.1333	0.1342	0.1343	0.1342	0.0001
12	0.1352	0.1360	0.1362	0.1361	0.0001
12	0.1370	0.1379	0.1380	0.1380	0.0001
12	0.1389	0.1398	0.1399	0.1399	0.0001
12.5	0.1408	0.1417	0.1418	0.1418	0.0001
12.5	0.1427	0.1436	0.1437	0.1436	0.0001
12.5	0.1438	0.1439	0.1441	0.1440	0.0001
12.5	0.1442	0.1443	0.1444	0.1444	0.0001
12.5	0.1453	0.1462	0.1463	0.1462	0.0001
12.5	0.1472	0.1481	0.1482	0.1481	0.0001
12.5	0.1491	0.1499	0.1501	0.1500	0.0001
12.5	0.1510	0.1518	0.1520	0.1519	0.0001
12.5	0.1521	0.1523	0.1524	0.1523	0.0001
12.5	0.1533	0.1542	0.1543	0.1542	0.0001
12.5	0.1545	0.1546	0.1548	0.1547	0.0001
12.5	0.1549	0.1550	0.1551	0.1551	0.0001
12.5	0.1553	0.1554	0.1556	0.1555	0.0001
12.5	0.1564	0.1573	0.1575	0.1574	0.0001
12.5	0.1583	0.1592	0.1593	0.1593	0.0001
12.5	0.1595	0.1597	0.1598	0.1597	0.0001
12.5	0.1607	0.1615	0.1617	0.1616	0.0001
12.5	0.1618	0.1620	0.1621	0.1621	0.0001
12.5	0.1622	0.1624	0.1625	0.1624	0.0001
13.5	0.1634	0.1643	0.1645	0.1644	0.0001
13.5	0.1658	0.1671	0.1672	0.1672	0.0001
13.5	0.1681	0.1690	0.1692	0.1691	0.0001
13.5	0.1701	0.1710	0.1711	0.1711	0.0001
13.5	0.1721	0.1730	0.1731	0.1730	0.0001
13.5	0.1740	0.1749	0.1751	0.1750	0.0001
13.5	0.1760	0.1769	0.1770	0.1770	0.0001
13.5	0.1783	0.1796	0.1798	0.1797	0.0001
14	0.1807	0.1816	0.1818	0.1817	0.0001
14	0.1827	0.1836	0.1837	0.1836	0.0001
14.5	0.1842	0.1847	0.1849	0.1848	0.0001
14.5	0.1854	0.1859	0.1860	0.1860	0.0001
14.5	0.1865	0.1870	0.1872	0.1871	0.0001
14.5	0.1873	0.1875	0.1877	0.1876	0.0001
14.5	0.1878	0.1880	0.1881	0.1881	0.0001
14.5	0.1883	0.1885	0.1886	0.1885	0.0001
14.5	0.1888	0.1889	0.1891	0.1890	0.0001
14.5	0.1892	0.1894	0.1896	0.1895	0.0001
14.5	0.1897	0.1899	0.1900	0.1900	0.0001
14.5	0.1900	0.1900	0.1901	0.1901	0.0001
14.5	0.1901	0.1901	0.1903	0.1902	0.0001

14.5	0.1908	0.1913	0.1914	0.1913	0.0001
14.5	0.1914	0.1914	0.1915	0.1915	0.0001
14.5	0.1917	0.1919	0.1920	0.1919	0.0001
14.5	0.1922	0.1923	0.1925	0.1924	0.0001
14.5	0.1926	0.1928	0.1930	0.1929	0.0001
14.5	0.1939	0.1948	0.1949	0.1948	0.0001
14.5	0.1958	0.1967	0.1969	0.1968	0.0001
15.5	0.1970	0.1970	0.1972	0.1971	0.0001
15.5	0.1985	0.1998	0.1999	0.1999	0.0001
15.5	0.2009	0.2018	0.2019	0.2018	0.0001
15.5	0.2028	0.2037	0.2039	0.2038	0.0001
15.5	0.2052	0.2065	0.2066	0.2066	0.0001
15.5	0.2067	0.2068	0.2069	0.2069	0.0001
16.5	0.2078	0.2087	0.2089	0.2088	0.0001
16.5	0.2098	0.2107	0.2109	0.2108	0.0001
16.5	0.2118	0.2127	0.2128	0.2127	0.0001
16.5	0.2141	0.2154	0.2156	0.2155	0.0001
16.5	0.2169	0.2182	0.2184	0.2183	0.0001
17	0.2193	0.2202	0.2203	0.2202	0.0001
17	0.2212	0.2221	0.2223	0.2222	0.0001
17	0.2232	0.2241	0.2242	0.2242	0.0001
17	0.2251	0.2260	0.2262	0.2261	0.0001
17	0.2271	0.2280	0.2282	0.2281	0.0001
17	0.2291	0.2300	0.2301	0.2300	0.0001
17	0.2310	0.2319	0.2321	0.2320	0.0001
17	0.2330	0.2339	0.2340	0.2340	0.0001
17	0.2349	0.2358	0.2360	0.2359	0.0001
17	0.2369	0.2378	0.2380	0.2379	0.0001
17	0.2389	0.2398	0.2399	0.2398	0.0001
17	0.2408	0.2417	0.2419	0.2418	0.0001
17	0.2428	0.2437	0.2438	0.2438	0.0001
17	0.2447	0.2456	0.2458	0.2457	0.0001
17.5	0.2468	0.2477	0.2479	0.2478	0.0001
17.5	0.2488	0.2498	0.2499	0.2499	0.0001
17.5	0.2509	0.2518	0.2520	0.2519	0.0001
17.5	0.2529	0.2539	0.2541	0.2540	0.0001
17.5	0.2550	0.2560	0.2561	0.2560	0.0001
17.5	0.2571	0.2580	0.2582	0.2581	0.0001
17.5	0.2591	0.2601	0.2603	0.2602	0.0001
17.5	0.2612	0.2622	0.2623	0.2622	0.0001
18.5	0.2633	0.2642	0.2644	0.2643	0.0001
18.5	0.2653	0.2663	0.2665	0.2664	0.0001
18.5	0.2666	0.2668	0.2670	0.2669	0.0001
18.5	0.2671	0.2673	0.2675	0.2674	0.0001
18.5	0.2676	0.2678	0.2680	0.2679	0.0001
19.5	0.2700	0.2721	0.2723	0.2722	0.0001
19.5	0.2743	0.2764	0.2766	0.2765	0.0001
19.5	0.2766	0.2767	0.2769	0.2768	0.0001
19.5	0.2770	0.2770	0.2772	0.2771	0.0001
19.5	0.2773	0.2774	0.2775	0.2775	0.0001
19.5	0.2776	0.2777	0.2779	0.2778	0.0001
19.5	0.2779	0.2780	0.2782	0.2781	0.0001
19.5	0.2783	0.2783	0.2785	0.2784	0.0001
19.5	0.2786	0.2787	0.2788	0.2788	0.0001
19.5	0.2789	0.2790	0.2792	0.2791	0.0001
19.5	0.2792	0.2793	0.2795	0.2794	0.0001

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19.5	0.2796	0.2796	0.2798	0.2797	0.0001
19.5	0.2799	0.2800	0.2801	0.2801	0.0001
19.5	0.2802	0.2803	0.2805	0.2804	0.0001
19.5	0.2805	0.2806	0.2808	0.2807	0.0001
19.5	0.2809	0.2809	0.2811	0.2810	0.0001
19.5	0.2812	0.2813	0.2814	0.2813	0.0001
19.5	0.2815	0.2816	0.2818	0.2817	0.0001
19.5	0.2818	0.2819	0.2821	0.2820	0.0001
19.5	0.2822	0.2822	0.2824	0.2823	0.0001
19.5	0.2825	0.2826	0.2827	0.2826	0.0001
19.5	0.2828	0.2829	0.2831	0.2830	0.0001
19.5	0.2831	0.2832	0.2834	0.2833	0.0001
19.5	0.2835	0.2835	0.2837	0.2836	0.0001
19.5	0.2838	0.2839	0.2840	0.2839	0.0001
19.5	0.2841	0.2842	0.2844	0.2843	0.0001
19.5	0.2844	0.2845	0.2847	0.2846	0.0001
19.5	0.2848	0.2848	0.2850	0.2849	0.0001
19.5	0.2851	0.2852	0.2853	0.2852	0.0001
19.5	0.2854	0.2855	0.2857	0.2856	0.0001
19.5	0.2857	0.2858	0.2860	0.2859	0.0001
19.5	0.2861	0.2861	0.2863	0.2862	0.0001
19.5	0.2864	0.2865	0.2866	0.2865	0.0001
19.5	0.2867	0.2868	0.2870	0.2869	0.0001
20	0.2879	0.2888	0.2890	0.2889	0.0001
20	0.2900	0.2909	0.2911	0.2910	0.0001
20.5	0.2920	0.2930	0.2932	0.2931	0.0001
20.5	0.2941	0.2950	0.2952	0.2951	0.0001
21	0.2957	0.2963	0.2964	0.2964	0.0001
21	0.2970	0.2975	0.2977	0.2976	0.0001
21	0.2986	0.2995	0.2997	0.2996	0.0001
21	0.3002	0.3008	0.3009	0.3009	0.0001
21	0.3019	0.3028	0.3030	0.3029	0.0001
21	0.3035	0.3040	0.3042	0.3041	0.0001
21	0.3047	0.3053	0.3054	0.3054	0.0001
21.5	0.3064	0.3073	0.3075	0.3074	0.0001
21.5	0.3085	0.3094	0.3096	0.3095	0.0001
21.5	0.3097	0.3098	0.3100	0.3099	0.0001
21.5	0.3109	0.3119	0.3120	0.3119	0.0001
21.5	0.3130	0.3139	0.3141	0.3140	0.0001
21.5	0.3150	0.3160	0.3162	0.3161	0.0001
21.5	0.3163	0.3164	0.3166	0.3165	0.0001
21.5	0.3167	0.3168	0.3170	0.3169	0.0001
21.5	0.3171	0.3172	0.3174	0.3173	0.0001
21.5	0.3183	0.3192	0.3194	0.3193	0.0001
21.5	0.3195	0.3196	0.3198	0.3197	0.0001
21.5	0.3208	0.3217	0.3219	0.3218	0.0001
21.5	0.3228	0.3238	0.3240	0.3239	0.0001
21.5	0.3249	0.3258	0.3260	0.3259	0.0001
21.5	0.3261	0.3262	0.3264	0.3263	0.0001
21.5	0.3265	0.3266	0.3268	0.3267	0.0001
21.5	0.3278	0.3287	0.3289	0.3288	0.0001
21.5	0.3290	0.3291	0.3293	0.3292	0.0001
21.5	0.3294	0.3295	0.3297	0.3296	0.0001
21.5	0.3298	0.3299	0.3301	0.3300	0.0001
21.5	0.3302	0.3303	0.3305	0.3304	0.0001
21.5	0.3306	0.3307	0.3309	0.3308	0.0001

21.5	0.3310	0.3311	0.3313	0.3312	0.0001
21.5	0.3314	0.3315	0.3317	0.3316	0.0001
21.5	0.3318	0.3319	0.3321	0.3320	0.0001
22	0.3330	0.3339	0.3341	0.3340	0.0001
22	0.3351	0.3360	0.3362	0.3361	0.0001
22	0.3371	0.3381	0.3383	0.3382	0.0001
22	0.3392	0.3401	0.3403	0.3402	0.0001
22	0.3413	0.3422	0.3424	0.3423	0.0001
22	0.3433	0.3443	0.3445	0.3444	0.0001
22	0.3454	0.3463	0.3465	0.3464	0.0001
22	0.3475	0.3484	0.3486	0.3485	0.0001
22	0.3495	0.3505	0.3507	0.3506	0.0001
22.5	0.3516	0.3526	0.3528	0.3527	0.0001
22.5	0.3538	0.3548	0.3550	0.3549	0.0001
22.5	0.3571	0.3593	0.3595	0.3594	0.0001
22.5	0.3616	0.3638	0.3640	0.3639	0.0001
22.5	0.3661	0.3683	0.3685	0.3684	0.0001
22.5	0.3695	0.3704	0.3706	0.3705	0.0001
22.5	0.3716	0.3726	0.3728	0.3727	0.0001
23.5	0.3738	0.3748	0.3750	0.3749	0.0001
23.5	0.3759	0.3769	0.3771	0.3770	0.0001
24.5	0.3789	0.3806	0.3808	0.3807	0.0001
24.5	0.3826	0.3843	0.3845	0.3844	0.0001
24.5	0.3863	0.3880	0.3882	0.3881	0.0001
24.5	0.3892	0.3902	0.3904	0.3903	0.0001
24.5	0.3914	0.3923	0.3925	0.3924	0.0001
24.5	0.3935	0.3945	0.3947	0.3946	0.0001
24.5	0.3961	0.3975	0.3977	0.3976	0.0001
24.5	0.3978	0.3979	0.3981	0.3980	0.0001
24.5	0.3991	0.4000	0.4002	0.4001	0.0001
24.5	0.4012	0.4022	0.4024	0.4023	0.0001
24.5	0.4038	0.4052	0.4054	0.4053	0.0001
24.5	0.4055	0.4056	0.4058	0.4057	0.0001
24.5	0.4059	0.4059	0.4061	0.4060	0.0001
24.5	0.4071	0.4081	0.4083	0.4082	0.0001
25.5	0.4097	0.4111	0.4113	0.4112	0.0001
25.5	0.4123	0.4133	0.4135	0.4134	0.0001
25.5	0.4145	0.4155	0.4157	0.4156	0.0001
25.5	0.4166	0.4176	0.4178	0.4177	0.0001
25.5	0.4188	0.4198	0.4200	0.4199	0.0001
25.5	0.4209	0.4219	0.4221	0.4220	0.0001
25.5	0.4231	0.4241	0.4243	0.4242	0.0001
25.5	0.4257	0.4271	0.4273	0.4272	0.0001
25.5	0.4283	0.4293	0.4295	0.4294	0.0001
25.5	0.4305	0.4315	0.4317	0.4316	0.0001
25.5	0.4326	0.4336	0.4338	0.4337	0.0001
25.5	0.4348	0.4358	0.4360	0.4359	0.0001
25.5	0.4369	0.4379	0.4381	0.4380	0.0001
25.5	0.4391	0.4401	0.4403	0.4402	0.0001
25.5	0.4413	0.4422	0.4424	0.4423	0.0001
25.5	0.4434	0.4444	0.4446	0.4445	0.0001
25.5	0.4456	0.4466	0.4468	0.4467	0.0001
25.5	0.4473	0.4478	0.4480	0.4479	0.0001
25.5	0.4486	0.4491	0.4493	0.4492	0.0001
25.5	0.4503	0.4513	0.4515	0.4514	0.0001
25.5	0.4524	0.4534	0.4536	0.4535	0.0001

25.5	0.4546	0.4556	0.4558	0.4557	0.0001
26.5	0.4568	0.4577	0.4579	0.4578	0.0001
26.5	0.4589	0.4599	0.4601	0.4600	0.0001
26.5	0.4611	0.4621	0.4623	0.4622	0.0001
26.5	0.4632	0.4642	0.4644	0.4643	0.0001
26.5	0.4654	0.4664	0.4666	0.4665	0.0001
26.5	0.4676	0.4685	0.4687	0.4686	0.0001
27	0.4697	0.4707	0.4709	0.4708	0.0001
27	0.4719	0.4729	0.4731	0.4730	0.0001
27	0.4740	0.4750	0.4752	0.4751	0.0001
27	0.4762	0.4772	0.4774	0.4773	0.0001
27	0.4784	0.4793	0.4795	0.4794	0.0001
27	0.4805	0.4815	0.4817	0.4816	0.0001
27	0.4827	0.4836	0.4839	0.4838	0.0001
27	0.4848	0.4858	0.4860	0.4859	0.0001
27.5	0.4871	0.4881	0.4883	0.4882	0.0001
27.5	0.4893	0.4904	0.4906	0.4905	0.0001
27.5	0.4929	0.4951	0.4954	0.4953	0.0001
27.5	0.4976	0.4999	0.5001	0.5000	0.0001
27.5	0.5012	0.5022	0.5024	0.5023	0.0001
27.5	0.5039	0.5054	0.5056	0.5055	0.0001
27.5	0.5072	0.5087	0.5089	0.5088	0.0001
27.5	0.5099	0.5109	0.5112	0.5111	0.0001
29.5	0.5122	0.5132	0.5134	0.5133	0.0001
29.5	0.5145	0.5155	0.5157	0.5156	0.0001
29.5	0.5172	0.5188	0.5190	0.5189	0.0001
29.5	0.5205	0.5220	0.5222	0.5221	0.0001
29.5	0.5232	0.5243	0.5245	0.5244	0.0001
29.5	0.5255	0.5266	0.5268	0.5267	0.0001
29.5	0.5273	0.5279	0.5281	0.5280	0.0001
31	0.5291	0.5302	0.5304	0.5303	0.0001
31	0.5314	0.5325	0.5327	0.5326	0.0001
31	0.5337	0.5348	0.5350	0.5349	0.0001
31	0.5360	0.5370	0.5373	0.5372	0.0001
31	0.5383	0.5393	0.5395	0.5394	0.0001
31	0.5406	0.5416	0.5418	0.5417	0.0001
31.5	0.5429	0.5439	0.5441	0.5440	0.0001
31.5	0.5452	0.5462	0.5464	0.5463	0.0001
31.5	0.5474	0.5485	0.5487	0.5486	0.0001
31.5	0.5497	0.5508	0.5510	0.5509	0.0001
31.5	0.5520	0.5531	0.5533	0.5532	0.0001
31.5	0.5543	0.5553	0.5556	0.5554	0.0001
31.5	0.5574	0.5593	0.5595	0.5594	0.0001
31.5	0.5613	0.5632	0.5634	0.5633	0.0001
31.5	0.5652	0.5671	0.5673	0.5672	0.0001
31.5	0.5675	0.5677	0.5679	0.5678	0.0001
31.5	0.5680	0.5682	0.5684	0.5683	0.0001
31.5	0.5686	0.5688	0.5690	0.5689	0.0001
31.5	0.5700	0.5710	0.5713	0.5711	0.0001
31.5	0.5723	0.5733	0.5735	0.5734	0.0001
31.5	0.5746	0.5756	0.5758	0.5757	0.0001
31.5	0.5769	0.5779	0.5781	0.5780	0.0001
31.5	0.5792	0.5802	0.5804	0.5803	0.0001
31.5	0.5814	0.5825	0.5827	0.5826	0.0001
31.5	0.5837	0.5848	0.5850	0.5849	0.0001
31.5	0.5860	0.5871	0.5873	0.5872	0.0001

31.5	0.5883	0.5893	0.5895	0.5894	0.0001
31.5	0.5906	0.5916	0.5918	0.5917	0.0001
32	0.5929	0.5939	0.5941	0.5940	0.0001
32	0.5952	0.5962	0.5964	0.5963	0.0001
33.5	0.5974	0.5985	0.5987	0.5986	0.0001
33.5	0.5997	0.6008	0.6010	0.6009	0.0001
33.5	0.6020	0.6031	0.6033	0.6032	0.0001
33.5	0.6043	0.6053	0.6056	0.6054	0.0001
33.5	0.6066	0.6076	0.6078	0.6077	0.0001
33.5	0.6089	0.6099	0.6101	0.6100	0.0001
33.5	0.6116	0.6131	0.6134	0.6133	0.0001
33.5	0.6149	0.6164	0.6166	0.6165	0.0001
33.5	0.6176	0.6187	0.6189	0.6188	0.0001
33.5	0.6199	0.6209	0.6212	0.6211	0.0001
33.5	0.6222	0.6232	0.6234	0.6233	0.0001
33.5	0.6245	0.6255	0.6257	0.6256	0.0001
35.5	0.6269	0.6281	0.6283	0.6282	0.0001
35.5	0.6294	0.6306	0.6308	0.6307	0.0001
35.5	0.6320	0.6332	0.6334	0.6333	0.0001
35.5	0.6345	0.6357	0.6359	0.6358	0.0001
35.5	0.6371	0.6383	0.6385	0.6384	0.0001
35.5	0.6396	0.6408	0.6410	0.6409	0.0001
35.5	0.6422	0.6434	0.6436	0.6435	0.0001
35.5	0.6447	0.6459	0.6461	0.6460	0.0001
37	0.6473	0.6485	0.6487	0.6486	0.0001
37	0.6498	0.6510	0.6512	0.6511	0.0001
37	0.6524	0.6536	0.6538	0.6537	0.0001
37	0.6549	0.6561	0.6563	0.6562	0.0001
37	0.6575	0.6587	0.6589	0.6588	0.0001
37	0.6600	0.6612	0.6614	0.6613	0.0001
37.5	0.6626	0.6638	0.6640	0.6639	0.0001
37.5	0.6651	0.6663	0.6665	0.6664	0.0001
37.5	0.6677	0.6689	0.6691	0.6690	0.0001
37.5	0.6702	0.6714	0.6716	0.6715	0.0001
37.5	0.6728	0.6740	0.6742	0.6741	0.0001
37.5	0.6753	0.6765	0.6767	0.6766	0.0001
39.5	0.6779	0.6791	0.6793	0.6792	0.0001
39.5	0.6804	0.6816	0.6818	0.6817	0.0001
39.5	0.6830	0.6841	0.6844	0.6843	0.0001
39.5	0.6855	0.6867	0.6869	0.6868	0.0001
41	0.6881	0.6892	0.6894	0.6893	0.0001
41	0.6906	0.6918	0.6920	0.6919	0.0001
41	0.6932	0.6943	0.6945	0.6944	0.0001
41	0.6957	0.6969	0.6971	0.6970	0.0001
41	0.6973	0.6975	0.6977	0.6976	0.0001
41	0.6979	0.6981	0.6983	0.6982	0.0001
41	0.6985	0.6987	0.6989	0.6988	0.0001
41	0.6991	0.6994	0.6996	0.6995	0.0001
41	0.6998	0.7000	0.7002	0.7001	0.0001
41	0.7004	0.7006	0.7008	0.7007	0.0001
41	0.7010	0.7012	0.7014	0.7013	0.0001
41.5	0.7026	0.7038	0.7040	0.7039	0.0001
41.5	0.7051	0.7063	0.7065	0.7064	0.0001
41.5	0.7082	0.7099	0.7101	0.7100	0.0001
41.5	0.7118	0.7135	0.7137	0.7136	0.0001
41.5	0.7154	0.7171	0.7173	0.7172	0.0001

41.5	0.7190	0.7207	0.7209	0.7208	0.0001
41.5	0.7221	0.7232	0.7234	0.7233	0.0001
41.5	0.7251	0.7268	0.7270	0.7269	0.0001
41.5	0.7282	0.7294	0.7296	0.7295	0.0001
41.5	0.7308	0.7319	0.7321	0.7320	0.0001
41.5	0.7333	0.7345	0.7347	0.7346	0.0001
41.5	0.7359	0.7370	0.7372	0.7371	0.0001
41.5	0.7398	0.7424	0.7426	0.7425	0.0001
41.5	0.7451	0.7477	0.7479	0.7478	0.0001
41.5	0.7490	0.7502	0.7504	0.7503	0.0001
41.5	0.7516	0.7528	0.7530	0.7529	0.0001
41.5	0.7555	0.7581	0.7583	0.7582	0.0001
41.5	0.7608	0.7634	0.7636	0.7635	0.0001
41.5	0.7662	0.7687	0.7689	0.7688	0.0001
41.5	0.7715	0.7740	0.7742	0.7741	0.0001
43.5	0.7768	0.7794	0.7795	0.7794	0.0001
43.5	0.7821	0.7847	0.7849	0.7848	0.0001
43.5	0.7860	0.7872	0.7874	0.7873	0.0001
43.5	0.7886	0.7898	0.7900	0.7899	0.0001
43.5	0.7911	0.7923	0.7925	0.7924	0.0001
43.5	0.7937	0.7949	0.7950	0.7950	0.0001
43.5	0.7962	0.7974	0.7976	0.7975	0.0001
43.5	0.7988	0.8000	0.8001	0.8001	0.0001
43.5	0.8013	0.8025	0.8027	0.8026	0.0001
43.5	0.8039	0.8051	0.8052	0.8052	0.0001
43.5	0.8064	0.8076	0.8078	0.8077	0.0001
43.5	0.8090	0.8102	0.8103	0.8103	0.0001
45.5	0.8117	0.8131	0.8132	0.8131	0.0001
45.5	0.8146	0.8159	0.8161	0.8160	0.0001
45.5	0.8175	0.8188	0.8190	0.8189	0.0001
45.5	0.8204	0.8217	0.8219	0.8218	0.0001
45.5	0.8232	0.8246	0.8248	0.8247	0.0001
45.5	0.8261	0.8275	0.8277	0.8276	0.0001
45.5	0.8290	0.8304	0.8306	0.8305	0.0001
45.5	0.8319	0.8333	0.8334	0.8334	0.0001
47.5	0.8348	0.8362	0.8363	0.8362	0.0001
47.5	0.8377	0.8390	0.8392	0.8391	0.0001
47.5	0.8406	0.8419	0.8421	0.8420	0.0001
47.5	0.8435	0.8448	0.8450	0.8449	0.0001
47.5	0.8464	0.8477	0.8479	0.8478	0.0001
47.5	0.8492	0.8506	0.8508	0.8507	0.0001
47.5	0.8521	0.8535	0.8537	0.8536	0.0001
47.5	0.8550	0.8564	0.8565	0.8565	0.0001
47.5	0.8579	0.8593	0.8594	0.8594	0.0001
47.5	0.8608	0.8622	0.8623	0.8622	0.0001
47.5	0.8637	0.8650	0.8652	0.8651	0.0001
47.5	0.8666	0.8679	0.8681	0.8680	0.0001
49.5	0.8681	0.8681	0.8683	0.8682	0.0001
49.5	0.8683	0.8683	0.8684	0.8684	0.0001
49.5	0.8698	0.8712	0.8713	0.8712	0.0001
49.5	0.8727	0.8741	0.8742	0.8741	0.0001
49.5	0.8756	0.8769	0.8771	0.8770	0.0001
49.5	0.8785	0.8798	0.8800	0.8799	0.0001
49.5	0.8814	0.8827	0.8829	0.8828	0.0001
49.5	0.8842	0.8856	0.8858	0.8857	0.0001
49.5	0.8871	0.8885	0.8886	0.8886	0.0001

49.5	0.8900	0.8914	0.8915	0.8915	0.0001
51.5	0.8929	0.8943	0.8944	0.8944	0.0001
51.5	0.8958	0.8972	0.8973	0.8972	0.0001
51.5	0.8987	0.9001	0.9002	0.9001	0.0001
51.5	0.9016	0.9029	0.9031	0.9030	0.0001
51.5	0.9045	0.9058	0.9060	0.9059	0.0001
51.5	0.9073	0.9087	0.9089	0.9088	0.0001
51.5	0.9102	0.9116	0.9117	0.9117	0.0001
51.5	0.9131	0.9145	0.9146	0.9146	0.0001
51.5	0.9160	0.9174	0.9175	0.9175	0.0001
51.5	0.9189	0.9203	0.9204	0.9203	0.0001
51.5	0.9218	0.9232	0.9233	0.9232	0.0001
51.5	0.9247	0.9261	0.9262	0.9261	0.0001
56	0.9280	0.9299	0.9300	0.9300	0.0001
56	0.9319	0.9337	0.9338	0.9338	0.0001
56	0.9357	0.9376	0.9377	0.9376	0.0001
60.5	0.9395	0.9414	0.9415	0.9414	0.0001
60.5	0.9434	0.9452	0.9453	0.9453	0.0001
62.5	0.9472	0.9491	0.9492	0.9491	0.0001
62.5	0.9510	0.9529	0.9530	0.9529	0.0001
66.5	0.9557	0.9583	0.9584	0.9584	0.0001
66.5	0.9611	0.9637	0.9638	0.9638	0.0000
66.5	0.9665	0.9691	0.9692	0.9692	0.0000
66.5	0.9719	0.9745	0.9746	0.9746	0.0000
68.5	0.9765	0.9784	0.9785	0.9784	0.0000
68.5	0.9803	0.9822	0.9823	0.9823	0.0000
68.5	0.9842	0.9860	0.9861	0.9861	0.0000
68.5	0.9880	0.9899	0.9899	0.9899	0.0000
68.5	0.9918	0.9937	0.9938	0.9937	0.0000
68.5	0.9957	0.9976	0.9976	0.9976	0.0000

Appendix C: Thermostat Questionnaire

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Produced by
King County
as part of the **Local Hazardous Waste Management Program in King County**

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Final Report

Mathematical Model Estimating Mercury Thermostats in Commercial Buildings

Taylor Watson, Research/Technical Lead
Local Hazardous Waste Management Program in King County
Technical Assistance Pollution Prevention

This report was prepared by the Local Hazardous Waste Management Program in King County, Washington. The program seeks to reduce hazardous waste from households and small quantity generator businesses in King County by providing information and technical assistance to protect human health and the environment.

For more information or to order additional copies of this report contact:

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ABSTRACT

A research study to estimate the number of mercury thermostats in commercial buildings in King County was conducted in 2005 by the Local Hazardous Waste Management Program in King County. Data was obtained from the 30,975 commercial building assessment records in the 2004 and 2005 King County Assessors Office Commercial Buildings Database and study data collected from 346 sample sites. A mathematical model using predictive statistical relationships was developed as part of the study. Regression analysis and proportional attribution techniques were used to estimate the total number of mercury thermostats. The arithmetic mean for the number of ampoules observed was used to estimate the pounds of mercury.

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INTRODUCTION

Mercury is used in industry processes because of its diverse properties as a component in product ingredients or in industrial processing. Although industrial demand for mercury has declined in recent years due largely to the elimination of mercury additives in paints and pesticides and the reduction of mercury in batteries, it continues to be used in many commercial and consumer products.

A substantial amount of mechanical switches contain mercury and are still found in many types of products, including thermostats. Through end-of-life replacement and building remodeling or demolition, mercury-containing thermostats can enter the waste stream. National and local efforts to further eliminate sources of mercury have identified mercury-containing thermostats as a significant source of mercury in many states, including Washington, making mercury thermostats a high priority for collection and reclamation

Included in the long-term effort to reduce mercury emissions in King County, the Local Hazardous Waste Management Program in King County (LHWMP) conducted the Mercury Thermostat Research Study in 2005. The focus of this study was to determine reliable estimates of the number of mercury thermostats in King County commercial properties and the variables associated with mercury thermostat use. Results from this study will be used to identify cost-effective options to reduce mercury emissions through material substitution and end-point disposal options that encourage product recycling.

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MERCURY EXPOSURE RISK

Mercury in the Environment

Mercury occurs in the environment naturally as metallic (the purest form of mercury that is not combined with other elements), inorganic, or organic. Inorganic mercury occurs in the environment when mercury combines with other elements such as chlorine, sulfur or oxygen. When mercury combines with carbon, organic or organomercurial compounds are formed in the natural environment.

Mercury can also occur in the environment from anthropogenic sources such as from industrial releases and mercury-containing products disposed to landfills. For example, metallic (elemental) mercury is the liquid metal used commonly in thermostats and other mechanical switching devices because of its ability to remain in liquid form at room temperature. However it's these same properties which allow the mercury to readily evaporate to the air and the environment.

Atmospheric Mercury

As a result of natural and anthropogenic activities, mercury cycles in the environment where it can remain for long periods of time. Atmospheric mercury is predominantly composed of elemental mercury vapor that can circulate in the atmosphere for up to a year. Often transported miles from the emission source, atmospheric mercury is deposited to water or soil (Keating, 1997).

Approximately 80% of the mercury released into the environment from anthropogenic activities is elemental mercury. Approximately 15% of the total mercury released is deposited to soil and from municipal solid waste (ATSDR, 1999) which includes the disposal of mercury-containing thermostats to the landfill. The amount of mercury that naturally exists in any one place is usually very low. In contrast, as a result of anthropogenic activity, mercury found in soil at a contaminated site can be well over 200,000 times the naturally-occurring levels.

Methylmercury Toxicity

Mercury deposition influences the most susceptible ecosystems with piscivorous birds and mammals more highly exposed at the top of the food chain. Mercury deposits in the aquatic environment are converted by microorganisms through methylation to methylmercury (MeHg). Through MeHg biomagnification throughout the food chain, it reaches it's most toxic concentration in larger longer-lived species, some of which are consumed as food by humans (Goyer, 2000).

Among humans and wildlife that consume fish, methylmercury is the predominant chemical species contributing to mercury exposure. Methylmercury can bioaccumulate in human tissue, where acute and chronic exposures can produce adverse health affects.

Methylmercury is classified by the Environmental Protection Agency (EPA) as a Group C possible human carcinogen.

Persistent and Bioaccumlative Toxins

Due to the persistent, bioaccumlative, and toxic nature of mercury in the environment, in Washington State, mercury was selected as the first priority pollutant to be addressed in the state's Persistent and Bioaccumlative Toxins (PBT) Reduction Strategy (Gallagher, 2000). From this initial mercury reduction strategy the Washington State Mercury Chemical Action Plan (CAP) was developed in 2003 by the Washington State Department of Ecology (Ecology) and Health (DOH) (Peele, 2003).

The Mercury CAP identified anthropogenic sources of mercury released into Washington's environment at an estimated rate of 3,800 to 5,000 pound annually. Estimated mercury releases from the most common mercury containing products, which includes wall thermostats with an estimated 412 pounds of mercury disposed of as solid waste per year.

Routes of Exposure

The primary routes of human exposure to mercury come from eating mercury-contaminated fish, inhaling mercury vapor from liquid-mercury spills and through dermal absorption from contact with liquid mercury. In a non-industrial setting, children have the highest exposure risk to mercury.

Mercury-Contaminated Fish

The populations of greatest concern with respect to exposure to mercury-contaminated fish are women of child bearing age and children. Through the consumption of mercury-contaminated fish, 90 to 100 percent of MeHg is absorbed through the gastrointestinal tract where it easily enters the bloodstream and distributes throughout the body. MeHg is transported across the blood-brain barrier by an amino acid carrier and readily accumulates in the brain. It can also cross the placenta where it accumulates in fetal tissues.

Although MeHg is distributed throughout all organs in the body, as a neurotoxin the most pronounced effect is on the developing brain of a child with the potential for neurodevelopmental effects that are more diffuse and extensive than the effects seen in the adult brain. Although there are historical examples of high-dose chronic and acute MeHg poisonings, they appear to be uncommon. Mercury poisoning in children is most commonly the result of consuming foods, primarily fish, which are contaminated with MeHg.

Exposure Risk from Mercury Spills

In mercury thermostats, the mercury is completely enclosed and does not pose an immediate threat to human health or the environment. Health exposure risks occur only if the glass ampoule breaks. Should a mercury spill occur metallic mercury is often

difficult to remove from many types of materials and surfaces where it can remain for months or years as a continuing source of mercury exposure. Exposure to mercury and mercury vapor can be immediately toxic and can bioaccumulate in human tissue.

Commercial buildings that contain mercury thermostats are often accessible by children. Elementary, junior and senior high schools, churches and day cares are all examples of commercial buildings that can contain mercury thermostats. Through intentional tampering or accidental breakage, children can easily become exposed to mercury.

Since metallic mercury readily volatilizes at room temperature, the most important route of exposure to metallic mercury is through inhalation. Children and adults who regularly occupy a space containing spilled mercury that was not adequately removed are at risk for long-term exposure and associated health risks.

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MERCURY AND NON-MERCURY THERMOSTATS AND SENSORS

Thermostats are used in residential and commercial buildings to control the temperature of an entire building or of an individual space within the building. Generally there are two purposes why temperature is controlled. Either for the comfort of the occupants or for the climate control of a space used for a specified purpose.

Spaces that are temperature controlled for comfort will generally have thermostats located in occupant areas. Thermostats are set for the comfort of the occupants. If it is a large space, more than one thermostat is usually installed. A space (zone) will be regulated by the thermostat that is set to control the temperature in that specific zone. Often different types of thermostats are in use in the same space if the space has been partially remodeled or if different thermostats are more efficient for different zones.

Spaces that are climate controlled will generally have thermostats that are durable and control the temperature of a space at a constant rate. Examples of a climate controlled area would be document storage, equipment, and refrigeration rooms. Dependant on specific temperature needs, the thermostat is frequently located in areas not generally associated with comfort control. For example, a ceiling mounted heater in a large warehouse structure could have the thermostat mounted on the heater itself or mounted high on a nearby post or wall. These types of heaters are commonly installed to provide ceiling heat to warehouse building pipes to prevent freezing and are not installed for occupant comfort.

Mercury Thermostats

The most common mercury thermostat contains an electromechanical on/off switch that is set manually to a single temperature set point[1]. The switch that controls a heating or cooling system is activated by temperature changes. The sensing element is usually a spiral bimetallic strip (Figure 1) that expands or contracts in response to temperature changes because of the differential expansion of the two bonded metals. In a mercury-switch thermostat, liquid mercury rolls between contacts in one or more sealed glass ampoules, which are attached to a bimetallic strip. The switch works when the mercury makes (cut-in) or breaks (cut-out) an electrical circuit, creating a signal to the heating or cooling system. When the temperature reaches the cut-in state the thermostat is fully on and fully off when it reaches the cut-out state. Temperature states of fully on or fully off can create a temperature swing that results in inefficient heating and cooling. For this reason, some electromechanical mercury thermostats also contain an anticipator control (wire loop resistor) that can turn heating or cooling equipment on/off prior to the actual

[1] Manufacturer and distributor technical data and information used in describing thermostat types and functions.

cut-in/cut-out points of the thermostat reducing the magnitude of temperature swing for increased efficiency.

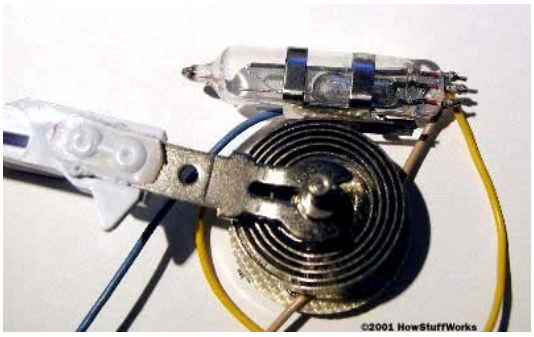

Figure 1. Mercury Ampoule with Spiral Bimetallic Strip Sensing Element

Mercury's unique properties (high conductivity, high surface tension and liquidity at room temperature) make it a useful component in many electric switches. Each glass ampoule contains approximately three grams of metallic (elemental) mercury with each mercury thermostat containing from one to six glass ampoules of mercury (3-18 grams of mercury) dependant on single stage or multistage applications. Thermostats are installed in the area they regulate, most often on a wall or the heating and cooling equipment itself. Mercury thermostats operate quietly, require little maintenance, and provide up to 30-40 years of service.

Non-Mercury Thermostats

Electromechanical

Commonly, non-mercury electromechanical thermostats utilize a snap-action on/off switch with conductive bimetal construction. The bimetallic element carries the circuit current under short circuit conditions with quick make/quick break switching action. Other than the switching mechanism, both mercury and non-mercury electromechanical thermostats maintain similar specifications and applications for use.

Digital

Digital thermostats often utilize a thermistor (resistor) or other integrated circuit sensors whose electrical resistance changes with temperature. These microcontrollers can measure the resistance and convert that number to a temperature reading. Both non-programmable and programmable digital thermostats are set manually to a single temperature set point the same as electromechanical thermostats. Programmable digital thermostats offer additional features that allow for temperature setback at predetermined days and times that correspond with heating and cooling need making programmable digital thermostats more energy efficient.

Sensors

In commercial buildings, wall-mounted sensors are thermostats that are installed to control building temperature where tamper-proof controls are required, such as public access areas of buildings, and to maintain a constant temperature set point. Wall-mounted sensors are typically installed in a locking case requiring a manufacturer-specific key to gain access.

There are several different switch types used in wall-mounted sensors that include mercury, non-mercury and electronic. Mechanical sensors that utilize preset, adjustable single or multistage hermetically sealed snap-in mercury switches offer precise temperature control that is generally unaffected by fatigue and vibration and will operate in any position without leveling. Preset sensors are purchased at a single standard temperature set point that cannot be adjusted. Adjustable sensors (both single and multistage) have set points that can typically be adjusted from $+40^{o}$F to $+90^{o}$F. Non-mercury mechanical sensors typically use preset bimetal switches. Electronic sensors that are digitally controlled by centralized building systems are less commonly used, especially in smaller facilities.

Since the objective of this study was to locate those sensors that are associated with building heating and cooling systems that are readily accessible such as wall-mounted sensors, capillary sensors in the heating and cooling ductwork of a building that control building temperature or installed in a refrigeration unit to control equipment temperature are examples of temperature sensors that are not readily accessible and were not included in this study.

Thermostat and Sensor Types

Research information compiled on thermostats and sensors currently being sold and installed that contain mercury are shown in Table 1. Data and information for older temperature control technologies (prior to 1953) was not readily available and is not included in Table 1.

Table 1. Thermostats and Sensors Currently Manufactured and Installed

Thermostat/Sensor Type	Switch Type	Contains Mercury?
Sensor	Mechanical	Yes
Sensor	Electronic	No
Thermostat - Mechanical	Bi-metal Snap Action	No
Thermostat - Mechanical	Bi-metal Mercury Switch	Yes
Thermostat - Line Voltage – 120/ 240V	Direct Voltage	No
Thermostat -Line Voltage – Low Voltage 24 V	Direct Voltage	Yes
Thermostat - Digital	Electronic	No

Many product descriptions from the manufacturer did not indicate the type of switch used or if a mercury ampoule was present[2]. For this reason it was often necessary to review the product specification sheet diagram to confirm whether a specific thermostat contained mercury or remove the outer cover and look for the mercury ampoule(s) though direct observation to determine if a mechanical thermostat or sensor contained mercury.

Thermostat Manufacturers

There are many manufacturers of thermostats and sensors for building temperature controls. Honeywell was the most common manufacturer found during study development for both mercury and non-mercury thermostats. Several manufactures print the contractor or third-party distributor name on the thermostat they manufacture. For the purposes of this study and based on available information, the manufacturer rather than the contractor or third-party distributor name was documented during study development and data collection.

[2] Some mechanical thermostats and sensors have the same outer cover and contain either a mercury switch or a non-mercury snap action switch.

STUDY DEVELOPMENT

Goals and Objectives

The goal of the Mercury Thermostat Research Study was to develop a method to reliably estimate of the number of mercury-containing thermostats for commercial buildings in King County. Results of the study would enable King County to better estimate how many mercury-containing thermostats are currently in use and how many are potentially disposed annually.

Estimates of the number of mercury-containing thermostats in commercial buildings in King County was determined by collecting statistically-significant survey data from randomly selected sample sites for multiple building variables and by utilizing available commercial building data. A predictive mathematical model to derive statistically-reliable estimates was used for data analysis.

The study was designed to provide data and information on:

1) How many mercury thermostats are in King County commercial buildings?
2) What is the building variables associated with thermostat use?
3) Is King County Assessors Office (KCAO) commercial building data a reliable source for statistically-significant data analysis for this study?

Method Development

Library research, elective site investigations and manufacturer and trade information were used by the research lead to obtain information during study development. The study design was evaluated for feasibility of meeting study objectives. Key study design elements to define the sampling method, data collection and analysis were:

- Define study population
- Locate reliable population data source
- Determine statistically-significant sample size
- Construct data collection instrument that is unbiased and maintains respondent's interest with minimal inconvenience
- Develop data coding system to facilitate efficient and consistent data entry
- Develop relational database to enter, organize and evaluate data collected
- Utilize multivariate statistical techniques for quantitative analysis using SPSS statistical analysis software.

During method development, it was recognized there are many switching devices which contain mercury that are used within a building for purposes other than controlling building temperature. Pressure, level and temperature switches that are used for equipment controls are a few examples.

For the purposes of this study, research was focused on the types and applications of mercury and non-mercury thermostat switching devices used to control building temperature that are installed and replaced as a normal course of new construction and building remodeling/renovation. Research for this study was limited to single and multistage thermostat technology with on/off control technology that includes differential, cycle rate and anticipator controls commonly used for heating/cooling commercial buildings. These thermostats are thought to have a high potential for disposal to the landfill and resulting mercury release.

Limited data was collected for wall-mounted temperature sensors due to difficulties in identifying mercury content. Sensors are typically housed in a tamper-proof cover, frequently without manufacture identification. Without visual identification of a snap-in mercury switch or readily available manufacture data, for the purposes of this study, sensor data will have limit data quality.

Initial Research and Investigation

An informational investigation of the King County Environmental Laboratory in Seattle Washington was conducted by the research lead during study development. The multi-use building represented both occupant and non-occupant use space with the majority of the space dedicated to special use. Temperature was controlled by a pneumatic system with no mercury thermostats observed. Additionally, windows that open to allow ventilation from outside air were present in occupant spaces.

Although this site investigation did not prove to be representative of a standard commercial building, the general information obtained on heating and cooling systems proved very valuable. Two key pieces of information were obtained from the site contact on heating and cooling system configuration and maintenance. 1) Most systems tend to be a hybrid of the original system installed. Over time technicians can repair, replace and upgrade systems using their own judgment on the best course of action to meet the needs of the building that do not necessarily match the manufacturer's original design; and, 2) the prescribed heating and cooling schematic in the original building design can be altered by the installation contractor if it meets the same building load, for example, if digital thermostats are prescribed mercury thermostats can be installed by the contractor if they meet the same temperature control specifications.

A second informational investigation of the Fred Hutchinson Research Center in Seattle Washington was conducted by the research lead during study development. This multi-building campus was particularly helpful during initial research because it represented what was believed to be a good cross section of building age, use and varying stages of building renovation all within the same location.

Site investigations were conducted at the Fred Hutchinson Research Center in several older structures built in 1930 to 1940 that were approximately 10,000 to 15,000 square feet. Many of the areas within each building had been renovated and contained primarily non-mercury thermostats. However, several mercury thermostats were located in unoccupied areas of the building that were believed to be building artifacts and, to a

lesser degree, occupied areas where the thermostats had not been replaced during renovation or were original to the building where no renovation had occurred. Special use areas of buildings such as the freezer repository and document storage warehouse were also investigated and were found to have mercury thermostats associated with ceiling-mounted electrical heaters designed for climate control of non-occupant spaces.

In contrast, new buildings at the site were built starting in the year 2000 and contain state-of-the-art digitally-controlled heating and cooling systems. All heating and cooling needs are controlled through the use of digital building sensors that send digital signals back to the main unit for each specific zone within the building. No mercury-containing thermostats or sensors were observed in buildings built in or after 2000.

Reconnaissance Study

Based on initial research and informational investigations, a draft data collection instrument was developed by the Research Lead to test probable data collection variables. The instrument was pre-tested with several area businesses and was modified according to feedback received to further clarify project objectives. Data collection variables include:

- Heating/cooling system;
- Building characteristics such as ceiling height, age and square feet;
- Predominant use of space (e.g. retail, office, etc.);
- Number of mercury and non-mercury thermostats.

Using the modified data collection instrument, a reconnaissance study was conducted by the research lead to further test data collection variables and study feasibility. Each of 35 businesses selected was easily accessible by public access for observational purposes with a varying range in year built, square feet and building use. For each geographic location, the random selection process of choosing every third building was used to assure building variability and reduce bias. The types of buildings included in the reconnaissance study were:

- Small to medium retail spaces
- Large warehouse retail spaces
- Public library
- Bank
- Grocery stores
- Mini-marts
- Greenhouse

Specific building information, such as square feet, age of building and predominant use was obtained from the KCAO commercial buildings database after the reconnaissance

data was collected. Based on reconnaissance and KCAO data for a specified geographic location, the following was observed:

- All mercury thermostats observed during the reconnaissance study were in buildings built between 1972 and 1978 with average square feet of 2,780 (min 800 and max 9,348 square feet).
- Digital thermostats were observed in buildings built in 1982 to 1997 with average square feet of 5,000 (min 4,000 and max 6,000 square feet).
- The largest buildings observed did not have visible thermostats in the majority of the space accessed by the general public. These buildings were built between 1982 and 1997 and have average square feet of 61,936 (min 3,500 and max 142,158 square feet).
- A correlation between building use, square feet and year built and/or remodeled and the likelihood that the building contained a mechanical thermostat containing mercury was observed.
- Although age of building appears to be a likely indicator where the majority of mercury thermostats are found, buildings that are remodeled can still contain mercury thermostats even though digital technology was available at the time of the renovation.
- Buildings observed did not always contain one type of thermostat. A combination of mercury and non-mercury thermostats were observed for some buildings built between 1972 and 1978.

Buildings with the common factor of square feet had as high a degree of variability for the types of thermostat(s) in use as those that did not share this same common factor. The following figure illustrates the great differences between three hypothetical 5,000 square foot commercial buildings based on building variables and percent use.

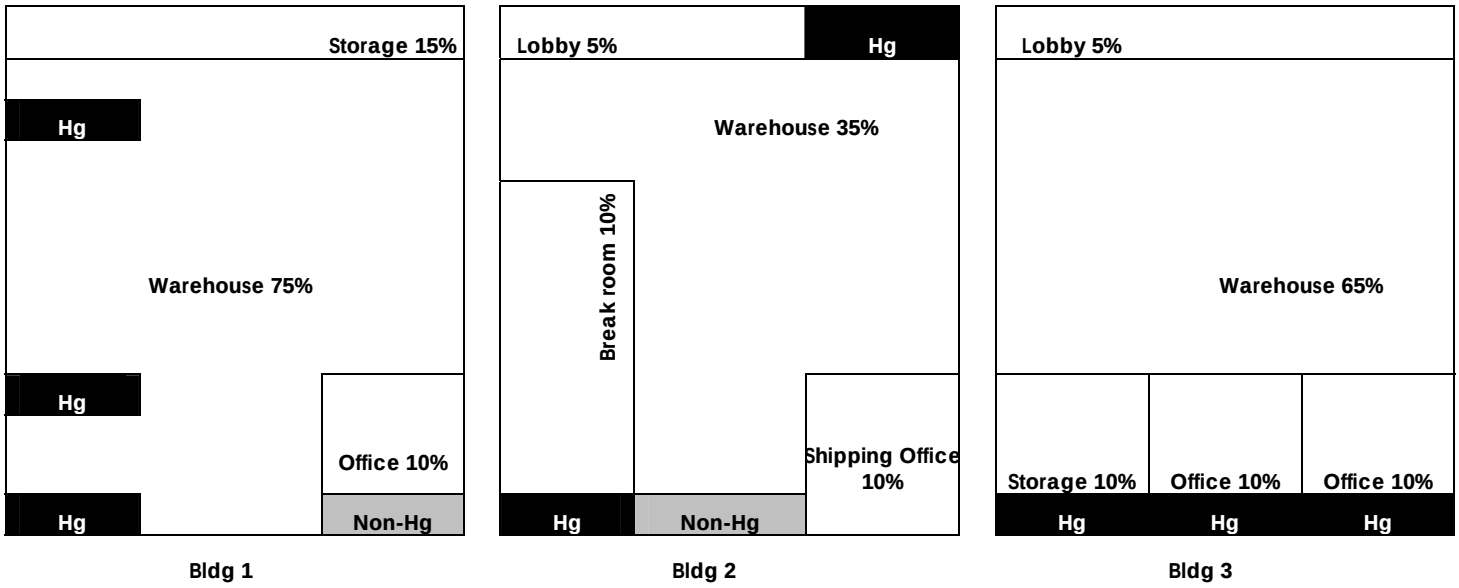

Figure 2. Building Variability Based on Percent Use - Hypothetical Example

Using the example in Figure 2, it's clear that simply counting thermostats in each building would not be sufficient to extrapolate to all King County commercial buildings. Using the variable of square feet in combination with how many thermostats were found would also not adequately predict the number of thermostats in all buildings.

Data from Figure 2 are presented in Table 2 which shows the associated Local Area Characteristics variable for each building and the associated thermostat type. Although this example is hypothetical and does not represent specific sample sites, it is representative of the variability of all sample sites surveyed during the reconnaissance survey.

Table 2. Local Area Characteristics – Building Variables; Hypothetical Example

			Ceiling Height Type			Number / Type of Thermostat			
Sample Site	**%Use**	**Use Type**	**Warehouse**	**High**	**Standard**	**Hg**	**Non-Hg**	**No Heat**	**Heat Type[3]**
Bldg 1	75%	Warehouse	X			3			CMH
	15%	Storage			X			X	N/A
	10%	Office			X		1		EBB
Bldg 2	35%	Warehouse	X				1		EBB
	10%	Break Room			X	1			FA
	10%	Shipping Office			X			X	N/A
	5%	Lobby		X		1			FA
Bldg 3	65%	Warehouse	X					X	N/A
	10%	Office			X	1			FA
	10%	Office			X	1			FA
	5%	Lobby		X				X	N/A
	10%	Storage	X	X		1			CMH

Ceiling height, heat type and use of the space appeared to be variables with greater predictive value for thermostat type and application. In order to extrapolate the sample data to all commercial buildings in King County, thermostat data and these predictive variables were documented and used to formulate the Sampling and Analysis Plan for this study.

[3] Where CMH = Ceiling Mounted Heater; EBB = Electric Baseboard Heater; FA = Forced Air Heat; N/A = not applicable – no heat

Hypotheses

Based on initial research data, factors that contributed in the development of the following hypotheses were the age of buildings that are likely to contain a mercury thermostat based on the year technology for both the mercury and digital thermostats were introduced and installed, the conditions where a thermostat would be replaced and what type of an environment where mercury thermostats are likely to still be in use.

- There is a direct correlation between the year built and/or remodeled and the likelihood that the building contains a mechanical thermostat containing mercury.
- The age range of a building most likely to contain wall-mounted mercury thermostats is 1953 – 1980.
- Mechanical thermostats containing mercury are used in conjunction with specific heating and cooling equipment that are based on building requirements.
- Buildings that are remodeled can contain mercury thermostats even though digital technology is available. Cost of replacing thermostats that are working properly can preclude thermostat replacement with a digital thermostat.
- Buildings designed for heavy industrial use such as manufacturing are more likely to contain mercury thermostats since they are more durable and less sensitive to vibration and air particles associated with industrial buildings.

King County Assessors Office Database

In addition to initial research and reconnaissance data, existing electronic data was used to formulate the Sampling and Analysis Plan for this study. The best available source of electronic data for commercial buildings specific to King County is from the King County Assessors Office (KCAO). The KCAO database provided data from the Assessors site assessment record from periodic site visits as well as self-reported changes to the recorded information from the commercial building owner. There is one record for each commercial building with no upper limit on the number of buildings per parcel. For the purposes of this study, the data contained in the KCAO database is assumed to be the most accurate record available of the number and specific characteristics of commercial buildings in King County.

The following data fields are available in the King County Assessor's Commercial Building Database. Highlighted fields show those selected as containing information that was used for this study. KCAO intended interpretation of each data field was confirmed through the Assessor's office and is reflected in Table 3 (Roe, 2005). Commercial Building Record Description.

Table 3. KCAO Commercial Properties Database Fields.

Field Name	Description
Major[4]	Parcel number associated with each property
Minor[5]	Plat number unique to parcel number
Building Number[6]	Building number within parcel
Number of Buildings	The number of buildings aggregated into this record.
Address	Location of parcel/plat
Number Stories	Number of stories for specific building number
Predominant Use	Use listed for specific building on property
Shape	Standard shape description
Construction Class	Building classification by construction type
Building Quality	Overall soundness of building
Building Description	Type of building (i.e. warehouse, office etc.)
Building Gross Square Feet	Square feet that includes all spaces
Building Net Square Feet	Square feet that includes only occupant space
Year Built	Year building was initially constructed
Effective Year	Year building was last remodeled
Percent Complete	Building construction or remodeling completed
Heating System	Type of heating system based on twenty pre-selected heating types
Sprinklers	Presence/absence of sprinkler system
Elevators	Presence/absence of elevator in building

The 2004 KCAO Commercial Building database used for study development and sample selection contained records for 40,949 commercial properties. Included in the commercial building database are commercial residential properties, such as apartment buildings. Since a prior phone survey for residential buildings had been conducted to determine the number and type of thermostats in households (LHWMP et al, 2004), residential properties were excluded from this study. The following residential Predominant Use Codes were removed (Table 4):

[4] Primary unique KCAO identifier for each record
[5] Secondary unique KCAO identifier for each record
[6] Used to further identify specific sample site

Table 4. KCAO Predominant Use Codes Removed

Predominant Use Code	Description
300	Apartment
330	Home for the Elderly
352	Multiple Residence (low rise)

When residential buildings are removed from the dataset, the remaining number of commercial buildings for all other predominant uses is 30,684. Appendix D provides data on the distribution of all other KCAO Predominant Use Codes that were included in the study.

Random Sample Selection

Systematic Sampling Strategy

For the purposes of statistical analysis and data extrapolation, a systematic sampling strategy was developed. Using the KCAO Commercial Buildings Database, distribution of the sample set by year built or remodeled was chosen based on the availability of the first mercury thermostat and first digital thermostats sold and installed. The proportionally-based and heavy industrial subset random sample selection was based on the following criteria:

Proportional Sample 1 (P1) - Buildings built or remodeled prior to 1953: The type of mechanical thermostats installed and used in 1900-1952 was not readily available. Difficulties in obtaining data during study development include variable historical technology and insufficient documentation readily available for review. Since this dataset contain buildings built or remodeled prior to the manufacture of mercury thermostats, for the purposes of this study, it is assumed that thermostats within this time period do not contain mercury or are no longer in use.

Proportional Sample 2 (P2) – Buildings built or remodeled between 1953-1980: In 1953, Honeywell Corporation (one of the largest manufacturers and distributors of thermostats) manufactured and sold the first Honeywell T86 round thermostat. This particular mercury-containing thermostat is very popular and is still sold and in use today. Many companies followed Honeywell and the manufacture of mercury thermostats was common during this time. The assumption for the years 1953-1980 is the majority of thermostats installed during this time period will contain mercury and are still in use.

Proportional Sample 3 (P3) – Buildings built or remodeled after 1980: In 1981 the first digital thermostat was manufactured and sold. Not all conditions are appropriate for the use of digital thermostats. It is assumed that during 1981-2004 some mercury thermostats may have been replaced by digital thermostats. It is also assumed that digital thermostats were more frequently installed instead of mechanical thermostats containing

mercury for new construction. During this time period a combination of both mechanical (mercury-containing) and digital thermostats are in use.

Sample selection for the proportionally-based sample selection was based on the percent of the total sample set as illustrated in Table 5.

Table 5. Proportionally-Based Random Sample Selection Based on Year Built.

Proportional Sample Designation	Year Built or Remodeled	KCAO Commercial Properties n=	Total Properties %
P1	1900-1952	1,936	6
P2	1953-1980	15,316	50
P3	1981-2004	13,390	44

Heavy Industrial Sample (H): A stratified sample subgroup was also included for the 42 heavy industrial sites in King County. These 42 sites were considered anomalous to the overall dataset. Heavy manufacturing and industrial processes were thought to require heating and cooling conditions not seen in commercial buildings designed for other than heavy manufacturing use.

Data Composition and Unique Identifiers

Random sample sites were generated from the KCAO data using Major, Minor, and Building Number fields as KCAO unique identifiers. Data were arranged according to proportional and subset distribution and were assigned a unique sample site identifier (Site ID). Based on data distribution, random numbers were generated by Site ID using Microsoft Excel. All sample sites had an equal opportunity to be selected within each dataset.

For KCAO database verification and to ensure all potential commercial buildings were represented in the random sample, parcel descriptions were included where no building was indicated (lots, garages, etc.) and for buildings that were listed as having no heat.

Percent Sample Selection

A 1.0 percent random sample was drawn (excluding heavy industrial subset data) from the 2004 King County Assessor's Office commercial building database proportionally for each of the three time periods based on the expected number of sample sites (300 sample sites). To assure sufficient randomly-selected sites were available in case of site refusals, a slightly larger sample was drawn proportionally for a total of 400 sample sites.

A separate random sample was drawn from the 2004 King County Assessor's Office commercial building database for the heavy industrial subset population, predominant use code 495. Seventeen samples, 40 percent, of the data set were drawn randomly with 5

additional samples drawn for a total of 22 sample sites to assure sufficient randomly-selected sites were available as alternative sample sites for site refusals.

Acceptable Statistical Accuracy

The proportional sample was drawn with an acceptable statistical accuracy at the 95 percent confidence level at a 5 percent level of error $\pm$ 1 percent. Sample sites drawn for the more anomalous heavy industrial sample subset were not held to the same statistical accuracy. With limited researcher availability and the larger scope of the proportional sample set, for the heavy industrial subset samples were drawn with an acceptable statistical accuracy at the 95 percent confidence level at a 20 percent level of error. Consultation with the project statistician confirmed these levels were acceptable to meet project objectives.

Sample Distribution Bias

Sample sites were assigned to each field researcher to assure that any bias in sample distribution was within acceptable limits. An independent review of the random sample distribution was provided by the project statistician. The Predominant Use building category in the KCAO database was evaluated for the effectiveness of the random sample drawn for the study. Although a random sample does not guarantee that all categories in a sample will be reproduced exactly, it does guarantee that each category has the same chance of appearing in the sample as in the population studied. Based on these evaluation criteria, the random sample drawn for the study survey was noted by the project statistician as "remarkably good in its reproduction of the KCAO database" and is a "statistically efficient sample".

Bias in sample distribution was evaluated by verification index for each field researcher. A statistical evaluation of the distribution of sample sites was completed by the research lead using KCAO data by Year Built, Square Feet and Predominant Use (see summary data calculations in Appendix G).

Comparable Index= Year Built Index * Ln Square Feet Index * Predominant Use Index

Figure 3. Bias Verification Index Equation

Where Comparable Index is the total numerical value for each site, Year Built Index (KCAO Year Built * 0.01), Ln Square Feet Index (Log normal * KCAO Square Feet) and Predominant Use (KCAO Predominant Use *0.1) assign numerical values that calculate an indexed rating for each sample site to compare researcher site assignments based on the variables for age of building, square feet and predominant use.

The comparable median index by field researcher indicates no bias was introduced based on building variables assuring that no one researcher received any one building type and that all building types were equitably distributed. An independent review of the results provided to the project statistician verified no bias in sample distribution.

Table 6. Sample Distribution Bias Verification Index

Researcher	n =	MIN	MEDIAN[7]	MAX
A	83	3,993.38	6,295.16	19,725.72
B	84	4,431.93	6,060.71	9,902.88
C	91	4,352.79	7,014.21	14,569.95
D	72	4,297.29	7,648.89	16,551.36
E	48	4,105.34	6,269.75	17,477.72
F	32	4,126.77	6,108.86	8,964.13

Sample Site Definition

For the purposes of this study, a sample site is defined as a single building, regardless of the size, use, occupancy or number of businesses it contains, whose structural footprint is continuous. Structures that reside on the same parcel/plat but are not attached are considered a separate building and not considered part of the sample site.

Variations such as a very large 300,000 square foot building, a multiple floor high rise to a 100 square foot pump house and a 1,000 square foot retail store could all be selected in the random sample. All space within a single building regardless of the number of addresses or businesses (occupants) of that building was considered a single sample site.

[7] Results demonstrate no analytical bias due to random sample generation, sample selection and sample site distribution to field researchers.

Data Collection Variables

The data collected for this study was assumed to be highly variable. Examples of sample site variability include a multitude of heating and cooling systems, their associated thermostat controls, use of building, square feet and age of building. To collect reliable data that could be used for statistically-significant data extrapolation, the data collection variables selected provide information and data on the:

- Accuracy and reliability of the database used and data obtained for sample site.
- Potential parameter selection for data extrapolation.
- Mercury thermostat use and occurrences in King County.

Data Limitations

The following limitations may affect the accuracy of data collected and analyzed.

King County Assessors Office Data

- Electronic data provided by the King County Assessor's Office may have limited reliability representing all buildings currently in King County.
- KCAO database may not represent current building conditions. Visual verification by an assessor occurs in 2-5 year intervals with inspections randomly selected.
- Data is updated based on information called into the Assessor's Office based on property owner's call-in information of errors in their property information. Information is not visually confirmed by an inspector;
- Not all parcel/plat numbers contain buildings so the total count of possible commercial buildings in King County is less than 30,642;
- Buildings within a specific predominant use type do not have a set number of thermostats based on any other comparable data (e.g. thermostats per square foot, thermostats per heating/cooling type, etc.);
- The type of heating source is not known for 1,455 commercial buildings and is listed as unknown or none;
- Multiple heating and cooling systems may be present at a building but not recorded in the Assessor's database since only one code is used for each parcel/plat number
- Building age based on KCAO year remodeled does not necessarily mean a thermostat has been replaced or installed. Category represents all building/property remodel activities.
- Multiple parcel/plat numbers represent a single building.

Data Collection

- Building characteristics have a high degree of variability. Within the same category of buildings, such as a warehouse, varying ceiling heights, number of

stories, square footage and predominant use (e.g. manufacturing vs. retail) can be vastly different making data collection difficult for some buildings.

- Not all areas of a building are remodeled at one time. Some older thermostats may still be in use even though a building has been remodeled after 1980.
- Information obtained during the field study may potentially have limited accuracy based on the extent of knowledge, availability and interest of the site contact.
- Unoccupied building space may contain mercury thermostats that are not accounted for.
- Depending on who is responsible for handling hazardous materials at the site, accurate records may not be available for how many thermostats are in the building at present time for those buildings that are remodeled.
- Building Engineer and/or contractor maintains information off-site;
- Sensitive areas of building not accessible;
- Building size and site contact availability prohibits the time needed to accurately count each thermostat present.

Model Limitation

- Statistical models developed for this study are based on individual KCAO commercial building datasets for years 2004 (survey study) and 2005 (data extrapolation) and may not be effective for other data applications.
- Models may have limited predictive value for future extrapolations of KCAO commercial building data. Unknown variables such as continual changes in exiting buildings (e.g. remodel, demolition, changes in building use, etc.) and the growth of new construction in King County may change how the Assessor's Office track and document commercial buildings in the future.

FIELD DATA COLLECTION METHODS

Researcher Recruitment and Training

Study data was collected by experienced field researchers to assure accurate data for each sample site. The Local Hazardous Waste Management Program in King County provided several Health and Environmental Investigators and necessary equipment such as vehicles, computers, digital cameras and mercury spill kits from its Public Health—Seattle & King County and Water & Land Resources Division offices for the duration of the project.

Field researcher training was provided by the research lead to assure consistent and accurate data collection. Both in-class and one-on-one in-field trainings were provided. Training goals were to provide data and information that would allow the field researchers to become proficient with the data collection instrument, be able to visually identify and document the many types of heating/cooling systems, mercury and non-mercury thermostats and building characteristics.

Single Blind Data Collection

A single blind data collection method was utilized to assure data quality and reduce the potential of personal bias. Field researchers were not provided information regarding the assumptions or hypotheses developed for the study prior to or during the data collection event. Each field researcher was assigned an anonymous Researcher ID (letters A-F) that was known only to the individual field researcher and research lead for site assignment, tracking and report generation purposes. Individual site surveys, project tracking and data quality were data-focused and did not include field researcher bias.

Data Collection Instrument

The data collection instrument (Appendix A) was developed to facilitate consistent data collection by all field researchers reducing the potential for bias and error. The variables selected for data collection were identified as those variables most likely to be associated with the occurrence of mercury thermostats and associated building characteristics. Data variables were also selected for verification of the KCAO Commercial Building Database as a reliable data source for data analysis and extrapolation. Components of the data collection instrument are:

- Site Contact Data
- Sample Site Visit Quality
- KCAO Database Verification
- Local Area Characteristics

Data was not coded at the time of data collection. All data compression and coding was done by the research lead at the time of data entry. Regardless of the complexity of the sample site, if a building had multiple addresses, businesses or site contacts each sample site was documented on an individual data collection instrument. Data was collected for all space within a single building, such as office, warehouse, storage, repair shop, loading dock, etc.

Site Contact Data

The quality of data collected relied heavily on the reliability of the information received from the site contact based on their knowledge of the building structure, heating cooling systems installed and the associated thermostats for their site. To track and evaluate data integrity, field researchers completed the contact information portion of the data collection instrument (see Appendix A). Data received was coded during data entry by the research lead using predetermined data fields to categorize the quality of information based on job category (see Table 7).

Table 7. Data Integrity Verification by Site Contact Job Category

Site Contact Job Category
Building Custodian
Building Engineer
Business Administrator/Manager
Business Front Office/Retail Clerk
Business Owner
Employee NOS
Facilities Manager
HVAC Contractor
Maintenance Engineer
None given
Other
Property Manager
Property Owner
Section Manager/Supervisor

Sample Site Visit Quality

The quality of data collected at each sample site was evaluated by a predetermined ranking system for visit quality. Only those samples sites with a visit quality of 1 or 2 were considered acceptable and complete. To achieve statistically-significant data, a total of 300 *completed* sample sites for the proportional population and a total of 15 *completed* sample sites for the heavy manufacturing subset population were needed to meet the criteria for visit quality 1 and/or 2. Even though a site has been surveyed, poor visit quality that does not meet the minimum visit quality 1 and/or 2 may require an

additional site be added from the list of randomly selected sites to the total sites surveyed to maintain the total count of useable data collected. Visit quality and completeness was documented by the field researcher on the data collection instrument in the visit quality section.

Visit Quality 1 - Useable Data.

A site survey with all of the following characteristics would be indicated on the data collection instrument as a visit quality 1:

1) Access to the site was sufficient to identify and document the type and number of thermostats. If the building did not contain thermostats, it was documented and still considered a completed site survey.
2) Access to the site was sufficient to identify and document the type of heating and cooling system(s); and
3) Building use was identified and documented.

It was important that all areas of the building were visually observed and documented. A site survey did not qualify for a Visit Quality 1 based on a phone interview. For special circumstances where a building was too large to observe all thermostats and building variables, such as a 37-story high rise, an acceptable method to obtain a visit quality 1 rating would be to

1) Observe and document sufficient information during the initial site survey to determine heating/cooling system, building variables and the number and type of thermostats. This can be done through reviewing a recent building schematic and confirming 10% of the building's thermostats, heating/cooling system(s) and building variables through direct observation.
2) Follow-up by phone with site contact, when needed, to further interpret building schematic to complete site survey.

Visit Quality 2 - Useable Data

Useable site survey data collected that did not meet all visit quality 1 criteria would have the following characteristics:

1) Access to the site was sufficient to identify the type of thermostats for the building but was not sufficient to count all thermostats;
2) Access to the site was sufficient to identify the type of heating and cooling systems at that site; and
3) Building use was identified.

A completed sample site using the above criteria would be indicated on the data collection instrument as a visit quality 2.

Visit Quality 3 - Unusable Data (Limited Access).

Access to a site that was insufficient to determine the type and number of thermostats, heating/cooling system(s) and building use was considered an incomplete site survey and

would be indicated on the data collection instrument as a visit quality 3. A replacement sample site was given to the Field Research from the list of randomly selected sites.

Visit Quality 4 - Unusable Data (Site Refusal)

If a site refused entry or required information, the field researcher documented the site survey on the data collection instrument as a visit quality 4 and went to the next assigned sample site. A replacement site was issued from the random samples selected for each site refusal to maintain the minimum number of completed sample sites needed.

Visit Quality 4 - Unusable Data (Non-Building Site)

If a site did not contain a building, the field researcher documented the site survey on the data collection instrument as a visit quality 4 and went to the next assigned sample site. A replacement site was issued from the random samples selected for each non-building site to maintain the minimum number of completed sample sites needed.

Visit Quality 4 - Unusable Data (Site Not Located)

If a site could not be located, the field researcher documented the site survey on the data collection instrument as a visit quality 4 and went to the next assigned sample site. A replacement site was issued from the random samples selected for each site not located to maintain the minimum number of completed sample sites needed.

King County Assessors Office Database Verification

Data was collected for Year Built, Year Remodeled, Predominant Use, Building Description and Square Feet. KCAO database data was provided on the data collection instrument for these variables for each sample site. A visual verification was made by the field researcher during the site survey to confirm whether the data provided is the same as what was observed on site. A check box was provided on the data collection instrument to document verification.

Local Area Characteristics Assessment

The purpose of the Local Area Characteristics Assessment was to describe each unique space within a building by:

- The purpose of the space
- Heating/cooling unit
- Ceiling height
- Percent of the building it pertained to
- The thermostats that were observed.

For example, 50 percent of a building could contain 3 electric baseboard heaters with standard ceiling height and 2 non-mercury thermostats in a space designated as an office. In the same building, 50 percent of the building could contain 6 ceiling-mounted gas heaters, all with mercury thermostats with a warehouse height ceiling designated for

document storage. Using this example, 2 Local Area Characteristics Assessments would be completed for this site.

Building Artifacts

Many sample sites have been remodeled or partially remodeled with old heating/cooling systems and thermostats that are no longer in use and have not been removed. To document these systems and thermostats, the Local Area Characteristics Assessment data field provided a check box to record the status of artifact.

Locating Sample Sites

All samples sites are located within the cities and unincorporated areas of King County. The site address listed in the KCAO commercial building database was used to document the site location on each data collection instrument. For those sites where address information was incomplete, other resources such as the King County iMAP/Parcel Viewer Database and Thomas Guide maps were used to document site location.

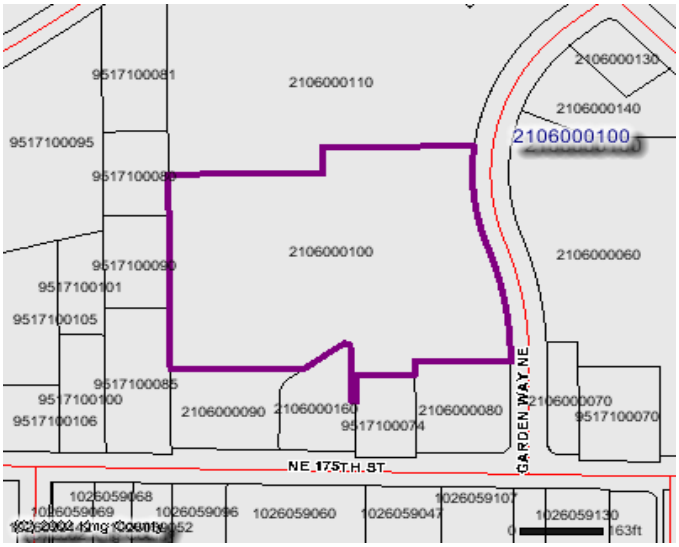

Figure 4. King County iMAP/Parcel Viewer Map

Using the KCAO database major/minor (parcel/plat) unique identifier and the King County iMAP/Parcel Viewer database, field researchers were provided a site map containing the parcel/plat number and the surrounding street information. The site map was attached to each data collection instrument for each sample site.

In addition to the King County Parcel Viewer map provided, other tools were used by the field researchers to locate sample sites, such as website search engines such as www.switchboard.com. or Thomas Guide map book. Since this was a blind study, no additional information from the King County Assessor's Office or King County iMAP/Parcel Viewer databases were used by the field researchers to locate information beyond site location.

Non-building sites

Within each stratified population, each commercial building listed in the KCAO database had an equal chance of being randomly selected. In some instances sites were a non-building (e.g. parking lot). Since the KCAO Commercial Building Database predominantly contained properties with a building structure, field researchers conducted a site survey to verify that the KCAO database was correct and that no building had been built. If the KCAO database was correct, the site was documented as a visit quality 4 and an alternate site was issued. If the KCAO database was incorrect and the site contained a building, the field researchers completed a site survey and documented the change in KCAO building description.

Difficulty Locating Sample Sites

For the majority of sample sites, data from the KCAO Commercial Properties database correctly associated building location with a corresponding parcel/plat number and building description. However due to database complexities, incidences of variation for how a building was recorded in KCAO database were observed. These variations included:

- A single continuous building that spans over several parcel/plat numbers;
- Building addresses that did not correspond with the database
- Sites that indicated a building on site where there was a vacant lot
- Residential properties listed as commercial buildings
- Building description not current
- Commercial building was residential/commercial mixed use

For those sites where visit quality 4 was documented (e.g. no building exists, residential properties, etc.) a replacement sample site was issued.

Many sample sites contained multiple unattached buildings that did not match the description given in the database. When the exact building could not be located for sites with multiple buildings on the same parcel/plat, the field researcher used a random selection method to choose the building survey site. Random building selection consisted of an alternate pattern of choosing the building to the left, then to the right, the closest building and the building with the most remote distance. If the on site random selection method was not feasible, the research lead was contacted for assistance in random sample site selection. The alternate random building selection was documented on the data collection instrument in the comments field.

Photo Documentation

Digital photos were taken by field researchers of thermostats and sensors observed during a site survey where the presence or absence of mercury could not be determined through visual inspection. The Site ID and heating/cooling system code associated with the thermostat or sensor was documented at the time each photo was taken. Based on the

review of information and photo documentation provided, the research lead provided information on the thermostat and/or sensor type and possible mercury content.

Sample Site Assignment

Each field researcher was assigned an equal balance of ten new sample sites each week. Due to the variability in building complexity, the number of sites surveyed varied each week. To meet project timelines, each field researcher's goal was to complete six sample sites a week with a visit quality of 1 and/or 2.

Random distributions of sample sites were assigned so no one field researcher would receive a single building type, complexity or complete geographical location. To reduce travel time, groups of sites were assigned on a geographical basis whenever possible. Based on completed data collection instruments received, the geographical location for each field researcher changed as groups of sample sites were completed.

Sample sites assigned and completed were tracked by the research lead for each field researcher on the Sample Status Tracking Report (Appendix B) generated from the project database. To keep field researchers informed of their sample status, individual reports were generated and distributed weekly. A weekly Sample Status Tracking Report containing data for all field researchers was also generated for use by the research lead to track:

- Overall project completion status
- Random site assignment
- Workload distribution
- Workload and progress reporting to the Project Coordinator and Management.

Quality Assurance/Qualtiy Control

A systematic data collection method was implemented through predictable and accountable variable data collection. All data collection instruments received a baseline Quality Assurance/Quality Control (QA/QC) review for completeness by the research lead. An additional 20 percent (82 data collection instruments) were randomly selected and received a full QA/QC review of all data variables by the research lead.

As a research study progresses and more information is obtained, it is not uncommon for the categorization and documentation of data collected to change as well. To effectively manage this potential, each field researcher received a periodic data review with the research lead. These follow-ups helped to assure consistent data collection for all variables across all field researchers with minimal drift in data collection interpretation.

An individual QA/QC Data Analysis Milestone Report was provided to each field researcher showing researcher's data usability (Appendix G). Data corrections were documented on the corresponding data collection instrument.

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SURVEY DATA

Data Collection

A team of six field researchers collected survey data for three months (January 4 – March 31, 2005) for 412 sample sites. From these sample sites, 346 provided useable data. The distribution of the 329 useable proportional sample data (see Table 8) show a direct correlation between the total percent of each sample type in the population and the percent useable data. Site refusals and unusable site conditions, such as mislabeled sites in the KCAO database for residential buildings, resulted in data from 66 sample sites (16 percent) as unusable.

Table 8. Proportional and Heavy Industrial Subset Data Collected

Sample Type	KCAO Commercial Buildings n=	Total Buildings in Proportional Sample %	Random Samples Surveyed n=	Useable Date Collected n=	Useable Proportional Data %
P1 = 1900 – 1952	1,936	6.0	30	22	6.7
P2 = 1953-1980	15,316	50.0	200	167	50.8
P3 = 1981- 2004	13,390	44.0	160	140	42.6
Proportional Total	**30,642**		**390**	**329**	
H = Heavy Industrial	42	N/A	22	17	N/A
Total Sample Set			**412**	**346**	

Based on the total KCAO Commercial Building population, the useable survey data collected for 346 sample sites achieved statistical accuracy goals for the project at the 95 percent confidence level for number of sample drawn as indicated in Table 9.

Table 9. Survey Data Collected at 95 Percent Confidence Level

	Project Goal %	Achieved %
Proportional Samples	5.0	5.4
Heavy Industrial Subset	20.0	18.3

Data Entry

Based on the complexity of the data collected and to assure consistent data entry, all data was entered into the project database by the research lead. This streamlined data entry method provided a process for:

- Consistent data compression and coding at time of data entry;
- Consistency of data entry across all data collected and entered;
- Consistent QA/QC and data corrections for each field Researcher.

Data Compression and Coding

Not all data required data compression and coding. Many data variables (e.g. KCAO verification data, visit quality, ceiling height, etc.) were directly entered into the project database. For those data requiring further assessment and coding, at the time of data entry, each data collection instrument was reviewed and coded according to a predetermined categorization system for each variable. Data was entered into the project database using this coding system.

During the study development phase, KCAO commercial building data indicated a possible correlation opportunity using the KCAO data field for Heat Type (see Appendices H and J) and several building variables (e.g. square feet, building age, etc.). Since KCAO Heat Type data records only the predominant system and does not reflect all systems possible within a sample site, a categorization system was developed for the study and used for data compression and coding purposes at the time of data entry (Tables 10 – 13).

Table 10. Data Compression and Coding – Heating/Cooling System Type

Heating/Cooling System Type
Individual - Cooling
Individual - H/C
Individual - Heat
Individual System - Non Specific
Inside Central System
Non-Specified
Outside Central System
Special Use - Central system
Special Use - Individual H/C
Special Use - Non Specific
Special Use - Stand alone controls

Table 11. Data Compression and Coding – Heating/Cooling Unit Location

Heating/Cooling Unit Location
Baseboard
Ceiling
Floor
Not Specified
Other
Roof
Wall

Table 12. Data Compression and Coding – Source of Energy

Source of Energy
Electric
Gas
Gas & Electric
Not Specified
Oil
Other
Waste Oil

Table 13. Data Compression and Coding – Unit Type

Type of Heating/Cooling Unit
Boiler
Forced
Furnace
HVAC
Not Specified
Pump
Radiant
Radiator
Space

KCAO data for building Predominant Use provided useful information for KCAO database verification, however like the KCAO Heat Type data, Predominant Use pertains to the whole building and does not reflect the variability within each buildings. To better captures building variability as it relates to thermostats, a categorization system was

developed for the study that was used for data compression and coding purposes at the time of data entry (Table 14).

Table 14. Data Compression and Coding – Building Use

Survey Data - Building Use
Church
Day Care/Pre-School
Equipment/Special Use
Food Service
Garage
Hotel/Motel
Laboratory
Maintenance
Manufacturing
Medical Facility
Office
Other
Public Use Facility
Recreation Facility
Repair Shop
Retail
Schools
Storage Area/Shed
Transportation
Warehouse/Shipping

Data Entry Quality Assurance/Quality Control

Data entered for 412 data collection instruments resulted in 198,132 data points entered. An independent QA/QC review was conducted for 10 percent of the data collection instruments by random selection. Data interpretation, coding and entry were evaluated for 17,680 data points with an observed error rate of 0.006 percent. Results of QA/QC demonstrate no analytical bias due to data entry error.

DATA MANAGEMENT

Project Database

A project-specific relational database was developed by the research lead to capture data collected for the study. The integrity of database design received an independent review prior to data entry. Database modules were created for:

- Sample/Project Tracking
- Site Location Information
- Local Area Characteristics
- KCAO Data Verification

Sample/Project Tracking Module

Sample and project status were monitored throughout the project by the research lead using the Sample/Project Tracking module (Appendix C, Table C.1). Data maintained in this module was used to generate various reports for management, the project coordinator and field researchers to keep the project on track and on time.

Site Location Information Module

Site location information was recorded during the site survey to document the initial site visit, follow up activities, contact information and site address verification with the KCAO database. The Site Location Information module (Appendix C, Table C.2) was used to track and analyze the quality of data collected. It was important to the integrity of the data collected to indicate how the data was obtained. The quality of data received was used by the research lead as one data point in determining overall data quality for each site. By independently verifying the field researcher's self-reported visit quality rating and the quality of the data obtained based on the site contact available, data quality was assured.

Local Area Characteristics Module

Data describing the building characteristics, heating and cooling systems and the thermostats and/or sensors observed was recorded in the Local Area Characteristics Module (Appendix C, Table C.3.). This more complex core data was used to extrapolate the number of thermostats and/or sensors to all buildings in King County commercial buildings. Data was collected over a greater number of variables than utilized in the final data analysis due to uncertainties in variable attainability and statistical significance.

King County Assessors Office Data Verification Module

Verification data collected to track differences between the data indicated for each parcel in the KCAO Commercial Building Database with specific test parameters was captured in the KCAO Data Verification Module (Appendix C, Table C.4). Variables such as year

built, year remodeled, predominant use, building description and square feet were used to verify the Assessor's Office data with site survey observations.

Data entered in the project database was continually tracked using a master tracking table (Appendix C, Table C.5). Sample and data variable status was monitored by the research lead to keep the project on track and within study design objectives.

MERCURY THERMOSTAT ESTIMATION

Techniques used to estimate the total number of mercury thermostats in King County commercial buildings were regression analysis and proportional attribution. Each analysis model produced separate but comparable estimates. Data used in analysis was obtained from the 30,975 commercial building assessment records (2005 KCAO Commercial Building Database) and survey data for 346 sample sites (2005 Mercury Thermostat Research Study).

Analysis of Variables

The predictive survey variables were the number of total thermostats, number of non-mercury thermostats, age of building, age of remodel, building gross square feet, ceiling height and data type (another measure of age).

Survey data collected for building use was not statistically related to other variables and not used in the estimate analysis. The KCAO variable Predominant Use describing building use contained such a large number of categories, after calculations, there would be not data left to relate KCAO Predominant Use to survey thermostat data (insufficient degree of freedom).

Data collected for the study variable, Heating/Cooling Unit, proved difficult and unreliable. This qualitative data point was subject to variable interpretation and dependent on the individual site contact's breadth and depth of knowledge of the building's heating and cooling system. Data compression and coding was difficult to interpret with certainty and accuracy and was not included in survey data submitted for analysis.

No statistically-significant relationships were found regarding thermostats in data collected at the detailed building level. Relationships were only found when aggregating data to the entire building.

Regression Analysis Model

A statistical model to estimate the total number of thermostats was developed that would find predictive statistical relationships from thermostat survey data (see Figure 5). The following regression analysis equation was found to be the best fit to the data.

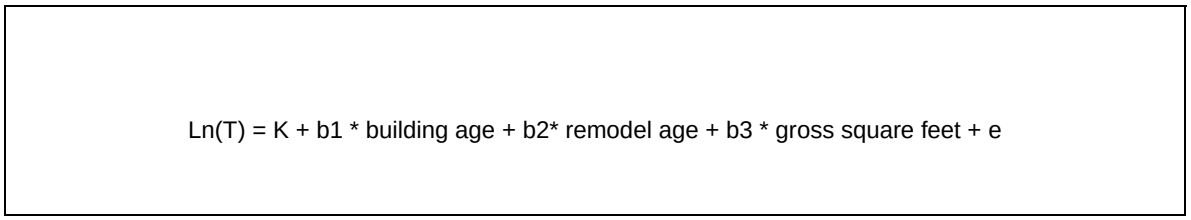

Figure 5. Regression Analysis Model Equation

Where Ln(T) is the natural log of the total number of thermostats, K (1.289) is a constant (intercept) estimated by the technique, b1 (0.00585), b2 (0.00025) and b3 (0.0000148) are coefficients that calculate the contribution of the variables building age, age of remodel and gross square feet, e is unexplained variation in the regression. Taking the anti-log of Ln (T), the total number of thermostats is predicted.

To estimate the number of mercury thermostats, the number of non-mercury thermostats are subtracted from the total thermostats estimated (both mercury and non-mercury). The best predictive variables of non-mercury thermostats are total thermostats and gross square feet. To negate their correlation, a variable was created (see Figure 6) by multiplying total thermostats by gross square feet with the following equation.

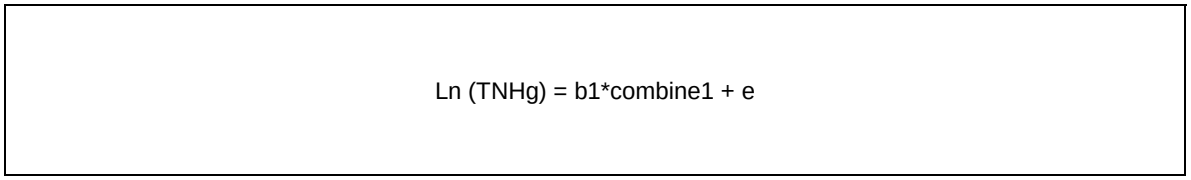

Figure 6. Regression Analysis Model Variable Correlation Equation

Where Ln(TNHg) is the natural log of total non-mercury thermostats, combine1 is the product of total thermostats times the gross square feet, b1(.08747) is the coefficient that calculates the contribution of combine1 to non-mercury thermostats, e is unexplained variation in the regression. Taking the anti-log of Ln (t) – Ln (TNHg), the total number of mercury thermostats is predicted.

Both total thermostat and non-mercury thermostat regressions had difficulty with large buildings that were >200,000 square feet. Building size was limited in the regression analysis to $\leq$ 200,000 square feet. Based on survey data, buildings >200,000 square feet contained an average of 2 mercury thermostats per building. The predictive estimation was the sum of the number of mercury thermostats from regression analysis plus the number of estimated thermostats by percentage from the >200,000 square feet buildings. The regression analysis model estimated 46,941 mercury thermostats in King County commercial buildings.

Proportional Attribution Analysis Model

Retaining the regression analysis model for prediction of total thermostats including buildings up to but not including 300,000 square feet, a second technique was applied to estimate total thermostats that included building ≤ 300,000 square feet. In the proportional attribution model, instead of using non-mercury thermostat predictions to arrive at the number of mercury thermostats, a calculated percentage of 18 percent was applied to the total predicted number of thermostats. This calculation was derived from the survey data that indicated the average number of mercury thermostats across all building types and square feet represented 18 percent of all thermostats. The application of 2 mercury thermostats per building for buildings >300,000 square feet was also used in the proportional model. The proportional attribution method produced an estimate of 43,338 mercury thermostats in King County commercial buildings.

Generalized Extrapolation

An extrapolation of study data by non-statistical generalization provides further comparison of the analysis models. Using survey data collected from one percent of all commercial buildings in King County, data show 444 mercury thermostats. By multiplying the 444 mercury thermostats observed by 100 to extrapolate to the entire population of buildings, 44,400 mercury thermostats are predicted. This generalized extrapolation falls somewhere in between the two predictions of 46,941 and 43,338 and provides a third data extrapolation with comparable estimates.

Table 15. Comparative Estimate Analysis Models

Year Built/Remodeled Sample Type	Number of Buildings[8]	Regression Analysis Model	Proportional Attribution Analysis Model	Generalized Extrapolation
1900 – 1952 (P1)	1,796	3,145	2,912	2,600
1953 – 1980 (P2)	15,035	23,423	21,687	29,500
1981 – 2004 (P3)	14,101	18,214	16,913	10,600
Heavy Industrial (H)	43	2,159	1,826	1,700
Totals	30,975	46,941	43,338	44,400

[8] Estimates based on 2005 KCAO Commercial Properties Database.

Analytical Model Goodness of Fit

In predictive models, how well a model predicts known data is one true measure of goodness of fit. R square is a common measurement of how well the model fits the data (R-square of 1.0 perfect fit).

The R-square of 0.03 for the total thermostat regression model was not particularly good. However the model's ability to predict thermostats with a 4.2 error rate was good. The model predicted 2,314 out of the 2,433 thermostats in the sample data.

For the non-mercury thermostat model, the R-square value was particularly good at 0.98. The model's ability to predict thermostats was less accurate than the total thermostat model with a 9.6 percent error rate. The model predicted 1,800 non-mercury thermostats out of the 1990 mercury thermostats in the sample data.

Estimated Pounds of Mercury

Mercury thermostats typically contain one to four mercury ampoules, with one ampoule appearing to be the most common. In some cases, a mercury thermostat can contain 5 or 6 ampoules, however based on study observation, both five and six ampoule mercury thermostats were observed only once. Table 16 shows, for each of the analysis models, estimated pounds of mercury based on the number of mercury ampoules.

Table 16. Analysis Model Estimates for Pounds of Mercury

Mercury Ampoules n =	Elemental Mercury (g)	Regression Analysis Model (lbs)[9]	Proportional Attribution Model (lbs)[10]	Generalized Extrapolation (lbs)[11]
1	3	310.51	286.68	293.71
2	6	621.03	573.36	587.41
3	9	931.54	860.04	881.12
4	12	1,242.06	1,146.72	1,174.82

Data for the number of mercury ampoules for each thermostat counted by this study is unknown. The presumed amount of time needed to verify the number of ampoules in

[9] Where n = 46,941 for thermostats estimated
[10] Where n = 43,338 for thermostats estimated
[11] Where n = 44,400 for thermostats estimated

each thermostat by removing the outer cover, site contact availability and the number of samples sites precluded collecting these data.

The arithmetic mean of the commonly observed number of ampoules [12] is 2.5 per thermostat[13]. Based on this estimated number of ampoules per thermostat, the pounds of mercury in King County commercial buildings for each analysis method14 are shown in Figure 7.

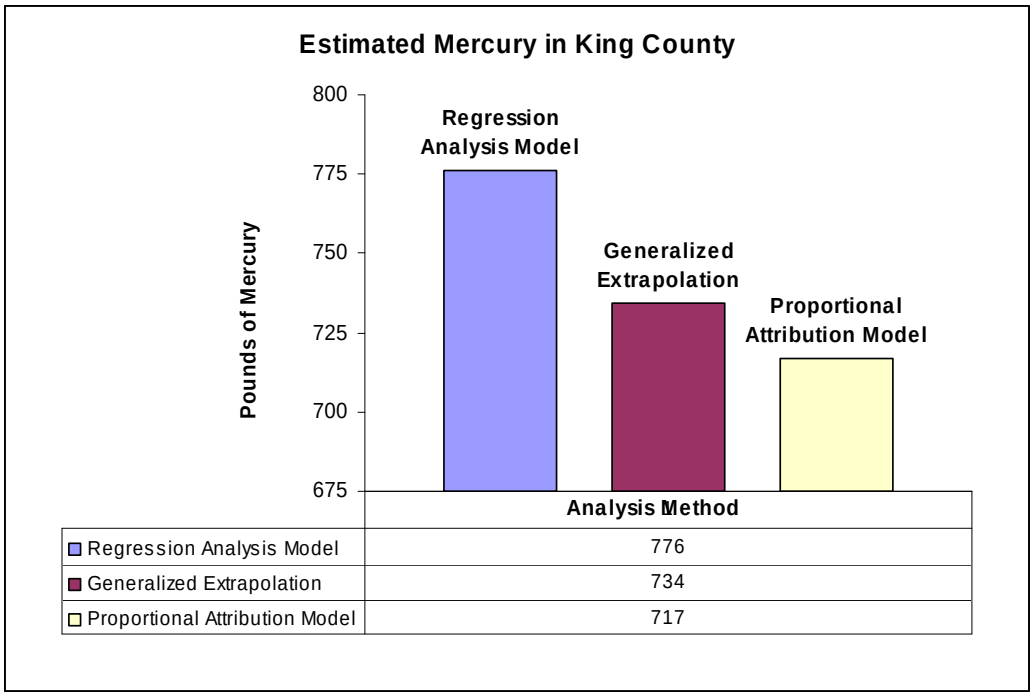

Figure 7. Estimated Pounds of Mercury in King County Commercial Buildings

King County Assessors Office Data Verification

KCAO database accuracy was verified using study data collected for year built, year remodeled, predominant use, and square feet. For year built/year remodeled, the most recent year observed during the site survey corroborated KCAO data and was used for data verification.

Year Built: When unknown and site refusal categories are removed, study data show 94 percent agreement with KCAO data.

[12] Commonly, 1 to 4 mercury ampoules.
[13] Where 1 ampoule contains 3 grams of elemental mercury, 2.5 ampoules contain 7.5 grams.
[14] A 3 percent difference between analysis methods.

Year Remodeled: When unknown and site refusal categories are removed, study data show 86.5 percent agreement with KCAO data.

Square Feet: When unknown and site refusal categories are removed and a 10 percent plus or minus error factor is included, study data show a 92 percent agreement with KCAO data.

Predominant Use: When unknown and site refusal categories are removed, study data show a 91.8 percent agreement with KCAO data.

Table 17. KCAO Database Usability Verification by Percent Verified for each Test Variable

KCAO Data Variable	Percent Verification from Study Data[15]
Year Built	94.0
Year Remodeled	86.5
Square Feet	92.0
Predominant Use	91.8

In the approximately 10 percent of cases where there is disagreement between study data and KCAO data it is not possible to determine which is more correct. This possible difference may be account for by simple timing where changes have occurred since the last KCAO site assessment was recorded. If consideration is taken with respect to those building types that may be susceptible to changes at a frequency that is shorter than the frequency of KCAO site assessments, evidence implies KCAO data accuracy sufficient for data extrapolation.

[15] Results demonstrate KCAO database is a viable source of data for data extrapolation to all commercial buildings in King County.

SUMMARY OF FINDINGS

Sample sites distributed by proportional and stratified data subsets were randomly selected. A total of 412 sample sites were selected. Results from 346 sample sites surveyed provided useable quality data. Both mercury and non-mercury thermostats were observed. A total of 2,433 thermostats were documented, 444 thermostats contained mercury and 1,989 were non-mercury thermostats. A total of 3,133 sensors were documented; 12 contained mercury and 3,121 were non-mercury sensors.

Thermostat data was collected through visual identification for all wall-mounted thermostats considered a permanent structure of the building. Difficulties in collecting thermostat data include identical outer casing for mechanical thermostats that contained either mercury ampoules or snap-action switches. Where possible, removal of the outer casing was necessary to positively identify switch type for these mechanical thermostats. In some instances, specialized lock boxes were installed encasing the thermostat. For the 149 mechanical thermostats documented (6 percent) that were inaccessible, data recorded for mercury or non-mercury switch type was documented as not specified. Since a statistically-significant number of sample sites did not record thermostat inaccessibility, thermostat data collected is thought to be representative.

For the purposes of this study, sensor data was collected for wall-mounted sensors and ceiling mounted heaters. Temperature sensors that reside in building ductwork or general equipment were not included in the scope of sensor data collected. Sensors were documented the same as for thermostats through visual identification. Sample site ID 18654, the largest building in the study (791,396 square feet), contained the largest number of non-mercury sensors (1,583) in a single building representing 51 percent of all non-mercury sensors documented. No other sample site contained a significant proportion of the data collected for either thermostats or sensors. For the purposes of representing thermostat and sensor total distribution, this anomalous data was excluded in the data analysis.

For large footprint buildings, accurate building schematics were used when available. Difficulties in collecting sensor data included locked sensors and ceiling-mounted heaters that were inaccessible. Data accuracy for the number of sensors documented is dependant on accessibility for visual identification of sensors and accurate building schematics for large footprint buildings. Sensor data collected for this study is under represented to an unknown degree based on data collection difficulties.

Thermostat and Sensor Distribution

A total of 2,433 thermostats were observed across all sample types for mercury and non-mercury thermostats. Distributions of thermostats show 444 (18 percent) mercury thermostats and 1,989 (82 percent) non-mercury thermostats were observed during site surveys. Data analysis of thermostat distribution by sample and thermostat type is provided in Table 18.

Table 18. Thermostat Distribution by Age of Building

Year Built/Remodeled Sample Type	Mercury Thermostats n =	Non-Mercury Thermostats n =	Total Thermostats Observed n =
1900 – 1952 (P1)	26	72	98
1953 – 1980 (P2)	295	702	997
1981 – 2004 (P3)	106	1,181	1,287
Heavy Industrial (H)	17	34	51
Total	**444**	**1,989**	**2,433**

A total of 3,133 sensors were observed across all sample types for mercury and non-mercury sensors. Distributions of sensors show 12 (0.4 percent) mercury sensors and 3,121 (99.6 percent) non-mercury sensors were observed during site surveys. Data analysis of sensor distribution by sample and sensor type is provided in Table 19.

Table 19. Sensor Distribution by Age of Building

Year Built/Remodeled Sample Type	Mercury Sensors n =	Non-Mercury Sensors n =	Total Sensors n =
1900 – 1952 (P1)	0	0	0
1953 – 1980 (P2)	3	292	295
1981 – 2004 (P3)	3	2,802	2,805
Heavy Industrial (H)	6	27	33
Total	**12**	**3,121**	**3,133**

Distribution of the 5,566 thermostats and sensors documented show non-mercury thermostats are the most observed thermostat or sensor type. Data analysis for sensor distribution indicate of the 3,121 non-mercury sensors, 1,583 (51 percent) were found at one sample site (Site ID 18654) representing a possible data anomaly. Figure 8 show adjusted data totals with anomalous data excluded.

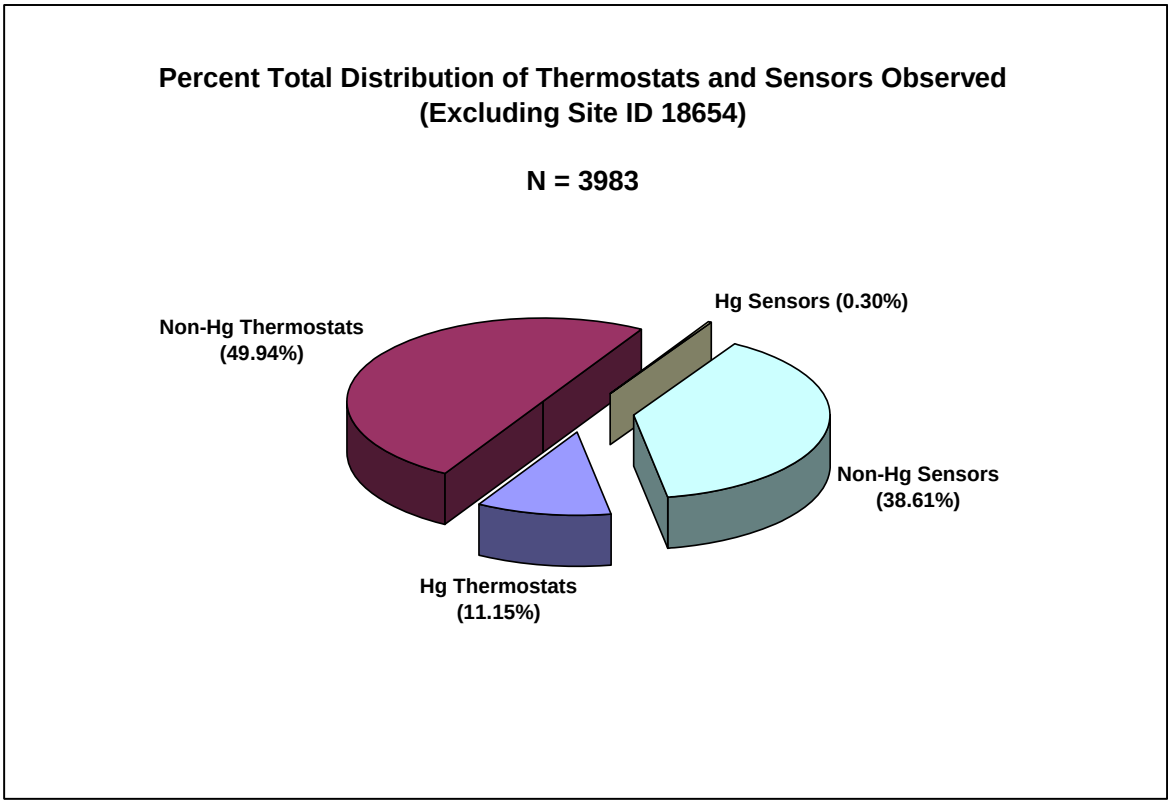

Figure 8. Total Distribution of Thermostats and Sensors Observed

Of the 346 sample sites surveyed, 294 (85 percent) of buildings contained at least one mercury or non-mercury thermostat (see Table 20 for distribution data). A small percentage of buildings (7 percent) contained only sensors and is primarily associated with large building footprint. Data also show 29 buildings (8 percent) that contained no thermostat or were not determined.

Table 20. Thermostat and Sensor Distribution by Building and Percent Total Sample

Thermostat Type	Buildings n =	Percent Total Sample %
Mercury Thermostats	134	39
Non-Mercury Thermostats	160	46
Sensors Only	23	7
No Thermostat or unknown	29	8
Total	346	

Data was collected for all thermostat and sensor types for use in comparative analysis. However, the total number of mercury thermostats in King County commercial buildings remains the key focus of data distribution for this study. In Figures 9 and 10, data show the majority of mercury thermostats were observed in the P2 proportional sample set (1953-1980) for both total and proportional sample type.

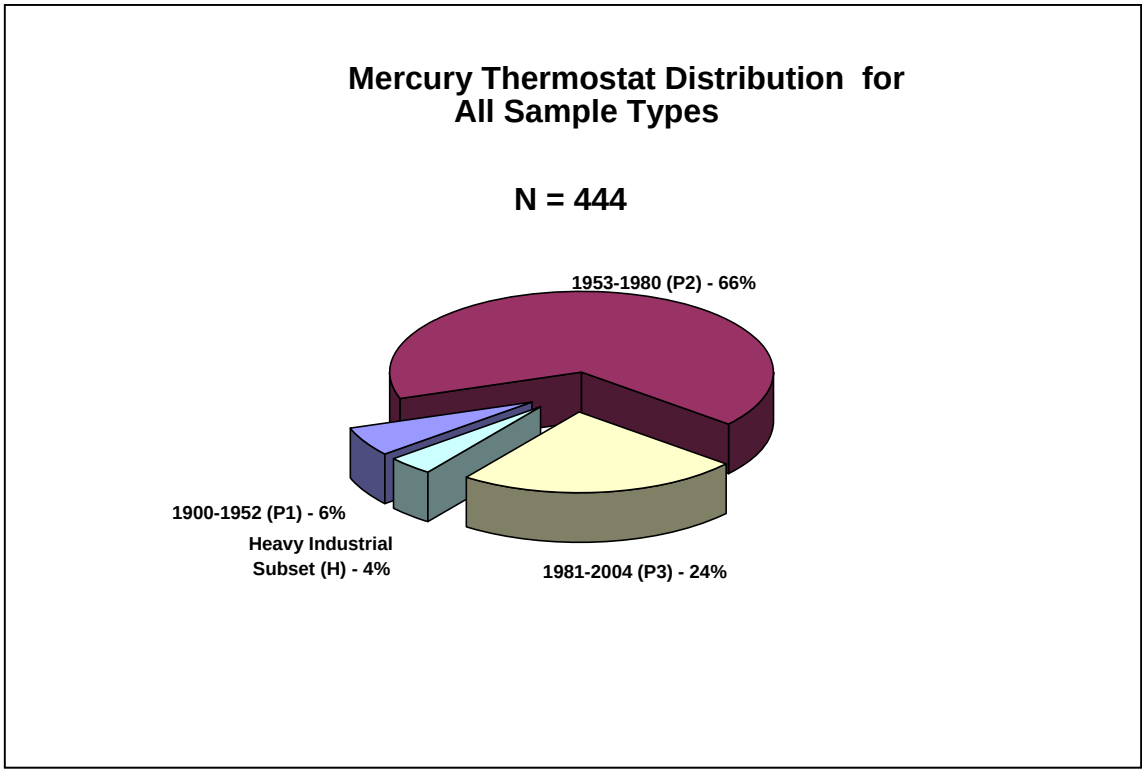

Figure 9. Mercury Thermostat Distribution for all Sample Types

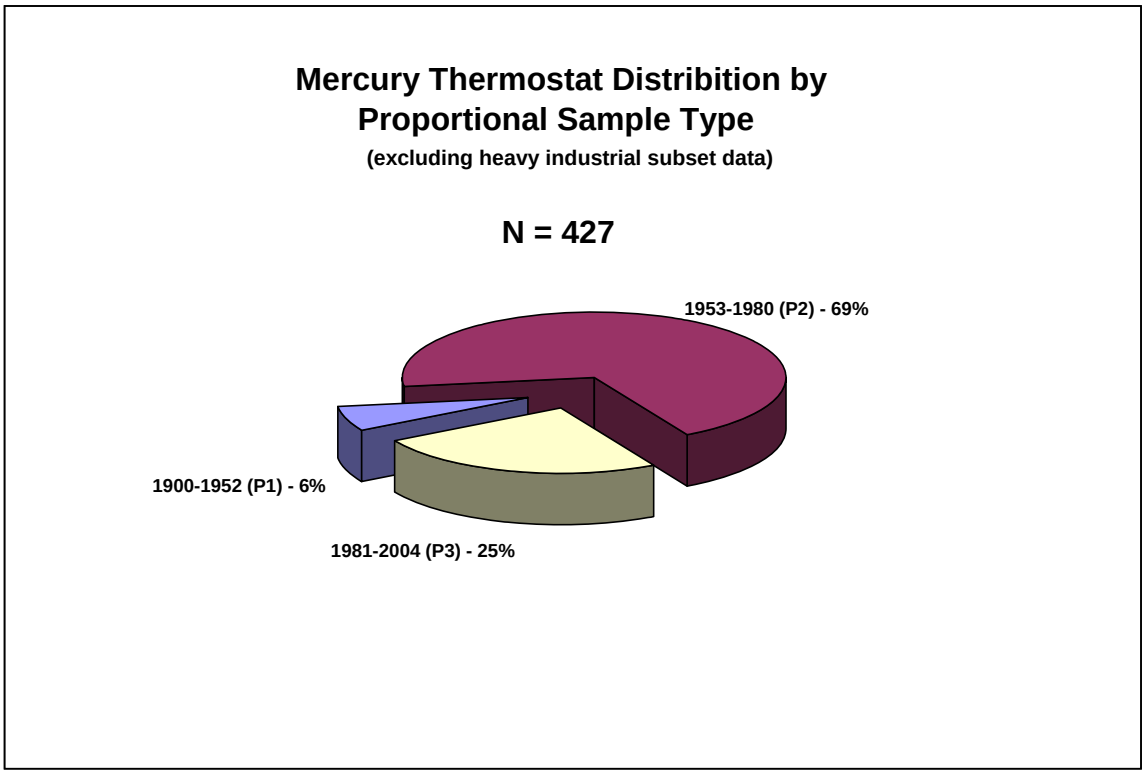

Figure 10. Mercury Thermostat Distribution by Proportional Sample Type

Based on the assumption of the first mercury thermostat manufactured and sold in 1953 and the first digital thermostat manufactured and sold in 1981, data support proportional study design for building age and the number of mercury thermostats observed. Study data indicate the majority of mercury thermostats were observed in buildings built or remodeled during 1953-1980 which correlates with mercury thermostat manufacturing prior to digital technology availability.

When data is weighed against the number of samples sites (opportunities to observe mercury thermostats) and the number of mercury thermostats found, the P2 proportional sample type has 0.5 more mercury thermostats per sample site than the average for all samples (see Table 21).

Table 21. Mercury Thermostat Distribution Weighted by Thermostats/Site

Sample Type	Mercury Thermostats n =	Sample Sites n=	Thermostats/ Site n =
P1 = 1900 – 1952	26	22	1.2
P2 = 1953-1980	295	167	1.8
P3 = 1981- 2004	106	140	1.3
Proportional Total	**427**	**329**	
H = Heavy Industrial	17	17	1.0
Total Sample Set	**444**	**346**	**1.3**

Local Area Characteristics Assessment

From the local area characteristics assessment data collected, variables were selected based on statistical significance for extrapolation. Although survey data collected for building use provided qualitative data for sample sites observed, it did not provide statistically-significant data for estimating mercury thermostats. Table 22 shows the distribution of each building use category. Based on data collected, the "office" building use category was most often observed representing 63 percent of the total building use occurrences documented.

Table 22. Distribution of Building Use by Category and Percent

Building Use Category	Occurrences n =	Total Building Use %
Office	3,764	62.69
Hotel/Motel	314	5.23
Schools	314	5.23
Retail	241	4.01
Food Service	193	3.21
Medical Facility	187	3.11
Equipment/Special Use	160	2.66
Warehouse/Shipping	144	2.40
Church	140	2.33
Other	124	2.07
Manufacturing	91	1.52
Recreation Facility	86	1.43
Storage Area/Shed	85	1.42
Laboratory	52	0.87
Repair Shop	43	0.72
Maintenance	34	0.57
Day Care/Pre-School	21	0.35
Garage	11	0.18
Transportation	0	0.00
Public Use Facility	0	0.00
Totals	**6,004**	**100**

Ceiling height was a significant variable in estimating the number of mercury thermostats and sensors in King County commercial properties. Figure 11 shows the total distribution of thermostats and sensors based on this variable. There are two values for non-mercury sensors. Data for standard ceiling height indicate, of the 2,514 non-mercury sensors observed, 1,583 (96 percent) were found at one sample site (Site ID 18654) representing a possible data anomaly. Data trends in Figure 11 show total and adjusted data. Appendix E provides data used in the analysis of thermostat and sensor distribution by ceiling height.

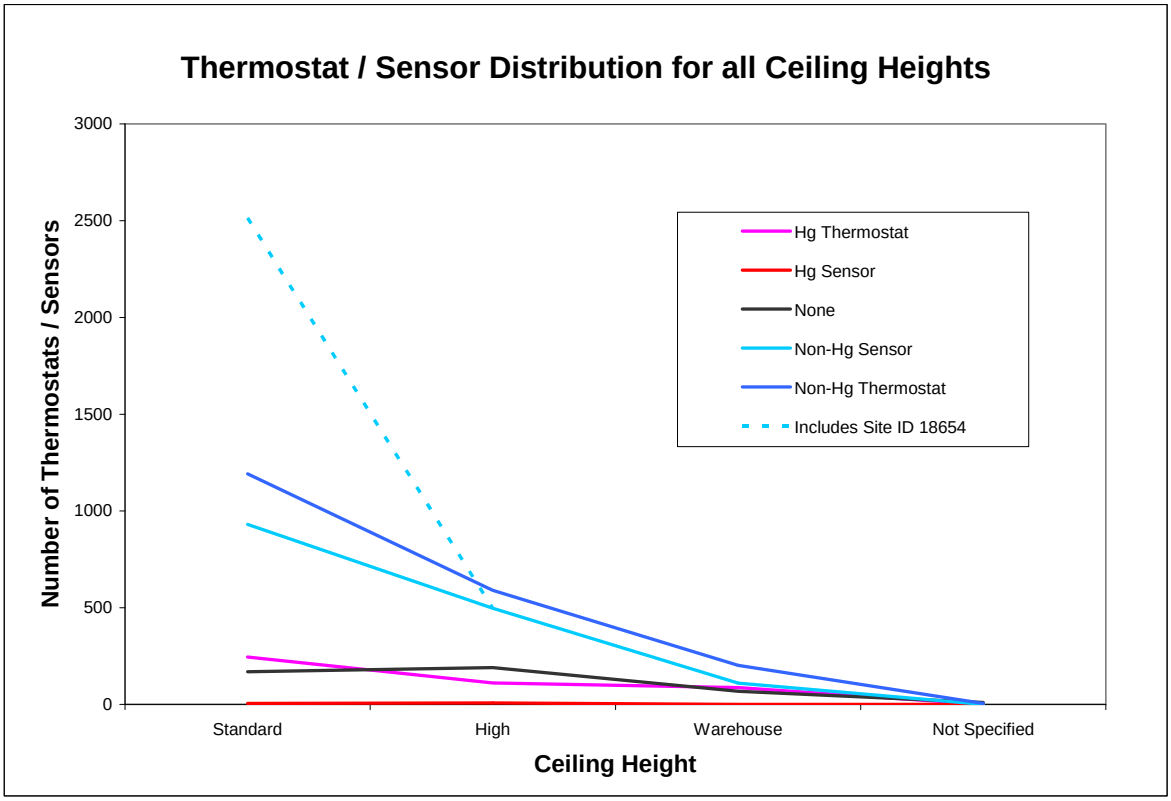

Figure 11. Total Thermostat and Sensor Distribution by Ceiling Height

Data collected for thermostats and sensors showed variable distributions by individual ceiling height. Each figure below shows a comparison for each ceiling height by sample type for each thermostat and sensor type[16].

The total number of occurrences documented for warehouse ceiling height is 468, high ceiling height is 1,395 and standard ceiling height is 4,116. A comparatively small amount of non-specified ceiling heights (n=16) were documented and is not represented graphically.

[16] Figure key shows n = is the number of occurrences for that ceiling height documented for each sample type.

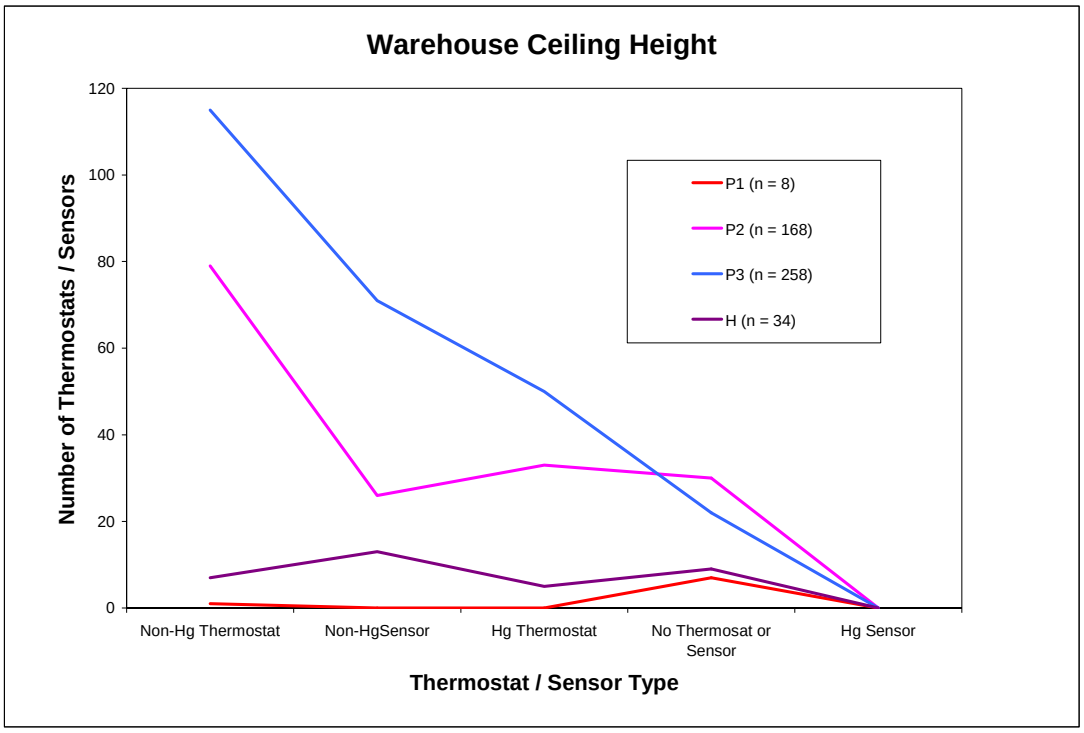

Figure 12. Thermostat and Sensor Distribution by Warehouse Ceiling Height and Sample Type

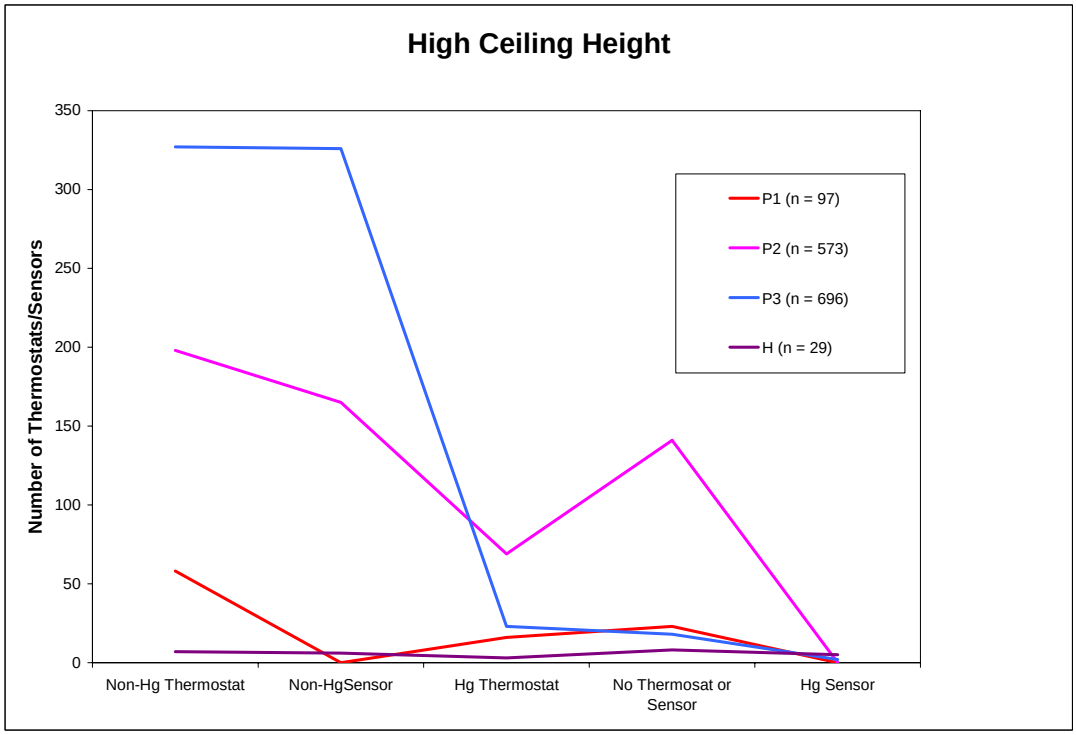

Figure 13. Thermostat and Sensor Distribution by High Ceiling Height and Sample Type

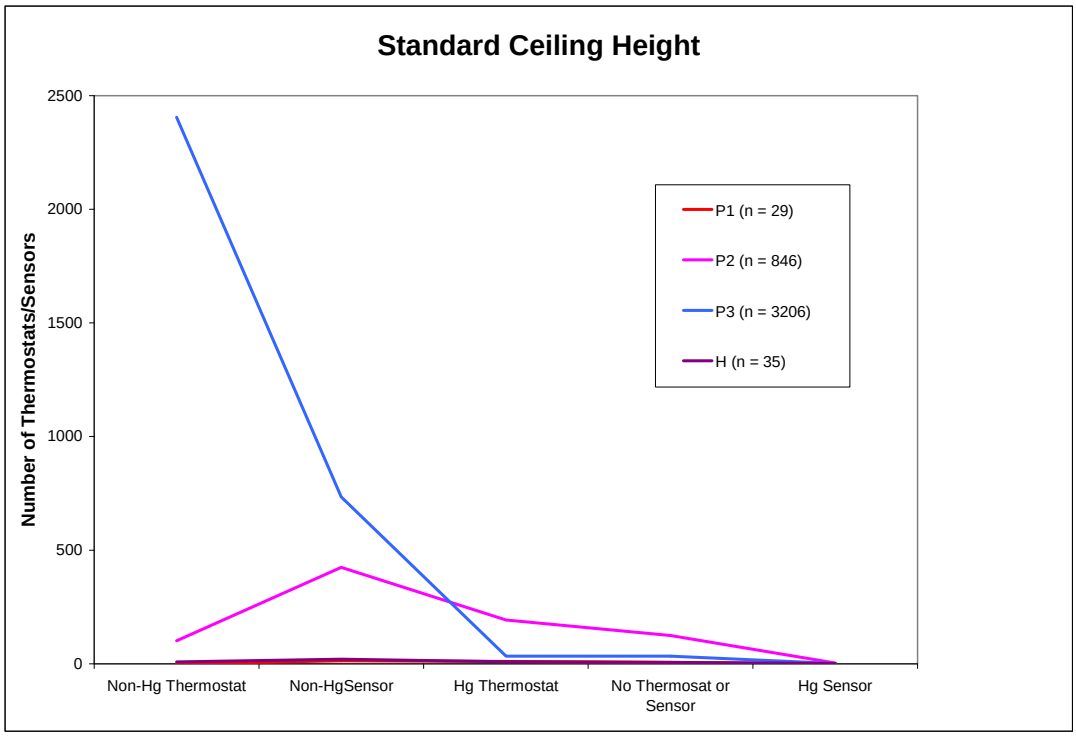

Figure 14. Thermostat and Sensor Distribution by Standard Ceiling Height and Sample Type

Another local area characteristic data variable used for estimating the number of mercury thermostats and sensors in King County commercial properties was building square feet. The square feet central tendency reported in Table 23 show median values for sample site distribution by building square feet. Data indicate buildings built between 1900 and 1981, representing two proportional samples (P1 and P2), have comparable median square feet values. Buildings built 1981-2004, P3 proportional sample, were substantially larger with a building footprint similar in size as the heavy industrial subset (H).

Table 23. Square Feet Distribution of Sample Buildings

Sample Type	MIN ft^2	MEDIAN ft^2	MAX ft^2
P1	540	18,306	27,600
P2	100	16,896	336,330
P3	176	186,800	791,396
H	600	216,224	557,414
All Samples	100	111,415	791,396

Thermostat and Sensor Manufacturers

In a high percentage of thermostats (42 percent), manufacturer type was not determined at the time of data collection and is noted in Table 24 as Not Specified. Excluding those thermostats that were not identified by manufacturer, the manufacturer most often observed for both mercury and non-mercury thermostats was Honeywell accounting for 43 percent of the total thermostats, 59 percent of the mercury thermostats and 37 percent of the non-mercury thermostats observed. The remaining thermostats were distributed among other manufacturers in varying numbers.

Table 24. Thermostat Distribution by Manufacturer

Manufacturer	Thermostats n=	Mercury Thermostats n=	Non-Mercury Thermostats n=
Carrier	14	10	4
Coleman	31	0	31
Comfort	15	0	15
Dayton	6	4	2
DDC Controls	150	0	150
Edwards Engineering	49	49	0
Friedrich	14	0	14
General Electric	161	5	156
Honeywell	604	209	395
Hunter	5	0	5
Invensys	3	0	3
Johnson Controls	17	0	17
Kadet	16	0	16
King	53	4	49
Lennox	6	3	3
Lux	27	9	18
Mitsubishi	5	0	5
Not Specified	1,018	90	930
Other	62	15	47
Powers Johnson	46	4	42
Robertshaw	4	1	3
Totaline	9	0	9
Trane	23	3	20
White-Rogers	95	38	57
Total:	**2,433**	**444**	**1,989**

In a high percentage of sensors (70 percent), manufacturer type was not determined at the time of data collection and is noted in Table 25 as Not Specified. Excluding those sensors that were not identified by manufacturer, the two manufacturers were most often observed for non-mercury sensors, Johnson Controls and Alerton, each with an observation rate of 31 percent of the total non-mercury sensors? A total of 12 mercury sensors were observed primarily categorized in the other category (58 percent) representing various manufacturers not listed. The remaining sensors were distributed among other manufacturers in varying numbers.

Table 25. Sensor Distribution by Manufacturer

Manufacturer	Total Sensors n =	Mercury Sensors n =	Non-Mercury Sensors n =
Accustat	4	3	1
Alerton	299	0	299
Andover Control	86	0	86
Barber-Coleman	9	0	9
BAS	55	0	55
Carrier	17	0	17
Coleman	29	0	29
DDC Controls	2	0	2
General Electric	1	0	1
Honeywell	54	0	54
Invensys	8	0	8
Johnson Controls	297	0	297
King	1	1	0
MCC Powers	20	0	20
Not Specified	2,168	1	2,167
Other	19	7	12
Powers Johnson	6	0	6
Robertshaw	3	0	3
Siemens	17	0	17
Totaline	1	0	1
Trane	31	0	31
White-Rogers	6	0	6
Total:	**3,133**	**12**	**3,121**

Proportional Population Dataset

A systematic sampling strategy was developed from data distributions observed in the KCAO Commercial Properties Database used for data extrapolation. Distribution of the sample set by year built or remodeled was chosen based on the availability of the first mercury thermostat and first digital thermostats manufactured and installed. Data analysis for each of the proportional sample sets show mercury thermostats were observed consistent with data predictions for proportional sample distribution.

P1 Proportional Samples

Buildings built or remodeled for years 1900-1952 were selected proportionally based on the assumption that thermostats installed during this time period do not contain mercury or are past their service life and are longer in use. The P1 proportional population dataset contained 1,936 sample sites representing 6 percent of the total sites available in the KCAO database. A proportional number of random samples were selected for a total of 30 samples.

A total of 22 samples site provided useable data. At least one mercury or non-mercury thermostat was observed in all sites except for 4 (18 percent). As indicated in Table 26, the remaining sites contained:

Table 26. Thermostat Type Observed for Buildings in P1 Proportional Samples

Thermostat Type Observed	Total Number of Sites n = 22	Total P1 Sample Sites %
Mercury (only)	6	27
Non-Mercury (only)	9	41
Mercury & Non-Mercury (both)	3	14
No Thermostat or Sensor Observed	4	18

Data collected for the buildings built or remodeled in 1900-1952 show 98 total thermostats and sensors were observed. Non-mercury thermostats were the most observed thermostat type (74 percent) with an overall distribution of 100 percent thermostats and no sensors observed (see Table 27 for distribution of mercury and non-mercury thermostats and sensors).

Table 27. Total Distribution of Thermostats and Sensors for P1 Proportional Samples

Type	P1 Thermostats n =	Total Proportional Sample %	P1 Sensors n =	Total Proportional Sample %
Mercury	26	0.47	0	0
Non-Mercury	72	1.31	0	0
Total	**98**	1.78	**0**	0

The P1 proportional sample represented 6 percent of the 444 mercury thermostats observed. For the years 1900-1952, it was not unexpected that some mercury thermostats might be found in this proportional sample population based on KCAO data accuracy representing year remodeled and the largely unknown thermostat technology for this building age. The initial hypothesis for sample distribution for this proportional sample did not confirm that no mercury thermostats would be found, however, it did confirm, of the sample sites documented, that thermostats original to buildings built or remodeled in 1900-1952 were no longer in use. Those mercury thermostats observed for the P1 proportional sample were manufactured in or after 1953.

P2 Proportional Samples

The assumption for the years 1953-1980 was expected that the majority of thermostats installed during this time period contained mercury. The P2 proportional population dataset contained 15,316 sample sites representing 50 percent of the total sites available in the KCAO database. A proportional number of random samples were selected for a total of 200 samples.

A total of 167 samples site provided useable data. At least one mercury or non-mercury thermostat was observed in all sites except for 15 (9 percent). As indicated in Table 28 the remaining sites contained:

Table 28. Thermostat Type Observed for Buildings in P2 Proportional Samples

Thermostat Type Observed	Total Number of Sites n = 167	Total P2 Sample Sites %
Mercury (only)	27	16
Non-Mercury (only)	76	46
Mercury & Non-Mercury (both)	49	29
No Thermostat or Sensor Observed	15	9

Data collected for the buildings built or remodeled in 1953-1980 show 1,292 total thermostats and sensors were observed. Non-mercury thermostats were the most observed thermostat type (70 percent) with an overall distribution of 77 percent thermostats and 23 percent sensors observed (see Table 29 for distribution of mercury and non-mercury thermostats and sensors).

Table 29. Total Distribution of Thermostats and Sensors for P2 Proportional Samples

Type	P2 Thermostats	Total Proportional Sample %	P2 Sensors	Total Proportional Sample %
Mercury	295	5.38	3	0.05
Non-Mercury	702	12.80	292	5.32
Total	**997**	18.18	**295**	5.37

The P2 proportional sample represents 66 percent of the 444 mercury thermostats observed. Study data confirmed the hypothesis that the largest number of mercury thermostats would be found in buildings built or remodeled in 1953-1980. The number of sensors documented, 6 percent, is a further indication that mechanical technology is predominately used during this time period which would be expected prior to the availability of digital thermostats and sensors.

P3 Proportional Samples

For years 1981-2004 the assumption is a combination of both mechanical (mercury-containing) and digital thermostats are in use with digital, non-mercury thermostats predominantly in use. The P3 proportional population dataset contained 13,390 sample

sites representing 44 percent of the total sites available in the KCAO database. A proportional number of random samples were selected for a total of 160 samples.

A total of 140 samples site provided useable data. At least one mercury or non-mercury thermostat was observed in all sites except for 11 (8 percent). As indicated in Table 30, the remaining sites contained:

Table 30. Thermostat Type Observed for Buildings in P3 Proportional Samples

Thermostat Type Observed	Number of Sites n = 140	Total P3 Sample Sites %
Mercury (only)	12	8.57
Non-Mercury (only)	82	58.57
Mercury & Non-Mercury (both)	35	25.00
No Thermostats or Sensors	11	7.86

Data collected for the P3 proportional population dataset show 4,092 total thermostats and sensors were observed. Non-mercury thermostats were the most observed thermostat type (92 percent) with an overall distribution of 31 percent thermostats and 69 percent sensors observed (see Table 31 for distribution of mercury and non-mercury thermostats and sensors). Of the 2,805 non-mercury sensors observed for the P3 proportional population, 1,583 (56 percent) were found at one sample site (Site ID 18654) representing a possible data anomaly.

Table 31. Total Distribution of Thermostats and Sensors for P3 Proportional Samples

Type	P3 Thermostats	Total Proportional Sample %	P3 Sensors	Total Proportional Sample %
Mercury	106	1.93	3	0.05
Non-Mercury	1181	21.54	2802	51.11
Total	**1,287**	23.47	**2,805**	51.16

The P3 proportional sample represents 24 percent of the 444 mercury thermostats observed. Study data confirmed the hypothesis that mercury thermostats would be found in the 1981-2004 time period in greater numbers than the P1 proportional sample and in less numbers than the P2 proportional sample. The number of sensors documented, 51 percent, is a further indication that digital technology is used for this time period which also correlates with the introduction of the first digital thermostat available in 1981.

Heavy Industrial Data Subset

Buildings that are designed for heavy industrial and manufacturing purposes were thought to have conditions that would be anomalous to most buildings designed for commercial use. Heavy vibration and air particles can often negatively impact more sensitive digital thermostats making the general performance and durability of mercury thermostats a more likely choice for heavy industrial and manufacturing use.

Based on the assumption of anomalous conditions, the heavy industrial subset data population was stratified from the overall population in the KCAO database. Of the 42 buildings identified in the KCAO Database with the predominant use code for Industrial Heavy Manufacturing (495), 22 sites were randomly selected as sample sites.

Mercury thermostats were found in all building age ranges with the largest number of mercury thermostats observed in buildings built prior to 1953. Non-mercury thermostats were found in all buildings with the largest number observed in buildings built after 1980.

Table 32. Thermostat Distribution by Age of Building for Heavy Industrial Subset

Thermostats	1900-1952	1953-1980	1981-2004	Total Observed
Mercury	10	5	1	**16**
Non-Mercury	9	12	14	**35**
Total	**19**	**17**	**15**	**51**

Mercury sensors were observed in buildings built prior to 1953. Non-mercury sensors were found in buildings building after 1953 with the largest number observed in buildings built after 1980.

Table 33. Sensor Distribution by Age of Building for Heavy Industrial Subset

Sensors	1900-1952	1953-1980	1981-2004	Total Observed
Mercury	6	0	0	6
Non-Mercury	0	2	25	27
Total	**6**	**2**	**25**	**33**

A total of 17 samples sites provided useable data. At least one mercury or non-mercury thermostat was observed in all sites except for 2 sample sites (12 percent). As indicated in Table 34 the remaining sites contained:

Table 34. Thermostat Type Observed for Buildings in Heavy Industrial Subset Sample

Thermostat Type Observed	Number of Sites n = 17	Total H Sample Sites %
Mercury (only)	2	12
Non-Mercury (only)	8	47
Mercury & Non-Mercury (both)	5	29
No Thermostat or Sensor Observed	2	12

Data collected for the heavy industrial subset show 84 total thermostats and sensors were observed. Non-mercury thermostats were the most observed thermostat type (40 percent) with an overall distribution of 61 percent thermostats and 39 percent sensors (see Table 35 for distribution of mercury and non-mercury thermostats and sensors).

Table 35. Total Distribution of Thermostats and Sensors for Heavy Industrial Subset Data

Type	H Thermostats n =	% Total Thermostats and Sensors n = 84	H Sensors n =	% Total Thermostats and Sensors n = 84
Mercury	16	20	6	7
Non-Mercury	35	40	27	32
Total	**51**	**61**	**33**	**39**

Building predominant use confirmed as part of the site survey indicates 2 samples sites (12 percent) do not corroborate KCAO heavy industrial predominant use records. Table 36 shows actual building use verified during the site survey, other than Heavy Industrial, and the thermostat and sensor distribution.

Table 36. Non-mercury Sensor and Thermostat Distribution for Observed Predominant Use in Heavy Industrial Subset Data

Site ID	Predominant Use	Thermostat Type	Non-Mercury Sensor n =	Non-Mercury Thermostat n =
32	**Museum**	Sensor	5	5
41	**Vacant for 3 years**	Thermostat	18	3

These data represent 31 percent of the total number of thermostats and sensors observed and 40 percent of data collected for non-mercury sensors. For one sample site, Site ID 41, the largest numbers of sensors were observed in the heavy industrial subset with a count of 18 sensors (31 percent).

Three sample sites, 18% of the total sample sites surveyed, site access was granted and thermostat and building variables documented, however the buildings were unoccupied due to vacancy or renovation and may not be representative of building use when occupied.

Seven sample sites with a warehouse ceiling height, 41 percent of the total samples sites surveyed for the Heavy Industrial subset, were unheated. For sample sites observed with no heat, Table 37 shows the percent of building and use of the unheated space arranged in order of building total square feet.

Table 37. Unheated Space Observed for Heavy Industrial Subset

Building Total Square Feet	Percent Building without Heat %	Total Square Feet without Heat	Unheated Space Use
600	0	0	
2,391	24	580	Equipment/Special Use
2,924	0	0	
3,064	0	0	
3,120	0	0	
4,800	86	4,128	Manufacturing
5,200	0	0	
6,028	0	0	
9,560	93	8,891	Manufacturing
17,845	0	0	
19,096	89	16,995	Manufacturing
21,624	0	0	
24,000	94	22,464	Manufacturing
27,140	0	0	
30,750	57	17,528	Warehouse/Shipping
87,074	25	22,073	Equipment/Special Use
557,414	0	0	

The heavy industrial subset sample data represents 4 percent of the 444 mercury thermostats observed. These subset data were collected as an anomalous dataset from the proportional samples that hypothesized that the majority of thermostats in a heavy industrial building would contain mercury based on their durability in high vibration and particle environments. Data does not confirm this study hypothesis. Data indicates 41 percent of the warehouse height ceiling space, the space within the building most likely to contain manufacturing activities, are unheated. Data also indicates the majority of mercury thermostats were found in buildings built or remodeled prior to 1953 and was associated with ceiling mounted heaters. No strong evidence was found, based on a

limited number of samples, there are specific heating/cooling requirements in a heavy industrial setting.

King County Assessors Office Data Trends

It is not unexpected that the composition and distribution of commercial properties will vary from each year of reported data in the KCAO database. Data distribution between years 2004 and 2005 does not show a significant difference based on the proportional and heavy industrial study designation. However looking at the data trend (Table 38), there are fewer buildings built or remodeled in 1900-1952 (P1) and 1943-1980 (P2) and an increased number of buildings built or remodeled in 1981-2004 (P3) with a slight increase in the number of heavy industrial buildings.

Table 38. Data Trends for 2004 and 2005 KCAO Data

Sample Type	2004 KCAO Database n =	2005 KCAO Database n =
1900 – 1952 (P1)	1,936	1,796
1953-1980 (P2)	15,316	15,035
1981- 2004 (P3)	13,390	14,101
Heavy Industrial (H)	42	43
Totals	**30,684**	**30,975**

CONCLUSIONS/RECOMMENDATIONS

Sample Variability

Sample sites were highly variable resulting in a systematic study design that collected a broad range of data to account for variability. It was expected that not all data collected would produce statistically-significant data that was useable for estimating mercury thermostats in King County commercial buildings. However, data variables for building age, square feet, ceiling height and the number of mercury and non-mercury thermostats provided statistically-significant data resulting in useable estimates of the number of mercury-containing thermostats.

Mercury Thermostat Distribution

Distribution of thermostat and sensor data indicate 46 percent of the buildings sampled across all sample types contained at least one non-mercury thermostat. Thirty-nine percent contained at least one mercury thermostat. Although many buildings reported large numbers of non-mercury thermostats and/or sensors, for buildings that report both mercury and non-mercury thermostats less than 3 mercury thermostats were present per building.

Digital technology appears to have reduced the installation of mercury thermostats during renovation and new construction for the majority of space within a building. Although many buildings contain predominantly non-mercury thermostats or sensors, data indicate specific building characteristics and use of space are conducive to continued mercury thermostats use.

Based on building age and age of the HVAC system, study data indirectly confirmed the hypothesis that remodeled buildings can contain mercury thermostats even though digital technology is available. It is presumed that the cost of replacing mercury thermostats that are working properly can preclude thermostat replacement with digital technology. No data was collected on a cost analysis basis.

Ceiling-mounted heaters found in warehouse height ceilings and building space that is not connected to the main HVAC system requiring individual heating are examples of building requirements where mechanical thermostats containing mercury are found. Study data confirm the hypothesis that mechanical thermostats containing mercury are used in conjunction with specific heating and cooling equipment that are based on building requirements

Proportional Sample Data

Proportional sample data indicates the majority of mercury thermostats observed (69 percent) was in buildings built or remodeled 1953-1980. Since mercury thermostat

technology had not yet been introduced, the oldest buildings, built or remodeled in 1900-1952, were thought to contain the least amount of mercury thermostats. Data shows 6 percent of the mercury thermostats observed in this proportional dataset. The newest buildings built or remodeled in 1981-2004 show some mercury thermostats (24 percent) with the majority of thermostats observed non-mercury. Data confirm the hypotheses that there is a direct correlation between the year built and/or remodeled and the likelihood that a building contains a mercury thermostat and that the age range of buildings most likely to contain a wall-mounted mercury thermostats is 1953-1980.

Heavy Industrial Subset Data

Data for mercury thermostat distribution in the heavy industrial subset sample show the number of buildings where at least one mercury thermostat was observed was in older buildings, especially built before 1953. Mercury sensors documented for this sample subset were associated with ceiling mounted heaters instead of wall mounted sensors and represent the majority of mercury sensors observed for all data collected for all sample types. Data collected for approximately 30 percent of the heavy industrial sample sites were unoccupied (vacancy or renovation) or was no longer categorized as a heavy industrial use building. Data does not confirm the study hypothesis that buildings built for heavy industrial use would contain more mercury thermostats based on their durability and the building environment where sensitivity to vibration and air particles would preclude other thermostat types.

Based on the study results and study design for this subset population[17], it is recommended that survey data be collected for the remaining 20 buildings in this subset population[18]. Although buildings were considered anomalous by the study design and priorities were made based on available resources, no further conclusions regarding this subset population are possible.

Thermostat Manufacturers

Limited manufacturer data was collected for thermostats and sensors due to the high occurrence of non specified manufacturer data. Data does provide, for those manufacturers identified, a point of reference for potential outreach to thermostat manufacturers.

[17] Acceptable accuracy criteria at the 95 percent confidence level set at 20 percent for the number of samples drawn for this subset sample.

[18] In order to achieve a high level of accuracy a standard practice in drawing random samples with small populations is to sample the entire population versus in large populations sampled a smaller percentage samples provide a higher level of accuracy.

Non-Thermostat Sources of Mercury

Buildings contain an unknown amount of mercury-containing switches, many that contain far more grams of mercury than a standard mercury thermostat, which are used to regulate equipment. There is also an unknown amount of mercury sensors located in building ducts that regulate building temperature. The scope of this study did not include these potential sources of mercury. These sources of mercury switches, and others to be identified, may contain a significant amount of mercury in commercial buildings. A further study to determine the amount of mercury and frequency of disposal is recommended.

Proportional Trends for Commercial Buildings

KCAO data for years 2004 and 2005 show buildings identified by the study with the highest number of mercury thermostats (66 percent) for years 1953-1980 have fewer buildings in 2005 than in 2004. With fewer buildings built or remodeled in 1900-1952 (P1) and 1943-1980 (P2) and an increased number of buildings built or remodeled in 1981-2004 (P3) the data trend suggests the mercury thermostat replacement and/or disposal rate may be increasing due to renovation and remodeling activities.

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APPENDIX A

DATA COLLECTION INSTRUMENT

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Mercury Thermostat Study

Produced by King County as part of the **Local Hazardous Waste Management Program in King County**

Initial Visit Date/Time _____

Follow-up Visit Date/Time _____

Investigator _____

Visit Quality

1 2 3 4

Questionnaire ☐

Site ID Number _____

Parcel/Platt _____

Address _____

_____

_____

Building Number _____

Year Built _____

Last Remodeled _____

Square Feet _____

Heat/Cooling code _____

Predominant Use

Building Description

Contact Name _____

Title _____

Business Name _____

Address _____

_____

Phone / e-mail _____

Site Location/Address _____

_____

Year Built ☐ Year Remodeled ☐ Predominant Use ☐ Building Description ☐ Square Feet ☐

Heating/Cooling System Code

A - Central system - Outside building
B - Central system - Inside building
C - Individual system
D - Special use equipment

Local Area Characteristics Assessment

Heating/Cooling System Code: **A** **B** **C** **D**

Describe Space

Describe Heating/Cooling Unit: Artifact ☐

Ceiling Height
Standard High Warehouse

% of Building _____

Age _____

Thermostats Y / N / ?

 # NON-Hg _____

 # Hg _____

Total # Tstats

Mfg/Model: Photo ☐

Sensors Y / N / ?

 # NON-Hg _____

 # Hg _____

Total # Sensors

Mfg/Model: Photo ☐

Comments:

Heating/Cooling System Code

A - Central system - Outside building
B - Central system - Inside building
C - Individual system
D - Special use equipment

Local Area Characteristics Assessment

Heating/Cooling System Code: A B C D

Describe Space

Describe Heating/Cooling Unit: Artifact

Ceiling Height Standard High Warehouse	% of Building Age
Thermostats Y / N / ? Total #	Sensors Y / N / ? Total #
# **NON**-Hg Tstats	# **NON**-Hg Sensors
# **Hg**	# **Hg**
Mfg/Model: Photo	Mfg/Model: Photo

Comments:

Local Area Characteristics Assessment

Heating/Cooling System Code: A B C D

Describe Space

Describe Heating/Cooling Unit: Artifact

Ceiling Height Standard High Warehouse	% of Building Age
Thermostats Y / N / ? Total #	Sensors Y / N / ? Total #
# **NON**-Hg Tstats	# **NON**-Hg Sensors
# **Hg**	# **Hg**
Mfg/Model: Photo	Mfg/Model: Photo

Comments:

DATABASE Date Entered _____Initials _____QA/QC _____Initials_____

APPENDIX B

SAMPLE STATUS TRACKING REPORT

Mercury Thermostat Project

Sample Status as of : **24-Jan-05** **Field Researcher Name**

	Date								
Visit Number	Issued	Received	Complete	Visit Quality	Site ID	Business Name	Address	City	ZIP
1									
2									
3									
4									
5									
6									

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APPENDIX C

PROJECT DATABASE MODULES

Table C.1 Data Fields for Sample/Project Tracking Database Module

Site ID	Unique Identifier assigned to sample site
Sample Status	
Researcher	Unique alpha identifier assigned to each researcher
Issued	Date sample site issued to Researcher
Received	Date sample site data received from Field researcher for data entry
Visit Quality	Researcher designation of site visit quality
Complete	Yes/No - Sample site activities complete with no further action
Site Location	
Business Name	If available, used as sample site locating tool only
KCAO Address	Address as listed in the KCAO Database
KCAO City	City as listed in the KCAO Database
KCAO Zip	Zip as listed in the KCAO Database
QA/QC Status	
QA/QC	Date of completeness review by research lead
Useable Data	Yes/No - Indicates if sample site data is useable for study
Data Quality Report	
VQ 1/2	Report generator indicating sample site information that meets Visit Quality 1and 2 criteria
VQ 3/4	Report generator indicating sample site information that meets Visit Quality 3and 4 criteria
Building Type Report	
H	Report generator indicating sample site information for Heavy Industrial sub sample data
P1	Report generator indicating sample site information for buildings built/remodeled in 1900-1952
P2	Report generator indicating sample site information for buildings built/remodeled in 1953-1980
P3	Report generator indicating sample site information for buildings built/remodeled in 1981-2004

Researcher Report	
Chamberlain	Report generator for all data records collected by individual researcher
Foster	Report generator for all data records collected by individual researcher
Galstad	Report generator for all data records collected by individual researcher
Joyce	Report generator for all data records collected by individual researcher
Rivera	Report generator for all data records collected by individual researcher
VanHooser	Report generator for all data records collected by individual researcher

Table C.2 Data Fields for Site Location Database Module

Site ID	Unique Identifier assigned to sample site
Site Visit Data	
Initial Visit	Date of the first site visit
Follow-Up Visit	Check box indicating one or more site visits occurred
Follow-Up Phone	Check box indicating one or more follow-up phone contacts occurred
Contact Data	
Primary Contact	Pre-determined list - job titles/roles/responsibilities
Multiple Contacts	Check box indicating one more contacts for sample site
Site Refusal	Check box indicating Field researcher was refused entry to site
KCAO Site Verification	
KCAO Site Address	Check box verifying KCAO database site address same as sample site.
Actual Address	Actual address - sample site not the same as KCAO database
Actual City	Actual city - sample site not the same as KCAO database
Actual Zip	Actual zip code - sample site not the same as KCAO database

Table C.3 Data Fields for building Local Area Characteristics Module

Site ID	Unique Identifier assigned to sample site
Local Area Characteristics	Building characteristics that may be associated with thermostat use
Heating Cooling System Code	Look Up Table with predefined system types such as individual heating/cooling unit or special use cooling unit
Building Use	Look Up Table with predefined building use types such as office, retail or warehouse
Ceiling Height	Look Up Table with predefined building ceiling height such as standard, high or warehouse
Percent Building	Field documents the building percent specific Local Area Characteristics pertain to
HVAC	Heating Ventilation Air Conditioning unit
Age	Age of HVAC
Unknown	Age of HVAC Unknown
New	Age of HVAC < one year
Heating/Cooling Unit	Both Primary and Secondary Heating/Cooling Data were documented
Heating Cooling Type	Look Up Table for temperature control type such at heating or cooling
Energy Source	Look Up Table for energy source such as gas or electric
Heating Cooling Source	Look Up Table for carrier source such as air or water
Unit Type	Look Up Table for type of unit such as boiler, furnace or HVAC
Unit Location	Look Up Table for unit location such as ceiling, baseboard or wall
Artifact	Check box indicating heating/cooling unit not in use; building artifact
Appliance	Check box indicating heating/cooling unit was an appliance rather than a building heating/cooling unit, such as a portable electric heater
Thermostats and Sensors	Thermostats and sensor observations
Thermostats and Sensors	Look Up Table for thermostat or sensor designation
Manufacturer	Look Up Table for thermostat/sensor manufacturer
Contains Mercury	Check box indicating thermostat/sensor contain mercury
Unknown Mercury	Check box indicating mercury content of thermostat/sensor is unknown
No Thermostat/Sensor	Check box indicating no thermostat/sensor observed
Unknown	Check box indicating unable to determine if thermostat/sensor present
Artifact	Check box indicating thermostat/sensor is a building artifact and not in use
Photo	Check box indicating a photo was taken of thermostat/sensor by Field researcher for further evaluation

General Information	Data pertaining to overall Site Survey
Site Refusal	Check box indicating Field researcher was refused entry to site
No Heat	Check box indicating no heat present for documented portion of building
Residence	Check box indicating residential property
Unoccupied Space	Check box indicated unoccupied space for documented portion of building
Under Renovation	Check box indicated building renovation in progress for documented portion of building

Table C.4 Data Fields for KCAO Data Verification Module

Site ID	Unique Identifier assigned to sample site
Year Built	
KCAO Year Built	Check box indicating agreement with KCAO database
Unknown	Check box indicating data not available
Actual	Field documents actual year built based on site survey
Year Remodeled	
KCAO Year Remodeled	Check box indicating agreement with KCAO database
Unknown	Check box indicating data not available
Actual	Field documents actual year remodeled observed based on site survey
Predominant Use	
KCAO Predominant Use	Check box indicating agreement with KCAO database
Unknown	Check box indicating data not available
Actual	Look Up Table for predefined actual predominant use based on site survey
Building Description	
KCAO Building Description	Check box indicating agreement with KCAO database
Unknown	Check box indicating data not available
Actual	Look Up Table for predefined actual building description based on site survey
Square Feet	
KCAO Square Feet	Check box indicating agreement with KCAO database
Unknown	Check box indicating data not available
Actual	Field documents actual square feet observed based on site survey

Table C.5 Master Tracking Table

Data Field	Description
Visit Number	Tracked the number of sample sites visited
Date Issued	Date sample site issued to Field researcher
Date Received	Date sample site data received from Field researcher for data entry
Date Complete	Date sample site activities complete with no further action
Visit Quality	Tracked usability of data by visit quality code 1 to 4
Researcher	Field researcher assigned to site
Data Type	Proportional sample code P1, P2, P3 or H
Site ID	Unique identifier assigned to each sample site during random number generation
Major	KCAO numerical designation for Parcel
Minor	KCAO numerical designation for Plat
BldgNbr	KCAO numerical designation for each building within a given Major/Minor
NbrBldgs	KCAO numerical designation for the total number of buildings within a given Major/Minor
Business Name	Business name as listed in KCAO database
Address	Site Address as listed in KCAO database
City	City as listed in KCAO database
Zip	Zip code as listed in KCAO database
Predominant Use	KCAO numerical designation for the predominant use of a building
BldgDescr	KCAO building description
BldgGrossSqFt	KCAO gross square feet that include non-occupied space
YrBuilt	KCAO recorded building year built
EffYr	KCAO last recorded remodel/renovation year for each building
HeatingSystem	KCAO numerical designation for predominant heating system
Number of Stories	KCAO numerical designation for the number of stories within the building

APPENDIX D

KCAO PREDOMINAN USE CODE AND PERCENT RANDOM SAMPLE

KCAO Code	KCAO Description	KCAO Data n=	KCAO Data %	Study Random Sample n=	Sample %
0	No Description	382	1.23	5	1.21
300*	APARTMENT (300)	0	0.00	0	0.00
301	ARMORY (301)	6	0.02	0	0.00
302	AUDITORIUM (302)	148	0.48	2	0.49
303	AUTOMOBILE SHOWROOM (303)	63	0.20	1	0.24
304	BANK (304)	329	1.06	5	1.21
305	BARN (305)	38	0.12	0	0.00
306	BOWLING ALLEY (306)	20	0.06	1	0.24
308	CHURCH WITH SUNDAY SCHOOL (308)	130	0.42	3	0.73
309	CHURCH (309)	1,069	3.45	17	4.13
310	CITY CLUB (310)	7	0.02	0	0.00
311	CLUBHOUSE (311)	298	0.96	6	1.46
313	CONVALESCENT HOSPITAL (313)	89	0.29	2	0.49
314	COUNTRY CLUB (314)	17	0.05	0	0.00
315	CREAMERY (315)	5	0.02	0	0.00
316	DAIRY (316)	14	0.05	1	0.24
317	DAIRY SALES BUILDING (317)	0	0.00	0	0.00
318	DEPARTMENT STORE (318)	32	0.10	2	0.49
319	DISCOUNT STORE (319)	227	0.73	4	0.97
320	DISPENSARY (320)	3	0.01	0	0.00
321	DORMITORY (321)	85	0.27	1	0.24
322	FIRE STATION (STAFFED) (322)	159	0.51	2	0.49
323	FRATERNAL BUILDING (323)	114	0.37	3	0.73
324	FRATERNITY HOUSE (324)	52	0.17	1	0.24
326	GARAGE, STORAGE (326)	419	1.35	8	1.94
327	GOVERNMENT BUILDING (327)	147	0.47	2	0.49
328	HANGAR, STORAGE (328)	92	0.30	0	0.00
329	HANGAR, MAINTENANCE & OFFICE (329)	33	0.11	0	0.00
330*	HOME FOR THE ELDERLY (330)	0	0.00	0	0.00
331	HOSPITAL (331)	53	0.17	0	0.00

KCAO Code	KCAO Description	KCAO Data n=	KCAO Data %	Study Random Sample n=	Sample %
332	HOTEL, LIMITED (332)	70	0.23	0	0.00
335	JAIL-CORRECTIONAL FACILITY (335)	7	0.02	0	0.00
336	LAUNDROMAT (336)	66	0.21	0	0.00
337	LIBRARY, PUBLIC (337)	77	0.25	1	0.24
338	LOFT (338)	70	0.23	1	0.24
339	LUMBER STORAGE SHED, HORIZONTAL (339)	73	0.24	0	0.00
340	MARKET (340)	146	0.47	2	0.49
341	MEDICAL OFFICE (341)	744	2.40	8	1.94
342	MORTUARY (342)	45	0.15	0	0.00
343	MOTEL, LIMITED (343)	263	0.85	3	0.73
344	OFFICE BUILDING (344)	4,690	15.14	62	15.05
345	PARKING STRUCTURE (345)	151	0.49	1	0.24
346	POST OFFICE (346)	41	0.13	0	0.00
348	RECTORY (348)	371	1.20	2	0.49
349	FAST FOOD RESTAURANT (349)	342	1.10	3	0.73
350	RESTAURANT, TABLE SERVICE (350)	1,131	3.65	18	4.37
352*	MULTIPLE RESIDENCE (LOW RISE) (352)	0	0.00	0	0.00
353	RETAIL STORE (353)	3,663	11.83	45	10.92
365	ELEMENTARY SCHOOL (ENTIRE) (365)	1,004	3.24	23	5.58
366	JUNIOR HIGH SCHOOL (ENTIRE) (366)	65	0.21	2	0.49
377	COLLEGE (ENTIRE) (377)	78	0.25	0	0.00
378	STABLE (378)	37	0.12	0	0.00
379	THEATER, LIVE STAGE (379)	23	0.07	2	0.49
380	THEATER, CINEMA (380)	41	0.13	1	0.24
381	VETERINARY HOSPITAL (381)	108	0.35	1	0.24
384	BARBER SHOP (384)	93	0.30	3	0.73
386	MINI-WAREHOUSE (386)	568	1.83	6	1.46
387	TRANSIT WAREHOUSE (387)	39	0.13	0	0.00
388	UNDERGROUND PARKING STRUCTURE (388)	2	0.01	0	0.00
391	MATERIAL STORAGE BUILDING (391)	44	0.14	1	0.24
392	INDUSTRIAL ENGINEERING BUILDING (392)	60	0.19	1	0.24
405	SKATING RINK (405)	8	0.03	0	0.00
406	STORAGE WAREHOUSE (406)	3,397	10.97	39	9.47
407	WAREHOUSE, DISTRIBUTION (407)	965	3.12	16	3.88
409	T-HANGAR (409)	5	0.02	0	0.00
410	AUTOMOTIVE CENTER (410)	53	0.17	0	0.00
412	NEIGHBORHOOD SHOPPING CENTER (412)	8	0.03	0	0.00
413	COMMUNITY SHOPPING CENTER (413)	13	0.04	0	0.00

KCAO Code	KCAO Description	KCAO Data n=	KCAO Data %	Study Random Sample n=	Sample %
414	REGIONAL SHOPPING CENTER (414)	9	0.03	0	0.00
416	TENNIS CLUB, INDOOR (416)	9	0.03	0	0.00
417	HANDBALL-RACQUETBALL CLUB (417)	5	0.02	0	0.00
418	HEALTH CLUB (418)	28	0.09	0	0.00
419	CONVENIENCE MARKET (419)	409	1.32	7	1.70
423	MINI-LUBE GARAGE (423)	42	0.14	1	0.24
424	GROUP CARE HOME (424)	65	0.21	1	0.24
426	DAY CARE CENTER (426)	217	0.70	1	0.24
427	FIRE STATION (VOLUNTEER) (427)	17	0.05	1	0.24
428	HORSE ARENA (428)	8	0.03	1	0.24
431	OUTPATIENT SURGICAL CENTER (431)	0	0.00	0	0.00
432	RESTROOM BUILDING (432)	137	0.44	1	0.24
441	COCKTAIL LOUNGE (441)	8	0.03	0	0.00
442	BAR/TAVERN (442)	77	0.25	2	0.49
444	DENTAL OFFICE/CLINIC (444)	52	0.17	0	0.00
446	SUPERMARKET (446)	129	0.42	2	0.49
447	COLD STORAGE FACILITIES (447)	40	0.13	0	0.00
451	MULTIPLE RESIDENCE (SENIOR CITIZEN) (451)	125	0.40	0	0.00
453	INDUSTRIAL FLEX BUILDINGS (453)	40	0.13	0	0.00
455	AUTO DEALERSHIP, COMPLETE (455)	59	0.19	0	0.00
458	WAREHOUSE DISCOUNT STORE (458)	32	0.10	0	0.00
459	MIXED RETAIL W/RES. UNITS (459)	251	0.81	0	0.00
468	SHED, MATERIAL STORAGE (468)	166	0.54	0	0.00
470	EQUIPMENT (SHOP) BUILDING (470)	359	1.16	3	0.73
471	LIGHT COMMERCIAL UTILITY BUILDING (471)	91	0.29	3	0.73
472	EQUIPMENT SHED (472)	274	0.88	3	0.73
475	POULTRY HOUSE-FLOOR OPERATION (475)	0	0.00	0	0.00
477	FARM UTILITY BUILDING (477)	44	0.14	0	0.00
481	MUSEUM (481)	37	0.12	0	0.00
482	CONVENTION CENTER (482)	8	0.03	0	0.00
483	FITNESS CENTER (483)	34	0.11	1	0.24
484	HIGH SCHOOL (ENTIRE) (484)	126	0.41	2	0.49
485	NATATORIUM (485)	20	0.06	0	0.00
486	FIELD HOUSES (486)	28	0.09	0	0.00
487	VOCATIONAL SCHOOLS (487)	34	0.11	0	0.00
489	JAIL - POLICE STATION (489)	4	0.01	0	0.00
490	KENNELS (490)	6	0.02	0	0.00
491	GOVERNMENT COMMUNITY SERVICE BUILDING	83	0.27	1	0.24

KCAO Code	KCAO Description	KCAO Data n=	KCAO Data %	Study Random Sample n=	Sample %
	(491)				
494	INDUSTRIAL LIGHT MANUFACTURING (494)	1,556	5.02	14	3.40
495	INDUSTRIAL HEAVY MANUFACTURING (495)	42	0.14	22	5.34
496	LABORATORIES (496)	28	0.09	0	0.00
497	COMPUTER CENTER (497)	0	0.00	0	0.00
498	BROADCAST FACILITIES (498)	8	0.03	1	0.24
525	MINI WAREHOUSE, HI-RISE (525)	66	0.21	1	0.24
527	MUNICIPAL SERVICE GARAGE (527)	10	0.03	0	0.00
528	GARAGE, SERVICE REPAIR (528)	1,820	5.88	18	4.37
529	SNACK BAR (529)	33	0.11	1	0.24
530	CAFETERIA (530)	26	0.08	0	0.00
531	MINI-MART CONVENIENCE STORE (531)	46	0.15	0	0.00
532	FLORIST SHOP (532)	5	0.02	0	0.00
533	WAREHOUSE FOOD STORE (533)	3	0.01	0	0.00
534	WAREHOUSE SHOWROOM STORE (534)	39	0.13	1	0.24
551	ROOMING HOUSE (551)	161	0.52	6	1.46
573	ARCADE (573)	6	0.02	0	0.00
574	VISITOR CENTER (574)	11	0.04	0	0.00
636	??????	6	0.02	0	0.00
701	BASEMENT, FINISHED (701)	20	0.06	0	0.00
702	BASEMENT, SEMIFINISHED (702)	5	0.02	0	0.00
703	BASEMENT, UNFINISHED (703)	150	0.48	2	0.49
704	BASEMENT, DISPLAY (704)	0	0.00	0	0.00
705	BASEMENT, OFFICE (705)	46	0.15	2	0.49
706	BASEMENT, PARKING (706)	18	0.06	0	0.00
707	BASEMENT, RESIDENT LIVING (707)	0	0.00	0	0.00
708	BASEMENT, STORAGE (708)	0	0.00	0	0.00
709	BASEMENT, RETAIL (709)	0	0.00	0	0.00
810	WAREHOUSE OFFICE (810)	136	0.44	1	0.24
820	OPEN OFFICE (820)	215	0.69	0	0.00
830	MIXED USE RETAIL (830)	176	0.57	2	0.49
840	MIXED USE OFFICE (840)	164	0.53	1	0.24
841	HOTEL, FULL SERVICE (841)	76	0.25	1	0.24
842	HOTEL, SUITE (842)	39	0.13	1	0.24
843	MOTEL, FULL SERVICE (843)	35	0.11	0	0.00
844	MOTEL, SUITE (844)	60	0.19	0	0.00
845	CONDO, OFFICE (845)	44	0.14	0	0.00
846	CONDO, RETAIL (846)	36	0.12	0	0.00

KCAO Code	KCAO Description	KCAO Data n=	KCAO Data %	Study Random Sample n=	Sample %
847	MIXED USE-OFFICE CONDO (847)	20	0.06	0	0.00
848	MIXED USE-RETAIL CONDO (848)	28	0.09	0	0.00
849	CONDO, STORAGE (849)	2	0.01	0	0.00
850	CONDO, PARKING STRUCTURE (850)	0	0.00	0	0.00
851	UNDERGROUND CONDO PARKING (851)	0	0.00	0	0.00
852	CONDO HOTEL, FULL SERVICE (852)	0	0.00	0	0.00
853	CONDO HOTEL, LIMITED SERVICE (853)	1	0.00	0	0.00
860	LINE RETAIL (860)	171	0.55	1	0.24
	Commercial Building Total:	**30,684**		**412**	

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APPENDIX E

THERMOSTATS AND SENSOR DISTRIBUTION BY CEILING HEIGHT AND SAMPLE TYPE

Site ID	Warehouse Ceiling Height	High Ceiling Height	Standard Ceiling Height	Ceiling Height Not Specified
P1	n = 8	n = 97	n = 29	n = 0
Mercury Thermostat	0	16	10	0
Non-Mercury Thermostat	1	58	13	0
Mercury Sensor	0	0	0	0
Non-Mercury Sensor	0	0	0	0
No Thermostat or Sensor	7	23	6	0
P2	n = 168	n = 573	n = 846	n = 8
Mercury Thermostat	33	69	193	0
Non-Mercury Thermostat	79	198	425	0
Mercury Sensor	0	0	3	0
Non-Mercury Sensor	26	165	101	0
No Thermostat or Sensor	30	141	124	8
P3	n = 258	n = 696	n = 3206	n = 8
Mercury Thermostat	50	23	33	0
Non-Mercury Thermostat	115	327	734	5
Mercury Sensor	0	2	1	0
Non-Mercury Sensor	71	326	2,405	0
No Thermostat or Sensor	22	18	33	3
H	n = 34	n = 29	n = 35	n = 0
Mercury Thermostat	5	3	9	0
Non-Mercury Thermostat	7	7	20	0
Mercury Sensor	0	5	1	0
Non-Mercury Sensor	13	6	8	0
No Thermostat or Sensor	9	8	6	0
Total	n = 468	n = 1,395	n = 4,116	n = 16

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APPENDIX F

DATA QA/QC BY RESEARCHER – MILESTONE REPORT

Mercury Thermostat Project

Milestone Report - Data QA/QC

Visit Number	Date		Week	Visit Quality	Field Researcher	Site ID	City	BldgDescr	BldgNetSqFt	Number of Stories	QA/QC Document Check							Not Useable Data
	Issued	Received									KCAO Verification	Heating/Cooling Des.	#Thermostats	#Sensors	Ceiling Height	%building use	Space Description	
Week #																		
Week 1 totals:					**# Received**			**% Useable Data**										

Data Summary:

Data Errors by Category
KCAO Verification
Heating/Cooling Des.
#Thermostats
#Sensors
Ceiling Height
%building use
Space Description
Total number of errors
Percent error rate

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APPENDIX G

KCAO VERIFICATION INDEX DATA BY RESEARCHER

Table G.1 Researcher A

Index Data Calculation Summary

Comparable Index		
MIN n=66	**MAX n=66**	**MEDIAN n=66**
3993.38	19725.72	6295.16

Index Data Calculation

Data type	KCAO Year built	Yr Blt Index	KCAO Sq Ft	Log N Sq Ft Index	KCAO Predom Use Code	Predom Use Index	Comparable Index Totals
P2	1962	19.62	936	6.84	470	47.00	6308.93
P2	1957	19.57	35926	10.49	306	30.60	6281.38
P2	1939	19.39	544	6.30	384	38.40	4690.05
P2	1961	19.61	960	6.87	344	34.40	4632.32
P2	1973	19.73	640	6.46	471	47.10	6004.53
P2	1959	19.59	46669	10.75	407	40.70	8571.78
P2	1923	19.23	6634	8.80	344	34.40	5821.28
P2	1924	19.24	2600	7.86	344	34.40	5204.35
P2	1945	19.45	3675	8.21	353	35.30	5636.39
P2	1975	19.75	567	6.34	348	34.80	4357.73
P2	1956	19.56	378	5.93	344	34.40	3993.38
P2	1952	19.52	44496	10.70	344	34.40	7187.04
P2	1954	19.54	7476	8.92	344	34.40	5995.44
P2	1948	19.48	13196	9.49	309	30.90	5710.93
P2	1946	19.46	1686	7.43	326	32.60	4713.63
P2	1964	19.64	6300	8.75	344	34.40	5910.49
P2	1947	19.47	7628	8.94	353	35.30	6144.09
P2	1955	19.55	4322	8.37	341	34.10	5580.88
P2	1964	19.64	8376	9.03	406	40.60	7202.87

Data type	KCAO Year built	Yr Blt Index	KCAO Sq Ft	Log N Sq Ft Index	KCAO Predom Use Code	Predom Use Index	Comparable Index Totals
P2	1970	19.70	12180	9.41	406	40.60	7524.35
P2	1967	19.67	16941	9.74	309	30.90	5918.48
P2	1964	19.64	22466	10.02	309	30.90	6080.75
P2	1962	19.62	71343	11.18	365	36.50	8002.94
P2	1930	19.30	2048	7.62	350	35.00	5150.43
P2	1960	19.60	2288	7.74	344	34.40	5215.54
P3	1987	19.87	2497	7.82	419	41.90	6512.93
P2	1964	19.64	33160	10.41	313	31.30	6398.81
P2	1902	19.02	3914	8.27	384	38.40	6041.83
P3	1973	19.73	47940	10.78	340	34.00	7229.90
P3	1904	19.04	3483	8.16	344	34.40	5341.75
P3	1989	19.89	37960	10.54	407	40.70	8535.84
P3	1993	19.93	33146	10.41	407	40.70	8443.01
P3	1999	19.99	2000	7.60	344	34.40	5226.81
P3	1978	19.78	17516	9.77	0		
P3	1978	19.78	60448	11.01	406	40.60	8841.41
P3	1986	19.86	7000	8.85	406	40.60	7138.85
P3	1987	19.87	35970	10.49	0		
P3	1986	19.86	10856	9.29	344	34.40	6348.47
P3	1976	19.76	791396	13.58	344	34.40	9231.98
P3	2003	20.03	56035	10.93	340	34.00	7446.09
P3	1967	19.67	2460	7.81	419	41.90	6435.07
P3	1999	19.99	6000	8.70	344	34.40	5982.27
P3	1968	19.68	23177	10.05	494	49.40	9771.42
P3	2000	20.00	24500	10.11	327	32.70	6609.60
P3	2002	20.02	124816	11.73	406	40.60	9538.02
P3	1991	19.91	51000	10.84	494	49.40	10661.31
P3	1995	19.95	86430	11.37	494	49.40	11202.61
P3	1981	19.81	4900	8.50	350	35.00	5891.39
P3	1952	19.52	67720	11.12	498	49.80	10812.76
P3	1962	19.62	1665	7.42	353	35.30	5137.31
P3	1983	19.83	186800	12.14	341	34.10	8207.61
P3	2000	20.00	2500	7.82	528	52.80	8262.19
P3	1995	19.95	122638	11.72	344	34.40	8041.14
P3	1999	19.99	122942	11.72	842	84.20	19725.72
P3	2000	20.00	400	5.99	432	43.20	5176.63
P3	1982	19.82	8808	9.08	344	34.40	6193.15
P3	1982	19.82	1200	7.09	406	40.60	5705.33

Data type	KCAO Year built	Yr Blt Index	KCAO Sq Ft	Log N Sq Ft Index	KCAO Predom Use Code	Predom Use Index	Comparable Index Totals
P3	1992	19.92	15888	9.67	406	40.60	7823.32
P3	1987	19.87	28481	10.26	353	35.30	7194.37
P3	1969	19.69	7960	8.98	344	34.40	6083.96
P3	1974	19.74	17600	9.78	406	40.60	7834.64
P3	1985	19.85	5000	8.52	353	35.30	5968.04
P3	2000	20.00	57132	10.95	344	34.40	7535.75
P3	1990	19.90	1620	7.39	423	42.30	6220.83
P3	1903	19.03	7852	8.97	381	38.10	6502.57
P3	1980	19.80	22674	10.03	309	30.90	6135.93
P3	2000	20.00	53040	10.88	326	32.60	7092.98
P2	1922	19.22	6932	8.84	353	35.30	6000.29

Table G.2 Researcher B

Index Data Calculation Summary

Comparable Index		
MIN n=72	**MAX n=72**	**MEDIAN n=72**
4431.93	9902.88	6060.71

Index Data Calculation

Data type	KCAO Year built	Yr Blt Index	KCAO Sq Ft	Log N Sq Ft Index	KCAO Predom Use Code	Predom Use Index	Comparable Index Totals
P1	1940	19.40	3824	8.25	309	30.90	4944.98
P1	1914	19.14	16612	9.72	324	32.40	6026.41
P1	1910	19.10	1130	7.03	344	34.40	4618.97
P1	1923	19.23	2412	7.79	353	35.30	5286.79
P1	1948	19.48	696	6.55	353	35.30	4500.87
P1	1949	19.49	4212	8.35	353	35.30	5741.81
P1	1919	19.19	25128	10.13	365	36.50	7096.62
P1	1900	19.00	2668	7.89	384	38.40	5755.88
P2	1926	19.26	4908	8.50	353	35.30	5778.03
P2	1970	19.70	4920	8.50	323	32.30	5409.31
P2	1969	19.69	432	6.07	470	47.00	5615.90
P2	1976	19.76	1402	7.25	344	34.40	4925.19
P2	1968	19.68	4256	8.36	344	34.40	5657.00
P2	1956	19.56	1920	7.56	343	34.30	5072.12
P2	1956	19.56	5481	8.61	344	34.40	5792.72
P2	1952	19.52	21900	9.99	407	40.70	7940.07
P2	1928	19.28	148110	11.91	345	34.50	7919.20
P2	1926	19.26	6000	8.70	353	35.30	5914.61
P2	1959	19.59	113173	11.64	343	34.30	7819.11
P2	1926	19.26	1120	7.02	350	35.00	4732.91
P2	1934	19.34	1982	7.59	353	35.30	5182.98
P2	1972	19.72	3715	8.22	344	34.40	5576.28
P2	1926	19.26	2880	7.97	350	35.00	5369.57
P2	1962	19.62	3738	8.23	353	35.30	5697.42
P2	1956	19.56	1264	7.14	326	32.60	4554.16
P2	1942	19.42	2622	7.87	353	35.30	5396.25

Data type	KCAO Year built	Yr Blt Index	KCAO Sq Ft	Log N Sq Ft Index	KCAO Predom Use Code	Predom Use Index	Comparable Index Totals
P2	1962	19.62	5120	8.54	534	53.40	8948.38
P2	1946	19.46	11174	9.32	309	30.90	5605.06
P2	1961	19.61	2930	7.98	353	35.30	5525.93
P2	1962	19.62	21723	9.99	365	36.50	7151.37
P2	1959	19.59	15856	9.67	322	32.20	6100.64
P2	1962	19.62	12394	9.42	303	30.30	5603.01
P2	1940	19.40	9583	9.17	528	52.80	9390.71
P2	1966	19.66	2400	7.78	419	41.90	6411.46
P2	1924	19.24	8528	9.05	350	35.00	6095.02
P2	1950	19.50	1030	6.94	353	35.30	4775.30
P2	1958	19.58	18660	9.83	407	40.70	7836.88
P2	1916	19.16	4050	8.31	344	34.40	5474.83
P2	1900	19.00	1880	7.54	406	40.60	5815.61
P2	1948	19.48	16600	9.72	406	40.60	7685.18
P2	1964	19.64	10800	9.29	406	40.60	7405.55
P2	1915	19.15	3183	8.07	551	55.10	8510.52
P3	1988	19.88	13800	9.53	353	35.30	6689.51
P3	1960	19.60	5600	8.63	353	35.30	5971.29
P3	1996	19.96	32760	10.40	406	40.60	8425.45
P3	1988	19.88	8063	9.00	528	52.80	9441.77
P3	2001	20.01	53621	10.89	302	30.20	6580.67
P3	1981	19.81	1556	7.35	311	31.10	4528.19
P3	1999	19.99	19861	9.90	344	34.40	6805.40
P3	2001	20.01	1848	7.52	326	32.60	4906.70
P3	1989	19.89	6848	8.83	528	52.80	9274.99
P3	1988	19.88	10777	9.29	365	36.50	6737.50
P3	1977	19.77	4188	8.34	344	34.40	5671.92
P3	2003	20.03	25000	10.13	407	40.70	8255.44
P3	1991	19.91	14272	9.57	365	36.50	6951.80
P3	1998	19.98	9266	9.13	344	34.40	6277.98
P3	1970	19.70	1704	7.44	419	41.90	6141.80
P3	1985	19.85	2080	7.64	349	34.90	5292.81
P3	1972	19.72	1716	7.45	419	41.90	6153.84
P3	1998	19.98	67037	11.11	446	44.60	9902.88
P3	1999	19.99	9840	9.19	406	40.60	7461.97
P3	2003	20.03	52000	10.86	365	36.50	7938.96
P3	1960	19.60	19220	9.86	406	40.60	7849.14
P3	1925	19.25	680	6.52	353	35.30	4431.93

Data type	KCAO Year built	Yr Blt Index	KCAO Sq Ft	Log N Sq Ft Index	KCAO Predom Use Code	Predom Use Index	Comparable Index Totals
P3	1959	19.59	2222	7.71	426	42.60	6431.06
P3	1978	19.78	20125	9.91	341	34.10	6684.09
P3	2000	20.00	302186	12.62	318	31.80	8025.56
P3	1995	19.95	3980	8.29	350	35.00	5787.82
P3	1985	19.85	3705	8.22	311	31.10	5072.91
P3	1981	19.81	87807	11.38	344	34.40	7757.03
P3	1992	19.92	40059	10.60	392	39.20	8275.68
P3	1995	19.95	1600	7.38	419	41.90	6167.11

Table G.3 Researcher C

Index Data Calculation Summary

Comparable Index		
MIN n=71	**MAX n=71**	**MEDIAN n=71**
4352.79	14569.95	7014.21

Index Data Calculation

Data type	KCAO Year built	Yr Blt Index	KCAO Sq Ft	Log N Sq Ft Index	KCAO Predom Use Code	Predom Use Index	Comparable Index Totals
H	1920	19.20	27140	10.21	495	49.50	9702.41
H	1959	19.59	9560	9.17	495	49.50	8887.68
P1	1920	19.20	9940	9.20	309	30.90	5460.74
P1	1950	19.50	1755	7.47	406	40.60	5914.18
P1	1912	19.12	988	6.90	840	84.00	11075.02
P2	1901	19.01	2160	7.68	344	34.40	5020.89
P2	1974	19.74	11250	9.33	528	52.80	9722.44
P2	1979	19.79	106364	11.57	353	35.30	8085.88
P2	1946	19.46	11859	9.38	365	36.50	6663.12
P2	1905	19.05	3372	8.12	353	35.30	5462.61
P2	1971	19.71	2031	7.62	344	34.40	5164.02
P2	1957	19.57	5552	8.62	365	36.50	6158.68
P2	1969	19.69	4500	8.41	350	35.00	5797.01
P2	1970	19.70	10588	9.27	309	30.90	5641.39
P2	1964	19.64	4000	8.29	494	49.40	8047.02
P2	1950	19.50	10700	9.28	407	40.70	7363.48
P2	1980	19.80	7500	8.92	386	38.60	6819.41
P2	1961	19.61	12062	9.40	313	31.30	5768.31
P2	1960	19.60	76922	11.25	365	36.50	8048.64
P2	1974	19.74	10400	9.25	406	40.60	7413.01
P2	1977	19.77	7600	8.94	528	52.80	9327.80
P2	1977	19.77	3690	8.21	344	34.40	5585.82
P2	1961	19.61	45906	10.73	366	36.60	7704.32
P2	1960	19.60	5842	8.67	341	34.10	5796.57
P2	1957	19.57	1204	7.09	528	52.80	7329.59
P2	1938	19.38	8820	9.08	350	35.00	6162.20

Data type	KCAO Year built	Yr Blt Index	KCAO Sq Ft	Log N Sq Ft Index	KCAO Predom Use Code	Predom Use Index	Comparable Index Totals
P2	1973	19.73	3,200	8.07	406	40.60	6,465.10
P2	1975	19.75	4,080	8.31	0		
P2	1934	19.34	2,912	7.98	350	35.00	5,399.36
P2	1964	19.64	7,000	8.85	494	49.40	8,589.97
P2	1908	19.08	9,900	9.20	830	83.00	14,569.95
P2	1960	19.60	2,509	7.83	344	34.40	5,277.71
P3	2000	20.00	68,040	11.13	407	40.70	9,058.07
P3	1987	19.87	228,044	12.34	407	40.70	9,977.28
P3	1992	19.92	2,820	7.94	528	52.80	8,355.83
P3	1982	19.82	13,125	9.48	494	49.40	9,284.17
P3	1995	19.95	3,584	8.18	344	34.40	5,616.68
P3	1955	19.55	22,022	10.00	484	48.40	9,462.01
P3	1974	19.74	14,162	9.56	344	34.40	6,490.63
P3	2004	20.04	3,043	8.02	304	30.40	4,886.28
P3	1990	19.90	62,900	11.05	319	31.90	7,014.21
P3	1988	19.88	103,702	11.55	407	40.70	9,344.70
P3	1988	19.88	115,920	11.66	407	40.70	9,434.82
P3	1989	19.89	7,272	8.89	406	40.60	7,180.42
P3	2003	20.03	99,433	11.51	491	49.10	11,317.06
P3	1970	19.70	56,827	10.95	365	36.50	7,871.99
P3	1928	19.28	1,482	7.30	350	35.00	4,926.81
P3	1985	19.85	5,854	8.67	344	34.40	5,923.56
P3	2000	20.00	476	6.17	353	35.30	4,352.79
P3	2001	20.01	213,832	12.27	344	34.40	8,448.01
P3	1994	19.94	8,800	9.08	343	34.30	6,211.91
P3	1991	19.91	10,380	9.25	365	36.50	6,720.40
P3	1981	19.81	2,747	7.92	344	34.40	5,396.01
P3	1987	19.87	4,018	8.30	350	35.00	5,771.22
P3	1988	19.88	11,950	9.39	344	34.40	6,420.52
P3	1976	19.76	5,559	8.62	350	35.00	5,963.79
P3	1984	19.84	1,152	7.05	528	52.80	7,384.46
P3	1977	19.77	56,514	10.94	446	44.60	9,648.24
P3	1993	19.93	111,419	11.62	341	34.10	7,897.82
P3	1970	19.70	44,937	10.71	406	40.60	8,568.49
P3	1979	19.79	12,000	9.39	319	31.90	5,929.60
P3	1908	19.08	11,420	9.34	350	35.00	6,239.34
P3	1989	19.89	27,349	10.22	386	38.60	7,843.71
P3	2003	20.03	58,978	10.98	341	34.10	7,502.95

Data type	KCAO Year built	Yr Blt Index	KCAO Sq Ft	Log N Sq Ft Index	KCAO Predom Use Code	Predom Use Index	Comparable Index Totals
P3	1993	19.93	5,000	8.52	353	35.30	5,992.09
P3	1988	19.88	27,120	10.21	353	35.30	7,163.63
P3	1994	19.94	13,528	9.51	318	31.80	6,031.81
P3	1994	19.94	9,436	9.15	308	30.80	5,620.90
P3	1995	19.95	2,966	7.99	349	34.90	5,566.54
P3	1952	19.52	3,849	8.26	528	52.80	8,508.65
P3	2003	20.03	10,925	9.30	386	38.60	7,189.45
P3	1984	19.84	6,672	8.81	337	33.70	5,887.54
P3	1948	19.48	7,178	8.88	353	35.30	6,105.44
P3	1986	19.86	10,884	9.30	406	40.60	7,494.75
H	1950	19.50	3,064	8.03	495	49.50	7,748.52
H	1998	19.98	2,924	7.98	495	49.50	7,893.00

Table G.4 Researcher D

Index Data Calculation Summary

Comparable Index		
MIN n=71	**MAX n=71**	**MEDIAN n=71**
4,297.29	16,551.36	7,648.89

Index Data Calculation

Data type	KCAO Year built	Yr Blt Index	KCAO Sq Ft	Log N Sq Ft Index	KCAO Predom Use Code	Predom Use Index	Comparable Index Totals
H	1925	19.25	30750	10.33	495	49.50	9846.67
H	1916	19.16	557414	13.23	495	49.50	12548.61
H	1959	19.59	4800	8.48	495	49.50	8219.58
H	1943	19.43	21624	9.98	495	49.50	9600.11
H	1943	19.43	600	6.40	495	49.50	6152.47
H	1993	19.93	87074	11.37	495	49.50	11221.36
H	1997	19.97	3120	8.05	495	49.50	7953.18
P1	1910	19.10	3660	8.21	353	35.30	5532.20
P1	1927	19.27	15360	9.64	365	36.50	6780.01
P1	1914	19.14	20000	9.90	406	40.60	7695.84
P1	1941	19.41	540	6.29	406	40.60	4958.05
P1	1943	19.43	14460	9.58	407	40.70	7575.19
P2	1972	19.72	18624	9.83	494	49.40	9578.22
P2	1962	19.62	384	5.95	810	81.00	9456.88
P2	1975	19.75	13200	9.49	406	40.60	7607.93
P2	1977	19.77	16896	9.73	860	86.00	16551.36
P2	1963	19.63	5680	8.64	304	30.40	5158.75
P2	1964	19.64	2728	7.91	311	31.10	4832.27
P2	1965	19.65	1946	7.57	311	31.10	4628.30
P2	1964	19.64	729	6.59	705	70.50	9126.96
P2	1959	19.59	24000	10.09	406	40.60	8021.79
P2	1977	19.77	17920	9.79	406	40.60	7861.01
P2	1977	19.77	100	4.61	472	47.20	4297.29
P2	1968	19.68	75773	11.24	353	35.30	7805.34
P2	1979	19.79	2880	7.97	528	52.80	8323.29
P2	1979	19.79	8465	9.04	344	34.40	6156.73

Data type	KCAO Year built	Yr Blt Index	KCAO Sq Ft	Log N Sq Ft Index	KCAO Predom Use Code	Predom Use Index	Comparable Index Totals
P2	1918	19.18	111415	11.62	344	34.40	7667.45
P2	1938	19.38	7049	8.86	308	30.80	5288.95
P2	1953	19.53	3900	8.27	344	34.40	5555.20
P2	1973	19.73	6090	8.71	391	39.10	6722.67
P3	1991	19.91	68921	11.14	344	34.40	7630.32
P3	1982	19.82	1000	6.91	326	32.60	4463.32
P3	1986	19.86	3285	8.10	311	31.10	5001.15
P3	1981	19.81	8937	9.10	406	40.60	7317.36
P3	2001	20.01	176	5.17	529	52.90	5473.11
P3	1968	19.68	18270	9.81	528	52.80	10196.74
P3	1982	19.82	7200	8.88	365	36.50	6425.39
P3	1962	19.62	9140	9.12	309	30.90	5529.32
P3	2003	20.03	3200	8.07	344	34.40	5561.11
P3	1964	19.64	3717	8.22	353	35.30	5699.33
P3	1988	19.88	9600	9.17	528	52.80	9624.91
P3	1990	19.90	9300	9.14	483	48.30	8782.95
P3	1997	19.97	9600	9.17	428	42.80	7837.33
P3	1980	19.80	3727	8.22	304	30.40	4949.80
P3	1983	19.83	672	6.51	419	41.90	5409.22
P3	1959	19.59	3748	8.23	472	47.20	7608.91
P3	1951	19.51	2484	7.82	528	52.80	8053.15
P3	1988	19.88	16205	9.69	406	40.60	7823.55
P3	1970	19.70	11850	9.38	302	30.20	5580.59
P3	1999	19.99	48818	10.80	407	40.70	8783.43
P3	1986	19.86	12464	9.43	344	34.40	6442.83
P3	1987	19.87	1264	7.14	703	70.30	9976.43
P3	1999	19.99	5400	8.59	386	38.60	6631.37
P3	1999	19.99	54150	10.90	525	52.50	11438.77
P3	1987	19.87	13440	9.51	406	40.60	7668.69
P3	1996	19.96	576	6.36	365	36.50	4630.68
P3	2003	20.03	2889	7.97	349	34.90	5570.47
P3	1999	19.99	41218	10.63	407	40.70	8645.75
H	1974	19.74	2391	7.78	495	49.50	7601.55
H	1917	19.17	17845	9.79	495	49.50	9289.38
H	1942	19.42	24000	10.09	495	49.50	9695.39
H	1997	19.97	6028	8.70	495	49.50	8604.20
H	1969	19.69	19096	9.86	495	49.50	9607.40
H	1997	19.97	5200	8.56	495	49.50	8458.14

Table G.5 Researcher E

Index Data Calculation Summary

Comparable Index		
MIN n=43	**MAX n=43**	**MEDIAN n=43**
4105.34	17477.72	6269.75

Index Data Calculation

Data type	KCAO Year built	Yr Blt Index	KCAO Sq Ft	Log N Sq Ft Index	KCAO Predom Use Code	Predom Use Index	Comparable Index Totals
P1	1920	19.20	4660	8.45	309	30.90	5011.30
P1	1900	19.00	6038	8.71	309	30.90	5111.19
P1	1922	19.22	27600	10.23	338	33.80	6642.90
P1	1949	19.49	9600	9.17	406	40.60	7255.78
P2	1964	19.64	336330	12.73	344	34.40	8597.79
P2	1974	19.74	1210	7.10	705	70.50	9878.60
P2	1920	19.20	6763	8.82	380	38.00	6434.50
P2	1971	19.71	13849	9.54	365	36.50	6860.32
P2	1913	19.13	25256	10.14	365	36.50	7077.98
P2	1956	19.56	960	6.87	353	35.30	4741.40
P2	1966	19.66	3180	8.06	353	35.30	5596.84
P2	1966	19.66	6800	8.82	353	35.30	6124.31
P2	1961	19.61	396	5.98	350	35.00	4105.34
P2	1964	19.64	5952	8.69	551	55.10	9405.61
P2	1967	19.67	8774	9.08	494	49.40	8822.58
P2	1954	19.54	8104	9.00	348	34.80	6120.00
P2	1956	19.56	27400	10.22	406	40.60	8114.72
P2	1968	19.68	2487	7.82	494	49.40	7601.41
P2	1969	19.69	7900	8.97	344	34.40	6078.83
P2	1968	19.68	4232	8.35	406	40.60	6672.06
P2	1965	19.65	3456	8.15	353	35.30	5651.73
P2	1950	19.50	55229	10.92	323	32.30	6877.49
P2	1975	19.75	1920	7.56	353	35.30	5270.70
P2	1967	19.67	320	5.77	472	47.20	5355.45
P2	1960	19.60	1120	7.02	350	35.00	4816.46
P2	1961	19.61	7795	8.96	308	30.80	5412.48

Data type	KCAO Year built	Yr Blt Index	KCAO Sq Ft	Log N Sq Ft Index	KCAO Predom Use Code	Predom Use Index	Comparable Index Totals
P2	1971	19.71	30648	10.33	365	36.50	7431.79
P2	1950	19.50	5720	8.65	353	35.30	5955.41
P2	1931	19.31	6454	8.77	350	35.00	5928.86
P2	1925	19.25	1990	7.60	350	35.00	5117.73
P2	1966	19.66	10492	9.26	341	34.10	6206.87
P2	1910	19.10	29400	10.29	379	37.90	7447.92
P2	1957	19.57	2536	7.84	703	70.30	10783.77
P2	1926	19.26	8200	9.01	344	34.40	5970.77
P2	1979	19.79	3600	8.19	494	49.40	8005.48
P2	1960	19.60	5441	8.60	341	34.10	5749.04
P2	1960	19.60	400	5.99	406	40.60	4767.77
P2	1970	19.70	43615	10.68	424	42.40	8923.43
P2	1950	19.50	2750	7.92	406	40.60	6269.75
P2	1928	19.28	48006	10.78	841	84.10	17477.72
P3	1983	19.83	5700	8.65	528	52.80	9054.90
P3	1994	19.94	1300	7.17	386	38.60	5518.73
P3	1981	19.81	11600	9.36	353	35.30	6544.52

Table G.6 Researcher F

Index Data Calculation Summary

Comparable Index		
MIN n=29	**MAX n=29**	**MEDIAN n=29**
4126.77	8964.13	6108.86

Index Data Calculation

Data type	KCAO Year built	Yr Blt Index	KCAO Sq Ft	Log N Sq Ft Index	KCAO Predom Use Code	Predom Use Index	Comparable Index Totals
P1	1950	19.50	11000	9.31	494	49.40	8964.13
P1	1948	19.48	3168	8.06	528	52.80	8290.94
P2	1976	19.76	24900	10.12	406	40.60	8120.94
P2	1978	19.78	26112	10.17	379	37.90	7624.18
P2	1968	19.68	8776	9.08	304	30.40	5432.18
P2	1970	19.70	173500	12.06	344	34.40	8175.49
P2	1979	19.79	32628	10.39	344	34.40	7075.25
P2	1969	19.69	3384	8.13	353	35.30	5648.60
P2	1963	19.63	9926	9.20	353	35.30	6377.06
P2	1971	19.71	3111	8.04	304	30.40	4819.06
P2	1956	19.56	352	5.86	470	47.00	5390.55
P2	1961	19.61	37843	10.54	309	30.90	6387.43
P2	1957	19.57	12320	9.42	484	48.40	8921.54
P2	1980	19.80	4032	8.30	366	36.60	6016.31
P2	1965	19.65	3000	8.01	344	34.40	5411.98
P2	1966	19.66	5472	8.61	311	31.10	5262.79
P2	1965	19.65	16319	9.70	344	34.40	6556.87
P2	1940	19.40	768	6.64	365	36.50	4704.47
P2	1900	19.00	384	5.95	365	36.50	4126.77
P2	1965	19.65	49404	10.81	406	40.60	8622.34
P2	1961	19.61	7608	8.94	365	36.50	6396.76
P2	1961	19.61	3993	8.29	344	34.40	5593.85
P2	1946	19.46	7280	8.89	353	35.30	6108.86
P2	1930	19.30	4213	8.35	353	35.30	5686.00
P2	1969	19.69	3776	8.24	407	40.70	6600.53
P2	1924	19.24	6532	8.78	353	35.30	5966.17

Data type	KCAO Year built	Yr Blt Index	KCAO Sq Ft	Log N Sq Ft Index	KCAO Predom Use Code	Predom Use Index	Comparable Index Totals
P2	1975	19.75	6984	8.85	309	30.90	5401.77
P2	1956	19.56	1595	7.37	344	34.40	4962.12
P2	1970	19.70	28490	10.26	344	34.40	6951.17

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APPENDIX H

KCAO DATA FOR PREVALANCE OF HEATING SYSTEM BY YEAR AND ASSOCIATED SQUARE FEET[19]

		1900-1952				
KCAO Heat Type Code	**Description**	**N=**	**Median ft²**	**Min ft²**	**Max ft²**	**Percent**
3	Forced air unit	442	2,636	150	410,000	22.72
6	Space heaters	411	5,024	257	296,752	21.13
20	No heat	378	7,363	56	557,414	19.43
4	Hot water	217	8,976	374	205,000	11.16
0	None or Unknown	172	1,411	168	161,180	8.84
2	Electric wall	117	1,170	228	179,161	6.02
		1953-1980				
KCAO Heat Type Code	**Description**	**N=**	**Median ft²**	**Min ft²**	**Max ft²**	**Percent**
3	Forced air unit	4,178	3,920	112	694,072	27.29
6	Space heaters	3,487	5,724	200	662,728	22.78
20	No heat	1,719	2,400	30	16,001,600	11.23
4	Hot water	1,384	10,832	336	1,236,136	9.04
2	Electric wall	1,005	2,272	128	71,343	6.56
12	Warmed / Cooled Air	883	8,565	27,042	1,038,000	5.77
14	Heat pump	845	6,689	247	776,762	5.52
		1981-2004				
KCAO Heat Type Code	**Description**	**N=**	**Median ft²**	**Min ft²**	**Max ft²**	**Percent**
6	Space heaters	2,747	15,150	60	527,118	20.52
14	Heat pump	2,480	7,960	192	1,605,578	18.52
3	Forced air unit	2,023	5,664	104	342,484	15.11
12	Warmed / Cooled Air	1,513	14,707	224	1,952,220	11.30
20	No heat	1,008	3,200	60	1,846,950	7.53
0	None or Unknown	729	5,000	32	1,123,435	5.45
17	Complete HVAC	699	21,670	476	1,578,732	5.22

[19] Data represents heating systems with a $\geq$ 5 percent rate of occurrence.

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APPENDIX I
KCAO DATA FOR PREVALANCE OF HEATING SYSTEM, NUMBER OF BUILDINGS AND PERCENT SAMPLE POPULATION TOTAL

KCAO Heat Type Code	Description	Number of buildings	Percent Sample (n=30,642)
0	None or Unknown	1,455	4.7
1	Electric	1,067	3.5
2	Electric wall	1,613	5.3
3	Forced air unit	6,643	21.7
4	Hot water	1,884	6.1
5	Hot water radiant	90	0.3
6	Space heaters	6,645	21.7
7	Steam	293	1.0
8	Steam without boiler	183	0.6
9	Ventilation	26	0.08
10	Wall furnace	39	0.1
11	Package Unit	672	2.2
12	Warmed and Cooled Air	2,420	7.9
13	Hot and chilled water	109	0.4
14	Heat pump	3,335	10.8
15	Floor furnace	22	0.07
16	Thru-wall heat pump	4	0.01
17	Complete HVAC	816	2.7
18	Evaporative cooling	1	0.003
19	Refrigerated cooling	220	7.2
20	No heat	3,105	10.1

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APPENDIX J

RANDOM SAMPLES SURVEYED BY CITY AND VISIT QUALITY

Cities Surveyed n = 32	Total Samples n =	Useable Data n =	Unusable Data n =	Percent Sample %
Auburn	21	17	4	5.1
Bellevue	22	17	5	5.3
Black Diamond	5	5	0	1.2
Bothell	5	5	0	1.2
Burien	5	5	0	1.2
Carnation	4	3	1	1.0
Des Moines	8	5	3	1.9
Duvall	1	1	0	0.2
Enumclaw	7	6	1	1.7
Fall City	1	1	0	0.2
Federal Way	8	8	0	1.9
Issaquah	11	10	1	2.7
Kenmore	3	2	1	0.7
Kent	32	27	5	7.8
Kirkland	14	13	1	3.4
Lake Forest Park	1	1	0	0.2
Maple Valley	3	3	0	0.7
Medina	1	1	0	0.2
Newcastle	3	3	0	0.7
North Bend	5	4	1	1.2
Redmond	11	8	3	2.7
Renton	19	17	2	4.6
Sammamish	5	4	1	1.2
SeaTac	7	6	1	1.7
Seattle	155	132	23	37.6
Shoreline	14	13	1	3.4
Skykomish	3	0	3	0.7
Snoqualmie	5	3	2	1.2
Tukwila	5	4	1	1.2
Vashon	2	2	0	0.5
Unincorporated King County	16	11	5	3.9
Woodinville	10	9	1	2.4
Totals	**412**	**346**	**66**	100.0

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LEGISLATIVE REPORT

THE VERMONT
AGENCY OF NATURAL RESOURCES (ANR)

{Title 10 VSA, Chapter 164 §7107(d)}

Submitted to the Vermont General Assembly By:

Department of Environmental Conservation

Agency of Natural Resources

January 15, 2008

I. Introduction

10 V.S.A. §7107(d) required the following study by the Agency:

"*The agency shall conduct a study, and in consultation with the advisory committee on mercury pollution, make recommendations on methods to increase recycling of mercury thermostats. The study shall identify incentive-based programs and other feasible programs, including costs and mechanisms for financing such programs. The agency shall report to the general assembly no later than January 15, 2008."*

The results of this study and the recommendations presented in this report have been shared with the Advisory Committee on Mercury Pollution (ACMP). The Advisory Committee's report also contains recommendations for increasing collection and recycling of mercury thermostats that are consistent with this report.

In 2006, the Agency submitted a report to the Legislature with recommendations on improving collection of mercury thermostats. In this report, the Agency concluded the following:

- The replacement and discard of mercury thermostats in Vermont constitutes a significant amount of mercury (15-23 pounds per year) and efforts are necessary to prevent environmental releases of this mercury.
- Despite bans on the purchase and disposal of mercury thermostats the Agency needs to continue educational efforts to inform the public of the requirements of the law and the opportunities for convenient recycling.
- The Agency should explore financial incentives to increase the rates of capture and recycling and should consider a pilot project.

In 2007, the Department of Environmental Conservation (DEC) on behalf of the Agency developed, funded, and conducted a two-month mercury thermostat collection pilot project at retail locations throughout the state to test the effect of a financial incentive on thermostat collection from homeowners. A financial incentive in the form of $5.00 off of the purchase of anything at the retail store was offered.

The results of this pilot project are discussed in this report, as well as pilot projects in two other states (Indiana and Oregon) that evaluated financial incentives. Also, the state of Maine's experience with its mercury thermostat law with financial incentives is reviewed.

II. Background on Mercury Thermostats

A typical mercury wall thermostat contains mercury in one or more sealed glass ampoules and serves as an on-off electromechanical switch in heating and cooling systems. The mercury moves in the glass ampoule to make or break an electrical circuit to turning the system on or off. Mercury thermostats generally contain between one and

six mercury-containing switches. The average mercury thermostat contains about four grams of mercury.

There are an estimated 50 million thermostats in use in the U.S. today, and about 90% of these contain mercury. Thermostat manufacturers estimate that two to three million thermostats are taken out of service each year. About 75% of thermostats are installed by professionals and 25% by homeowners.

Vermont has banned the sale of mercury thermostats after July 1, 2006. Many other states have also implemented sales bans. Mercury-free alternatives include electronic programmable thermostats and mechanical thermostats. Vermont law also bans the disposal of mercury thermostats in solid waste facilities.

Based on thermostat discard rates determined by the Product Stewardship Institute (as described in Section V), approximately 2000-3000 thermostats are discarded annually in Vermont. This equates to 15-23 pounds of mercury per year in discarded thermostats.

Due to the long life of mercury thermostats, many still remain in service in residential, institutional, and commercial locations. As the popularity of electronic programmable thermostats grows, more of these in-service mercury thermostats will be removed from service in all likelihood. Coupled with the ban on the sale of new mercury thermostats, it can be expected that the number of mercury thermostats available for collection and recycling each year will diminish over time.

III. Thermostat Manufacturer-Sponsored Collection

Three of the major thermostat manufacturers in the U.S. created a voluntary thermostat collection program in 2001 under the name of Thermostat Recycling Corporation (TRC) to recycle discarded mercury thermostats generated and collected by heating, ventilation, and cooling (HVAC) contractors. HVAC contractors can take a mercury switch thermostat to a participating wholesaler of plumbing and heating supplies free-of-charge. Wholesalers collect thermostats in collection bins provided by TRC which are then shipped at no cost by the wholesaler to a recycling facility in Minnesota. There is a one-time startup fee of $25 paid by the wholesaler to participate in the program. TRC provides yearly data, by state, on the number of thermostats collected through the program. Since the onset of the collection program in 2001, TRC has reported that on average, 97% of the thermostats collected were manufactured by either Honeywell, General Electric, or White Rogers. Recently a fourth manufacturer, Nordyne, has joined TRC.

In 2001, DEC on be half of the Agency set up approximately 30 wholesale supply locations across the state to collect mercury containing thermostats from contractors utilizing the TRC program. Some of these wholesalers are electrical supply and some are plumbing and heating supply wholesalers. Two additional wholesaler locations had enrolled with TRC prior to the onset of the DEC's program. The initial set up included a

site visit and instructions on how to properly implement the program. In 2002 DEC did a follow-up visit and provided posters and bill stuffers to the wholesalers to further promote the program. From the results of the follow up visits which also evaluated the progress of the program; it was noted that several locations, within the first year, had lost or misplaced their collection bin and needed to be re-instructed on the program. On two occasions after the follow-up visits, the Agency sent mailings to licensed plumbers to inform them of the sales and disposal ban and locations for the free recycling program. The program was promoted on the mercvt.org web site for both homeowners and contractors and displays were set up at various building contractor conferences.

In 2007, the Agency visited all 32 locations and found that two locations had gone out of business and several had moved. Eleven locations in all were no longer collecting and the remaining 21 locations were still participating in the program. Of the 21 participating locations, seven were very active in thermostat collection but many of the remaining bins were still not full after six years. None of the locations visited had posters which promoted the program; however, those who were actively collecting thermostats felt that there was awareness with the contractors who frequented their stores and no need for promotion. All wholesalers were knowledgeable about thermostats being banned from sale and that thermostats could not be thrown away in the regular trash. They also believed that contractors had the same level of awareness.

The number of thermostats collected in Vermont through the TRC program is as follows:

YEAR	2002	2003	2004	2005	2006
NUMBER OF THERMOSTATS COLLECTED	54	194	151	372	223

In the past year, TRC has made thermostat collection bins available to municipalities, and several of Vermont's municipal solid waste districts and alliances use this program to collect residential thermostats and thermostats from small businesses. TRC distributed about 30 collection bins to household hazardous waste programs.

IV. Vermont's Thermostat Pilot Project

The DEC conducted a two-month mercury thermostat collection pilot project directed at households to test the effect of a financial incentive on increasing the rate of mercury thermostat recycling. There were 86 hardware stores serving as collection points throughout the state during the months of October and November. A $5.00 cash incentive was provided in the form of $5.00 off the purchase of anything in the participating store where the thermostat was returned. DEC paid for the program through its special fund for mercury reduction projects. The Thermostat Recycling Corporation provided the collection bins and recycling at no charge to the stores. DEC arranged for newspaper and radio advertisements and in-store advertising materials.

Almost 1,200 mercury thermostats were collected during the two-month program. The majority of thermostats were brought in by homeowners but some thermostats were returned by contractors. In comparison, there were 192 mercury thermostats delivered to municipal solid waste districts during a two-and-a-half month period prior to the pilot. The collection numbers significantly exceeded total yearly collections at TRC wholesaler locations.

The collection of thermostats collected in the two-month pilot represents 40 – 60 % of the thermostats estimated to be available for collection on a yearly basis as estimated by DEC in its 2006 report to the Legislature.

V. Indiana and Oregon Thermostat Collection Pilot Projects Through PSI

The Product Stewardship Institute (PSI) is a nonprofit membership-based organization in Boston that works with state and local governments to partner with manufacturers, retailers and others to encourage manufacturer and joint responsibility for end-of-life product management, including collection and recycling. PSI's work has focused on a number of product categories including: carpet, consumer electronics, paints, pesticides, pharmaceuticals, and mercury products, including thermostats.

A report was prepared by the Product Stewardship Institute on two separate state mercury thermostat collection pilot projects (Indiana and Oregon) directed toward heating, ventilating and air conditioning contractors and designed to test the effect of financial incentives. One-year pilots in these states provided a $3.00 and $4.00 incentive, respectively, in the form of a rebate off the purchase of an Energy Star qualified non-mercury thermostat. In Indiana there was a 6% increase in thermostat recycling and in Oregon, there was a 124% increase. According to the report, a key difference in the two states was a greater degree of outreach in Oregon about the pilot program. The PSI report concluded that financial incentives can be effective and must be long term. There was a significant decrease in thermostat recycling in both states after the pilot program ended. The report also concluded that three factors appear to be important in yielding successful collection results: program awareness, convenient collection programs, and sufficient motivation.

VI. Maine's Thermostat Recycling Program

The State of Maine's thermostat law contains a provision for a minimum financial incentive of $5.00 for contractor and household mercury thermostats that are turned in for collection. Maine is implementing the law in two phases. The first phase began in May 2007 for contractors who remove thermostats. Thermostat manufacturers provide collection bins to plumbing, heating, and electrical wholesaler locations. A $5.00 cash coupon is provided to HVAC contractors that turn in a thermostat. This coupon is mailed in by the contractor in order to obtain a cash rebate. There is a dual system collection system – a collection container for TRC-member thermostats (GE, Honeywell, White Rogers, and Nordyne) and a collection container for all other thermostat manufacturers.

Coupons are returned to two different third-party administrators. Maine has determined that there are approximately 35 thermostat manufacturers who are responsible for participating in the collection programs and providing financial incentives. According the Maine DEP, since the law went into effect, the recycling of thermostats from contactors has more than doubled compared to the same period the previous year. The great majority of mercury thermostats collected are manufactured by Honeywell, GE and White Rogers, with only a few or no thermostats from other manufacturers.

The second phase, a homeowner collection program for TRC members, is currently under review by the Maine Department of Environmental Protection. In order to serve the rural parts of the state, there will be a mail-back component whereby homeowners can request a pre-paid UPS mailing label from TRC for return of the thermostat. The homeowner would have to provide the packaging material for mailing. TRC would then send a check to the homeowner once the thermostat is received. As another option, homeowners may also take their thermostat to a participating wholesale location or a household hazardous waste facility. Using this option, they would be given a mail-in coupon in order to claim their $5.00 incentive, similar to a contractor, and the thermostat would be dropped off for collection through the TRC bin program.

VII. Proposed Thermostat Legislation in Vermont – H.515

In 2007, the House passed H.515 related to mercury thermostat collection and is under consideration by the Senate. Under the bill, all thermostat manufacturers who sold or distributed mercury-containing thermostats in Vermont at any time must: (1) implement a collection system for discarded mercury thermostats that includes wholesaler locations; (2) implement an education and outreach program directed toward wholesalers, retailers, contractors, and homeowners; (3) provide a financial incentive with a minimum value of $5.00 for all thermostats turned in for collection; (4) submit a collection plan for approval by the Agency that ensures that certain collection rates of discarded thermostats are met; and (5) report annually to the agency on collection results.

Wholesalers who sell thermostats would be required to act as a collection sites for discarded mercury thermostats and promote the thermostat collection program, including outreach materials, provided by manufacturers. Retailers who sell thermostats would be required to display educational materials as provided by the manufacturers. Retailers, municipal solid waste districts, and municipalities may register as collection points and would be provided with collection containers by the thermostat manufacturers for a one-time fee.

The Agency must review collection plans submitted by manufacturers and report annually on the effectiveness of thermostat collection and make recommendations to the Legislature on program improvements.

VIII. Conclusion and Recommendations

Collection of thermostats increased dramatically during Vermont's two-month pilot collection project when a $5.00 cash incentive was offered for thermostats at retail locations. The number of thermostats collected exceeded in-state collection prior to the program by more than five-fold. In the two-month pilot, Vermont's thermostat collection exceeded the total annual collection of thermostats in 22 states (through the TRC program).

Consistent with the findings in Maine, Indiana, and Oregon, a financial incentive coupled with adequate program advertising and convenient recycling can yield substantial increases in mercury thermostat recycling. Through contact with homeowners who participated in Vermont's pilot program, there seemed to be a variety and often a combination of factors that motivated individuals to participate, including the cash incentive, convenient recycling, and environmental concerns. It was also clear that since many of the collected thermostats were in service at the time, this pilot provided motivation to make a change to an energy-conserving digital programmable thermostat.

We believe that the form of the cash incentive - $5.00 off the purchase of anything in the store - was more effective than incentives offered through programs in other states. First of all, it was a direct rebate to the customer with no requirement to mail in rebates forms or coupons. Secondly, it appears that the $5.00 cash incentive also was a motivation for hardware stores to voluntarily participate in and promote the program. This can be seen by the large number of hardware stores that elected to participate in the two-month pilot (86 hardware stores from four different chains). The DEC was easily able to administer the reimbursement to the 86 hardware stores rather than to each customer participating in the program. Each participating customer returning the thermostat completed a short form, thus providing easy verification for reimbursement.

Was the cash incentive a significant motivating factor in the collection program? It was significant enough that of all the thermostats collected, only about 40 of the thermostats did not have a cash incentive payout (and some of this was due to a limit of 3 thermostat rebates per customer when a customer turned in more than three thermostats).

The DEC has seen disappointing results in thermostat collection at wholesaler locations when only outreach and convenient recycling have been provided as motivators. Despite letters to contractors and advertising in wholesale locations, the best year yielded 372 thermostats. Based on the experiences in Maine and Oregon, we believe that a similar financial incentive offered for mercury thermostats returned primarily by contractors to wholesale locations would yield significant increases in thermostat collection.

Based on the DEC's experience over the last five years in thermostat recycling, a key to success in achieving high rates of mercury thermostat collection is a collaboration involving manufacturers, retailers, wholesalers, municipalities, and the DEC, each playing a critical role in providing the necessary collection infrastructure, convenience, and education/outreach, and regulatory oversight of the mercury product disposal ban in landfills.

Vermont's pilot project demonstrated a very effective and straightforward type of financial incentive that has many benefits over more complicated rebate or coupon programs. This type of incentive provides an additional motivation for retailers to participate in collection because they too derive financial benefit from the cash incentive. The customer returning a mercury thermostat receives an immediate cash incentive, instead of mailing in a form and waiting for a check. The reimbursement process is simple and would reduce overhead costs for administering a financial incentive, a primary concern that thermostat manufacturers expressed in Committee discussion of H.515 in 2007. A similar cash incentive mechanism at wholesaler locations may also be appropriate.

The Agency continues to support H.515 as passed by the House. However, based on the findings in this report, modifications should be considered to the bill to streamline the implementation process including the following considerations:

- Specifying financial incentive rebates, like that offered through the Vermont pilot, which would reduce administrative burden and cost for wholesalers, retailers, manufacturers, homeowners, and contractors.
- A goal of the legislation and a directive to the Agency in approving manufacturer collection plans should be a single collection system in which all responsible parties participate. This would avoid several different collection systems for individual manufacturers' thermostats to be managed at any given collection location. Considering that approximately 97% of the collected thermostats originate from the three manufacturers who already have a working recycling infrastructure in place through TRC, and, considering that since 2001, TRC, under their collection program, has been recycling thermostats regardless of manufacturer, it makes sense to continue this straightforward collection system that is much easier to implement at wholesaler and retailer locations. We urge the Legislature to explore this issue with thermostat manufacturers during legislative testimony to find out how a single collection system can be achieved.
- Based on Maine's experience in implementing their mercury thermostat legislation, the 20-30 other manufacturers that represent only 3% of the market share of thermostats turned in for recycling have been difficult to identify. Many of these still have not submitted collection plans. Vermont's current resources would be limited to identify and enforce the requirements for manufacturers who have a lesser contribution to the overall universe of thermostats that may be collected for recycling. Given this, the law may be more practical if Original Equipment Manufacturers (OEMs) were the only thermostat manufacturers subject to the requirements of H.515. This would greatly reduce the number of manufacturers subject to the law and may facilitate a single collection system that all manufacturers can agree to.

Turning Up The Heat

Exposing the manufacturers' lackluster mercury thermostat collection program

February 2010

Acknowledgements

Mercury Products Campaign Partners

Clean Water Action
Clean Water Fund
Clean Wisconsin
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Illinois Environmental Council
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Vermont Public Interest Research Group

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Executive Summary

Throughout the United States, mercury poses a severe health and environmental threat. The federal Centers for Disease Control and Prevention estimates that between 300,000 and 630,000 infants are born in the United States each year with mercury levels that are associated with the loss of IQ.

Mercury containing thermostats are a significant source of preventable mercury pollution. The U.S. Environmental Protection Agency (EPA) estimated that 2-3 million thermostats come out of service each year. Each thermostat contains about four grams of mercury.

While intact mercury-containing thermostats do not pose a public health risk, when they are disposed of in landfills or incinerators, the mercury can be released into the environment where it makes its way into lakes, rivers, and streams and contaminates fish.

Over the last fifteen years, the use of mercury in U.S. thermostat manufacturing has been reduced from 15-21 tons annually to less than one ton per year. This striking reduction can be attributed to state legislation banning the sales of new mercury thermostats, and the subsequent ending of mercury thermostat production by the "Big 3 manufacturers," Honeywell, White-Rodgers, and General Electric.

However, ending the production and sale of new mercury thermostats addresses only part of the problem. **Tens of millions of mercury thermostats containing several hundred tons of mercury are still in use in U.S. homes and businesses.** Given that mercury-containing thermostats can last 15 to 30 years or more, this vast reservoir of mercury currently on the walls in homes and businesses will be making its way into landfills and incinerators for decades to come unless effective collection programs are created.

In 1998, the Big 3 manufacturers developed a voluntary recycling program, administered by a non-profit entity they created called the Thermostat Recycling Corporation (TRC). TRC provides participating wholesalers with collection bins where HVAC contractors drop off old mercury thermostats. When the bins are full, they are shipped to TRC for recycling.

Unfortunately, TRC collection data indicates that their voluntary program has failed to collect the vast majority of mercury thermostats coming out of service. From 1999 to 2008, TRC collected 3.65 tons of mercury. During that same period, the EPA conservatively estimated 70-100 tons of mercury in thermostats came out of service. **Over the past decade, TRC has collected less than 5% of what EPA estimated came out of service.**

In many states, the TRC program barely functions, capturing only a tiny fraction of discarded mercury thermostats. It's clear that the TRC program is capturing only the tip of the iceberg, and certainly not meeting its own program objective of "recycling every end of use mercury-containing thermostat."[1]

However, the TRC program results are much better when financial incentives are included. In 2006, Maine enacted the nation's first comprehensive mercury thermostat collection law and has the highest per capita mercury thermostat collection rate in the country. Among other requirements, the law obliges thermostat manufacturers to collect mercury thermostats and provide a $5 financial incentive to encourage professionals and homeowners to recycle thermostats. A project in Vermont and a nationwide review of collection programs also found a financial incentive to be a critical factor for motivating program participation.

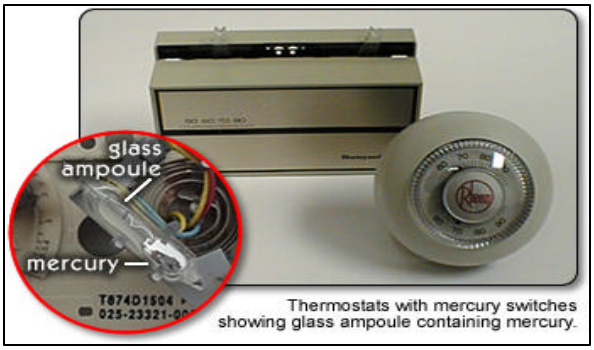
Adopting strong state laws with financial incentives and performance standards for recycling mercury thermostats is the most important change needed to drastically improve the TRC program and prevent mercury pollution. This report reviews the threat posed by mercury thermostats and makes recommendations for state programs. The full set of recommended changes is detailed at the end of the report.

Introduction

Mercury's Health and Environmental Threats

Even in small quantities, mercury can cause significant health and environmental problems. Mercury released into the atmosphere can be transported long distances and deposited in aquatic ecosystems, where it converts to methyl mercury, the most toxic form of mercury.

Mercury is a danger to the development of the human fetus and young children. The federal Centers for Disease Control and Prevention estimate that between 300,000 and 630,000 infants are born in the United States each year with mercury levels that are associated, at later ages, with the loss of IQ.[2] New evidence indicates that methyl mercury exposure may increase the risk of cardiovascular disease in humans, especially adult men.[3]



Thermostats with mercury switches showing glass ampoule containing mercury.

Methyl mercury bioaccumulates and biomagnifies in the food chain, so for most people, the main source of exposure is fish consumption. If mercury accumulation reaches levels that pose risks to human health, states issue fish consumption advisories to provide information to their residents on the amount and types of fish that are safe to eat.[4] In 2008, 80% of all fish advisories in the United States were due to the presence of mercury, covering all 50 states, one U.S. territory, and three tribes. **Twenty-seven states have statewide advisories for all their fresh water lakes and rivers, and 13 states have statewide advisories for all their coastal waters.[5]**

Similarly, the Food and Drug Administration (FDA) and the Environmental Protection Agency (EPA) advise women who may become pregnant, pregnant women, nursing mothers, and young children to avoid some types of fish and to eat fish and shellfish that are lower in mercury.[6]

Mercury Use in Thermostats

Mercury thermostats use mercury switches to control room temperature through communication with heating, ventilating, and air conditioning (HVAC) equipment. Older thermostats often contain mercury. The photo shows some common mercury thermostats and the glass ampule under the cover, which contains the mercury.

Mercury thermostats have bimetal coils that contract and expand with room temperature. When the coil contracts or expands, it activates the mercury switch, which opens or closes a circuit to make the furnace, heat pump, or air conditioner turn on or off.[7]

The amount of mercury in each thermostat largely depends upon the number of switches it contains, which will depend on how many heating and cooling systems it activates. According to TRC, mercury thermostats contain an average of 1.4 mercury switches, with a minimum of 2.8 grams of elemental mercury per switch. **Therefore, the total amount of mercury used in each mercury thermostat averages to about four grams.[8]**

The mercury in a thermostat will pollute the air, land or water if not managed properly at the end of its useful life. **As TRC correctly observes on its website, "a mercury-switch thermostat poses a risk to the environment... when improperly disposed in solid waste" because the mercury will be released if the thermostat is broken, crushed, or burned during waste handling or at a landfill or incinerator.[9]** Since mercury is volatile at room temperature, even mercury releases during crushing or breakage typically becomes part of the mercury pollution problem.

Alternatives to Mercury Thermostats

Excellent alternatives to mercury thermostats are available, many of which have the added benefit of being energy efficient. The best alternatives are programmable, digital thermostats, which can be set to change the temperature at specific times of the day.

EPA's Energy Star program notes that a properly programmed digital thermostat can save a family $180 a year in energy costs.[10] Several electric utilities around the country offer rebates of $25-$100 to encourage the purchase of programmable thermostats in order to reduce energy use.[11]

Although programming the thermostat is no more difficult than adjusting a digital watch, many new thermostats are "smart" – meaning they come pre-programmed with energy efficient settings. This way, even those not adept at working digital gadgets can immediately start accruing cost savings and environmental benefits from their non-mercury thermostat.

The Phase-Out of Mercury Thermostats

For decades, mercury-added thermostats occupied a dominant share of the U.S. market place, particularly after Honeywell's introduction of the popular T-87 round model in 1953. Even after electronic non-mercury thermostats were introduced several decades ago, millions of mercury-added thermostats were still manufactured.

EPA estimated 15-21 tons of mercury was used to manufacture thermostats in 1997.[12] In 2001, thermostat manufacturers used 14.63 tons of mercury to manufacture thermostats, according to the reports they filed with the Interstate Mercury Education and Reduction Clearinghouse (IMERC).[13] Virtually all of this mercury was reportedly used by the Big 3, as indicated by the IMERC report they filed collectively.[14]

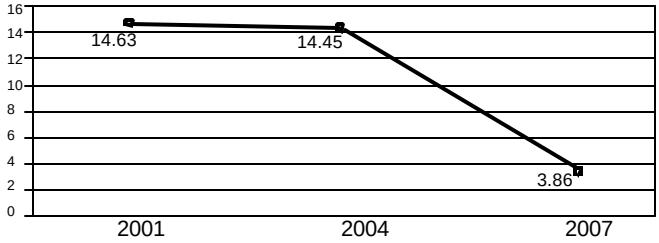
Even in 2004, 14.45 tons of mercury were reportedly used to manufacture thermostats, again mostly by the Big 3. **However, by 2007 mercury use dropped by 73%.** (See Exhibit 1.)

This dramatic drop in mercury use from 2001-2007 can be attributed in large part to the passage of legislation in 15 states prohibiting the sale of new mercury thermostats. In the face of shrinking market availability for their mercury products, Honeywell announced in 2006 that it would end its production of mercury thermostat switches, and the other companies in the Big 3 have reportedly followed suit. Based on these announcements, post-2007 mercury use can be expected to decline to under one ton.[16]

This 73% reduction in thermostat mercury use mirrors a smaller but still substantial drop of 46% in overall mercury use in U.S. product manufacturing. IMERC reports decreases by various product categories, largely due to state product restrictions. (See Exhibit2.)

Exhibit 1

Annual Mercury Use in Thermostat Manufacturing 2001-2007 (Tons)



Mercury use in thermostats dropped 73% from 2001-7 in large part due to state laws banning the sale of mercury-containing thermostats.[15]

Exhibit 2

2001-2007 Mercury Consumption U.S. Mercury Product Manufacturing

Products & Components	Total Mercury Sold in U.S. (Tons)		
	2001	2004	2007
Switches & Relays	57.81	51.78	30.77
Dental Amalgam	30.77	30.39	16.48
Thermostats	14.63	14.16	3.86
Lamps	10.16	9.56	10.63
Miscellaneous	5.11	2.40	2.78
Batteries	2.95	2.53	2.07
Chemicals & Solutions	1.03	0.91	1.43
Sphygmomanometers	2.15	1.11	0.83
Thermometers	1.70	1.40	0.30
Manometers	0.97	1.27	0
Barometer	0.18	0.12	0
Total	~129.4 tons	~115.2 tons	~69.2 tons

Mercury use in U.S. product manufacturing dropped by 46% from 2001 to 2007.[17]

The Failing Industry Thermostat Collection Program

Tons of Mercury in Thermostats Awaiting Collection

While very few new mercury thermostats will be manufactured in the United States,[18] there are many millions of mercury thermostats still in use from historic sales. **Conservative estimates show these thermostats contain 230 tons or more of mercury.** Thermostats can effectively operate for 30 years or more, and in fact are more routinely replaced as a result of building renovations or heating/cooling system upgrades than product failure.

In 1994, EPA estimated 70 million mercury thermostats were installed in domestic residences, and based on three grams of mercury per thermostat, calculated that 230 tons of mercury were on the wall in American homes.[19] The 230 tons may have been an underestimate of the mercury reservoir attributable to thermostats insofar as only thermostats in homes (and not commercial or other buildings) were considered, and the average mercury thermostat contains about four grams of mercury.[20]

Of course, not all these thermostats will come out of service at the same time. **EPA estimated that 2-3 million mercury thermostats come out of service each year, amounting to 7-10 tons of mercury,** again assuming only three grams of mercury per thermostat.[21] This EPA value must also be considered a very conservative estimate, since that same year, in consultation with Honeywell as part of the economic support for the universal waste rulemaking, EPA estimated about 4.5 million mercury thermostats were removed from service annually, 3.4 million from households and the remainder from businesses.[22]

Similarly, TRC (through its consultant) recently provided the State of California its estimate of how many mercury thermostats are available for recycling annually in that state. Estimating only 22%-46% of thermostats from businesses and 27%-47% of thermostats from households in California contain mercury, TRC calculated between 237,000 - 490,000 mercury thermostats will be discarded this coming year statewide.[23] Significantly, the midpoint of this TRC estimate (363,500) is larger than the uppermost range of EPA's very conservative 1994 estimate, based upon California's per capita portion of this estimate.[24]

The Thermostat Recycling Corporation

In 1998, the Big 3 established a non-profit entity called the Thermostat Recycling Corporation (TRC), and began a voluntary industry take back program to collect mercury thermostats in nine states. The TRC program expanded to an additional 13 states in 2000, and became a national program (excluding Alaska and Hawaii) in 2001.[25]

Under the base TRC program, thermostat wholesalers voluntarily enroll to receive a TRC-supplied container for thermostat collection. HVAC contractors are then encouraged to drop off mercury thermostats at participating wholesaler locations when they purchase new thermostats or other supplies.

When the collection container is full, the wholesaler ships it, at TRC expense, to a Honeywell facility in Minnesota, where the thermostat is dismantled and the mercury switch is sent to a commercial mercury recovery facility. A new collection box is sent to the wholesaler after receipt of the shipped container, free of charge, so the out-of-pocket cost for the participating wholesaler is limited to a one-time charge (now $25.00) for the initial collection box.[26]

TRC Program Collection Data

Unfortunately, TRC collection data indicate the base program has failed to collect the vast majority of mercury thermostats coming out of service. Exhibit 3 provides the national program collection data through 2008, the last year for which data are publicly available.

Over this ten year period, TRC collected 7,300 pounds, or 3.65 tons of mercury**. Compared to the conservative EPA estimate of 70-100 tons of mercury in thermostats coming out of service, the TRC program captured 3.7 -5%.**

Even looking at just 2008, the program's most successful year, TRC collected 6.4 -9.2% of the EPA mercury estimate.

Another way to evaluate TRC program effectiveness is to examine the state-by-state program performance data. Exhibit 4 provides the 2008 state collection data, sorted by per capita rates. In almost half of the states where TRC collected thermostats in 2008 (21 of 45), TRC collected less than 1,000 thermostats. TRC collected more than 5,000 thermostats in only nine states.

Exhibit 3

TRC National Annual Collection Summary

Year	Thermostats Collected	Mercury lbs. Collected
1999	27,780	237
2000	31,611	256
2001	48,215	402
2002	90,501	762
2003	64,957	626
2004	80,094	729
2005	87,899	820
2006	113,658	1,083
2007	114,158	1,103
2008	135,604	1,282

Over the past decade, TRC has collected 7,300 lbs. of mercury – less than 5% of what EPA conservatively estimated came out of service.

Using TRC's own estimate of the number of mercury thermostats discarded in California, TRC collected only 1 -3% of the available thermostats in that state.

Other evaluations of the TRC program come to a similar conclusion. For example, the Northeast Waste Management Officials' Association (NEWMOA) recently estimated TRC collected approximately 3% of the mercury thermostats coming out of service in Massachusetts during 2006. Capture rates for other northeast states ranged from 1.3% in New York to 12.7% in Maine.[27]

TRC as Spin Doctors

Rather than working to address these meager collection rates, TRC is working to spin the results of their program. In its 2008 Annual Report, TRC is "ecstatic" about the 19% overall increase in thermostats collected versus 2007, and the "double digit" increases in 27 states.[28]

However, a closer look at TRC's data indicates this method of measuring program performance by annual improvement mostly identifies state collection rates moving from paltry to pathetic.

Exhibit 5 reproduces Table 1 of TRC's 2008 Annual Report providing the state-by-state 2007 and 2008 comparisons. The chart demonstrates, almost invariably, the states with the highest growth rates collected fewer than 1,000 thermostats in 2007, thus even with triple digit increases in collection rates, thermostat collection in these states remains extremely poor.

Accordingly, many of the states with the highest growth rates (i.e., Georgia, Texas) still rank among the lowest in per capita collection rates (compare Exhibits 4 and 5). For example, Georgia is ranked first with a 1050% improvement, but still barely collected 500 thermostats statewide and ranks near the bottom in per capita collection rates.

The objective of thermostat collection is to ensure the mercury in thermostats is not released into the environment at their end of life. Measuring program performance based on its ability to capture mercury thermostats coming out of service is the best indicator of achieving this objective.

In contrast, measuring effectiveness through annual program improvements masks the amount of mercury

Exhibit 4

TRC 2008 Per Capita State Collection Data

State	Thermostats Collected	Population 2008	Thermostats collected per 10,000 residents
Maine	5,555	1,316,456	**42.2**
Minnesota	12,724	5,220,393	**24.4**
Vermont	1,367	621,270	**22.0**
Maryland	10,207	5,633,597	**18.1**
Wisconsin	8,663	5,627,967	**15.4**
Virginia	8,191	7,769,089	**10.5**
Oregon	3,072	3,790,060	**8.1**
Delaware	681	873,092	**7.8**
North Dakota	483	641,481	**7.5**
Ohio	8,571	11,485,910	**7.5**
Michigan	7,436	10,003,422	**7.4**
Indiana	4,614	6,376,792	**7.2**
Florida	12,410	18,328,340	**6.8**
Pennsylvania	7,560	12,448,279	**6.1**
Nebraska	998	1,783,432	**5.6**
Connecticut	1,838	3,501,252	**5.2**
Iowa	1,536	3,002,555	**5.1**
Washington	3,336	6,549,224	**5.1**
Kansas	1,317	2,802,134	**4.7**
Montana	435	967,440	**4.5**
Massachusetts	2,770	6,497,967	**4.3**
New Hampshire	546	1,315,809	**4.1**
Idaho	565	1,523,816	**3.7**
North Carolina	3,407	9,222,414	**3.7**
Kentucky	1,571	4,269,245	**3.7**
Rhode Island	370	1,050,788	**3.5**
Illinois	4,336	12,901,563	**3.4**
New Jersey	2,756	8,682,661	**3.2**
West Virginia	455	1,814,468	**2.5**
South Dakota	173	804,194	**2.2**
New York	3,774	19,490,297	**1.9**
California	7,007	36,756,666	**1.9**
Missouri	895	5,911,605	**1.5**
Tennessee	880	6,214,888	**1.4**
Arizona	763	6,500,180	**1.2**
Nevada	254	2,600,167	**1.0**
Colorado	482	4,939,456	**1.0**
South Carolina	376	4,479,800	**0.8**
Texas	1,820	24,326,974	**0.7**
Arkansas	212	2,855,390	**0.7**
Oklahoma	248	3,642,361	**0.7**
Georgia	506	9,685,744	**0.5**
Mississippi	142	2,938,618	**0.5**
Louisiana	183	4,410,796	**0.4**
Alabama	119	4,661,900	**0.3**
Alaska		686,293	**0.0**
D.C.		591,833	**0.0**
Hawaii		1,288,198	**0.0**
New Mexico		1,984,356	**0.0**
Utah		2,736,424	**0.0**
Wyoming		532,668	**0.0**
Totals	**135,604**	**304,059,724**	**4.5**

Exhibit 5

TRC 2007 to 2008 State Comparisons of Number of Thermostats Collected

State	2007	2008	Growth
Georgia	44	506	1050.00%
Texas	344	1820	429.07%
Rhode Island	81	370	356.79%
Nevada	58	254	337.93%
North Dakota	112	483	331.25%
Idaho	166	565	240.36%
West Virginia	153	455	197.39%
Delaware	229	681	197.38%
Montana	174	435	150.00%
Michigan	3135	7436	137.19%
Kentucky	674	1571	133.09%
Connecticut	839	1838	119.07%
Nebraska	562	998	77.58%
Arkansas	122	212	73.77%
Kansas	836	1317	57.54%
New York	2396	3774	57.51%
Virginia	5817	8191	40.81%
Massachusetts	2024	2770	36.86%
South Carolina	280	376	34.29%
Ohio	6544	8571	30.97%
Pennsylvania	6175	7560	22.43%
California	5750	7007	21.86%
Maine	4656	5555	19.31%
New Jersey	2329	2756	18.33%
Minnesota	10795	12724	17.87%
Maryland	8765	10207	16.45%
North Carolina	2994	3407	13.79%
Oregon	2796	3072	9.87%
Florida	12261	12410	1.22%
Illinois	4367	4336	-0.71%
Colorado	490	482	-1.63%
Washington	3398	3336	-1.82%
Arizona	838	763	-8.95%
New Hampshire	615	546	-11.22%
Iowa	1735	1536	-11.47%
Indiana	5490	4614	-15.96%
Vermont	1665	1367	-17.90%
Wisconsin	11542	8663	-24.94%
Missouri	1332	895	-32.81%
Louisiana	391	183	-53.20%
South Dakota	564	173	-69.33%
Alabama	540	119	-77.96%

TRC's measure of program effectiveness, the percentage improvement over the previous year, ignores the fact that most mercury thermostats are still not collected and often highlights the states with the worst performing programs.

eluding the collection program and potentially released to the environment due to improper waste management.

It is essential to include performance goals in state programs because absent such goals, program success is undefined. This vacuum allows TRC to tout the collection of less than 1,000 thermostats in almost half their states as "successful," simply because the total number of thermostats collected grows a little bit each year.

Getting By On A Shoestring

TRC's poor program performance reflects the relatively meager resources manufacturers devote to the program.

For 2008, TRC spent about $275,000 to support its program nationwide, according to information TRC provided to the Maine Department of Environmental Protection.[29] Of this total, $160,405 reflects the cost associated with transporting, processing and recycling the thermostats.[30] An additional $77,542 supported the TRC Executive Director and overhead. Of the remaining amount, TRC devoted $21,024 to education and outreach in Maine, and virtually nothing on education and outreach anywhere else (besides general website maintenance).

With only one dedicated staff person for the entire country, and no significant budget for education and outreach (except where a new law forced the issue), the TRC program results are not surprising. Perhaps what is surprising is that TRC has been able to squeeze by with so little financial investment for so long. Again, without meaningful performance standards, the easy and cheaper road will remain available to TRC.

State Action to Promote Thermostat Collection Programs

In response to the lackluster TRC program, states and local governments have undertaken initiatives to improve thermostat collection rates. Two of the most important initiatives, from Maine and Vermont, are highlighted here.[31]

Maine's Leading Program

In 2006, Maine enacted the first comprehensive mercury thermostat collection law in the nation.[32] The legislation includes the following components:

- Mercury thermostat manufacturers who sold thermostats in Maine are required to establish a collection program serving both HVAC professionals and homeowners.
- The sale of *any* thermostat in Maine by manufacturers not complying with the collection requirement is prohibited.
- Manufacturers are required to provide a financial incentive with a minimum value of $5 to both professionals and homeowners for returning a mercury thermostat to their collection locations.
- Manufacturers are required to provide collection services to wholesalers and household hazardous waste (HHW) facilities.
- Wholesalers which sell thermostats must participate in the manufacturer collection programs.
- Aggressive performance goals were established for the manufacturer collection programs based on the amount of mercury collected from thermostats coming out of service.

As a result of implementing this legislation, Maine has achieved the highest per capita mercury thermostat collection rate in the country by far, almost twice as high as the second best state, and almost 10 times the national average (see Exhibit 4).

The Vermont Pilot

In 2007, the Vermont Agency of Natural Resources (VT ANR) launched a thermostat collection pilot project in collaboration with 86 retail hardware stores. For two months, homeowners were provided an in-store credit of $5 usable for any item in the store if they returned their used mercury thermostats for recycling.

During these two months, almost 1,200 mercury thermostats were collected, more thermostats than TRC had collected in Vermont in five years (from 2002-2006).[33] As the VT ANR indicated in its report on the pilot to the Vermont Legislature:

> ...a financial incentive coupled with adequate program advertising and convenient recycling can yield substantial increases in mercury thermostat recycling. Through contact with homeowners who participated in Vermont's pilot program, there seemed to be a variety and often a combination of factors that motivated individuals to participate, including the cash incentive, convenient recycling, and environmental concerns....
>
> Was the cash incentive a significant motivating factor in the collection program? It was significant enough that of all the thermostats collected, only about 40 of the thermostats did not have a cash incentive payout (and some of this was due to a limit of 3 thermostat rebates per customer when a customer turned in more than three thermostats).
>
> The [ANR] has seen disappointing results in thermostat collection at wholesaler locations when only outreach and convenient recycling have been provided as motivators....we believe that a similar financial incentive offered for mercury thermostats returned primarily by contractors to wholesale locations would yield significant increases in thermostat collection.[34]

This successful pilot led to the adoption of a Vermont thermostat collection law in 2008 that includes, among other provisions, a requirement that thermostat manufacturers provide a minimum $5.00 financial incentive for each mercury thermostat that is turned in for recycling by either professionals or homeowners.[35]

These practices are in line with the results of a report the state of Massachusetts contracted from NEWMOA to identify mechanisms that could be used to enhance the recycling of thermostats. The report reviewed thermostat collection and recycling programs from several states and by TRC in order to determine best practices. The report recommends four characteristics of successful programs, namely: 1) a mandated financial incentive for contractors and homeowners that collect and recycle thermostats, 2) an effective education program about disposal ban requirements, 3) accessible and convenient collection sites, and 4) outreach about the environmental and health benefits of thermostat recycling.[36]

Policy Recommendations

Based on the experiences of states with collection programs, and reinforced by the NEWMOA report, there are several key steps that state governments should take immediately to prevent mercury thermostats from entering the waste stream, and ultimately, contaminating the environment.

1.) States should ban the sale of mercury thermostats. While the Big 3 U.S. manufacturers report that they have ended mercury thermostat production, other smaller domestic or overseas manufacturers may continue to sell mercury thermostats where permitted by law. Fifteen states have already prohibited the sale of mercury-containing thermostats. With viable non-mercury thermostats now dominating the market, all states should ban the sale of mercury-containing thermostats.

2.) States should ban the disposal of all mercury-containing thermostats into the solid waste stream. To both encourage active participation in collection programs and to prevent mercury pollution in the environment, states should require that all mercury thermostats be recycled.

3) States should require manufacturers to finance thermostat collection systems and provide a financial incentive to encourage participation in the program. The collection and recycling of mercury thermostats should be made a legal obligation for manufacturers who sold mercury thermostats. The TRC program could meet this obligation, if it provides convenient collection options for both contractors and homeowners, enhanced education and outreach, and a financial incentive to encourage contractor and homeowner participation. The financial incentive has been demonstrated to significantly improve collection rates.

4) States should require that manufacturer take-back programs be held accountable to meaningful and quantifiable performance standards. Because the goal is to reduce mercury pollution, the TRC program must be held to meaningful performance standards based on the percentage of annually discarded mercury thermostats collected. Program performance should be evaluated periodically against the standards to determine if program enhancements are required.

5) States should require wholesalers to provide bins and consumer education as part of a collection program. Wholesalers selling thermostats to contractors must participate in the manufacturer collection program to ensure convenient collection locations are available to contractors. Wholesalers must inform their contractor customers of the presence of the bins in their stores, and the legal and environmental necessity of returning mercury thermostats for recycling.

6) States should require HVAC contractors to participate in the collection program as part of their licensing arrangement with the state. Contractors replacing mercury thermostats for homeowners should assume responsibility for complying with this collection requirement. Recycling mercury thermostats should become a condition of contractor professional licensing, where such licensing requirements exist.

7) All government agencies and low-income housing facilities should establish procurement preferences for energy efficient programmable thermostats. Even among non-mercury thermostats, there are often significant differences in efficiency. Purchases involving taxpayer dollars should be encouraging the production and use of the more energy efficient models.

End Notes

1. Thermostat Recycling Corporation (TRC) Website http://www.thermostat-recycle.org/FAQ, as viewed on January 14, 2010.

2. CDC's National Health and Nutrition Examination Survey (NHANES) http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5343a5.htm

3. Choi, AL, P Weihe, E Budtz-Jørgensen, PJ Jørgensen, JT Salonen, T-P Tuomainen, K Murata, HP Nielsen, MS Petersen, J Askham and P Grandjean. 2008. Methylmercury exposure and adverse cardiovascular effects in Faroese whaling-men. Environmental Health Perspectives http://ehp.niehs.nih.gov/docs/2008/11608/abstract.html.

4. Northeast States Succeed in Reducing Mercury in the Environment http://www.newmoa.org/prevention/mercury/MercurySuccessStorySummary.pdf

5. U.S. Environmental Protection Agency (EPA) National Listing of Fish Advisories General Fact Sheet: 2008 National Listing http://www.epa.gov/waterscience/fish/advisories/fs2008.html

6. EPA and FDA Advice. What You Need to Know about Mercury in Fish and Shellfish 2004 http://www.epa.gov/waterscience/fish/advice/index.html

7. Interstate Mercury Education and Reduction Clearinghouse (IMERC) Fact Sheet Mercury Use in Thermostats Last Update: July 2008 http://www.newmoa.org/prevention/mercury/imerc/factsheets/thermostats.pdf

8. See discussion below and IMERC Fact Sheet: Mercury Use in Thermostats http://www.newmoa.org/prevention/mercury/imerc/factsheets/thermostats.pdf

9. TRC Mercury Thermostat Facts http://www.thermostat-recycle.org/mercuryfacts

10. Energy Star Programmable Thermostats http://www.energystar.gov/index.cfm?c=thermostats.pr_thermostats

11. Million Car Carbon Campaign http://www.millioncarcampaign.com/thermostatrebates.php

12. Use and Release of Mercury in the United States, EPA/600/R-02/104, December 2002 (hereafter "EPA Report"), available at http://www.epa.gov/nrmrl/pubs/600r02104/600r02104prel.pdf, Exhibit 3 -8.

13. IMERC was created in 2001 to facilitate implementation of state mercury product legislation, including the collection and analysis of data submitted by product manufacturers pursuant to notification requirements in the legislation. Fourteen states are now members of IMERC. For more information on IMERC, see http://www.newmoa.org/prevention/mercury/imerc/about.cfm.

14. See IMERC notification report at http://www.newmoa.org/prevention/mercury/imerc/Notification/totals.cfm?total=417&filing=1162.

15. Presentation of Adam Wienert, IMERC Coordinator, November 2009 (hereafter "IMERC Presentation"), available at http://www.newmoa.org/prevention/mercury/conferences/sciandpolicy/presentations/Wienert_Session3B.pdf.

16. The Big 3 used 2.95 tons of mercury to manufacture thermostats in 2007, and based on their announcements, it can be presumed this mercury use ended shortly thereafter. See National Electrical Manufacturers Association (NEMA) notification to IMERC dated April 11, 2008.

17. IMERC Presentation.

18. The import and sale of mercury thermostats may still occur, thus legislation restricting mercury thermostat sales is still advised, as discussed below.

19. EPA Report at 29.

20. As noted in Exhibit 3, the 135,604 thermostats TRC collected in 2008 contained 1,282 pounds of mercury. This 1,282 pounds corresponds to 581,505 grams of mercury, or 4.29 grams of mercury per thermostat.

21. EPA Report at 30.

22. Analysis of Potential Cost Savings and the Potential for Reduced Environmental Benefits of the Proposed Universal Waste Rule, EPA 530-R-94-023, April 1994, p. 3-10.

23. Skumatz Economic Research Associates, Mercury-Containing Thermostats: Estimating Inventory and Flow from Existing Residential & Commercial Buildings, December 28, 2009, Tables 1.1 and 1.5 (hereafter "TRC California Report"), available at htt://www.dtsc.ca.gov/HazardousWaste/upload/TRCThermostat-Report-12_09.pdf.

24. California accounts for about 12% of the USA population, so 3,000,000 thermostats x 0.12 = 360,000 thermostats.

25. Other manufacturers have now joined the TRC collection program, in response to state laws requiring thermostat collection in Maine and elsewhere (see discussion below).

26. See generally the TRC website, at http://www.thermostat-recycle.org/howitworks.

27. Review and Assessment of Thermostat Recycling Activities in the Northeast, NEWMOA, June 2008 (hereafter "NEWMOA Report"), pp. 6-8, available at http://www.newmoa.org/prevention/mercury/publications.cfm.

28. TRC 2008 Annual Report, p. 3, available at http://www.thermostat-recycle.org/files/2008%20TRC%20Annual%20Report.pdf.

29. TRC's 2008 Annual Collection Report to Maine DEP, January 30, 2009, Table 4.

30. Because of TRC's accounting methods, the 2008 recycling expenses reflect the actual recycling costs in 2007. Since 114,158 thermostats were collected in 2007, TRC's recycling costs average to about $1.41/thermostat.

31. For a description of other state and local government initiatives, see the NEWMOA Report.

32. For the Maine law, see 38 MRSA §1665-B http://www.mainelegislature.org/legis/statutes/38/title38sec1665-B.html

33. Mercury Thermostats: Methods to Increase Recycling, VT ANR Legislative Report, January 15, 2008 (hereafter "VT Pilot Report"), pp. 3-4, available at http://www.mercvt.org/PDF/ThermostatFINAL.pdf.

34. Vermont Pilot Report, p. 6.

35. For a copy of the Vermont law, see http://www.leg.state.vt.us/docs/legdoc.cfm?URL=/docs/2008/acts/ACT149.HTM.

36. See the NEWMOA Report.

PRODUCT STEWARDSHIP INSTITUTE

Sustainable Solutions to Protect Our Environment

ELEMENTS OF STATE LEGISLATION							
STATE LEGISLATION ON MERCURY THERMOTSTATS	**SALES BAN[1]**	**DISPOSAL BAN[2]**	**HVAC LICENSING[3]**	**INCENTIVES[4]**	**PERFORMANCE GOALS[5]**	**RESPONSIBILITIES[6] M=manufacturer R=retailer W=wholesaler C=contractor A=agency HHW = household hazardous waste UW = Universal Waste**	**PILOT PROJECTS AND PAST EFFORTS**
PSI Model Legislation Developed through multi-stakeholder dialogue. http://productstewardship.us/displaycommon.cfm?an=1&subarticlenbr=99	Y	Y	Y	Options: 1. Specify amount but not cash v. rebate 2. Specify amount & whether cash v. rebate 3. Defer to administrative or stakeholder process	Y Recommended based on recycling rate	**M:** Must develop & implement free collection for C & public through HHW & UW collection; may be required to do outreach **R:** Education; may not sell products of a non-compliant manufacturer **W:** Collection center and education **C:** **A:** May do outreach	N/A

[1] "Sales ban" refers to a ban on the sale of any thermostats that contain mercury.
[2] "Disposal ban" refers to a ban on the disposal of mercury thermostats in municipal solid waste or any other disposal method besides recycling.
[3] "HVAC licensing" refers to a requirement that professional licenses for heating, ventilation, and air conditioning contractors include information about recycling and the requirement that all mercury thermostats be recycled.
[4] "Incentives" can be either financial or otherwise.
[5] "Performance goals" are based on either the number of thermostats collected/recycled or a rate (expressed as a percentage) based on both the number of thermostats collected/recycled and another variable (e.g., amount sold, amount available for collection, etc.).
[6] The roles and responsibilities of different groups are either specified in legislation or determined by the appropriate agency or stakeholder group.

ELEMENTS OF STATE LEGISLATION							
STATE LEGISLATION ON MERCURY THERMOTSTATS	SALES BAN[1]	DISPOSAL BAN[2]	HVAC LICENSING[3]	INCENTIVES[4]	PERFORMANCE GOALS[5]	RESPONSIBILITIES[6] M=manufacturer R=retailer W=wholesaler C=contractor A=agency HHW = household hazardous waste UW = Universal Waste	PILOT PROJECTS AND PAST EFFORTS
California AB 2347 Mercury Thermostat Collection Act 2008 Status: Passed the Senate 8-19-2008; Passed the Assembly 8-19-2008; Approved by Governor September 29, 2008. http://www.leginfo.ca.gov/cgi-bin/postquery?bill_number=ab_2347&sess=CUR&house=B&author=ruskin	Y	Y	N[7]	Y Manufacturers to provide incentives and education to contractors, service technicians and homeowners to encourage recycling. Amount not specified.	Y TBD by January 1, 2012, collection rates as percentage of out-of-service thermostats that become waste annually. Manufacturers to design and implement survey and present results to agency by December 31, 2009. Intent to recycle maximum feasible number of thermostats	**M:** Finance & manage program; provide collection bins for free to wholesalers, HHW sites and event and participating retailers; education & outreach; submit survey plan and data for calculating number of waste thermostats generated each year; submit annual report starting April 1, 2010 **R:** Encouraged to participate & negotiate with manufacturers to do so, not required. Can not offer for sale thermostats produced by a noncompliant manufacturer, must include mail-back options to buyers purchasing through mail **W:** Required to serve as collection site; distribute manufacturer's educational materials, must include mail-back options to buyers purchasing through mail **C:** Contractors that install thermostats must bring them to collection point (not left with the homeowner); demolition contractors must remove thermostats prior to demolition and take them to a collection point **A:** Review and approve manufacturer's stewardship plan; maintain website with program information; adopt regulations that set performance requirements and establish methodology for calculating the number of thermostats that become waste annually by January 1,2012	N/A

[7] Will not include licensing requirement, but may include language to the effect that contractors are not allowed to leave replaced mercury thermostats with home owners.

ELEMENTS OF STATE LEGISLATION							
STATE LEGISLATION ON MERCURY THERMOTSTATS	SALES BAN[1]	DISPOSAL BAN[2]	HVAC LICENSING[3]	INCENTIVES[4]	PERFORMANCE GOALS[5]	RESPONSIBILITIES[6] M=manufacturer R=retailer W=wholesaler C=contractor A=agency HHW = household hazardous waste UW = Universal Waste	PILOT PROJECTS AND PAST EFFORTS
Illinois HB5348 Mercury Thermostat Collection Act Status as of 9-30-2008: referred to Rules on April 9, 2008 http://www.ilga.gov/legislation/billstatus.asp?DocNum=5348&GAID=9&GA=95&DocTypeID=HB&LegID=36610&SessionID=51	Y[8]	N		Financial incentive or other incentives designed to encourage sufficient participation to achieve collection goals	2011-2012 15% of the estimated # in state that are removed from service during the calendar year 2013-14 30% 2015-16 50% 2017 + 80% No penalty for not meeting goals Thermostats handled as universal waste	**M**: Establish/maintain recycling program; include incentive to help meet goals; education/outreach to R, M, C, and homeowners; fines of $1,000 - $5,000+ fee and unable to sell thermostats if in non-compliance **R**: May voluntarily act as collection site; may provide educational materials **W**: May not sell thermostats unless participates as collection site **C**: May not install/replace thermostats unless return Hg thermostats to collection site; may voluntarily collect **R, W, C:** non-compliance penalty of $250 - $500; may pay one-time fee not to exceed $75 **A**: Enforcement; assist with education/outreach; estimate annual # of thermostats taken out of service; annual report on collection rate; study on collection options for retailers; approve M's plan	As of 2006, 47 wholesalers have bins (a less-than-20% participation rate). 28 contractors recruited by Dept (participation rate less than 1%). Collection at HHW events (20-30 per year) Legislative study: www.epa.state.il.us/mercury/iepa-mercury-report.pdf

[8] IL P.A. 095-0452 bans sale of mercury switch thermostats as of July 1, 2008.

ELEMENTS OF STATE LEGISLATION							
STATE LEGISLATION ON MERCURY THERMOTSTATS	SALES BAN[1]	DISPOSAL BAN[2]	HVAC LICENSING[3]	INCENTIVES[4]	PERFORMANCE GOALS[5]	RESPONSIBILITIES[6] M=manufacturer R=retailer W=wholesaler C=contractor A=agency HHW = household hazardous waste UW = Universal Waste	PILOT PROJECTS AND PAST EFFORTS
Iowa HF 2669 enacted in 2008 Collection and recycling of mercury-added thermostats. http://coolice.legis.state.ia.us/Cool-ICE/default.asp?Category=BillInfo&Service=Billbook&hbill=HF2329	Y	Y	N	If performance goals are not met the department, in consultation with NEMA and others, may consider modifications.	"As many of the thermostats as reasonably practicable." The department will set goals in consultation with stakeholders by 1/1/09. Department proposed goals: 50% recovery for 2009 80% recovery for 2010 90% recovery 2011 and beyond	**M:** Develop and implement a program that includes education and outreach to W, R, C, and homeowners, collection containers for all W, and establishment of collection points for homeowners **R:** Participate in education and outreach program (materials provided by manufacturers). May not sell thermostat from non-compliant manufacturer **W:** Serve as a collection point. May not sell thermostats from a non-compliant manufacturer **C:** Thermostats must be brought to collection point **A:** Review M plan, take public comment on plan, report annually to the legislature	Currently 20 wholesalers participate in TRC. A group of students from the West Branch Middle School recently received a grant to purchase 25 TRC collection containers that will be given to HVAC contractors.

ELEMENTS OF STATE LEGISLATION							
STATE LEGISLATION ON MERCURY THERMOTSTATS	SALES BAN[1]	DISPOSAL BAN[2]	HVAC LICENSING[3]	INCENTIVES[4]	PERFORMANCE GOALS[5]	RESPONSIBILITIES[6] M=manufacturer R=retailer W=wholesaler C=contractor A=agency HHW = household hazardous waste UW = Universal Waste	PILOT PROJECTS AND PAST EFFORTS
Maine Maine Thermostat Law 38 MRSA §1665-B	Y[9]	Y[10]	Y	$5 incentive (minimum) per thermostat, paid by manufacturers. Structure of incentive (cash, rebate etc.) left up to a stakeholder group. Stakeholders decided on direct cash incentive to the HVAC tech or homeowner. Retail may provide an in-store $5 gift card.	Y – 125 lbs. Mercury collected per year w/in 2 years, then 160 lbs./year thereafter (pounds based on % of # removed annually.)	**M:** Establish & maintain recycling program; pay incentive; conduct education and outreach **R:** May not sell any thermostats from non-compliant manufacturers. May voluntarily act as collection site **W:** Collection bins on site; provide HVAC techs with redemption coupon; do not sell any thermostats from noncompliant manufacturers **C:** Recycle thermostats; HVAC techs licensed by A **Municipalities:** Collection of thermostats at HHW; provide data on collection **A:** Develop financial incentive plan for M; Enforcement; assist with education & outreach	As of April 2008, 72 wholesalers are collecting thermostats. Expect 150+ retail stores to start collection by May 2008

[9] Maine law at 38 MRSA § 1661-C, sub-§ 5 banned sale of mercury switch thermostats as of January 1, 2006.

[10] Maine law at 38 MRSA § 1663 banned the disposal of any product containing mercury as of July 15, 2002.

ELEMENTS OF STATE LEGISLATION							
STATE LEGISLATION ON MERCURY THERMOTSTATS	SALES BAN[1]	DISPOSAL BAN[2]	HVAC LICENSING[3]	INCENTIVES[4]	PERFORMANCE GOALS[5]	RESPONSIBILITIES[6] M=manufacturer R=retailer W=wholesaler C=contractor A=agency HHW = household hazardous waste UW = Universal Waste	PILOT PROJECTS AND PAST EFFORTS
Massachusetts *M.G.L. - Chapter 21h, Section 6d *The law pertaining to mercury and solid waste facilities appears in Massachusetts General Laws, Chapter 21h, sections 6a through 6n. Effective date is May 1, 2008 ****	Y	Y	N	N	N	**M:** current manufacturers of thermostats are responsible for collection and recycling and submitting plans **R:** Not allowed to sell mercury thermostats after 5/1/08 **W:** May not sell/distribute mercury thermostats after 5/1/08. 63 participating in TRC, + 5 wholesaler chains & 1 additional **C:** Must recycle EOL mercury thermostats after 5/1/08 **A:** Education program	Offering TRC Box to all municipalities Major Municipal Waste Combustors have collection and incentive payment programs
Montana SB 423 tabled 04-07 for financial reasons (Campaign led by Women's Voices for the Earth (WVE)) http://data.opi.mt.gov/bills/2007/billpdf/SB0423.pdf *Needs to be revised according to new versions of legislation**							

ELEMENTS OF STATE LEGISLATION							
STATE LEGISLATION ON MERCURY THERMOTSTATS	SALES BAN[1]	DISPOSAL BAN[2]	HVAC LICENSING[3]	INCENTIVES[4]	PERFORMANCE GOALS[5]	RESPONSIBILITIES[6] M=manufacturer R=retailer W=wholesaler C=contractor A=agency HHW = household hazardous waste UW = Universal Waste	PILOT PROJECTS AND PAST EFFORTS
New Hampshire SB.528 http://gencourt.state.nh.us/bill_status/bill_status.aspx?lsr=2887&sy=2008&sortoption=&txtsessionyear=2008&txtbillnumber=SB528&q=1 Signed by Governor July 11, 2008 (Effective Date)	Y	Y	N	N	Y - Would be set w/in 4 months of 1st report of manufacturer's program M must "strive to maximize capture and recycling rate"	**M:** Fund collection and recycling program w/ C, W, and HHW; education/outreach; submit annual reports **R:** May not sell thermostats from noncompliant M; post signage **W:** Collect thermostats or cannot sell them; may pay one-time fee no more than $25 to collect; may not sell thermostats from noncompliant M **C:** Required to remove and recycle through M's program or manage as RCRA hazardous waste. Cannot install after 07/01/08 **HHW:** Collect thermostats **A:** Set safety guidelines; approve M's plan; involve stakeholders in plan review; maintain collection information on website	Wholesalers participation rate less than 50%

ELEMENTS OF STATE LEGISLATION							
STATE LEGISLATION ON MERCURY THERMOTSTATS	SALES BAN[1]	DISPOSAL BAN[2]	HVAC LICENSING[3]	INCENTIVES[4]	PERFORMANCE GOALS[5]	RESPONSIBILITIES[6] M=manufacturer R=retailer W=wholesaler C=contractor A=agency HHW = household hazardous waste UW = Universal Waste	PILOT PROJECTS AND PAST EFFORTS
Oregon HB3007 (passed 2001) http://ssl.csg.org/dockets/23cycle/2003A/23ABills/0223a01or.pdf	N[11]	N[12]	N	Manufacturers must provide incentives; not specific as to type/size	N	**M:** Mandated to provide collection programs, provide incentives, and outreach on proper disposal **R:** n/a **W:** n/a **C:** Required to dispose of thermostats as instructed **A:** Prohibit installation of mercury thermostats (residential or commercial); notify contractors of requirements	

[11] The law does not specifically include a sales ban, however it does require the Dept. of Consumer and Business Services to prohibit the installation of mercury thermostats in commercial and residential buildings, but not in industrial equipment using the thermostats for safety reasons.

[12] The law does not directly ban the disposal of thermostats, however, does ban the disposal of thermostats with mercury still in them. The mercury has to be removed before a thermostat enters the solid waste stream.

ELEMENTS OF STATE LEGISLATION							
STATE LEGISLATION ON MERCURY THERMOTSTATS	SALES BAN[1]	DISPOSAL BAN[2]	HVAC LICENSING[3]	INCENTIVES[4]	PERFORMANCE GOALS[5]	RESPONSIBILITIES[6] M=manufacturer R=retailer W=wholesaler C=contractor A=agency HHW = household hazardous waste UW = Universal Waste	PILOT PROJECTS AND PAST EFFORTS
Pennsylvania SB 830 and HB 44 http://www.legis.state.pa.us/CFDOCS/Legis/PN/Public/btCheck.cfm?txtType=HTM&sessYr=2007&sessInd=0&billBody=S&billTyp=B&billNbr=0830&pn=0967 (SB 830) http://www.legis.state.pa.us/CFDOCS/Legis/PN/Public/btCheck.cfm?txtType=HTM&sessYr=2007&sessInd=0&billBody=H&billTyp=B&billNbr=0044&pn=0069 (HB 44) On October 9, 2008, HB 44 was approved by the governor **Needs to be revised according to new versions of legislation**	Y	Y	N	May be included, but not required unless performance goals not met	Y Manufacturers establish goals in annual reports submitted to PA Department of Environmental Protection. Collection goals to ensure increase in the number of thermostats collected each year until 2015 or when department determines the number of in-service thermostats is declining	**M:** Establish and maintain collection and recycling for W, C, R, homeowners, and service technicians; provide education and outreach; must be free to participate, except for W, C, and R below; may provide incentives as means to achieve goals **R:** May pay one-time administrative fee; may not sell thermostats unless act as collection site or provide notice to consumer that recycling is required and include in notice names and locations of any collection sites within reasonably close proximity that recycle mercury thermostats **W:** May pay one-time administrative fee; may not sell thermostats unless act as collection site **C:** May pay one-time administrative fee; may not sell thermostats unless act as collection site or provide notice to consumer that recycling is required **A:** Education on safe disposal; approve M's program; distribute a list of collection sites to wholesalers, retailers and contractors or make the list available on the Department's web site	Voluntary manufacturer recycling program operating since 2000

ELEMENTS OF STATE LEGISLATION							
STATE LEGISLATION ON MERCURY THERMOTSTATS	SALES BAN[1]	DISPOSAL BAN[2]	HVAC LICENSING[3]	INCENTIVES[4]	PERFORMANCE GOALS[5]	RESPONSIBILITIES[6] M=manufacturer R=retailer W=wholesaler C=contractor A=agency HHW = household hazardous waste UW = Universal Waste	PILOT PROJECTS AND PAST EFFORTS
Vermont H.515 http://www.leg.state.vt.us/database/status/summary.cfm?Bill=H%2E0515&Session=2008 This Act (Act No. 149) has an effective date of July 1, 2008. Deadline for submission of plans October 1, 2008 – Deadline for implementation of plan by manufacturers – April 1, 2009 §7116 will become a part of 10 VSA Chapter 164 http://www.leg.state.vt.us/statutes/sections.cfm?Title=10&Chapter=164	Y	Y	N	$5 cash for technicians and other registered collection points $5 off the purchase of in store products in retail locations for homeowners	Y - 65% collection rate by 7/1/2011 Manufacturers report data each year	**M:** Set up collection and incentives for thermostats from all sources (W, R, municipalities and SWD) including education and outreach; annual reports- collection containers for all W, R and registered collection points **R:** Mandatory participation in education and outreach program (materials provided by manufacturers). Voluntary collection point. May not sell thermostat from non-compliant manufacturer **W:** Mandatory collection points. May not sell thermostats from noncompliant M **C:** Recycle thermostats **A:** Approve M's plan; public comment on plan, review M's annual reporting; conduct education and outreach	Wholesalers 32 bins - 2001 21 - 2007 2007 2-month retail Pilot Project – 86 participants –see details in legislative report below. Legislative study (mandated by law) report available at: http://www.mercvt.org/PDF/ThermostatFINAL.pdf 1999 mercury products law required contractors to source separate and manage as hazardous waste and disposal ban on labeled mercury-added products – (incl. thermostats) subsequent law disposal ban on mercury products labeled or not.

PRODUCT STEWARDSHIP INSTITUTE

Sustainable Solutions to Protect Our Environment

State Legislation

ELEMENTS OF STATE LEGISLATION							
STATE LEGISLATION ON MERCURY THERMOTSTATS	**SALES BAN[1]**	**DISPOSAL BAN[2]**	**HVAC LICENSING[3]**	**INCENTIVES[4]**	**PERFORMANCE GOALS[5]**	**RESPONSIBILITIES[6] M=manufacturer (brand owner); R=retailer; W=wholesaler; C=contractor; A=agency; H=Homeowner; HHW = household hazardous waste; UW = Universal Waste**	**PILOT PROJECTS AND PAST EFFORTS**
PSI Model Legislation Developed through multi-stakeholder process. http://productstewardship.us/displaycommon.cfm?an=1&subarticlenbr=99 Contact: Scott Cassel, PSI 29 Stanhope St., 3rd Floor Boston, MA 02116 617-236-4822 scott@productstewardship.us	Y	Y	Y	Y Specify amount and type	Y Percentage goals based on capture rate of mercury thermostats replaced (with timetable) Allows state agency to alter program to meet goals through stakeholder process State agency charged with estimating the	**M:** Must develop & implement agency-approved collection and recycling program (individually or collectively); provide collection bins at nominal one-time administrative cost to collection points; establish financial incentive and specify dollar amount and type; education and outreach; submit annual report to **A**; remain in compliance or be subject to sales ban for all thermostats **R**: Education (importance of recycling and locations); prohibited from selling mercury thermostats; may not sell any thermostats	N/A

[1] "Sales ban" refers to a ban on the sale of any thermostats that contain mercury.
[2] "Disposal ban" refers to a ban on the disposal of mercury thermostats in municipal solid waste or any other disposal method besides recycling.
[3] "HVAC licensing" refers to a requirement that professional licenses for heating, ventilation, and air conditioning contractors include information about recycling and the requirement that all mercury thermostats be recycled.
[4] "Incentives" can be either financial or otherwise.
[5] "Performance goals" are based on either the number of thermostats collected/recycled or a rate (expressed as a percentage) based on both the number of thermostats collected/recycled and another variable (e.g., amount sold, amount available for collection, etc.).
[6] The roles and responsibilities of different groups are either specified in legislation or determined by the appropriate agency or stakeholder group.

ELEMENTS OF STATE LEGISLATION							
STATE LEGISLATION ON MERCURY THERMOTSTATS	SALES BAN[1]	DISPOSAL BAN[2]	HVAC LICENSING[3]	INCENTIVES[4]	PERFORMANCE GOALS[5]	RESPONSIBILITIES[6] M=manufacturer (brand owner); R=retailer; W=wholesaler; C=contractor; A=agency; H=Homeowner; HHW = household hazardous waste; UW = Universal Waste	PILOT PROJECTS AND PAST EFFORTS
					number of mercury thermostats potentially available for collection annually	from a non-compliant manufacturer; collection optional; might facilitate a homeowner mail-back program paid for by manufacturers **W:** prohibited from selling mercury thermostats; disposal prohibition; must act as collection point or be banned from all thermostat sales; may not sell any thermostat from a non-compliant manufacturer **C:** Required to recycle; installation of mercury thermostats prohibited; disposal ban; disposal ban and recycling requirement conditions of licensing requirements (in some states) **A:** Review **M** plans; evaluate and/or set performance goals; enforce against non-compliant entities; report back to legislature on needed program improvements **H:** mercury thermostat disposal prohibition and installation prohibition	
Connecticut **HB6113:** Introduced January 2009. As of February 17, 2009, this bill did not get a hearing and will not be moved out of committee in the 2009 season.	Y	N	N	Y: $5 per thermostat for **W**, **C**, service technicians; and homeowners & nonprofessionals	Y: collection and recycling of 65% of out-of-service thermostats	**M:** Submit collection and financial incentive plan to **A**; education and outreach for **W**, **R**, **C,** and homeowners; provide containers to **W**; collection systems that use mail-back options OK; submit to **A** national annual sales data from 1958 to present; implement Agency-approved collection plans for **C** and service technicians by April 1, 2010 and for	

ELEMENTS OF STATE LEGISLATION							
STATE LEGISLATION ON MERCURY THERMOTSTATS	SALES BAN[1]	DISPOSAL BAN[2]	HVAC LICENSING[3]	INCENTIVES[4]	PERFORMANCE GOALS[5]	RESPONSIBILITIES[6] M=manufacturer (brand owner); R=retailer; W=wholesaler; C=contractor; A=agency; H=Homeowner; HHW = household hazardous waste; UW = Universal Waste	PILOT PROJECTS AND PAST EFFORTS
Contact: Tom Metzner Environmental Analyst Connecticut Department of Environmental Protection 79 Elm Street, 4th Floor Hartford, CT 06106 (860) 424-3242 Tom.metzner@ct.gov						homeowners and nonprofessionals by July 1, 2010; submit Annual Report to **A** that includes number of thermostats collected **W**: act as collection sites **R:** sales banned unless participate in education and outreach program for consumers **A**: website posting of registered collection points; education and outreach for **W**, **R**, **C**, and homeowners; Annual Report to General Assembly Environment Committee; estimate number of out-of-service thermostats generated annually in CT; may inspect manufacturer records, request third-party audits, or investigate to verify historic sales or collection program effectiveness data	
							As of 2006, 47 wholesalers have bins (a less-than-20% participation rate). 28 contractors recruited by Dept

ELEMENTS OF STATE LEGISLATION							
STATE LEGISLATION ON MERCURY THERMOTSTATS	SALES BAN[1]	DISPOSAL BAN[2]	HVAC LICENSING[3]	INCENTIVES[4]	PERFORMANCE GOALS[5]	RESPONSIBILITIES[6] M=manufacturer (brand owner); R=retailer; W=wholesaler; C=contractor; A=agency; H=Homeowner; HHW = household hazardous waste; UW = Universal Waste	PILOT PROJECTS AND PAST EFFORTS
							(participation rate less than 1%). Collection at HHW events (20-30 per year) Legislative study: www.epa.state.il.us /mercury/iepa-mercury-report.pdf
Massachusetts H. 831 filed on January 14, 2009, introduced by Representative Frank Smizik. Contact: Elizabeth Saunders Environmental Health Leg. Dir. Clean Water Action 262 Washington St #301 Boston, MA 02108 617-338-8131 x203	Y	Y	N	Y: $5 per thermostat cash or coupon to contractors, techs, homeowners and non-professionals	Y: collection and recycling of 65% of out-of-service thermostats	**M:** File implementation plan with Agency; edcuation and outreach; provide collection for **W** and collection points (mail-back OK); Annual Report to **A** including number of thermostats collected; report annually to legislature; annually provide **A** with number of thermostats in commonwealth including projections to 2030; may file alternate plans if achieve 90% capture rate **A:** Post registered collection points on website; education and outreach;Annual Report to legislature; annually estimate number of out-of-service thermostats generated and require adjustments to manufacturers plans if <65% recovery	
New York A10160, introduced March 2010. Currently held in Assembly Committee on Environmental Conservation	N	N	N	Program may include a financial incentive for consumers in the form of cash or coupons.	Beginning in June 2015, manufacturers must collect at least 65% of mercury thermostats available for collection throughout the state.	**M:** Submit plan to **A** for approval; education and outreach, provide collection for consumers at retail/wholesale locations or municipal collection events; annual report on program performance	

ELEMENTS OF STATE LEGISLATION							
STATE LEGISLATION ON MERCURY THERMOTSTATS	SALES BAN[1]	DISPOSAL BAN[2]	HVAC LICENSING[3]	INCENTIVES[4]	PERFORMANCE GOALS[5]	RESPONSIBILITIES[6] M=manufacturer (brand owner); R=retailer; W=wholesaler; C=contractor; A=agency; H=Homeowner; HHW = household hazardous waste; UW = Universal Waste	PILOT PROJECTS AND PAST EFFORTS
						A: Approve/deny manufacturer plans; maintain list of collection sites; present annual reports on website; establish performance standards by 2015.	

State Laws

ELEMENTS OF STATE LAWS							
STATE LAWS ON MERCURY THERMOSTATS	SALES BAN[7]	DISPOSAL BAN[8]	HVAC LICENSING[9]	INCENTIVES[10]	PERFORMANCE GOALS[11]	RESPONSIBILITIES[12] M=manufacturer R=retailer W=wholesaler C=contractor A=agency HHW = household hazardous waste UW = Universal Waste	PILOT PROJECTS AND PAST EFFORTS
California AB 2347 Mercury Thermostat Collection Act 2008 Approved by Governor September 29, 2008. Contact: Neena Sahasrabudhe, Ph.D. Cailfornia Department of Toxic Substances Control Office of Pollution Prevention and Green Technology (916) 323 2274 nsahasra@dtsc.ca.gov	Y	Y	N[13]	Y Manufacturers to provide incentives and education to contractors, service technicians and homeowners to encourage recycling. Amount not specified.	Y TBD by January 1, 2012, collection rates as percentage of out-of-service thermostats that become waste annually. Manufacturers to design and implement survey and present results to agency by December 31, 2009. Intent to recycle maximum feasible number of thermostats	**M:** Finance & manage program; provide collection bins for free to wholesalers, HHW sites and event and participating retailers; education & outreach; submit survey plan and data for calculating number of waste thermostats generated each year; submit annual report starting April 1, 2010 **R:** Encouraged to participate & negotiate with manufacturers to do so, not required. Can not offer for sale thermostats produced by a noncompliant manufacturer, must include mail-back options to buyers purchasing through mail **W:** Required to serve as collection site; distribute manufacturer's educational materials, must include mail-back options to buyers purchasing through mail **C:** Contractors that install thermostats must bring them to collection point (not left with the homeowner); demolition contractors	N/A

[7] "Sales ban" refers to a ban on the sale of any thermostats that contain mercury.
[8] "Disposal ban" refers to a ban on the disposal of mercury thermostats in municipal solid waste or any other disposal method besides recycling.
[9] "HVAC licensing" refers to a requirement that professional licenses for heating, ventilation, and air conditioning contractors include information about recycling and the requirement that all mercury thermostats be recycled.
[10] "Incentives" can be either financial or otherwise.
[11] "Performance goals" are based on either the number of thermostats collected/recycled or a rate (expressed as a percentage) based on both the number of thermostats collected/recycled and another variable (e.g., amount sold, amount available for collection, etc.).
[12] The roles and responsibilities of different groups are either specified in legislation or determined by the appropriate agency or stakeholder group.
[13] Will not include licensing requirement, but may include language to the effect that contractors are not allowed to leave replaced mercury thermostats with home owners.

ELEMENTS OF STATE LAWS							
STATE LAWS ON MERCURY THERMOSTATS	SALES BAN[7]	DISPOSAL BAN[8]	HVAC LICENSING[9]	INCENTIVES[10]	PERFORMANCE GOALS[11]	RESPONSIBILITIES[12] M=manufacturer R=retailer W=wholesaler C=contractor A=agency HHW = household hazardous waste UW = Universal Waste	PILOT PROJECTS AND PAST EFFORTS
						must remove thermostats prior to demolition and take them to a collection point **A:** Review and approve manufacturer's stewardship plan; maintain website with program information; adopt regulations that set performance requirements and establish methodology for calculating the number of thermostats that become waste annually by January 1,2012	
Illinois SB 3346 Signed by governor July 26, 2010 Illinois EPA Becky Jayne Pollution Prevention Specialist 1021 N Grand Ave, East PO Box 19276 Springfield, IL 62794-9276 (217) 524-9642 Becky.Jayne@illinois.gov	Y[14]	Y		Modifications to a manufacturer plan required by the agency may include a mandatory $5 incentive offered to consumers at time of return.	Y: 2011 – 5,000 thermostats 2012-2014 – 15,000 thermostats each year Department will determine collection rate for 2015-2020.	**M:** Establish/maintain recycling program; include incentive to help meet goals; education/outreach to **R, M, C,** and homeowners; fines of $2,500 per day of not reaching collection goals. **R:** May voluntarily act as collection site; may provide educational materials **W:** May not sell thermostats unless participates as collection site; must distribute educational materials to consumers **C:** May not install/replace thermostats unless return Hg thermostats to collection site; may voluntarily collect **R, W, C:** non-compliance penalty of $500 **A:** Set collection goals, conduct outreach,	

[14] IL P.A. 095-0452 bans sale of mercury switch thermostats as of July 1, 2008.

ELEMENTS OF STATE LAWS							
STATE LAWS ON MERCURY THERMOSTATS	SALES BAN[7]	DISPOSAL BAN[8]	HVAC LICENSING[9]	INCENTIVES[10]	PERFORMANCE GOALS[11]	RESPONSIBILITIES[12] M=manufacturer R=retailer W=wholesaler C=contractor A=agency HHW = household hazardous waste UW = Universal Waste	PILOT PROJECTS AND PAST EFFORTS
						report to governor and general assembly on program effectiveness by due by 2019, levy penalties for violations.	
Iowa HF 2669 enacted in 2008 Iowa Department of Natural Resources Theresa Stiner 502 East 9th Street Des Moines, IA 50319 515-281-8646 Theresa.Stiner@dnr.iowa.gov	Y	Y	N	If performance goals are not met the department, in consultation with NEMA and others, may consider modifications.	"As many of the thermostats as reasonably practicable." The department will set goals in consultation with stakeholders by 1/1/09. Department proposed goals: 50% recovery for 2009 80% recovery for 2010 90% recovery 2011 and beyond	**M:** Develop and implement a program that includes education and outreach to W, R, C, and homeowners, collection containers for all W, and establishment of collection points for homeowners **R:** Participate in education and outreach program (materials provided by manufacturers). May not sell thermostat from non-compliant manufacturer **W:** Serve as a collection point. May not sell thermostats from a non-compliant manufacturer **C:** Thermostats must be brought to collection point **A:** Review M plan, take public comment on plan, report annually to the legislature	Currently 20 wholesalers participate in TRC. A group of students from the West Branch Middle School recently received a grant to purchase 25 TRC collection containers that will be given to HVAC contractors.

ELEMENTS OF STATE LAWS							
STATE LAWS ON MERCURY THERMOSTATS	SALES BAN[7]	DISPOSAL BAN[8]	HVAC LICENSING[9]	INCENTIVES[10]	PERFORMANCE GOALS[11]	RESPONSIBILITIES[12] M=manufacturer R=retailer W=wholesaler C=contractor A=agency HHW = household hazardous waste UW = Universal Waste	PILOT PROJECTS AND PAST EFFORTS
Maine Maine Thermostat Law 38 MRSA §1665-B Contact: Ann Pistell Environmental Specialist Maine Department of Environmental Protection 17 State House Station Augusta, ME 04333-0017 (207) 287-7703 Ann.E.Pistell@maine.gov	Y[15]	Y[16]	Y	$5 incentive (minimum) per thermostat, paid by manufacturers. Structure of incentive (cash, rebate etc.) left up to a stakeholder group. Stakeholders decided on direct cash incentive to the HVAC tech or homeowner. Retail may provide an in-store $5 gift card.	Y – 125 lbs. Mercury collected per year w/in 2 years, then 160 lbs./year thereafter (pounds based on % of # removed annually.)	**M:** Establish & maintain recycling program; pay incentive; conduct education and outreach **R:** May not sell any thermostats from non-compliant manufacturers. May voluntarily act as collection site **W:** Collection bins on site; provide HVAC techs with redemption coupon; do not sell any thermostats from noncompliant manufacturers **C:** Recycle thermostats; HVAC techs licensed by A **Municipalities:** Collection of thermostats at HHW; provide data on collection **A:** Develop financial incentive plan for M; Enforcement; assist with education & outreach	As of April 2008, 72 wholesalers are collecting thermostats. Expect 150+ retail stores to start collection by May 2008

[15] Maine law at 38 MRSA § 1661-C, sub-§ 5 banned sale of mercury switch thermostats as of January 1, 2006.

[16] Maine law at 38 MRSA § 1663 banned the disposal of any product containing mercury as of July 15, 2002.

ELEMENTS OF STATE LAWS							
STATE LAWS ON MERCURY THERMOSTATS	SALES BAN[7]	DISPOSAL BAN[8]	HVAC LICENSING[9]	INCENTIVES[10]	PERFORMANCE GOALS[11]	RESPONSIBILITIES[12] M=manufacturer R=retailer W=wholesaler C=contractor A=agency HHW = household hazardous waste UW = Universal Waste	PILOT PROJECTS AND PAST EFFORTS
Montana Campaign led by Women's Voices for the Earth (WVE). SB 424, signed into law on April 17, 2009. Contact: Ms. Jamie Silberberger Campaign Manager P.O. Box 8743 Missoula, MT 59802 jamie@womenandenvironment.org phone: 406.543.3747 fax: 406.543.2557	Y	N	N	Y, but non-financial	Y: an increase in the number of thermostats collected each year until 2016 or when the number of in-service thermostats is steadily declining	**M:** Provide collection bins to **W**, **C**, & make bins available to local governments that request them for **HHW** facilities or events; pay for bin shipping, handling and recycling; education and outreach for **C** and homeowners; encourage purchase of programmable thermostats as replacements; education and outreach including establishment of a pubic website; submit Annual Report to **A** that includes number of thermostats collected; **A**: use Annual Report from **M** to determine if collection goals are being met and require adjustments to **M**'s plans if not **W**: act as collection location; if distributes by mail, offer mail-back program; distribute education and outreach information to customers	SB 423 was tabled in April 2007 for financial reasons
New Hampshire SB.528 Signed by Governor July 11, 2008 (Effective Date) Contact: Stephanie D'Agostino, M.S. Supervisor, Pollution Prevention Section Office of the Commissioner NH Department of Environmental Services 29 Hazen Drive/P.O. Box 95	Y	Y	N	N	Y - Would be set w/in 4 months of 1st report of manufacturer's program M must "strive to maximize capture and recycling rate"	**M:** Fund collection and recycling program w/ C, W, and HHW; education/outreach; submit annual reports **R:** May not sell thermostats from noncompliant M; post signage **W:** Collect thermostats or cannot sell them; may pay one-time fee no more than $25 to collect; may not sell thermostats from noncompliant M **C:** Required to remove and recycle through M's program or manage as RCRA hazardous	Wholesalers participation rate less than 50%

ELEMENTS OF STATE LAWS							
STATE LAWS ON MERCURY THERMOSTATS	SALES BAN[7]	DISPOSAL BAN[8]	HVAC LICENSING[9]	INCENTIVES[10]	PERFORMANCE GOALS[11]	RESPONSIBILITIES[12] M=manufacturer R=retailer W=wholesaler C=contractor A=agency HHW = household hazardous waste UW = Universal Waste	PILOT PROJECTS AND PAST EFFORTS
Concord, NH 03302-0095 (603) 271-6398 Stephanie.D'Agostino@des.nh.gov						waste. Cannot install after 07/01/08 **HHW:** Collect thermostats **A:** Set safety guidelines; approve M's plan; involve stakeholders in plan review; maintain collection information on website	
Pennsylvania SB 830 and HB 44 On October 9, 2008, HB 44 was approved by the governor Contact: Sharon Trostle Executive Assistant PA Department of Environmental Protection Office of Waste, Air and Radiation Management P. O. Box 2063 Harrisburg, PA 17105-2063 (717) 783-1653 shtrostle@state.pa.us	Y	Y	N	May be included, but not required unless performance goals not met	Y Manufacturers establish goals in annual reports submitted to PA Department of Environmental Protection. Collection goals to ensure increase in the number of thermostats collected each year until 2015 or when department determines the number of in-service thermostats is declining	**M:** Establish and maintain collection and recycling for W, C, R, homeowners, and service technicians; provide education and outreach; must be free to participate, except for W, C, and R below; may provide incentives as means to achieve goals **R:** May pay one-time administrative fee; may not sell thermostats unless act as collection site or provide notice to consumer that recycling is required and include in notice names and locations of any collection sites within reasonably close proximity that recycle mercury thermostats **W:** May pay one-time administrative fee; may not sell thermostats unless act as collection site **C:** May pay one-time administrative fee; may not sell thermostats unless act as collection site or provide notice to consumer that recycling is required **A:** Education on safe disposal; approve M's program; distribute a list of collection sites	Voluntary manufacturer recycling program operating since 2000

ELEMENTS OF STATE LAWS							
STATE LAWS ON MERCURY THERMOSTATS	SALES BAN[7]	DISPOSAL BAN[8]	HVAC LICENSING[9]	INCENTIVES[10]	PERFORMANCE GOALS[11]	RESPONSIBILITIES[12] M=manufacturer R=retailer W=wholesaler C=contractor A=agency HHW = household hazardous waste UW = Universal Waste	PILOT PROJECTS AND PAST EFFORTS
						to wholesalers, retailers and contractors or make the list available on the Department's web site	
Rhode Island H. 7199 Declared effective without governor's signature June 25, 2010 Contact: Sheila Dormody Rhode Island Director Clean Water Action 741 Westminster St. Providence, RI 02903 (401) 331-6972 sdormody@cleanwater.org	Y	Y	N	Y: Modifications to program, to be instituted no earlier than January 2014, may include a $5 cash/coupon incentive to be offered by **M** and **C** to consumers at time of return.	Y: 2011 –2,000 thermostats 2012 –2,250 thermostats 2013 – 2,500 thermostats 2014 – 2,500 thermostats Department will determine collection rate for 2015-2020.	**M:** Submit collection and financial incentive plan to **A**; education and outreach for **W**, **R**, **C,** and homeowners; provide containers to **W**; collection systems that use mail-back options OK; implement Agency-approved collection plans January 1, 2010; submit Annual Report to **A** that includes the number of thermostats and the amount of mercury collected during previous calendar year by that manufacturer in each state in the US **C:** must deliver removed mercury thermostats to appropriate location for recycling **W:** act as collection sites **R:** sales banned unless participate in education and outreach program for consumers **A:** website posting of registered collection points; education and outreach for **W**, **R**, **C**, and homeowners; annually report to House Committee on Environment and Natural resources and the Senate Committee on Environment and Agriculture; estimate number of out-of-service thermostats generated annually in RI; may inspect manufacturer records, request third-party	

ELEMENTS OF STATE LAWS							
STATE LAWS ON MERCURY THERMOSTATS	SALES BAN[7]	DISPOSAL BAN[8]	HVAC LICENSING[9]	INCENTIVES[10]	PERFORMANCE GOALS[11]	RESPONSIBILITIES[12] M=manufacturer R=retailer W=wholesaler C=contractor A=agency HHW = household hazardous waste UW = Universal Waste	PILOT PROJECTS AND PAST EFFORTS
						audits, or investigate to verify historic sales or collection program effectiveness data; use Annual Report from **M** to determine if collection goals after 2014.	
Vermont H.515 This Act (Act No. 149) has an effective date of July 1, 2008. §7116 will become a part of 10 VSA Chapter 164 **Update February 9, 2009:** An amendment to this law is being considered that modifies sales data collection requirements and allows the state agency to inspect, audit and investigate to verify historic sales data or system program effectiveness data submitted by manufacturers. Contact: Michael Bender Director Mercury Policy Project/Zero Mercury Working Group US 1420 North Street Montpelier, VT 05602 (802) 223-9000 Mercurypolicy@aol.com	Y	Y	N	$5 cash for technicians and other registered collection points $5 off the purchase of in store products in retail locations for homeowners	Y - 65% collection rate by 7/1/2011 Manufacturers report data each year	**M:** Set up collection and incentives for thermostats from all sources (**W**, **R**, municipalities and SWD) including education and outreach; annual reports- collection containers for all **W**, **R** and registered collection points **R:** Mandatory participation in education and outreach program (materials provided by manufacturers). Voluntary collection point. May not sell thermostat from non-compliant manufacturer **W:** Mandatory collection points. May not sell thermostats from noncompliant M **C:** Recycle thermostats **A:** Approve **M**'s plan; public comment on plan, review **M**'s annual reporting; conduct education and outreach **Update February 9, 2009**: Law amended to require **M** to submit national annual sales data from 1958 to present; submit (in Annual Report to **A**) the number of thermostats and the amount of mercury collected during previous calendar year for each state in the US; **A** may inspect	Wholesalers 32 bins - 2001 21 - 2007 2007 2-month retail Pilot Project – 86 participants –see details in legislative report below. Legislative study (mandated by law) report available at: http://www.mercvt.org/PDF/ThermostatFINAL.pdf 1999 mercury products law required contractors to source separate and manage as hazardous waste and disposal ban on labeled mercury-added products – (incl. thermostats) subsequent law

ELEMENTS OF STATE LAWS							
STATE LAWS ON MERCURY THERMOSTATS	SALES BAN[7]	DISPOSAL BAN[8]	HVAC LICENSING[9]	INCENTIVES[10]	PERFORMANCE GOALS[11]	RESPONSIBILITIES[12] M=manufacturer R=retailer W=wholesaler C=contractor A=agency HHW = household hazardous waste UW = Universal Waste	PILOT PROJECTS AND PAST EFFORTS
Jennifer Holliday Environmental Safety Compliance Manager Chittenden County Solid Waste District 1021 Redmond Road Williston, VT 05495 (802) 872-8100 x 223 jholliday@cswd.net Gary Gulka Assistance & Prevention Chief VT Department of Environmental Conservation Environmental Assistance Office 103 South Main Street Waterbury, VT 05671-4911 (802) 241-3626 gary.gulka@state.vt.us						manufacturer records, request third-party audits, or investigate to verify historic sales or collection program effectiveness data; use Annual Report from **M** to determine if collection goals (65% collection and recycling) are being met and require adjustments to **M**'s plans if not **W**: act as collection sites **R:** sales banned unless participate in education and outreach program for consumers	disposal ban on mercury products labeled or not.

INITIAL STATEMENT OF REASONS
MERCURY WASTE CLASSIFICATION AND MANAGEMENT
Department Reference Number: R-02-04
Notice File Number: xxxxx

CONTENTS

EFFORT TO AVOID DUPLICATION OR CONFLICTS WITH FEDERAL REGULATIONS

This proposal would change the way certain mercury-containing wastes are regulated in California. The regulations would designate four categories of discarded products as hazardous wastes. All four categories include products that would not be classified as hazardous wastes under existing federal and State criteria. By listing them, the Department of Toxic Substances Control's (DTSC's) intention is to ensure that all products in each category are identified as hazardous wastes when discarded, regardless of their current regulatory status.

The proposal would also add universal waste management standards for the newly listed hazardous wastes to the existing Universal Waste Rule, as well as standards for several additional waste categories that are already hazardous under current criteria. None of the proposed new universal wastes are included in the federal Universal Waste Rule. However, the addition of these wastes to California's rule is consistent with the federal Universal Waste Rule, which allows petitions to request designation of additional appropriate hazardous wastes as universal wastes.

STUDIES RELIED ON

DTSC has used information from a variety of sources in developing these proposed regulations.

In preparing its *Draft Mercury Report*, released in October 2001, DTSC extensively researched the State's mercury problem. The draft report discusses the nature and extent of mercury contamination in California, as well as the past and present sources of this contamination. It also reviews the toxicology and environmental behavior of important forms of mercury and outlines several options for reducing further contamination by changing the way mercury-containing wastes are classified and managed.

Sources consulted in the preparation of the *Draft Mercury Report* include reports by U.S. EPA and State agencies, Internet web sites of government and academic institutions, scientific journals and books, and related regulatory materials. Many of the materials used in drafting the report were also consulted during the development of these proposed regulations. A list of these references is included in the appendix to this document. Additional information on common mercury-containing devices was obtained from Purdue University's Internet web site at: http://pasture.ecn.purdue.edu/~mercury/src/devicepage.htm.

DTSC also conducted four workshops, in various locations throughout the State, at which the report's findings and regulatory recommendations were presented. Many comments

were received at the workshops, and they were taken into consideration in developing the current proposal.

Also relied on were:

- The State and federal Universal Waste Rules, found in chapter 23 of the California Code of Regulations, title 22, and in part 273 of the Code of Federal Regulations, title 40 (40 C.F.R.), respectively;
- Federal Register notices related to the federal Universal Waste Rule and the later modification to the economic analysis of the Lamps Rule;
- The Initial Study for these proposed regulations, prepared by DTSC under the authority of the California Environmental Quality Act (CEQA);
- The Health and Safety Code section 25150.6 analysis, which is part of this regulations package; and
- The fiscal and economic impact analyses prepared for this regulations package.

ALTERNATIVES CONSIDERED

Chosen Alternative: DTSC selected the option of designating a list of mercury-containing products as hazardous wastes when discarded. The products were chosen based on two criteria: the feasibility of recycling, and the availability of mercury-free substitutes. These criteria are consistent with section 25179.4 of the Health and Safety Code, in which the Legislature directs DTSC to make promotion of source reduction and recycling its two top priorities for the hazardous waste management program. In addition to listing these discarded mercury-containing products as hazardous wastes, DTSC proposes to adopt new standards for managing them. DTSC also proposes new management standards for several categories of discarded mercury-containing products that are hazardous under existing criteria, as universal wastes.

Rejected Alternatives:

1. *Do Nothing*. DTSC rejected this option because it would not support other efforts, in California and nationally, to limit further environmental contamination from mercury, nor would it promote mercury recycling and pollution prevention.

2. *Regulate all mercury-containing wastes*. Under this alternative, all mercury-containing wastes, regardless of their source or mercury concentration, would be classified as hazardous wastes. Discarded products containing mercury would be hazardous waste regardless of the feasibility of recycling their mercury or the availability of non-mercury substitutes.

DTSC rejected this alternative because it would lead to the classification of wastes with extremely low mercury concentrations (posing correspondingly low risks) as hazardous

wastes, due to the sensitivity of modern analytical instruments. Also, like option 1, this option would not effectively promote mercury recycling and product substitution.

3. *Regulate all wastes with intentionally added mercury as hazardous wastes*. As with option 2, this option would not consider the feasibility of recycling the mercury contained in discarded products when designating them as hazardous wastes, nor would it consider the availability of non-mercury substitutes.

DTSC rejected this option because it would have required generators to determine whether any mercury in their waste was intentionally added or naturally-occurring. Further, like option 2, this option would have included wastes that, arguably, pose insignificant risks when managed as nonhazardous waste, due to their very low mercury levels. DTSC believes the chosen alternative provides greater incentives for pollution prevention, the use of less-hazardous alternatives, and recycling. As discussed earlier, these objectives are consistent with section 25179.4 of the Health and Safety Code.

4. *Update hazardous waste thresholds*. Under this alternative, the Soluble Threshold Limit Concentration (STLC) and Total Threshold Limit Concentration (TTLC) regulatory thresholds would be updated, based on current science.

DTSC rejected this option because it would not be effective at promoting the use of less-hazardous alternatives. Products would be classified as hazardous or nonhazardous waste when discarded, without regard to the feasibility of recycling or the availability of non-mercury substitutes.

In evaluating this alternative, DTSC considered the possibility that revising the existing regulatory thresholds might provide an incentive for manufacturers of fluorescent lamps to further lower the mercury content of their products. Currently, only about 20 percent of the spent fluorescent lamps generated in the state are properly recycled. The remaining 80 percent continue to be land disposed. [Lamps generated by households and Conditionally Exempt Small Quantity Universal Waste Generators (CESQUWGs) are temporarily exempt from the Universal Waste Rule's prohibition on nonhazardous disposal.] DTSC believes that listing all mercury-containing lamps as hazardous waste would be more effective in reducing the amount of mercury going into our environment and would provide more of an incentive to recycle the lamps. Ongoing efforts to develop the state's infrastructure for collecting spent lamps from households and conditionally exempt small quantity universal waste generators will play a significant role in this improvement. The sunset of the current temporary disposal exemptions for households and CESQUWGs will also increase lamp recycling rates.

If, as DTSC proposes, all discarded lamps were designated as hazardous wastes, none would be allowed to be managed as municipal wastes. If, instead, the hazardous waste thresholds for discarded lamps were lowered, all lamps with mercury concentrations below

the lower thresholds could be managed as nonhazardous wastes. DTSC has concluded that designating all mercury-containing lamps as hazardous wastes will ultimately result in less mercury being released to the environment.

DETAILED STATEMENT OF REASONS/NON-CONTROLLING PLAIN ENGLISH SUMMARY

Add Section 66260.22 to Article 3 of Chapter 10:

California is a Resource Conservation and Recovery Act (RCRA) authorized state, which means that U.S. EPA has found the State's hazardous wastes regulatory program equivalent to, and no less stringent than, the federal RCRA program, and has authorized the State to implement its program in lieu of the federal program.

In adopting its final universal waste package in February 2002, DTSC decided not to include the federal rule's petition process for adding new universal wastes. This decision was based on the fact that the petition process found in California's Administrative Procedure Act (in Government Code section 11340.6) is essentially equivalent to that in the federal Universal Waste Rule. Although the Administrative Procedure Act's petition process is procedurally equivalent to the RCRA process, adopting a specific process for universal wastes that includes the federal petition process will facilitate U.S. EPA's determination of the equivalence of California's Universal Waste Rule with the federal rule.

DTSC is adopting the federal process in this new section. It allows a person who seeks to add additional universal wastes to chapter 23 to petition DTSC's director. Subsection (b) enumerates the information that must be contained in a successful petition. This section parallels the language found in 40 C.F.R. section 273.80, except that existing provisions for petitioning State agencies to adopt, amend, or repeal regulations are included; these requirements are found in Government Code section 11340.6.

Add Section 66260.23 to Article 3 of Chapter 10:

As part of the RCRA authorization process, DTSC is required to complete authorization checklists. On the checklist for the Universal Waste Rule, several entries address the federal rule's criteria for deciding whether to designate a hazardous waste as a universal waste. These criteria are not currently part of the State's rule.

This new section lists the factors that DTSC's Director will use to evaluate petitions, submitted pursuant to proposed section 66260.22, for addition of new universal wastes to chapter 23. The factors are intended to ensure that proposed universal wastes are appropriate for management under less stringent standards than are other hazardous wastes. Petitions to add hazardous wastes that are generated by a variety of generators in a variety of industries, that are produced in relatively small quantities by individual

generators, and that pose lower risk than other hazardous wastes are most likely to be successful. This section parallels the language found in 40 C.F.R. section 273.81.

Amend Section 66261.1:

This section discusses the purpose and scope of chapter 11. Chapter 11 identifies the wastes subject to regulation as hazardous wastes. Section 66261.1 enumerates the articles contained in chapter 11 and briefly describes their contents. Because this package adds a new article 4.1, a new paragraph (5), which describes the new article, is added to section 66261.1. The former paragraph (5) is renumbered as paragraph (6).

Amend Subsection (a) of Section 66261.3:

This subsection contains the definition of hazardous waste. This section is amended to reflect the addition of a new criterion for classifying wastes as hazardous waste to chapter 11 (namely, the list of mercury-containing hazardous waste in the new article 4.1).

Amend Subsection (b) of Section 66261.3:

This subsection enumerates the events that constitute the generation of a hazardous waste. Paragraph (2) is amended to address the generation of the mercury-containing wastes listed in the new article 4.1. As with the federally listed wastes, the wastes on the State's new 'M' list will be considered generated when they first meet the listing descriptions in article 4.1 of this chapter. In most cases, the listing descriptions in article 4.1 state that the waste is generated "when discarded." The exception is waste M001, motor vehicles that contain mercury switches. The listing description for waste M001 specifies that a listed hazardous waste is generated not when a vehicle that contains mercury switches is discarded, but when the owner decides to crush it for transport, bale, or shred it for recycling.

Paragraphs (3), (4), and (5) of this subsection address mixtures of hazardous and nonhazardous wastes. Under the existing paragraph (2) [which will be renumbered as (3)], mixtures of federally listed hazardous wastes and nonhazardous wastes are regulated as hazardous wastes, and are considered generated when first mixed. In the proposed new paragraph (4), DTSC addresses a different issue. In this case, the concern is with vehicles or other products that are manufactured with removable mercury-containing components. Unlike some industrially generated hazardous wastes, which are uniformly hazardous, the only hazardous constituent of some of the products to be listed under this proposal is contained in a discrete, removable component (e.g., a switch). DTSC's intent in including vehicles from which switches have not been removed in the listing description for M001 is to provide an incentive for dismantlers to remove mercury switches from vehicles prior to crushing, baling, or shredding them. By removing switches, dismantlers can avoid having to manage entire vehicles as hazardous waste, and can prevent the release of the mercury

encapsulated in switches to the environment. Alternatively, dismantlers may choose to manage discarded vehicles containing mercury switches as hazardous wastes. Persons who intend to crush, bale, or shred such vehicles will need to obtain a hazardous waste facility permit prior to doing so.

Amend Subsection (d) of Section 66261.3:

This subsection enumerates the criteria that a waste must meet in order to be classified as nonhazardous. Currently, a waste that does not exhibit a hazardous waste characteristic and is not listed in article 4 of chapter 11 is not a hazardous waste. A new paragraph (3) is being added to address the addition of the new list of hazardous wastes in the new article 4.1 of chapter 11. In order not to be classified as hazardous a waste, in addition to meeting the two existing criteria, may not be listed in the new 'M' list.

Amend Subsection (a) of Section 66261.6:

Hazardous wastes that meet the criteria listed in paragraph (6) of this subsection are exempted from most of the requirements in California Code of Regulations, title 22. Instead, these wastes are subject to special management requirements found in subparts C, F, G, and H of 40 C.F.R. Part 266. The wastes to be listed in article 4.1 will be managed as universal wastes under chapter 23 of the California Code of Regulations, title 22, not under Part 266. A new subparagraph (D) is added, making wastes listed in article 4.1 ineligible for exemption under paragraph (6) of this subsection.

Amend Subsection (a) of Section 66261.9:

Subsection (a) lists the hazardous wastes that may be managed under the standards for universal wastes in chapter 23, in lieu of the general hazardous waste management requirements of the Health and Safety Code and title 22. The subsection is amended to add the ten proposed new universal waste categories to the list.

Add Article 4.1:

Article 3 of chapter 11 contains the characteristics used to determine whether a waste is hazardous. Article 4 contains four lists of hazardous wastes that have been adopted from federal regulations. These proposed regulations will create California's first list of wastes that are hazardous regardless of whether they exhibit any of the hazardous waste characteristics in article 3. A new article 4.1 is added to chapter 11 to contain this new list, and other lists of hazardous wastes that may be adopted in the future.

Add Section 66261.50:

This new section 66261.50 enumerates the wastes that will be listed as hazardous wastes. Most wastes in each of the new listings would not be classified as hazardous waste for mercury under the toxicity characteristic. However, as discussed earlier, their (nonhazardous) management and disposal contribute significant amounts of mercury to the State's environment. The descriptions of some listed wastes include information on when they are considered generated.

M001

Most vehicles are so massive, relative to the weight of the mercury in their switches, that they do not exceed mercury concentration thresholds for classification as hazardous wastes. This is because the thresholds apply to the entire vehicle, not just to the switch itself. DTSC's intent in listing motor vehicles that contain mercury switches as hazardous wastes is to encourage handlers to remove the switches. DTSC estimates that the vehicles shredded annually in California contain between 0.75 and 1.5 tons of mercury. Refining the assumptions to estimate the amount of mercury from vehicle light switches yields approximately 1848 pounds of mercury. Of this amount, approximately 871 pounds finds its way into the nonmetallic waste ("fluff") generated by auto shredders. The remaining mercury is released to other environmental media (presumably, mainly to air). In light of the State's existing environmental contamination, the preventable release of almost one and a half tons of mercury from auto shredders is unacceptable.

This listing covers the mercury switches found in vehicles. It applies to tilt switches commonly used to activate trunk and hood lights, to mercury switches used in antilock brake systems (ABS), and to any other mercury switches found in motor vehicles. Vehicles and portions of vehicles from which switches have not been removed are also hazardous wastes under this listing. To avoid regulating intact vehicles as hazardous wastes, a vehicle that contains mercury switches is considered generated as a listed hazardous waste only when someone decides to crush, bale, shear, or shred it. To encourage the removal of mercury switches, vehicles from which all switches have been removed are not included in the listing description. Discarded vehicles from which all mercury switches are not removed are included in the listing, and could be managed as universal wastes or as fully-regulated hazardous wastes. Anyone intending to crush, bale, shred, or shear such vehicles without a hazardous waste facility permit would first need to remove all mercury switches.

The effective date of the listing is delayed until January 1, 2005, to be consistent with a deadline in Public Resources Code section 15029. This section, which was added by SB 633, prohibits the sale of vehicles containing mercury light switches manufactured after that date. The delay will also allow time to educate the regulated community on the potential

change in the hazardous waste status of vehicles that contain mercury switches, and on the advantages of and procedures for removing switches.

M002

This listing covers all mercury switches other than those in vehicles. It also includes mercury flame sensors, which are used in some gas-powered household appliances to prevent the flow of gas when a flame is not present. A non-inclusive list of switch types is provided to assist the regulated community in identifying the general types of switches covered by the listing. As with the M001 listing, this listing includes products that contain mercury switches and flame sensors, but excludes products from which all mercury switches and flame sensors have been removed. Again, DTSC's intent is to encourage the removal of intact switches from products before they undergo processing that may release their mercury to the environment. Discarded products from which all mercury switches are not removed could be managed as universal wastes or as fully-regulated hazardous wastes. Anyone intending to treat a product that contains one or more mercury switches (for example, by crushing a used washing machine that contains a mercury tilt switch to facilitate recovery of the steel) without a hazardous waste facility permit would first need to remove all switches.

The effective date of the listing is delayed for approximately one year. It becomes effective on February 9, 2004, which coincides with the date of the reduction in the quantity of batteries, lamps, and thermostats that a CESQUWG may dispose (pursuant to Cal. Code Regs., tit. 22, § 66273.8). The purpose of the delay is to provide time for the education of generators and handlers about the changes in the hazardous waste status of, and management requirements for, affected products. The delay will also allow generators time to prepare to properly manage—and ultimately recycle—all products with mercury switches.

M003

This listing covers all mercury-containing lamps, regardless of whether they exhibit a hazardous waste characteristic. DTSC believes that a lamp's mercury content is not a reasonable basis for classifying it as hazardous or nonhazardous. One reason is that the weight of a lamp's glass and metal components can affect whether or not the lamp exceeds hazardous waste thresholds for mercury. For example, compared with the standard T8 fluorescent lamps, smaller diameter T5 lamps use less glass and aluminum in their manufacture. Consequently, a T5 lamp that contains the same amount of mercury as a T8 lamp is more likely to exceed hazardous waste concentration thresholds for mercury than is the T8 lamp. Further, variables other than a lamp's mercury content may affect its impact on the environment. For example, if one type of lamp contains less mercury than another, but also produces less light or has a shorter life, using more of the lower-mercury lamps may not result in a net decrease in the mercury entering the environment.

One alternative to using the current concentration thresholds to classify lamps would be to replace the thresholds with a formula that considers a lamp's mercury dose, light output, and length of life. However, in light of the State's serious mercury contamination problem, DTSC believes that listing all mercury-containing lamps as hazardous wastes will be more protective of public health and the environment. As discussed below, the listing of mercury-containing lamps would be delayed until 2006; until then, some lamps would be classified as hazardous and others would not. Once it becomes effective, the listing will remove any confusion in the regulated community about which mercury-containing lamps are hazardous. It will also avoid the continued release of mercury to the environment that occurs when discarded lamps are broken during handling. The additional requirements for the generators of lamps not currently classified as hazardous wastes will be small; all newly classified hazardous waste lamps will be eligible for management under DTSC's universal waste management standards.

Most waste products that contain lamps are included in this listing description, but products from which all lamps have been removed are not. The listing also does not include liquid crystal displays (LCDs) that are back lit with mercury-containing lamps, or products that contain LCDs. These products are not included because less hazardous alternatives to the mercury-containing lamps in LCDs are not yet widely available. Also, the difficulty of separating a mercury-containing lamp from the rest of the display may make the recycling of the lamps impractical.

Delayed Implementation of the M003 Listing of Mercury-Containing Lamps

Under DTSC's existing Universal Waste Rule, all hazardous waste lamps, batteries, and thermostats generated by households and limited quantities generated by conditionally exempt small quantity universal waste generators (CESQUWGs) are exempt from management as hazardous or universal waste. The exempt quantity for CESQUWGs will be reduced to 30 lamps and 20 pounds of batteries per month, effective February 9, 2004. Both the household and CESQUWG exemptions will be phased out after February 8, 2006. After that date, all hazardous waste lamps will be subject to management as universal waste under chapter 23.

Currently, one of the three major brands of fluorescent lamps has been determined not to be hazardous waste under California's STLC/TTLC criteria. Regardless of who generates them, these waste lamps may be disposed in non-hazardous waste landfills in unlimited quantities. The two other major manufacturers produce lamps that are classified as hazardous waste in this State. Some of these waste lamps must be managed under the standards for universal waste lamps, while others (those produced by households and CESQUWGs) are temporarily exempt, and may be disposed in municipal landfills.

Landfill operators have instituted load checking programs, in which some incoming loads of garbage are checked for the presence of prohibited materials such as hazardous wastes. However, the landfill staff responsible for checking loads may not be able to determine the origin of a load of garbage that contains fluorescent lamps. Further, they may have difficulty distinguishing discarded lamps that are currently classified as hazardous wastes from those that are not. As a result, monitoring compliance by individual fluorescent lamp generators with the requirements that apply to them is currently very difficult.

DTSC proposes to delay the effective date of the listing of mercury-containing lamps as hazardous wastes until February 9, 2006, to coincide with the sunset of the household and CESQUWG exemptions. On that date, all discarded mercury-containing lamps will be classified as hazardous wastes. The delay of approximately three years will allow time to educate the generators of lamps that currently are not hazardous about the change in their status. It will also allow time for generators to prepare for the proper disposition of all mercury-containing lamps and for the development of the collection infrastructure. In typical use, most tubes purchased now will not reach the end of their lives until after the effective date of the hazardous waste listing. Therefore, the delay will not affect most lamps purchased today.

M004

This listing applies to a range of mercury-containing products whose manufacture and sale are banned, effective January 1, 2003, by Public Resources Code section 15027. It becomes effective on January 1, 2004, one year after the effective date of the ban on the manufacture and sale of these products. Some of the products banned by the bill may currently be classified as hazardous wastes, while others are already included in other listed waste categories. Listing M004 is intended to capture any novelty that would not be hazardous for these two reasons.

Mercury-added novelties fall into several categories:

- Novelties with liquid mercury;
- Novelties with mercury switches;
- Novelties with button-cell or other mercury-containing batteries;
- Novelties painted with mercury-containing paint; and
- Novelties with mercury-containing lamps.

Novelties with switches or lamps would be hazardous under listings M002 and M003, respectively; therefore, they are not included in this listing. Novelties with liquid mercury would likely fail the TTLC and be classified as hazardous wastes under the toxicity

characteristic (unless they are quite large[1]). However, novelties that contain mercury button-cell batteries or mercury-containing lamps, as well as novelties painted with mercury-containing paint, may not have enough mercury to exhibit the toxicity characteristic.

Delay in Listing Effective Date

This listing will become effective one year after sale, manufacture, and distribution of mercury-added novelties will be banned. This one-year delay will not affect mercury-added novelties classified as hazardous wastes under existing hazardous waste identification criteria; it applies only to novelties with mercury concentrations below current regulatory thresholds. The delay will allow time to educate generators of discarded novelties not currently classified as hazardous waste (most of them households) in the coming changes in how they must classify and manage them.

Chapter 11, Article 5: Categories of Hazardous Waste
Amend Subsection (a) of Section 66261.101:

This section lists the criteria a waste must meet to be classified as non-RCRA hazardous waste. Mercury-containing wastes listed in article 4.1 of chapter 11 that are not federally hazardous will be classified as non-RCRA hazardous waste. Paragraph (2) of subsection (a) of this section is amended to include the listing of a waste in article 4.1 as a criterion for classification as non-RCRA hazardous waste.

Amend Subsections (b) and (c) of Section 66262.11:

This section specifies the procedure for determining whether a waste is hazardous. After determining, pursuant to subsection (a), that the waste is not excluded from definition of hazardous waste, the generator is required to determine whether the waste is listed in article 4 or in Appendix X of chapter 11. If the waste is not excluded and does not appear on either list, the generator must then determine whether the waste exhibits any of the four hazardous waste characteristics.

These proposed regulations will classify wastes listed in appendix 4.1 of chapter 11 as hazardous whether or not they exhibit a hazardous waste characteristic. Therefore, subsection (b) is amended to require generators to determine whether a waste is listed in article 4.1 prior to determining whether the waste exhibits a characteristic. Subsection (c) is also amended to make clear that the generator of a waste listed in article 4.1 will not be required to determine whether the waste exhibits a characteristic.

[1] A novelty with a single switch containing 1 gram of mercury and weighing less than 110 pounds would fail TTLC; a novelty with one mercury switch and weighing up to 1100 pounds could potentially fail STLC.

Amend Subsection (g) of Section 66264.1:

Chapter 14 contains standards for owners and operators of hazardous waste transfer, treatment, storage, and disposal facilities. Subsection (g) lists persons who are not subject to the requirements of chapter 14. Paragraph (12) of subsection (g) exempts handlers and transporters of a list of hazardous wastes from regulation under chapter 14. Instead, these handlers and transporters are regulated under the universal waste requirements in chapter 23. These regulations will designate ten new universal wastes, and will include all mercury-containing lamps. The treatment, storage, and disposal facilities that receive these new universal wastes will be subject to the requirements in chapter 14, but handlers (including generators and offsite consolidators) and transporters of these wastes will be exempt. Paragraph (12) is amended to list the ten new universal wastes.

Amend Subsection (d) of Section 66265.1:

Chapter 15 contains standards for owners and operators of interim status hazardous waste transfer, treatment, storage, and disposal facilities. Subsection (d) lists persons who are not subject to the requirements of chapter 15. Paragraph (15) of subsection (d) exempts handlers and transporters of a list of hazardous wastes from regulation under chapter 15. Instead, these handlers and transporters are regulated under the universal waste requirements in chapter 23. Like handlers and transporters of the current universal wastes, the handlers and transporters of the ten new universal wastes and mercury-containing lamps designated by these regulations will not be subject to the requirements of chapter 15. Paragraph (15) is amended to add the ten new wastes to the list of universal wastes that are exempt from chapter 15.

Amend Subsection (g) of Section 66268.1, Purpose, Scope, and Applicability:

This subsection is amended by adding subsections (g)(4) through (g)(12). This amendment exempts handlers and transporters of the ten mercury-containing universal wastes and mercury-containing lamps added by these regulations from the land disposal restrictions and requirements imposed by sections 66268.7 and 66268.50. Instead, handlers and transporters of universal wastes are subject to the requirements of chapter 23.

Amend Subsection (c) of Section 66270.1, Purpose and Scope of These Regulations:

This section is amended by revising subsection (c)(2)(E)3 and adding subsections (c)(2)(E)4 through (c)(2)(E)13. These proposed amendments exempt handlers and transporters of the ten mercury-containing universal wastes and mercury-containing lamps added by these regulations from the hazardous waste permit requirements of chapter 20.

Instead, handlers and transporters of these ten new universal wastes are subject to the requirements of chapter 23.

Amend Chapter 23, Standards for Universal Waste Management:

Amend Article 1:

Article 1 contains the scope and applicability of chapter 23, as well as applicable definitions. This proposal amends article 1 to add applicability sections for ten new mercury-containing universal wastes. In most cases, DTSC is requiring recycling of the designated mercury-containing wastes as a condition of universal waste management. (If the wastes are not recycled, they are subject to full hazardous waste management.) This requirement is included for several reasons:

- Recycling conserves the State's resources and avoids mining of new mercury with the attendant mining waste production.
- Each mercury-containing product for which recycling will be required contains from one gram of mercury to, potentially, 100 grams or more.
- Mercury is very difficult to sequester permanently. It does not form stable long lasting, insoluble compounds. This disposal of mercury-containing products in landfills can create long-term problems. The U.S. EPA treatment standard for mercury is recycling – implying that no effective technology in use can permanently sequester mercury from the environment.
- The California Legislature, in Health and Safety Code section 25179.4, states that the second priority for DTSC's program, after source reduction (not producing waste in the first place), is to encourage recycling of the hazardous waste.

Amend Subsection (a) of Section 66273.1, Scope:

This section discusses the scope of chapter 23, which contains standards for universal waste management. Ten new universal wastes are added by these regulations. Subsection (a)(3), which lists lamps regulated under chapter 23, is amended to add a reference to mercury-containing lamps listed in the 'M' list in section 66261.50. Subsections (a)(5) through (a)(14) are added, listing the ten new universal wastes that will be regulated under chapter 23.

Amend Section 66273.5, Applicability—Lamps:

This section lists the lamps that are covered under chapter 23. Section 66261.50 of these regulations will designate all mercury-containing lamps as hazardous wastes, and consequently, all mercury-containing lamps will be subject to regulation under chapter 23. Discarded products that contain mercury-containing lamps are also subject to chapter 23. Currently, subsection (b)(2) exempts lamps that do not exhibit a hazardous waste

characteristic from chapter 23. It is amended to require that a lamp must also not meet the M003 listing description (i.e., it must not contain mercury) to be exempt from chapter 23. Subsection (b)(3) is amended to clarify that lamps not destined for an authorized recycling facility are fully-regulated hazardous wastes.

Add Section 66273.7.1, Applicability—Motor Vehicles that Contain Mercury Switches and Switches Removed from Motor Vehicles:

This section discusses the applicability of chapter 23 to mercury-containing motor vehicle switches and vehicles that contain them. It states that the universal waste management requirements of chapter 23 apply to discarded automotive mercury switches and to discarded vehicles and portions of vehicles that contain mercury switches. Both the switches and the vehicles that contain them are newly listed as hazardous wastes in listing M001 of section 66261.50.

Subsection (a) specifies the switches that are subject to universal waste management. On January 1, 2005, the M001 listing will make discarded mercury-containing motor vehicle switches, and vehicles that contain them, hazardous wastes. From the date these regulations become effective until December 31, 2004, universal waste requirements will apply to mercury switches that are voluntarily removed from motor vehicles. After the M001 listing becomes effective, universal waste management standards will also apply to vehicles and switches covered by the listing. This will ensure that the handlers of the affected vehicles and switches will not have to manage them under full hazardous waste management requirements.

Subsection (b) lists categories of vehicles and switches not covered under chapter 23. These include switches that are not wastes; switches that do not contain mercury; vehicles from which all mercury switches have been removed; switches that will not be recycled; and vehicles from which all mercury switches have not been removed that are crushed, baled, shredded, or sheared. Handlers are given a strong incentive to remove the switches from vehicles prior to processing them, and to recycle removed mercury switches: switches not destined for recycling and vehicles that are processed without having had all mercury switches removed are fully regulated as hazardous wastes.

Subsection (c) discusses when vehicle switches and vehicles that contain them become universal wastes. A used mercury switch becomes a universal wastes when a handler removes it from a vehicle and decides to discard it. A vehicle that contains mercury switches becomes a universal waste when a handler decides to crush, bale, shred, or shear it (but, as discussed earlier, it becomes a fully-regulated hazardous waste if it is processed without removing all switches). An unused switch that is destined for recycling becomes a universal waste when the handler decides to discard it.

Add Section 66273.7.2, Applicability—Products that Contain Mercury Switches and Switches Removed from Products:

Non-automotive mercury switches and products that contain them are designated as hazardous wastes elsewhere in these regulations (waste 'M002,' in section 66261.50). As noted earlier, the shredding of large appliances and other mercury-containing products is a significant source of mercury in California's nonhazardous waste stream.

Subsection (a) specifies the non-automotive mercury switches subject to universal waste management. On February 9, 2004, the M002 listing will designate discarded non-automotive mercury switches, and discarded products that contain them, as hazardous wastes. From the date these regulations become effective until February 8, 2004, universal waste requirements will apply to mercury switches and products containing them that are hazardous wastes under existing criteria (i.e., that exhibit the toxicity characteristic). After the M002 listing becomes effective, universal waste management standards will apply to all non-automotive mercury switches and products with such switches.

Subsection (b) lists categories of switches and products not covered under chapter 23. These include:

1) switches that are not wastes;
2) switches that do not contain mercury;
3) products from which all mercury switches have been removed;
4) mercury switches not destined for recycling; and
5) waste appliances that are crushed, baled, shredded, or sheared from which all mercury switches were not first removed.

Handlers are given an incentive to remove mercury switches from appliances that contain them prior to processing them, and to recycle non-automotive mercury switches: as with vehicle switches, non-automotive mercury switches not destined for recycling and appliances processed without having had all mercury switches removed are fully regulated as hazardous wastes. Crushed, baled, shredded, baled and sheared appliances are singled out from other products with mercury switches for full hazardous waste regulation because, like motor vehicles, they are commonly processed to recover their scrap metal. Aside from appliances, DTSC assumes that products with mercury switches are not typically processed by these methods.

Subsection (c), which discusses when non-automotive mercury switches are considered generated, is based on similar language in the applicability sections for the existing universal wastes. The designation as universal wastes of discarded products from which mercury switches have not been removed is intended to serve as an incentive for handlers

to remove the switches (when feasible), to avoid managing the entire products under chapter 23.

Add Section 66273.7.3, Applicability—Dental Amalgam wastes:

Silver amalgam restorations are widely used by dentists, and DTSC recognizes that the decision to use amalgam or another material is appropriately made by dentists and their patients. DTSC does establish the standards for managing amalgam waste, however, because it is hazardous waste under the TTLC.

Currently, some amalgam waste is exempt from hazardous waste regulation, while other amalgam waste is fully regulated. Larger scraps of dental amalgam that are recycled are exempt, pursuant to section 66261.6, subsection (a)(3)(B). Smaller amalgam fines (less than 100 microns in diameter) are not exempt, and currently may be subject to full hazardous waste regulation. In order to facilitate the proper management of amalgam wastes generated by dental offices, DTSC is designating dental amalgam wastes, as described in proposed section 66273.9, as universal waste. Chapter 23 does not apply to:

1) dental amalgam that is not waste as described in chapter 11,
2) empty amalgam capsules,
3) waste restorative materials that do not contain mercury,
4) dental amalgam wastes not destined for recycling (these are instead fully regulated as hazardous wastes).

Subsection (a) lists amalgam wastes that are covered under chapter 23's universal waste requirements; subsection (b) lists wastes to which chapter 23 does not apply. Subsection (c), which discusses when dental amalgam waste is considered generated, is based on similar language in the applicability sections for the existing universal wastes.

Add Section 66273.7.4, Applicability—Mercury-Containing Pressure or Vacuum Gauges:

This proposed section applies the requirements of chapter 23 to persons managing pressure or vacuum gauges, as described in section 66273.9, unless:

1) the gauges are not wastes as described in chapter 11;
2) the gauges do not contain mercury, or
3) the gauges will not be recycled.

This section parallels the language found in the applicability sections for the existing universal wastes.

DTSC proposes to make universal waste management of waste pressure or vacuum gauges contingent on recycling. Persons opting not to recycle waste gauges would be subject to full hazardous waste regulation. This is due to the large amount of mercury contained in each gauge—up to 100 grams or more (equivalent to the mercury in 100 fever thermometers or 10,000 fluorescent tubes). Further, gauges that are RCRA hazardous wastes generated by persons subject to the federal hazardous waste program would be subject to land disposal restrictions and would have to be treated prior to land disposal. One of the required treatment processes for high mercury wastes is retorting—the same process used by mercury recyclers.

Subsection (c), which discusses when waste pressure or vacuum gauges are considered generated, is based on similar language in the applicability sections for the existing universal wastes.

Add Section 66273.7.5, Applicability—Mercury-Added Novelties:

Public Resources Code section 15027 bans the sale of mercury-added novelties, effective January 1, 2003. Mercury added novelties are being designated as hazardous wastes elsewhere in these regulations (waste 'M004,' in proposed section 66261.50). To encourage the proper management of these products, DTSC is designating mercury-added novelties, as described in proposed section 66273.9, as universal wastes.

Subsection (a) specifies the discarded mercury-added novelties that are subject to universal waste management. On January 1, 2004, the M004 listing will designate all discarded mercury-added novelties as hazardous wastes. From the date these regulations become effective until December 31, 2003, universal waste requirements will apply only to discarded novelties that are hazardous wastes under existing criteria (i.e., that exhibit the toxicity characteristic). After the M002 listing becomes effective, universal waste management standards will apply to all mercury-added novelties when they become wastes.

Subsection (b) lists categories of novelties not covered under chapter 23. These include:

1) mercury-added novelties that are not wastes, as described in chapter 11,
2) waste novelties that do not contain mercury,
3) waste novelties that contain liquid mercury and are not destined for recycling (these are instead fully regulated as hazardous wastes).

Subsection (c), which discusses when mercury-added novelties are considered generated, is based on similar language in the applicability sections for the existing universal wastes.

Add Section 66273.7.6, Applicability—Mercury Counterweights and Dampers:

These products contain significant amounts of mercury and are currently classified as hazardous waste and subject to full hazardous waste regulation. This proposed section applies the requirements of chapter 23 to persons managing mercury counterweights and dampers, as described in section 66273.9. Chapter 23 does not apply to:

1) counterweights and dampers that are not wastes as described in chapter 11;
2) counterweights and dampers that do not contain mercury;
3) waste products from which mercury counterweights and dampers have been removed; or
4) counterweights and dampers that will not be recycled.

This section parallels the language found in the applicability sections for the existing universal wastes.

Subsection (c), which discusses when counterweights and dampers are considered generated, is based on similar language in the applicability sections for the existing universal wastes.

Add Section 66273.7.7, Applicability—Mercury Thermometers:

Mercury thermometers contain a gram or more of mercury each—enough to significantly exceed the 20 milligrams per kilogram TTLC for mercury. Mercury thermometers are currently fully regulated as hazardous wastes when discarded. This proposed section applies chapter 23's requirements to persons managing mercury thermometers, as described in section 66273.9. Chapter 23 does not apply to:

1) thermometers that are not wastes as described in chapter 11;
2) thermometers that do not use the expansion and contraction of a column of mercury to measure temperature, or
3) thermometers that will not be recycled.

This section parallels the language found in the applicability sections for the existing universal wastes.

The second condition for management of thermometers as universal wastes (that the thermometer must "use the expansion and contraction of a column of mercury to measure temperature") is intended to exclude thermometers whose only mercury is contained in a button-cell battery. Button-cell batteries, when discarded, are already hazardous wastes under existing criteria. As such, they may already be managed as universal wastes under chapter 23.

Subsection (c) is necessary, in order to specify when mercury thermometers become wastes. It is based on similar language in the applicability sections for the existing universal wastes.

Add Section 66273.7.8, Applicability—Mercury Dilators:

Like mercury thermometers, mercury dilators contain a relatively large amount of mercury and significantly exceed the TTLC for mercury. In addition, like mercury thermometers, mercury dilators are currently fully regulated as hazardous wastes when discarded. This proposed section applies the requirements of chapter 23 to persons managing mercury dilators, as described in section 66273.9. Chapter 23 does not apply to:

1) dilators that are not wastes as described in chapter 11;
2) dilators that do not contain mercury, or
3) dilators that will not be recycled.

This section parallels the language found in the applicability sections for the existing universal wastes.

Subsection (c) is necessary, in order to specify when mercury dilators become wastes. It is based on similar language in the applicability sections for the existing universal wastes.

Add Section 66273.7.9, Applicability—Mercury-Containing Rubber Flooring:

At least one brand of mercury-containing rubber flooring—used mainly in gymnasiums—was manufactured with intentionally added mercury. (To DTSC's knowledge, mercury is no longer used in the manufacture of rubber flooring.) Some of this flooring has been tested and found to exceed the TCLP threshold for mercury: 0.2 milligrams per liter. Presently, this flooring is fully regulated as hazardous waste when discarded. This proposed section applies the requirements of chapter 23 to persons managing mercury-containing rubber flooring, as described in section 66273.9. Chapter 23 does not apply to:

1) mercury-containing rubber flooring that is not waste, as described in chapter 11, and
2) rubber flooring that does not contain mercury.

Subsection (c), which discusses when mercury-containing rubber flooring is considered generated, is based on similar language in the applicability sections for the existing universal wastes.

Add Section 66273.7.10, Applicability—Mercury Gas Flow Regulators:

Mercury gas flow regulators significantly exceed the TTLC for mercury and are currently fully regulated as hazardous wastes when discarded. This proposed section applies the

requirements of chapter 23 to persons managing mercury gas flow regulators, as described in section 66273.9. Chapter 23 does not apply to:

1) mercury gas flow regulators that are not wastes, as described in chapter 11,
2) waste gas flow regulators that do not contain mercury, and
3) Mercury gas flow regulators that are not destined for recycling (these are instead fully regulated as hazardous wastes).

Subsection (c), which discusses when mercury gas flow regulators are considered generated, is based on similar language in the applicability sections for the existing universal wastes.

Amend Section 66273.8, Exemptions:

This section currently exempts households from managing universal waste batteries, lamps, and thermostats under the requirements of chapter 23 until February 8, 2006; instead, households may manage these wastes as nonhazardous waste. Beginning February 9, 2006, households would become subject to the labeling, training, and accumulation time requirements applicable to small quantity handlers of universal waste. This amendment would permanently exempt households from all universal waste handler requirements but one: they would continue to be prohibited from disposing of universal waste as non-hazardous waste. Instead, households would be required to transfer their universal waste to a handler or a destination facility.

This proposed change would make the requirements for household generators of batteries, lamps, thermostats, and the proposed new universal wastes consistent with the existing requirements for electronic product generators. Electronic product generators are persons who generate five or fewer CRT devices (primarily televisions and computer monitors) per year; they are exempted by current emergency regulations from most handler requirements. They are required to transfer CRT devices to a CRT material handler or household hazardous waste collection facility, and are prohibited from disposing of or disassembling them.

The rationale for exempting households from handler requirements is that the handler requirements are geared toward businesses and their employees. It will be more effective (and more protective of public health and the environment) to give a single, simple, message to households about these wastes: don't throw them away—get them to an appropriate destination facility.

In addition to the changes discussed above, section 66273.8 is renumbered and reorganized to improve clarity. The temporary disposal exemptions applicable to households and CESQUWGs for specific universal wastes are placed in subsections (a)(1) through (a)(4). The permanent household exemptions are placed in subsection (b);

subsections (b)(2)(A) through (b)(2)(K) enumerate the universal wastes which must be destined for recycling in order to be managed under the household exemption. The former subsection (d) is renumbered as (a)(5); the former subsections (e) and (f) are renumbered as (c) and (d), respectively.

Amend Section 66273.9, Definitions:

This section defines the terms used in chapter 23. Definitions of the wastes for which this proposal is adding universal waste standards are added to section 66273.9.

Amend Article 2, Standards for Small Quantity Handlers of Universal Waste, and Article 3, Standards for Large Quantity Handlers of Universal Wastes:

Articles 2 and 3, respectively, specify universal waste management standards applicable to small and large quantity handlers of universal waste. The waste management standards for small and large quantity handlers are identical. Both articles are amended to add waste-specific management standards for each of the new universal wastes added by this proposal. All of the management standards added by this proposal require universal waste handlers to manage each waste "in a way that prevents releases of any universal waste or component of a universal waste to the environment."

Universal waste management standards for wastes that contain similar amounts of mercury and pose similar risks during waste management have been consolidated. For the purpose of developing universal waste management standards, wastes have been grouped into categories based on several criteria:

1) The amount of mercury they contain;
2) The physical state of the mercury they contain;
3) Whether the mercury they contain is fully encapsulated within the product, or whether the product contains openings through which mercury could escape; and
4) Whether the mercury is encapsulated in glass or another fragile material that, if broken, could result in the release of mercury to the environment.

Add Subsection (d) to Sections 66273.13 and 66273.33:

These new subsections contain management standards for universal waste mercury switches and thermometers. Two categories of discarded mercury switches are designated as hazardous wastes in proposed article 4.1 of chapter 11, while discarded mercury thermometers are already classified as hazardous wastes under existing criteria. Universal waste management standards for all three of these wastes are consolidated in these two subsections, because mercury switches from vehicles, those from other products, and mercury thermometers all contain similar amounts of mercury and pose similar risks during management.

The standards are intended to prevent the release of mercury from switches and thermometers to the environment. Subsection (d)(1) requires a handler to contain broken, damaged, or leaking switches and thermometers in a closed, structurally sound, undamaged, and non-leaking container with packing materials sufficient to protect them from breakage. Similar requirements, in subsection (d)(2), apply to containers used to accumulate mercury thermometers and mercury switches that have been removed from vehicles or other products. The container standards for mercury switches and thermometers are based on the existing standards for mercury thermostats, which are similar in size and contain similar amounts of mercury.

Removal of Mercury Switches from Vehicles and Appliances

Subsection (d)(3) allows, and contains standards for, the removal mercury switches from vehicles and other products. The requirements include:

- Having a mercury clean-up system available;
- Transferring any spilled mercury to an airtight container;
- Removing switches in a well ventilated area that is monitored for compliance with occupational exposure limits for mercury; and
- Formally training employees who remove mercury switches in proper waste handling and emergency procedures.

These requirements are intended to prevent releases of mercury to the environment and to prevent worker exposure to mercury vapors.

Subsection (d)(3)(A) requires handlers who remove mercury switches from vehicles and products keep basic records of switch removal for three years. The information that must be retained is as follows:

1. The number of vehicles destined for crushing, baling, shearing, or shredding;
2. The number of appliances destined for crushing;
3. The number of vehicles or appliances counted in 1 and 2 that contain mercury switches;
4. The number of switches removed from the vehicles and appliances counted in 3; and
5. The number of vehicles counted in 3 that were damaged to the extent that switches could not be removed.

These requirements are intended to document that switches are properly removed. No specific forms or format are specified for the required information, to give maximum flexibility to the universal waste handlers who remove switches in how to document the required information.

Requirement to Remove Switches and Certification of Removal of Switches

On January 1, 2005, the M001 listing in proposed section 66261.50 will take effect. On and after that date, mercury-containing motor vehicle switches and vehicles that contain them will be designated as hazardous wastes. This designation applies to a vehicle that contain mercury switches only when someone decides to crush, bale, shear, or shred it. Effective on the same date, subsection (d)(3)(B) will require that all mercury switches must be removed from a vehicle that contains them prior to processing the vehicle by crushing, baling, shearing, or shredding it. Further, a handler who takes or sends a vehicle or vehicles to another person for crushing, baling, shearing, or shredding will be required, by subsection (d)(3)(C), to certify that all switches have been removed or have been verified to have been removed.

When the M001 hazardous waste listing takes effect, crushing, baling, shearing, or shredding a vehicle that contains one or mercury switches will be considered treatment of a hazardous waste, and will require a permit. These removal and certification requirements will prevent the release of mercury during the processing of scrap vehicles, and will give handlers who process vehicles, or send them to another person for processing, a method of documenting that they are not improperly transporting, treating, or accepting hazardous wastes.

Subsection (d)(4) requires universal waste handlers to determine whether spilled mercury, cleanup residues, and any other wastes generated as a result of handling switches and thermometers exhibit a hazardous waste characteristic. If they do exhibit a characteristic, the wastes are fully regulated hazardous wastes; if they do not, they may be managed as nonhazardous waste, in accordance with federal, State, and local regulations.

Add Subsection (e) to Sections 66273.13 and 66273.33:

These new subsections contain management standards for waste dental amalgam. Because this material is solid at room temperature, it poses different risks than the liquid mercury found in switches, thermostats, and thermometers. These differences are reflected in this subsection's waste management standards for handlers of waste dental amalgam. The standards for amalgam do not require handlers to have a mercury spill kit on hand, for example.

Amalgam fines smaller than 100 microns (or 1/250 inch) in diameter are currently fully regulated as hazardous waste. Due to stringent discharge limits imposed by their Regional Water Quality Control Boards, the providers of sewerage services in parts of the State are requiring dentists to install traps to capture amalgam fines that would otherwise enter the drain. These subsections would allow management of single-use amalgam traps, as well as amalgam fines and sludges removed from reusable traps, lateral lines, etc., as

universal waste. They would also allow management of extracted teeth with amalgam restorations as universal wastes.

Due to mercury's volatility, subsection (e)(1) of these two sections requires handlers to accumulate amalgam waste in airtight containers. Two other prohibitions in the waste management standards are also intended to prevent the release of amalgam waste to the environment. Subsection (e)(2) prohibits handlers of universal waste amalgam from rinsing amalgam traps into a sink, and subsection (e)(3) prohibits them from placing amalgam waste into a medical waste container.

The proposed universal waste management standards for amalgam waste prohibit handlers from placing amalgam into medical waste containers because, in most cases, medical waste is incinerated. While medical waste incinerators are generally equipped with air pollution control devices designed to trap pollutants, some of the mercury in incinerated medical waste inevitably escapes to the atmosphere. Keeping it from being incinerated is a more effective strategy for preventing the release of mercury to the environment than is allowing it to be incinerated and then attempting to trap it.

Add Subsection (f) to Sections 66273.13 and 66273.33:

These new subsections contain standards for the management of universal waste gauges. These products may contain many grams of mercury, and they generally include openings through which mercury could potentially escape. Additionally, the mercury in a universal waste gauge is often found in a glass tube, which can easily be broken, allowing mercury to be released. The proposed management standards for handlers of universal waste gauges were developed with these factors in mind.

Handlers are required, by subsection (f)(1)(A), to close all openings through which mercury could escape, in order to prevent spills or leaks of mercury. As a further precaution, subsection (f)(1)(B) requires that each gauge must be sealed in a plastic bag, which is then placed in a closed, structurally sound, compatible container that contains packing materials adequate to prevent breakage of gauges. Gauges must be kept upright during handling, accumulation, and transportation, in order to minimize the chance of mercury spills.

Subsection (f)(2) gives handlers the option of draining the mercury from universal waste gauges that they have generated (handlers may not drain the mercury from gauges that are received from other handlers, however). Because draining large numbers of gauges at a single consolidation site would increase the risk and potential size of mercury spills, only the handler who generates a universal waste vacuum or pressure gauge would be allowed to drain of mercury from the gauge, and draining could occur only at the site where the universal waste gauge was generated.

Draining mercury from gauges is a fairly common practice. At least one manufacturer of mercury sphygmomanometers offers sphygmomanometer service kits, which include one or more one-pound bottles of mercury. As a part of maintenance, mercury is drained from sphygmomanometers and replaced with fresh mercury from the kit. Because the sphygmomanometer will continue to be used after the mercury is changed, they are not considered wastes under current regulations and the draining activity is not considered hazardous waste treatment. However, a discarded sphygmomanometer would be classified as a hazardous waste, and draining mercury from it would currently be considered hazardous waste treatment requiring a permit.

The draining process itself poses risks of releases of mercury and of worker exposure to mercury vapors. For these reasons, subsections (f)(2)(A) through (f)(2)(J) of sections 66273.13 and subsection (f) 66273.33 require handlers who wish to drain mercury from gauges to comply with a number of requirements:

1) Develop and follow written procedures for safely draining mercury;
2) Drain gauges over a containment device;
3) Keep a mercury spill clean-up kit on hand;
4) Transfer drained mercury to an appropriate container;
5) Drain mercury in a well-ventilated area and monitor the area for compliance with OSHA mercury exposure levels;
6) Train employees in draining procedures, waste handling, and emergency procedures;
7) Store drained elemental mercury in an appropriate container, which is placed in a compatible secondary container;
8) Keep records of the gauges drained; and
9) Not accumulate more than 35 kilograms of drained mercury at any time.

Whether or not they drain liquid mercury from universal waste gauges, handlers are required [by subsections (f)(1)(C) and (f)(2)(C)] to have a mercury clean-up system readily available, and to immediately transfer any spilled mercury to an airtight container. Handlers are required, by subsection (f)(3)(A), to determine whether mercury that spills or leaks from universal waste gauges during management exhibits any hazardous waste characteristic. They must also determine whether absorbent materials used to clean mercury spills, and any other clean-up residues, exhibit a characteristic. If spilled mercury or cleanup residues are found to be hazardous, they are not universal wastes but are instead fully regulated hazardous wastes. However, drained universal waste gauges that exhibit a hazardous waste characteristic may continue to be managed as universal waste; drained gauges that are not hazardous may be managed accordingly.

Add Subsection (g) to Sections 66273.13 and 66273.33:

These new subsections contain management standards for mercury-added novelties. As discussed earlier, the term “mercury-added novelty” is contained in Public Resources

Code section 15025. Public Resource Code section 15027 bans the manufacture and sale of these products, effective January 1, 2003. "Novelties" is a broad category encompassing products containing varying amounts of mercury, which may be in an elemental or an oxidized form. Some mercury-added novelties can appropriately be managed under the standards for one of the other types of universal waste.

These two subsections provide management standards for several categories of novelties:

- Novelties whose only mercury is contained in battery or batteries;

Pursuant to subsection (g)(1), novelties whose only mercury is contained in batteries (and batteries removed from such novelties) will be subject to management under the standards for universal waste batteries in existing subsection (a) of 66273.13 and subsection (a) of 66273.33. After all batteries have been removed, if a novelty is not hazardous for any other reason, it may be managed as nonhazardous waste.

- Novelties that are painted with mercury containing paint;

Spillage or leakage of liquid mercury is not an issue during the handling of novelties that are painted with mercury-containing paint. However, mercury could volatilize from painted novelties, causing potential inhalation risks and the release of gaseous mercury to the environment. Mercury-containing paint may also flake off of painted novelties. For these reasons, subsection (g)(2) of section 66273.13 and subsection (g)(2) of 66273.33 require universal waste handlers to accumulate mercury painted novelties in airtight containers.

- Novelties that contain free liquid mercury; and

Novelties that contain free liquid mercury (i.e., mercury that is not contained in a switch or other encapsulated device), may be fragile and may have openings through which mercury could escape. Because they pose risks similar to those of mercury gauges, the management standards proposed for this type of novelties in subsection (g)(3) are very similar to those for gauges. Handlers are required to pack them in undamaged, closed, structurally sound, and airtight containers with packing materials that are adequate to prevent breakage. Handlers must also keep a mercury cleanup system readily available while handling novelties that contain liquid mercury.

- Novelties that contain mercury switches.

Pursuant to subsection (g)(4), universal waste novelties whose only mercury is contained in a switch or switches are regulated under the standards for universal waste switches and thermometers in proposed subsections 66273.13(d) and 66273.33(d).

Handlers are required, by subsection (g)(5), to determine whether mercury that spills or leaks from universal waste novelties during management exhibits any hazardous waste characteristic. They must also determine whether absorbent materials used to clean mercury spills, and any other clean-up residues, exhibit a characteristic. If spilled mercury or cleanup residues are found to be hazardous, they are not universal wastes but are instead fully regulated hazardous wastes. These requirements are similar to, and are based on, existing standards for handlers of universal waste batteries and thermostats.

Add Subsection (h) to Sections 66273.13 and 66273.33:

These subsections govern the management of universal waste mercury counterweights and dampers, which currently are fully regulated hazardous wastes. These items can contain large amounts of mercury, which is generally fully encapsulated within the product. Mercury counterweights and dampers are often less fragile than other types of mercury-containing products. However, due to the large amount of mercury that these products may contain, as well as the possibility that some may be breakable, a number of management requirements will be imposed on handlers of universal waste counterweights and dampers. Handlers will be required, by subsections (h)(1) through (h)(4), to:

- Recycle counterweights and dampers (no disposal will be allowed);
- Pack them with materials adequate to prevent breakage;
- Pack them in a closed, undamaged, structurally sound container that is compatible with mercury;
- Place leaking, spilling, or damaged counterweights or dampers in a sealed plastic bag in an airtight container; and
- Have a mercury clean-up system readily available.
- Manage spilled mercury and clean up residues that exhibit a hazardous waste characteristic as fully regulated hazardous waste.

These requirements are intended to prevent releases of mercury to the environment and to prevent worker exposure to mercury vapors.

Add Subsection (i) to Sections 66273.13 and 66273.33:

These subsections govern the management of universal waste dilators. Several types of gastrointestinal and esophageal dilators are used in certain medical procedures; some use mercury for weight. These devices may contain many grams of mercury, which is contained in a rubber tube. While not especially fragile, these tubes could rupture, releasing mercury. The standards for universal waste dilators are designed to minimize the possibility of such releases. Damaged or leaking dilators are subject to additional packaging requirements, to ensure that liquid mercury and mercury vapors are contained. The requirements for small quantity handlers, in subsections (i)(1) through (i)(4), include:

- Packing dilators with materials adequate to prevent breakage;
- Packing dilators in a closed, undamaged, structurally sound container that is compatible with mercury;
- Placing leaking, spilling, or damaged dilators in a sealed plastic bag in an airtight container; and
- Having a mercury clean-up system readily available.
- Managing spilled mercury and clean up residues that exhibit a hazardous waste characteristic as fully regulated hazardous waste.

All of these requirements are intended to prevent the accidental release of mercury to the environment during handling and transportation of dilators.

Add Subsection (j) to Sections 66273.13 and 66273.33:

This subsection governs the universal waste management of discarded rubber flooring that contains mercury. Samples of such flooring, which was used in gymnasiums until the late 1970s, were tested and found to exceed the TCLP for mercury, making the flooring hazardous waste when discarded.

Mercury-containing rubber flooring is unlike the other mercury-containing wastes for which new management standards are proposed. Its mercury is not in a liquid form, and is not contained in a discrete component of the waste. Spillage of the mercury is, therefore, less of a concern than for the other new universal wastes. Further, pieces of waste flooring may be generated that are too large to fit in a drum or other common container. Consequently, the waste management standards in this subsection are minimal; they require only that flooring be managed "in a way that prevents releases of any universal waste or component of a universal waste to the environment."

Add Subsection (k) to Sections 66273.13 and 66273.33:

These new subsections contain standards for the management of universal waste gas flow regulators. These devices, which were attached to older gas meters, may contain 100 grams or more of mercury. They generally include openings through which mercury could potentially escape. The mercury in a universal waste gas flow regulator is usually found in a small cup, which can easily spill during removal. The proposed management standards for handlers of universal waste gas flow regulators were developed with the prevention of such spills in mind. Handlers are required by subsection (k)(1) to keep universal waste gas flow regulators upright during handling. As a further precaution, subsection (k)(2) requires that regulators must be sealed in a closed, structurally sound, compatible container.

Handlers of universal waste gas flow regulators are required, by subsection (k)(3), to have a mercury clean-up system readily available, and to immediately transfer any spilled mercury to an airtight container. Handlers are required by subsection (k)(4) 1to determine

whether mercury that spills or leaks from universal waste regulators during management exhibits any hazardous waste characteristic. They must also determine whether absorbent materials used to clean mercury spills, any other clean-up residues, and drained gas flow regulators, exhibit a characteristic. If spilled mercury or cleanup residues are found to be hazardous, they are not universal wastes but are instead fully regulated hazardous wastes. If they are not hazardous, they may be managed accordingly.

Amend Sections 66273.14 and 66273.34:

These sections, which parallel language found in 40 C.F.R. sections 273.14 and 273.34, specify waste-specific labeling requirements for universal wastes. Handlers of universal waste are required to label or mark universal waste or the containers of universal waste to clearly indicate the waste description with one of the following phrases: "Universal waste--___", "Waste ___", or "Used ___", with the blank filled in with the applicable type of universal waste such as battery(ies), thermostat(s), or lamp(s). These regulations add ten new categories of universal waste to chapter 23. New labeling standards, based on the existing standards for batteries, lamps, thermostats, and CRTs, are added for each new universal waste category. In addition to those for the ten new waste categories, labeling standards for the mercury drained from universal waste gauges are also added.

Amend Section 66273.19:

DTSC proposes to add a requirement to section 66273.19, to require small quantity handlers of the 10 newly-added universal wastes to comply with the same recordkeeping requirements that already apply to large quantity handlers of batteries, thermostats, and lamps. Under California's existing universal waste rules, small quantity handlers (persons who never accumulate 5,000 kilograms of universal waste) are not required to keep records of their shipments or receipts of universal waste batteries, thermostats, and lamps. Large quantity handlers are required to retain such records for three years from the date they ship or receive universal waste.

The requirement is added because most of the wastes in question contain relatively large amounts of mercury (several grams, or more). If even a small percentage of these products is improperly disposed, the mercury released would add to the State's already unacceptable level of environmental contamination with mercury. DTSC believes that this minimal recordkeeping requirement will impose a very small additional burden on small quantity handlers, while making it easier for State and local officials to verify that the affected wastes are being managed properly. The recordkeeping requirement will provide an incentive for handlers to comply with the other requirements in this section.

Add Sections 66273.21 and 66273.41:

These new sections pertain to the siting of universal waste handlers that accumulate mercury-containing universal wastes received from other handlers. Due to potential risks associated with the accumulation of large volumes of mercury-containing wastes at non-permitted consolidation sites, these sections list several criteria for offsite accumulation of the wastes. A universal waste handler who accumulates any of the ten new mercury-containing universal wastes anywhere other than at the site of generation must meet these criteria. The criteria are:

- Compliance with all applicable requirements for handlers of hazardous materials;
- Disclosure that mercury is being handled in all applicable business and use permitting applications;
- Compliance with the standards in section 66265.18, which pertain to locating facilities in a 100-year floodplain;
- Compliance with the seismic precipitation design standards in section 66265.25;
- Accumulation of the wastes only in areas that are zoned for commercial or industrial uses; and
- Accumulation of the wastes at a location that does not pose site specific land use hazards or contain sensitive habitat area, based on a review of state and local planning documents and constraints mapping.

The criteria are intended to prevent accumulation of mercury-containing universal wastes at locations that are inappropriate due to incompatibility of the activity with local land use or zoning, or that are not designed to withstand flooding or earthquakes.

Updated Informative Digest

UPDATED INFORMATIVE DIGEST/POLICY STATEMENT OVERVIEW

Summary of Existing Statutes and Regulations

1. Classification of Mercury-Containing Waste

Federal Criteria

Under the United States Environmental Protection Agency's (U.S. EPA's) regulations, a waste has any of four hazardous waste characteristics (ignitability, corrosivity, reactivity, or toxicity) is said to exhibit that characteristic and is generally classified as a hazardous waste. Additionally, a waste that appears on any of four lists of hazardous wastes is classified as a hazardous waste. Pursuant to section 25159.5 of the Health and Safety Code, the federal criteria for identifying hazardous wastes have been adopted in California, in subsection (a) of section 66261.24 of the California Code of Regulations, title 22.[1]

A waste with a leachable concentration of a toxic contaminant equal to or exceeding the regulatory level for that contaminant is a hazardous waste. Leachable concentrations are determined by the Toxicity Characteristic Leaching Procedure (TCLP), published by U.S. EPA in *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846)*. The TCLP regulatory level for mercury is 0.2 milligrams per liter. A waste with a leachable mercury concentration that equals or exceeds this value is classified as a hazardous waste.

California has also adopted U.S. EPA's four lists of hazardous wastes in article 4 of chapter 11. The four lists and their corresponding sections in the regulations are:

- The 'F' List—"Hazardous Wastes from Non-Specific Sources" (Cal. Code Regs., tit. 22, §66261.31);
- The 'K' List—"Hazardous Wastes from Specific Sources" (Cal. Code Regs., tit. 22, §66261.32); and
- The 'P' and 'U' Lists—"Discarded Commercial Chemical Products, Off-Specification Species. Container Residues and Spill Residues Thereof" (Cal. Code Regs., tit. 22, §66261.33).

Several mercury-containing wastes appear on the federal hazardous waste lists. They are:

- K071 Brine purification muds from the mercury cell process in chlorine production, in which separately prepurified brine is not used.
- K106 Wastewater treatment sludge from the mercury cell process in chlorine production.

[1] All subsequent regulatory references, unless otherwise indicated, are to the California Code of Regulations, title 22, division 4.5

- P065 Mercury fulminate.
- P092 Phenylmercury acetate.
- U151 Mercury.

A mercury containing waste that meets any of the above listing descriptions is classified as a hazardous waste.

California Criteria

California has adopted additional properties for the corrosivity and toxicity characteristics. Wastes that have only these properties (i.e., that do not have the properties found in the federal regulations), and do not appear on any of the four federal lists, are "California-only" or "non-RCRA" hazardous wastes.

Toxicity is generally the characteristic of concern with mercury-containing wastes. A mercury containing waste that is not identified as toxic under federal criteria is toxic under California's criteria if it has any of the following properties:

- Its extractable mercury concentration, as determined by the Waste Extraction Test (WET), equals or exceeds 0.2 milligrams per liter;
- Its total mercury concentration equals or exceeds 20 milligrams per kilogram of sample;
- It has an acute oral lethal dose $(LD)_{50}$ less than 2,500 milligrams per kilogram;[2]
- It has an acute dermal LD_{50} less than 4,300 milligrams per kilogram;[2]
- It has and acute inhalation lethal concentration $(LC)_{50}$ less than 10,000 parts per million as a gas or vapor;[2]
- It has an acute aquatic 96-hour LC_{50} less than 500 milligrams per liter;[2] or
- "It has been shown through experience or testing to pose a hazard to human health or environment because of its carcinogenicity, acute toxicity, chronic toxicity, bioaccumulative properties or persistence in the environment."

Appendix X of chapter 11 contains a list of nearly 800 chemicals that, if present in a waste, are presumed to make the waste hazardous. A number of the chemicals listed in Appendix X contain mercury. However, a waste that contains a chemical listed in Appendix X but does not exhibit a hazardous waste characteristic is not a hazardous waste.

2. Hazardous Waste and Universal Waste Management

Chapter 23, section 66273.1 *et seq.*, contains DTSC's Universal Waste Rule (UWR). The UWR allows certain hazardous wastes that are widely generated to be managed under standards that are appropriate for the hazards of the wastes and the types of entities that generate them. For persons who generate, consolidate, and transport

2. The LD_{50} and LC_{50} values are determined using animal toxicity tests. They represent the dose or concentration of a sample of waste that is required to kill half of a group treated animals.

universal wastes, these standards are easier to comply with than the requirements that govern the management of most hazardous wastes. These requirements will lead to higher rates of proper management and disposition of these widely generated, relatively low risk wastes and better protection of public health and the environment. The standards that generators, consolidators, and transporters of most hazardous wastes must comply with are summarized below, followed by summaries of the standards that apply to handlers and transporters of universal waste.

Hazardous Waste Generator Standards

Generators of mercury-containing hazardous wastes are subject to requirements found in chapter 6.5 of the Health and Safety Code and in chapters 12 and 15 of California Code of Regulations, title 22. Some important generator requirements are listed below. Generators must:

- Determine whether their waste is hazardous;
- Obtain an EPA identification number;
- Accumulate hazardous waste in compliance with the applicable time limits specified in the Health and Safety Code section 25123.3 (90 days, 180 days, 270 days or 365 days);
- Keep records;
- Label/mark containers in which hazardous waste is accumulated;
- Prepare and implement emergency procedures/contingency plans;
- Train all employees in proper waste handling and emergency procedures, relevant to their responsibilities;
- Ensure that shipments of more than 50 pounds or 5 gallons of hazardous waste are carried by transporters that are registered with DTSC and have obtained an ID number; and
- Submit a biennial report.

Hazardous Waste Consolidation Facility Standards

A facility that consolidates mercury-containing hazardous wastes generated at offsite locations is required, as a hazardous waste storage facility, to obtain a permit from DTSC. Depending on whether or not the waste is federally regulated, either a full RCRA permit or a standardized permit may be required. Household hazardous waste collection facilities may consolidate mercury-containing hazardous wastes generated by households and Conditionally Exempt Small Quantity Generators. These facilities do not require full or standardized permits; instead, they may operate under the less stringent Permit-by-Rule authorization tier, pursuant to chapter 45.

Hazardous Waste Transporter Standards

Transporters of mercury-containing hazardous waste (other than those regulated as universal wastes) are subject to the standards for hazardous waste transporters found in chapter 13, and in article 6 of chapter 6.5 of the Health and Safety Code. Hazardous

waste transporters must keep a valid registration issued by DTSC in their possession while transporting hazardous waste. Prior to transporting hazardous waste, a registered transporter must obtain an identification number and a registration certificate from DTSC. A transporter may only carry hazardous waste that is accompanied by a Uniform Hazardous Waste Manifest. The manifest must be signed by the generator and transporter, and must be kept in the transporter's possession.

Standards for Managing Elemental Mercury that is Non-RCRA Hazardous Waste

Section 66266.120 exempts persons who handle waste elemental mercury from some hazardous waste management requirements. However, these reduced management requirements apply only to elemental mercury that is non-RCRA hazardous waste. Waste elemental mercury that exceeds the TCLP of 0.2 micrograms per liter, and is not otherwise exempt under RCRA regulations, is subject to the full hazardous waste management standards outlined above. Up to 10 pounds of non-RCRA waste elemental mercury may be stored onsite without a permit; up to 10 pounds can be transported to a recycler without a registered hazardous waste hauler or uniform hazardous waste manifest.

Universal Waste Handler Standards

In lieu of the above requirements, handlers (generators and offsite consolidators) of universal waste (which currently includes lamps, batteries and thermostats):[3]

- Must obtain an EPA identification number only if they accumulate 5,000 kilograms or more of universal waste at any time;
- May accumulate universal wastes for up to one year without a permit;
- Must keep shipping records only if they accumulate 5,000 kilograms or more of universal waste at any time;
- Are subject to more flexible labeling/marking requirements;
- May train employees informally, (unless they accumulate 5,000 kilograms or more of universal waste at any time, in which case more formal training is required);
- Must contain any releases or residues of universal wastes, determine whether the resulting materials exhibit any hazardous waste characteristic and, if they do, manage the materials as hazardous wastes;
- May ship universal waste using a common carrier; and
- Are not subject to biennial reporting.

Cathode ray tube (CRT) materials are also universal wastes, pursuant to emergency regulations adopted by DTSC.[4] In addition to complying with the requirements for universal waste handlers listed above, CRT material handlers who accept more than

3 These universal wastes are managed pursuant to Articles 2 and 3 of chapter 23, section 66273.10, *et seq.*

4 CRT materials are regulated as universal wastes under Article 7 of chapter 23, section 66273.80, *et seq.*

five CRTs or more than 100 kilograms of CRT glass from offsite generators, or who generate more than 5,000 kilograms of CRT material per year, are required to notify DTSC and their local CUPA of their activities. The emergency regulations also allow CRT material handlers to treat or recycle CRT materials, provided they comply with a list of additional requirements. DTSC is recently submitted the permanent CRT regulations to the Office of Administrative Law.

Effective January 1, 2002, Health and Safety Code section 25201.16 designates hazardous waste aerosol cans as universal wastes. The requirements for generators and consolidators of intact aerosol cans are very similar to those for the handlers of batteries, lamps, and thermostats in chapter 23 of the regulations. In addition, the aerosol cans statute allows handlers who are not "offsite commercial processors" to puncture, drain, and/or crush universal waste aerosol cans, provided they comply with a list of additional requirements.

Universal Waste Transporter Standards

Persons who transport universal waste batteries, lamps, thermostats, or CRT materials are regulated as universal waste transporters. Universal waste transporter requirements, which are found in article 4 of chapter 23, are much reduced compared with general hazardous waste transportation requirements. A universal waste transporter is not required to register with DTSC, and is not required to obtain an EPA identification number. The Uniform Hazardous Waste Manifest is not required for universal waste transporters; instead, they may transport universal waste with a bill of lading.

POLICY STATEMENT

1. Background

A number of sites in California are contaminated with mercury to the extent that clean-up or other mitigation activities have been necessary. Similarly, some of the state's waters exceed water quality standards for mercury, triggering a requirement for development of Total Maximum Daily Loads (TMDLs) under the federal Clean Water Act. The severity of California's mercury contamination problem is further evidenced by fish advisories issued by California's Office of Environmental Health Hazard Assessment (OEHHA) for a number of California recreational waters. OEHHA has advised the public to restrict or eliminate consumption of sport fish from some of these water bodies because they contain unsafe levels of methylmercury. In spite of the contamination of California's environment with mercury, certain mercury-containing wastes continue to be classified and managed as nonhazardous waste, resulting in the preventable release of more mercury. Other mercury-containing wastes that are widely generated by clinics, hospitals, laboratories, small businesses, and households are classified as hazardous waste and are subject to stringent requirements that are more appropriate for industrially generated wastes. These wastes are more likely to be properly managed and recycled as universal wastes.

Mercury-Containing Wastes Currently Classified as Nonhazardous

Under California's current waste identification criteria, some mercury-containing wastes are classified as nonhazardous, and may legally be disposed in (nonhazardous) municipal landfills. Based on one national estimate, the Department of Toxic Substances Control (DTSC) calculates that approximately 37.2 short tons of mercury were disposed in California's non-hazardous landfills in 1995. Although there have been decreased uses of mercury in products, DTSC calculates that approximately 17.3 tons of mercury were still disposed in 2000.

DTSC has identified several types of mercury-containing products that are frequently classified as nonhazardous wastes when discarded. While the mercury concentrations in these wastes are relatively low, their management and disposal contribute significant amounts of mercury to the State's environment, due to their large volumes. The wastes include some fluorescent lamps, certain novelty items, and vehicles and large appliances that contain mercury switches.

The mercury found in lamps and novelties can enter the environment when the products break during use, handling, or disposal. The mercury contained in switches is released when an appliance or vehicle is baled, sheared, crushed, or shredded for recycling. Some of the mercury is emitted directly to air, while some remains associated with the non-metallic fluff that is generated during shredding. Shredder fluff, which is produced after shredding both automobiles and appliances, is often used as daily cover in non-hazardous Class 3 landfills in California. Public Resources Code section 42175 already requires the removal of mercury switches from appliances prior to crushing them or transferring them to a baler or shredder for recycling. However, mercury switches generally are still not removed from vehicles prior to recycling.

Management Standards for Widely Generated Mercury-Containing Wastes

Many widely generated mercury-containing wastes are currently classified and fully regulated as hazardous wastes. Generators of these wastes must comply with numerous requirements, including labeling standards, accumulation time limits, manifesting, record retention, etc. Before they may accept them from offsite generators, consolidators of these wastes currently must comply with lengthy and relatively expensive permitting or authorization requirements.

Management standards have been adopted for several widely generated hazardous wastes in DTSC's Universal Waste Rule. Recent legislation [Senate Bill (SB) 633 (stats. 2001, ch. 656)] added section 25214.6 to the Health and Safety Code, which requires mercury light switches removed from motor vehicles to be managed under the Universal Waste Rule. However, waste-specific management standards for vehicle light switches, and for many other widely generated mercury-containing wastes, have yet to be adopted.

Large volumes of waste mercury-containing products discarded by certain businesses, government agencies and households in the State continue to be disposed in municipal landfills. In addition to vehicle light switches, these hazardous wastes include such common products as mercury fever thermometers, mercury-added novelty items, and products that contain mercury switches. DTSC believes that allowing these products to be managed as universal wastes will more effectively promote their proper management.

2. Objectives

The objectives of these regulations are to encourage the following:

1. pollution prevention through the use of non-mercury containing products,
2. development of products that use mercury alternatives, and
3. recycling of mercury containing waste.

These objectives will be accomplished by:

1. listing discarded products that contain intentionally-added mercury and can be recycled or have non-mercury alternatives as hazardous wastes
2. developing universal waste management standards to facilitate the collection, storage, and recycling of discarded mercury-containing products that are classified as hazardous wastes.

Currently, some widely generated products that contain mercury are not classified or regulated as hazardous waste. Consequently, the mercury they contain is more likely to enter the State's environment during management and disposal than would be the case if the products were regulated as hazardous wastes.

The regulations will designate a list of mercury-containing products as hazardous wastes when discarded. Products that met one or both of two criteria were chosen for listing: products for which recycling is feasible and/or for which mercury-free alternatives are available. These criteria are consistent with section 25179.4 of the Health and Safety Code, in which the Legislature directs DTSC to make promotion of source reduction and recycling its two top priorities for the hazardous waste management program.

In addition to listing these discarded mercury-containing products as hazardous wastes, DTSC proposes to adopt new standards for managing some of them. DTSC also proposes new universal waste management standards for several categories of discarded mercury-containing products that are already hazardous under existing criteria. DTSC's Universal Waste Rule, chapter 23, section 66273.5, already designates hazardous waste lamps as universal wastes, and sections 66273.13 and 66273.33 contain management requirements for handlers of universal waste lamps. Therefore, these regulations do not need to include universal waste management standards for the newly-listed lamps.

Designating these hazardous wastes as universal wastes will impose appropriate requirements for collection, storage, and transportation to a destination facility, where the mercury-containing wastes will be recycled. In some special instances, disposal is allowed in a hazardous waste landfill.

3. Regulations

Listing of Mercury-Containing Hazardous Wastes

These regulations will add a new article 4.1 to chapter 11. Article 4.1 contains a list of mercury-containing products that, when discarded, will be classified as hazardous wastes. Four waste types are listed in article 4.1: mercury-containing motor vehicle light switches, non-automotive mercury switches, lamps that contain mercury and mercury-added novelties. Mercury-containing wastes not appearing on the list will continue to be identified as hazardous or nonhazardous using the existing federal lists and the hazardous waste characteristics in chapter 11.

Universal Waste Management of Mercury-Containing Wastes

These regulations will establish new standards for the management of mercury-containing wastes as universal wastes. They include standards for both the wastes listed in article 4.1, and for several other widely generated wastes that are hazardous due to their mercury concentration. The new universal waste management standards for these wastes will be added to the existing standards for batteries, lamps, thermostats, and CRTs in chapter 23.

Under the regulations, generators will be required to properly dispose of or recycle their mercury-containing wastes, but will be subject to less restrictive storage and shipment requirements as universal waste handlers. In most cases, universal waste management will be conditioned on ultimately recycling the mercury contained in the discarded products. Currently, California's only mercury retorts (facilities that reclaim mercury) are limited to processing waste fluorescent lamps. All other mercury wastes for which recycling will be required will have to be sent to out-of-state facilities. Permitting requirements for these out-of-state facilities will depend on the individual state's hazardous waste permit requirements.

As with the current universal wastes, common carriers will be allowed to transport the proposed new mercury-containing universal wastes on bills of lading rather than hazardous waste manifests. In order to simplify transportation, the use of registered hazardous waste transporters will not be required. As is true for the current universal wastes, offsite facilities will be allowed to accumulate the new mercury-containing universal wastes for up to one year without authorization from DTSC.

4. Reason for Regulations

Why DTSC is Listing Mercury-Containing Wastes as Hazardous Wastes

Discarded mercury-containing products have been selected for designation as hazardous wastes based on the availability of non-mercury alternatives and on the feasibility of recycling the products' mercury. DTSC has determined that this designation will encourage the development and use of non-mercury substitutes, consistent with section 25179.4 of the Health and Safety Code. DTSC also believes that allowing management of these and other widely generated discarded mercury-containing products under the universal waste standards will maximize the rate of diversion from the nonhazardous waste stream to hazardous waste recycling and disposal. When recovery of the mercury in a discarded product is feasible, managing it as universal waste will be contingent on ultimately recycling it. This will provide a strong incentive for mercury recycling.

The regulations will list certain mercury-containing hazardous wastes in a new article 4.1 of chapter 11. The list is modeled after the RCRA hazardous waste lists, which have been adopted in article 4 of chapter 11. Each listed waste is assigned a unique 'M' number. Descriptions of each listed waste type give specific descriptions of the wastes that are and are not included. For some wastes, the listing description includes information on when they are considered generated.

The new listed wastes are:

- M001: Mercury-containing motor vehicle light switches and vehicles that contain them.

Mercury light switches are used in many makes and models of vehicles, both foreign and domestic. These switches are used to control lights in vehicle hoods and trunks. Each switch contains approximately one gram of mercury. Removed from a vehicle, the switches would currently be classified as hazardous wastes, because their total mercury concentration exceeds the Total Threshold Limit Concentration (TTLC) for mercury of 20 milligrams per kilogram. When the total mass of even a small vehicle is taken into account, however, the amount of mercury contained in its switches is generally below the thresholds that would make the vehicle hazardous waste. DTSC estimates that between 0.75 and 1.5 tons of mercury are contained in the vehicles scrapped annually in California. Little of this mercury is currently recycled or disposed as hazardous waste.

These regulations will designate discarded mercury-containing motor vehicle light switches, and discarded vehicles that contain them, as hazardous wastes, regardless of the total mass of the vehicle. Under the regulations, hazardous waste will be considered generated when a dismantler decides to crush, bale, shred, or shear a vehicle that contains mercury light switches. The entire vehicle will be a listed hazardous waste, unless and until the dismantler removes all of its mercury light switches. (Light switches that cannot be removed with reasonable effort due to *accidental* damage sustained by a vehicle will not cause the vehicle to be classified as a

hazardous waste. Waste derived from crushed or shredded vehicles from which all mercury-containing light switches have not been removed will not be in the listing description for 'M001' hazardous wastes. Such waste will be characterized as hazardous or nonhazardous using the existing hazardous waste characteristics.)

The scope of this listing has been changed since the 45-day public notice was issued. Only mercury-containing motor vehicle *light* switches are now included in the listing. As originally noticed, the M001 listing would have rendered a vehicle destined for crushing, baling, shearing, or shredding that contained any type of mercury switch as a hazardous waste. The listing has been revised in response to comments received during the 45-day public comment period. While mercury-containing motor vehicle light switches are fairly well characterized (i.e., information is available on the makes and models of vehicles that contain them),[5] neither vehicle recyclers nor DTSC has reliable information on which makes or models contain mercury switches in Antilock Braking Systems (ABS), ride stabilizer systems, alarm systems, etc. Absent such information, both compliance and enforcement would be exceedingly difficult. DTSC has determined that until such information is readily available, removal of mercury switches other than light switches from vehicles should remain voluntary (although persons who voluntarily remove non-lighting mercury switches may manage them as universal wastes).

- M002: Non-automotive mercury switches, and products that contain them.

Mercury switches are used in a variety of products besides vehicles. Smaller products that contain such switches are already hazardous wastes when discarded, because of their relatively small mass relative to the amount of mercury in the switches. Larger, heavier products that have only a single switch containing one gram of mercury (such as some washing machines) may not be hazardous under the current hazardous waste identification criteria. A product weighing more than 50 kilograms (or 110 pounds) and containing 1 gram of mercury would not exceed mercury's TTLC of 20 milligrams per kilogram (however, such a product could potentially exceed mercury's STLC or TCLP limits of 0.2 milligrams per liter).

These regulations will designate discarded non-automotive mercury switches, and products that contain these switches, as hazardous wastes. The entire product will be a listed hazardous waste, unless and until the generator removes all of the switches. DTSC's intention in designating discarded products with mercury switches as hazardous wastes is to ensure the removal of the switches prior to crushing or otherwise processing of products in ways that could cause mercury to be released.

- M003: Mercury-containing lamps and products that contain them.

[5] Subdivision (a) of section 25214.7 of the Health and Safety Code requires DTSC, in coordination with local agencies, to assist businesses that dismantle or crush motor vehicles to safely remove and properly dispose of mercury-containing light switches. This assistance is to include information on which makes and models contain mercury light switches and entities that provide mercury recycling services.

All fluorescent lamps, and some other lamp types, contain mercury. Often, discarded fluorescent, mercury vapor, and high intensity discharge (HID) lamps are hazardous wastes because they exhibit toxicity due to their mercury. However, samples of some currently available fluorescent lamps, while not free of mercury, were determined not to be hazardous wastes under the toxicity characteristic. These lamps may be discarded in the municipal (nonhazardous) waste stream in unlimited quantities. Anecdotal evidence suggests that sales of these low-mercury lamps have increased. If more of these low-mercury lamps are purchased because people wish to avoid managing them as universal wastes or recycling or disposing them as hazardous waste, the amount of mercury entering California's environment could actually increase. Also, the fact that some fluorescent lamps are currently hazardous and others are not causes confusion for municipal landfill operators attempting to identify and remove hazardous waste lamps from loads of garbage.

- M004: Mercury-added novelties.

SB 633 (Stats. 2001, ch. 656) added section 15027 to the Public Resource Code, which bans the manufacture and sale of mercury-added novelties, effective January 1, 2003. The bill defines a mercury-added novelty as "a mercury-added product intended mainly for personal or household enjoyment or adornment. A 'mercury-added novelty' includes, but is not limited to, any item intended for use as a practical joke, figurine, adornment, toy, game, card, ornament, yard statue or figure, candle, jewelry, holiday decoration, and item of apparel, including footwear." DTSC is aware of one novelty, a "quicksilver maze," that contained a ball of liquid mercury. Most other novelties likely contain mercury in switches, button cell batteries, or paint applied to their surface. The quicksilver maze would very likely exceed hazardous waste thresholds, if tested. Other novelties might not be classified as hazardous under current regulations. These regulations will designate all novelties meeting the listing description (which is repeated in the regulations, verbatim, from the definition in SB 633) as hazardous wastes.

Why DTSC is Allowing Universal Waste Management of Certain Mercury Containing Hazardous Wastes

The regulations include new universal waste management requirements for some discarded mercury-containing products.[6] As with the existing universal wastes, the standards will apply to these new universal wastes in lieu of full hazardous waste management requirements, provided the wastes are properly recycled, or in some cases, disposed of as hazardous waste. The existing general requirements for universal waste handlers, transporters, and destination facilities will also apply to persons managing these wastes. In developing their respective universal waste rules, U.S. EPA and DTSC used several criteria to determine whether a given category of hazardous waste should be included as universal waste. The criteria include:

[6] The Universal Waste Rule already includes management standards for hazardous waste lamps.

- The waste is commonly generated by a wide variety of types of establishments (including, for example, households, retail and commercial businesses, office complexes, conditionally exempt small quantity generators, small businesses, government organizations, as well as large industrial facilities);
- The waste or category of waste is generated by a large number of generators, frequently in relatively small quantities by each generator;
- Systems to be used for collecting the waste or category of waste (including packaging, marking, and labeling practices) will ensure close stewardship of the waste;
- The risk posed by the waste or category of waste during accumulation and transport is relatively low compared to other hazardous wastes; and
- Regulation of the waste or category of waste as universal waste will promote safe and effective collection and recycling.

DTSC has evaluated each waste it is proposing to include in an expanded Universal Waste Rule against these criteria. DTSC believes that each of the waste products it proposes to add to the Universal Waste Rule meets most or all of them.

Explanation of Each New Universal Waste Category Being Proposed

- Mercury-containing motor vehicle light switches, and vehicles that contain them (M001 Wastes)
- Non-automotive mercury switches and products that contain them (M002 Wastes)
- Mercury thermometers

The thermostats included in the existing universal waste regulations contain mercury tilt switches, which are mounted on bimetallic coils. Therefore, management of one category of mercury switches is already part of the Universal Waste Rule. The current regulations will broaden the rule's applicability to all mercury switches. As is the case with mercury thermostats, non-mercury alternatives to the mercury switches used in vehicles and other products are readily available. The risks posed by mercury switches in general are also very similar to those posed by those in thermostats. These facts support DTSC's decisions to add switches to the Universal Waste Rule and to establish very similar management standards to those for thermostats.

In order to encourage the removal of mercury switches, vehicles and other products that contain them will be listed hazardous wastes under the regulations, whether or not they exhibit toxicity for mercury. (The vehicle will not become hazardous waste until any person decides to crush, bale, shear, or shred it.) Removal of mercury switches from vehicles and other products will be allowed under new universal waste management standards. The switches covered by these two listings are essentially identical once they are removed. For this reason, management standards for vehicle and non-vehicle mercury switches are included in the same subsections (one covering small quantity handlers, the other large quantity handlers). Standards for management of mercury thermometers are also combined with those for switches because, while switches and

thermometers serve entirely different purposes, they contain similar amounts of encapsulated mercury (often in glass), and therefore their management poses very similar risks.

- Dental amalgam wastes

Dental amalgam is composed of approximately 50 percent mercury. Its mercury concentration exceeds the TTLC limit of 20 parts per million and it is normally classified as hazardous waste. Amalgam waste that is recycled and qualifies as scrap metal is exempt from hazardous waste regulations. Other amalgam wastes, such as fines, sludges, single-use traps, etc., are currently regulated as hazardous wastes. Under the regulations, all amalgam wastes could be managed as universal wastes. Dental amalgam waste meets DTSC's criteria for inclusion in the Universal Waste Rule: it is widely generated, it is recyclable, and non- mercury substitutes are available.

- Mercury-containing pressure or vacuum gauges (manometers, barometers, sphygmomanometers, etc.)

These products contain relatively large quantities of mercury and, when discarded, would generally be classified as hazardous wastes. They are also generated relatively widely, in relatively small quantities by each generator. The mercury in a vacuum or pressure gauge cannot be entirely encapsulated. In order to work, the surface of the mercury must be directly exposed to the gas whose pressure is being measured. While they meet the criteria for management as universal wastes, mercury gauges require extra care during handling due to their openings and the large amount of mercury they contain. The proposed management standards for mercury require that gauges be kept upright, that openings through which mercury could escape be closed, and that gauges be sealed in bags and packed to avoid breakage. Some handlers will also be allowed to drain the mercury from gauges, provided they comply with a number of requirements discussed later.

- Mercury-added novelties

This is a relatively broad, "catch all" category of products, whose definition has been taken directly from SB 633 (Public Resources Code section 15027). Many mercury-added novelties meet the descriptions in the "applicability" sections for other universal wastes. Novelties whose only mercury is contained in batteries can be managed under the standards for universal waste batteries; novelties whose only mercury is contained in switches can be managed under the standards for universal waste switches and thermometers. Specific management standards are established for novelties that contain liquid mercury, and for those that are painted with mercury-containing paint.

- Mercury counterweights and dampers

This new universal waste category includes products that take advantage of mercury's high density. Like the other new universal wastes DTSC proposes to add, these

products are widely generated and are more likely to ultimately be sent for hazardous waste recycling or disposal as universal wastes than as fully regulated hazardous wastes. In developing the proposed management standards for these products, it was assumed that they generally contain a relatively large amount of mercury, but that it is fully contained, and that the products are not especially fragile.

- Mercury dilators and weighted tubing[7]

The mercury contained in these medical devices is fully enclosed in flexible tubing. The dilators are widely used in hospitals and clinics, statewide. They contain a relatively large amount of liquid mercury, which should be readily recyclable. Further, tungsten powder has replaced mercury in the esophageal dilators manufactured in recent years. As with the other wastes for which DTSC is proposing universal waste management, mercury dilators meet the criteria for designation as universal wastes.

- Mercury containing rubber flooring

DTSC is aware of at least one brand of rubber flooring used in gymnasiums in the 1970s that contained mercury. DTSC believes that the manufacture of this material ceased in the 1970s, but it may continue to be replaced or disposed from time to time. Some of this flooring may contain sufficient mercury to exceed the TCLP threshold for mercury, and consequently, is classified as hazardous waste when discarded. These regulations will allow universal waste management of rubber flooring that is hazardous due to its mercury content.

- Mercury gas flow regulators

Some older residential gas meters (installed prior to 1961) contain mercury gas flow regulators, each of which can contain 100 grams of mercury. The handlers of these meters are, in most cases, gas company employees or their contractors. Due to the large amount of mercury these regulators contain, they would be classified as hazardous under the existing criteria, as would the meters in which they are found. The regulations will facilitate the proper removal, handling, transportation, and storage of mercury flow regulators by gas company personnel.

Universal Waste Management of Certain Hazardous Wastes Protects Public Health and the Environment

In the Initial Statement of Reasons for its original Universal Waste Rule, DTSC provided the rationale for regulating selected hazardous wastes less stringently to facilitate proper management, recycling and disposal. The arguments used for the original three wastes (lamps, batteries, and thermostats) apply equally to the wastes DTSC proposes

[7] The name of this new universal waste category has been changed since the original 45-day public notice. It was brought to DTSC's attention that some of the products in this category are not properly referred to as "dilators," but as "weighted tubing." The words "are weighted tubing" have been added to this universal waste category to correct this error in nomenclature.

to add in this rule. DTSC believes that regulating these products under universal waste standards will result in more recycling or proper disposal.

PEER REVIEW

DTSC has had the scientific basis of these regulations peer reviewed, pursuant to Health and Safety Code section 57004.

BUSINESS REPORT

DTSC has determined that this rulemaking will not require businesses to write a new report.

FISCAL IMPACT ESTIMATES

Estimate of Potential Cost or Savings to Local Agencies Subject to Reimbursement: DTSC has determined that adoption of these regulations will not impose a local mandate or result in costs subject to reimbursement pursuant to part 7 of division 4, commencing with section 17500, of the Government Code or other nondiscretionary costs or savings to local agencies.

Local agency generators will incur estimated cumulative costs of less than $44,000 in fiscal year 2005/2006 and less than $110,000 each year thereafter for managing previous non-hazardous lamps as hazardous/universal waste, as adjusted for inflation. Certified Unified Program Agencies (CUPAs) will inspect businesses that generate the newly designated hazardous/universal wastes. However, these businesses generate other universal wastes and are already subject to inspection by CUPAs. CUPA inspections of generators of the new hazardous/universal wastes will be incorporated into their existing inspection programs. CUPAs will incur minor additional costs only when complaints specific to the new hazardous/universal wastes are received. CUPAs are authorized by Health and Safety Code section 25404.3 to assess fees to recover the costs of their programs.

Costs or Savings to Any State Agency: There is an increased cost impact to the State and local agencies of less than $44,000 in fiscal year 2005/2006 and a cost of less than $110,000 each year thereafter for managing previous non-previously nonhazardous lamps as hazardous/universal waste, as adjusted for inflation for local agencies. These costs are not reimbursable because they are incurred by agencies as regulated entities identical to costs incurred by other hazardous waste generators.

Costs or Savings in Federal Funding to the State: State agencies will incur estimated cumulative costs of less than $12,000 in fiscal year 2005/2006 and less than $30,000 each year thereafter, as adjusted for inflation, for managing previous non-hazardous lamps as hazardous/universal waste. DTSC will incur minor costs to train CUPAs and industry in the new regulations. These costs will be absorbable because the associated workload will be incorporated into DTSC's existing training on universal

wastes.

Effect on Housing Costs: DTSC has determined that there will be no impact on housing costs.

Cost Impacts on Representative Private Persons or Businesses: Many businesses in California generate some currently nonhazardous fluorescent lamps. These businesses will experience a minor cost increase for managing these low-mercury lamps as hazardous/universal waste rather than nonhazardous waste. A much smaller number of businesses generating the other wastes affected by these regulations will see a savings. They include medical and dental offices, hospitals and laboratories generating mercury devices, appliance repair companies, and some gymnasium operators.

All businesses generating fluorescent lamps that are currently classified as nonhazardous in California will incur minor costs under the regulations. Auto dismantlers and recyclers will incur the largest costs increases--approximately $2,650 per dismantler, at most. Distribution of costs for lamps is unknown since generation rates not known. Although difficult to quantify, businesses including medical offices, appliance repair and recycling, dental offices, and other firms will experience a minor savings compared with the full hazardous waste management system that would be required if the proposed regulations were not enacted.

Households will be subject to the reduced standards of the Universal Waste Rule instead of the more complex and extensive general standards of the Hazardous Waste Control Law. The major costs facing households are associated with potential increased trips for disposal of accumulated universal wastes. However, households will be expected to transport universal waste, along with other hazardous wastes, to existing household hazardous waste collection programs during the same trip. The number of trips will remain the same, which nullifies the cost impacts due to transportation. DTSC expects that universal waste handler provisions will make it easier for private businesses to begin offering consolidations services to households that do not have access to public facilities. These services are not currently available to most households because current requirements make these services unprofitable.

All generators of currently hazardous mercury containing devices that comply with universal waste management standards will incur lower costs than under hazardous waste management.

There may be small costs to businesses for managing newly listed wastes, but these are not expected to be significant. DTSC estimates, for example, that the cost to remove and recycle two mercury switches from automobiles will be about $6.50 per automobile.

Significant Statewide Adverse Economic Impact on Businesses: DTSC has determined that the regulations will not have a significant statewide adverse economic impact directly affecting businesses, including the ability to compete with businesses in

other states.

Assessment Statement:

(A) Creation or elimination of jobs within California: The regulations will not cause the elimination of jobs within California and will create a small number of jobs. Because the regulations allow universal waste generators to avoid the costs of full hazardous waste management, the regulations will not lead to the elimination of jobs within California. Because the transport and recycling fees paid by generators are low on a per-firm basis, no jobs are likely to be eliminated within these entities. It is expected that increased demand for transport and recycling services may lead to a small number of new jobs in those sectors.

(B) Creation of new businesses or the elimination of existing businesses within California: Because the regulations allow universal waste generators to avoid the costs of full hazardous waste management, the regulations will not lead to the elimination of existing businesses within California. The increased demand for transport and recycling services is expected to be met via an expansion of existing businesses.

(C) Expansion of businesses currently doing business in California: The increased demand for transport, consolidation, and recycling services is expected to be met via an expansion of existing businesses.

Effect on Small Businesses: DTSC has determined that provisions of this rulemaking may have an effect on small businesses.

Final Statement of Reasons

FINAL STATEMENT OF REASONS
MERCURY WASTE CLASSIFICATION AND MANAGEMENT
Department Reference Number: R-02-04
Notice File Number: Z02-0806-09

CONTENTS

GENERAL INFORMATION

Two versions of the proposed regulation text are discussed in this Final Statement of Reasons:

The 45-Day Public Review and Comment Period:
This was the originally proposed language offered for public review and comment in August 2002. The public hearing was held on September 30, 2002, and the comment period closed on the same date.

The 15-Day Notice of Changes:
This document presents changes made, in two 15-day public notices, to the originally proposed text. The text in the first and second 15-day public notices was identical. The Department of Toxic Substances Control (DTSC) made the changes available a second time because 58 commenters from the 45-day public notice period were inadvertently not included on the mailing list for the first 15-day public notice. (There was also another 15-day public notice that made two external peer reviews of the scientific basis for the regulation available for review and comment.) The 15-day public notice periods were:

- Comments due November 20, 2002. This was the first 15-Day Public Review and comment period for changes to the text of the proposed regulations.
- Comments due December 5, 2002. This was the 15-Day Public Review period for the external scientific peer review documents, incorporated as documents relied upon.
- Comments due December 10, 2002. This was a re-issue of the first 15-Day Public Review and comment period. This comment period and the first 15-Day Comment Period are referred to collectively in this document as the "15-Day Notice of Changes."

EFFORT TO AVOID DUPLICATION OR CONFLICTS WITH FEDERAL REGULATIONS

These regulations change the way certain mercury-containing wastes are regulated in California. The regulations designate (list) four categories of discarded products as hazardous wastes. All four categories include products that would not be classified as hazardous wastes under existing federal and State criteria. By listing them, DTSC's intention is to ensure that all products in each category are identified as hazardous wastes when discarded.

The regulations also add universal waste management standards to the existing Universal Waste Rule for some of the newly listed hazardous wastes. The Universal Waste Rule already applies to and includes standards for hazardous waste fluorescent tubes, so no new standards were added for this newly listed category. The regulations also add universal waste standards for several waste categories that are already

hazardous wastes under current criteria. None of the new universal wastes are included in the federal Universal Waste Rule. However, the addition of these wastes to California's rule is allowed by the federal Universal Waste Rule. It allows states to add additional RCRA hazardous wastes [hazardous wastes regulated under the federal Resource Conservation and Recovery Act (RCRA)] to the list of wastes regulated as universal waste in those states.

STUDIES RELIED ON

DTSC used information from a variety of sources in developing these proposed regulations.

In preparing its *Draft Mercury Report*, released in October 2001, DTSC extensively researched the State's mercury problem. The draft report was finalized in August 2002 and made available to the public. The report discusses the nature and extent of mercury contamination in California, as well as the past and present sources of this contamination. It also reviews the toxicology and environmental behavior of important forms of mercury and outlines several options for reducing further contamination by changing the way mercury-containing wastes are classified and managed.

Sources consulted in the preparation of the *Draft Mercury Report* include reports by U.S. EPA and State agencies, Internet web sites of government and academic institutions, scientific journals and books, and related regulatory materials. The information compiled in DTSC's *Draft Mercury Report* was consulted during the development of these proposed regulations. Additional information on common mercury-containing devices was obtained from Purdue University's Internet web site at:

http://pasture.ecn.purdue.edu/-mercury/src/devicepage.htm.

DTSC also conducted four workshops, in various locations throughout the State, at which the report's findings and regulatory recommendations were presented. Many opinions and suggestions were received at the workshops, and they were taken into consideration in developing the current proposal.

Also relied on were:

- The State and federal Universal Waste Rules, found in chapter 23 of the California Code of Regulations, title 22, and in part 273 of the Code of Federal Regulations, title 40 (40 CFR), respectively;
- DTSC's final Mercury Report. This report was published by DTSC in August, 2002, and is posted on DTSC's web site (www.dtsc.ca.gov);
- 58 Federal Register (FR) 8102 (February 11, 1993): Proposed Universal Waste Rule;
- 59 FR 38288 (July 27, 1994): Proposed Universal Waste Lamps Rule;

- 60 FR 25492 (May 11, 1995): Final Universal Waste Rule;
- 64 FR 36466 (July 6, 1999): Final Universal Waste Lamps Rule;
- The Initial Study for these proposed regulations, prepared by DTSC under the authority of the California Environmental Quality Act (CEQA);
- The Health and Safety Code section 25150.6 analysis, which is part of this regulations package;
- The fiscal and economic impact analyses prepared for this regulations package;
- A Scientific Peer Review Report for the DTSC Mercury Report, California State University at Chico; and
- A Scientific Peer Review Report for the DTSC Mercury Report, University of California at Santa Cruz.

ALTERNATIVES CONSIDERED

Chosen Alternative: DTSC selected the option of designating a list of mercury-containing products as hazardous wastes when discarded. The products were chosen based on two criteria: the feasibility of recycling them, and/or the availability of mercury-free substitutes. These criteria are consistent with section 25179.4 of the Health and Safety Code, in which the Legislature directs DTSC to make promotion of source reduction and recycling its two top priorities for the hazardous waste management program. In addition to listing these discarded mercury-containing products as hazardous wastes, DTSC is adopting new standards for managing some of them as universal wastes. DTSC is also adopting new universal waste management standards for several categories of discarded mercury-containing products that are hazardous wastes under existing criteria. Hazardous waste lamps are already classified as universal waste and the existing Universal Waste Rule provides management standards for them. Thus, it is not necessary for these regulations to include new management standards for the newly listed lamps.

Rejected Alternatives:

1. *Do Nothing*. DTSC rejected this option because it would not support other efforts, in California and nationally, to limit further environmental contamination from mercury, nor would it promote source reduction and mercury recycling.

2. *Regulate all mercury-containing wastes*. Under this alternative, all mercury-containing wastes, regardless of their source or mercury concentration, would be classified as hazardous wastes. Discarded products containing mercury would be hazardous waste regardless of the feasibility of recycling their mercury or the availability of non-mercury substitutes.

DTSC rejected this alternative because it would lead to the classification of wastes with extremely low mercury concentrations (posing correspondingly low risks) as hazardous wastes, due to the sensitivity of modern analytical instruments. Also, similar to option 1,

this option would not effectively promote reduction in hazardous waste generation (product substitution) or mercury recycling.

3. *Regulate all wastes with intentionally-added mercury as hazardous wastes*. As with option 2, this option would not consider the feasibility of recycling the mercury contained in discarded products before designating them as hazardous wastes, nor would it consider the availability of non-mercury substitutes.

DTSC rejected this option because it would have required generators to determine whether any mercury in their waste was intentionally-added or naturally-occurring. Further, as with option 2, this option would include wastes that, arguably, pose insignificant risks when managed as nonhazardous waste, due to their very low mercury levels. The chosen alternative provides greater incentives for pollution prevention, the use of mercury-free or less-hazardous alternatives,[1] and recycling. As discussed earlier, these objectives are consistent with section 25179.4 of the Health and Safety Code.

4. *Update hazardous waste thresholds*. Under this alternative, the Soluble Threshold Limit Concentration (STLC) and/or the Total Threshold Limit Concentration (TTLC) regulatory thresholds would be updated based on current science. This alternative was also presented in comments during the 45-day comment period. Specifically, one commenter suggested lowering the TTLC for mercury to 15mg/kg.

DTSC rejected this option because it would not be effective at promoting the use of less-hazardous alternatives. Under this option, products would be classified as hazardous or nonhazardous waste when discarded, without regard to the feasibility of recycling or the availability of non-mercury substitutes.

A second reason for rejecting this alternative is that manufacturers could easily increase the mass of other portions of a product, such as the thickness of the glass envelope or the endcaps in fluorescent tubes, lowering the percentage of mercury in the product to non-hazardous levels without reducing the total amount of mercury in the lamp. Clearly, this alternative would not satisfy the foremost objective of this rule, which is to reduce emissions of mercury to the environment.

In evaluating this alternative, DTSC considered the possibility that revising the existing regulatory thresholds might provide an incentive for manufacturers of fluorescent lamps to further lower the mercury content of their products. Currently, only about 20 percent of the spent fluorescent lamps generated in the state are properly recycled. The remaining 80 percent continue to be land disposed. [Lamps generated by households and Conditionally Exempt Small Quantity Universal Waste Generators (CESQUWGs) are temporarily exempt from the Universal Waste Rule's prohibition on disposal as non-

[1] Pollution prevention and use of mercury-free or less hazardous alternatives cause a reduction in the generation of hazardous waste.

hazardous waste.] Evidence in the record and information DTSC gathered during preparation of the Universal Waste Rule demonstrate there is sufficient capacity to recycle all tubes generated in California.

DTSC has concluded that listing all mercury-containing lamps as hazardous waste would be more effective in reducing the amount of mercury going into our environment and would provide more of an incentive to recycle the lamps. Ongoing efforts to develop the state's infrastructure for collecting spent lamps from households and CESQUWGs will play a significant role in this improvement. The sunset of the current temporary disposal exemptions for households and CESQUWGs will also increase lamp recycling rates.

Under these regulations, all discarded lamps will be designated as hazardous wastes and none will be allowed to be managed as municipal (nonhazardous) solid wastes. If, instead, the hazardous waste thresholds for discarded lamps were lowered, all lamps with mercury concentrations below the lower thresholds could be managed as nonhazardous wastes. Thus, under option 4, there is no guarantee that disposal of mercury-containing lamps to the environment would actually be reduced. DTSC has concluded that designating all mercury-containing lamps as hazardous wastes will ultimately result in less mercury being released to the environment.[2]

5. *Allow removal of mercury light switches to be voluntary.* The automobile dismantlers association suggested, in a comment, that the removal of switches be voluntary with an emphasis on educational outreach to the dismantlers. DTSC rejected this alternative because a voluntary program would not result in removal of the maximum number of lighting switches. Although DTSC does not have enough information to precisely estimate of the efficacy of this alternative, mandatory removal and enforcing that mandate when necessary will result in a higher percentage of switches being recycled. Because removing and properly managing mercury-containing light switches costs money, and scrap metal recycling is a low margin activity, DTSC and CUPAs need to be able to enforce recycling to ensure switches are removed and recycled.

6. *Conditional Exemption.* This alternative was presented in several comments. Commenters suggested using the conditional exemption approach proposed by the U.S. EPA for cathode ray tubes to regulate products with mercury switches. Products would be conditionally exempt from regulation when recycled and regulated as hazardous waste when disposed.

DTSC has rejected this alternative for the following reasons:

[2] See the tables in the appendix to the 45-day written comment summaries and responses. The calculations in these tables demonstrate that less mercury will be released under the M003 listing than if the TTLC were retained for lamps.

- There is no regulatory control of wastes prior to disposal or recycling. Thus, wastes could be mismanaged by, for example, improper storage, which may release constituents to the environment. There would be no standards to prevent these releases, and enforcement would occur only after release to the environment. Although the performance standards of the Universal Waste Rule are streamlined and non-prescriptive, they do require prevention of release during storage and transportation.
- The conditional exemption approach fails to regulate the actual recycling operation as a hazardous waste facility. Regulation of hazardous waste recyclers is crucial to environmental protection as demonstrated by the large numbers of recycling facilities of all types on the federal Superfund list of severely contaminated sites.

7. Proposed Legislation. The recycling industries have suggested that DTSC support legislation that may be introduced in the next legislative session as an alternative to adopting these regulations. DTSC has rejected this alternative because there is no certainty that legislation will be passed, signed, and become law; in fact, the majority of bills introduced do not become law. Additionally, bills are modified many times during the Legislative process and there is no assurance that a given bill will still accomplish its originally intended purpose by the end of the session. However, adoption of these regulations does not rule out DTSC participation in future legislation. Any conflicting legislation that becomes law after these regulations are adopted will require that the standards adopted here be revised to be consistent with the legislation.

8. Continue the Use of the TTLC for Labeling and Marketing of Lamps. Californians Against Waste, in their written and oral comments on these regulations, proposed that use of the existing TTLC should be retained as a means of designating low mercury lamps for the purposes of product labeling, marketing, procurement, and other mechanisms, in order to minimize levels of mercury in lamps and encourage consumer purchases of those lamps. As discussed in the responses to comments, product labeling and marketing are beyond the scope of this rulemaking and beyond DTSC's authority. These regulations do not preclude lamp manufacturers from discussing the mercury content of their lamps in marketing them, nor from comparing the mercury content of the lamps produced by different manufacturers. However, any mention of the TTLC in such marketing should contain a caveat that, regardless of their mercury concentrations, all mercury-added lamps are hazardous wastes and must be managed appropriately.

DETAILED STATEMENT OF REASONS/NON-CONTROLLING PLAIN ENGLISH SUMMARY

Nonsubstantive Additions to the Table of Contents for Chapter 23 of Division 4.5:

- Add new sections 66273.21 and 66273.41 to the Table of Contents

These two new sections were added to Chapter 23 in the 45-Day Notice, but were inadvertently omitted from the Table of Contents.

- Add the words "and Weighted Tubing" to the title of section 66273.7.8.

The title of this section was changed in the 15-Day Notice of Proposed Post-Hearing Changes, but the corresponding change was inadvertently omitted from the Table of Contents.

Amend Section 66260.10:

This section contains most of the definitions applicable to the hazardous waste control regulations. It is amended to include a definition of "mercury-containing motor vehicle light switch". The definition addresses those switches found in the hood or trunk that turn on lighting when the hood or trunk is opened. The rationale for limiting the M001 listing to mercury-containing motor vehicle light switches is discussed in the statement of reasons for section 66261.50.

Add Section 66260.22 to Article 3 of Chapter 10:

California is a RCRA authorized state, which means that U.S. EPA has found the State's hazardous wastes regulatory program equivalent to, and no less stringent than, the federal RCRA program, and has authorized the State to implement its program in lieu of the federal program.

In adopting its final universal waste package in February 2002, DTSC decided not to include the federal rule's petition process for adding new universal wastes. This decision was based on the fact that the petition process found in California's Administrative Procedure Act (in Government Code section 11340.6) is essentially equivalent to that in the federal Universal Waste Rule. Although the Administrative Procedure Act's petition process is procedurally equivalent to the RCRA process, adopting a specific process for universal wastes that includes the federal petition process will facilitate U.S. EPA's determination that California's Universal Waste Rule is equivalent to, or more stringent than, the federal rule.

DTSC is adopting the federal process in this new section. It allows a person who seeks to add additional universal wastes to chapter 23 to petition DTSC's Director.

Subsection (b) enumerates the information that must be contained in a successful petition. This section parallels the language found in 40 Code of Federal Regulations (CFR) section 273.80, except that existing State provisions for petitioning State agencies to adopt, amend, or repeal regulations are included. These requirements are found in Government Code section 11340.6.

Add Section 66260.23 to Article 3 of Chapter 10:

As part of the RCRA authorization process, DTSC is required to complete authorization checklists. On the checklist for the Universal Waste Rule, several entries address the federal rule's criteria for deciding whether to designate a hazardous waste as a universal waste. These criteria are not currently part of the State's rule.

This new section lists the factors that DTSC's Director will use to evaluate petitions, submitted pursuant to proposed section 66260.22, for addition of new universal wastes to chapter 23. The factors are intended to ensure that proposed universal wastes are appropriate for management under less stringent standards than are other hazardous wastes. Petitions to add hazardous wastes that are generated by a variety of generators in a variety of industries, that are produced in relatively small quantities by individual generators, and that pose lower risk than other hazardous wastes are most likely to be successful. This section parallels the language found in 40 CFR section 273.81.

Amend Section 66261.1:

This section discusses the purpose and scope of chapter 11. Chapter 11 identifies the wastes subject to regulation as hazardous wastes. Section 66261.1 enumerates the articles contained in chapter 11 and briefly describes their contents. Because this package adds a new article 4.1, a new paragraph (5), which describes the new article, is added to section 66261.1. The former paragraph (5) is renumbered as paragraph (6).

Amend Subsection (a) of Section 66261.3:

This subsection contains the definition of hazardous waste. Subparagraph (D) of paragraph (2) is amended to reflect the addition of a new criterion for classifying wastes as hazardous waste to chapter 11 (namely, the list of mercury-containing hazardous waste in the new article 4.1). The former subparagraphs (D) and (E) are relettered accordingly.

Amend Subsection (b) of Section 66261.3:

This subsection enumerates the events that constitute the generation of a hazardous waste. Paragraph (2) is amended to address the generation of the mercury-containing wastes listed in the new article 4.1. As with the federally listed wastes, the wastes on

the State's new 'M' list will be considered generated when they first meet the listing descriptions in article 4.1 of this chapter. In most cases, the listing descriptions in article 4.1 state that the waste is generated "when discarded." The exception is waste M001, motor vehicles that contain mercury light switches. The listing description for waste M001 specifies that a listed hazardous waste is generated not when a vehicle that contains mercury light switches is discarded, but when the owner decides to crush it for transport, bale, or shred it for recycling. This provision was modified to include only mercury-containing motor vehicle light switches rather than the larger universe of all vehicle mercury-containing switches in response to comments received during the 45-Day Public Comment Period. This modification was made available for public review and comment during the 15-Day Notice of Changes. See the discussion of section 66261.50, below, for further discussion.

Nonsubstantive format changes were also made during the 15-Day Notice of Changes to paragraphs (1), (2), (3), and (4). The first word "in" was capitalized for consistency with other paragraphs, which is a change that makes no substantive changes to the regulation.

Paragraphs (3), (4), and (5) of this subsection address mixtures of hazardous and nonhazardous wastes. Under the existing paragraph (2) [which will be renumbered as (3)], mixtures of federally listed hazardous wastes and nonhazardous wastes are regulated as hazardous wastes, and are considered generated when first mixed. In proposed new paragraph (4) (since deleted in the 15-Day Notice of Changes), DTSC addressed a different issue. Under the deleted paragraph, a mixture of an otherwise nonhazardous waste with an intact, removable, mercury-containing listed waste would have become a hazardous wastes when the listed hazardous waste was first generated and could be, but was not, removed from the mixture. The concern was with vehicles or other products that are manufactured with removable mercury-containing components. Unlike some industrially generated hazardous wastes, which are uniformly hazardous, the only hazardous constituent of some of the products listed under this proposal is contained in a discrete, removable component (e.g., a switch). DTSC's intent in regulating mixtures of intact, removable 'M' listed wastes as hazardous wastes was to provide an incentive for dismantlers to remove mercury switches from vehicles prior to crushing, baling, or shredding them. By removing switches, dismantlers could have avoided managing entire vehicles as hazardous waste, and could have prevented the release of the mercury encapsulated in switches to the environment. Alternatively, dismantlers could have chosen to manage discarded vehicles containing mercury switches as hazardous wastes. Persons intending to crush, bale, or shred such vehicles would have needed to obtain a hazardous waste facility permit prior to doing so.

However, proposed new paragraph (4) was eliminated in the 15-Day Notice of Changes in response to comments from the automobile recycling industry. The provision was removed from the proposed regulations because it would have extended the listing beyond the actual application in cases where switches were inadvertently left in place

by error. Thus, an entire batch of scrap metal would be classified as hazardous waste because of one switch. Removal of this provision allows enforcement of the removal requirement for products (e.g., appliances) or automobiles, but it does not discourage recycling by labeling large volumes of processed scrap metal as hazardous waste due to the fact they include minor numbers of mercury switches. The altered regulation will still allow DTSC to enforce the regulation that requires removal of the switches or handling of the product (e.g., appliance) or vehicle as hazardous waste, because a permit or other grant of authorization would still be required to shred or crush a discarded product that is a listed hazardous waste.

Prior paragraphs (2) and (3) were renumbered to accommodate the addition of new paragraph (2).

Amend Subsection (c) of Section 66261.3:

Several changes are being made to this subsection. First, (c)(1) is being changed to conform both to an addition made to the regulation in a previous rulemaking and to conform to the addition of subsection (c)(5) in this rulemaking.

Paragraph (1) states that a hazardous waste remains a hazardous waste until it meets the criteria of subsection (d) (which establishes when a hazardous waste ceases to be classified as a hazardous waste). Paragraph (1) also states that a hazardous waste does not remain a hazardous waste if it meets the criteria for several exceptions listed in paragraphs (2) to (5). The subsection is being modified nonsubstantively to list paragraph (4), added in a previous rulemaking, and the newly added paragraph (5) to the list of paragraphs that establish exceptions to the general rule stated in paragraph (1).

Paragraph (5) was added in the 15-Day Notice of Changes in response to comments from lighting waste recyclers and vehicle recyclers. It states that waste derived from the recycling of the newly listed wastes, M001 (mercury-containing motor vehicle light switches and vehicles containing them), M002 (non-automotive mercury-containing switches and wastes containing them), M003 (lighting wastes with intentionally-added mercury), and M004 (mercury-containing novelties) is not a hazardous waste if it does not exhibit a characteristic of a hazardous waste. This addition is necessary to allow recovered materials such as glass, scrap metal, and phosphors to be managed as secondary materials rather than as hazardous wastes. Thus, for instance, glass recovered from recycled hazardous waste lamps can be reused as feedstock for new glass rather than disposed as hazardous waste. Note that this exit from classification as hazardous waste does not apply if the recovered materials continue to exhibit a characteristic of a hazardous waste or continue to meet a listing description in new article 4.1 of chapter 11.

Amend Subsection (d) of Section 66261.3:

This subsection enumerates the criteria that a waste must meet in order to be classified as nonhazardous. A new paragraph (3) is being added to clarify that a waste cannot be listed in the new article 4.1 of chapter 11 and be classified as nonhazardous. In order not to be classified as a hazardous waste, a waste must meet the two existing criteria (that is, cannot exhibit a characteristic of a hazardous waste and cannot be listed in article 4), and cannot be listed in the new 'M' list.

Grammatical changes were made to subsection (d) and paragraphs (1) and (2) to accommodate the addition of new paragraph (3).

Amend Subsection (a) of Section 66261.6:

Hazardous wastes that meet the criteria listed in paragraph (6) of this subsection are exempted from most of the management requirements in California Code of Regulations, title 22. Instead, these wastes are subject to special management requirements found in subparts C, F, G, and H of 40 CFR Part 266. The wastes to be listed in article 4.1 in this rulemaking may be managed as universal wastes under chapter 23 of the California Code of Regulations, title 22, not under 40 CFR Part 266. Therefore, new subparagraph (D) is added, to clarify that wastes listed in article 4.1 are ineligible for exemption under paragraph (6) of this subsection.

Amend Subsection (a) of Section 66261.9:

Subsection (a) lists the hazardous wastes that may be managed under the standards for universal wastes in chapter 23, in lieu of the general hazardous waste management requirements of the Health and Safety Code and title 22. Several changes are being made to this subsection.

The original regulations proposed in the 45 Day Notice amended subsection (a) to add the ten new universal waste categories to the list. This is necessary to inform the reader that these wastes have been incorporated into the wastes eligible for universal waste standards presented later in chapter 23.

The language of subsection (a) was modified to incorporate changes recently made by emergency regulations into these permanent regulations. When the original universal waste standards were adopted, the language of this subsection exempted universal wastes from "…chapter 6.5 of division 20 of the California Health and Safety Code…" DTSC did not intend to exempt universal wastes from all standards of that chapter. This intent was expressed in the Statement of Reasons and other supporting documents, including the Health and Safety Code section 25150.6 analysis. Recognizing that the existing wording was confusing and could be incorrectly interpreted to exempt persons managing or, more importantly, mismanaging universal wastes from the enforcement provisions of chapter 6.5, DTSC adopted emergency regulations (OAL File Number 02-

0912-02 E) that changed the wording to affirm that persons managing universal wastes remain subject to article 8 of chapter 6.5, the enforcement authorities. Further study of the exact wording of Health and Safety Code section 25150.6 clarifies that DTSC only has the authority to exempt persons managing universal wastes from the management requirements of the statute rather than all statutory provisions.

"Management" is defined in Health and Safety Code section 25117.2 as follows:

> "25117.2. "Hazardous waste management" or "management" means the transportation, transfer, recycling, recovery, disposal, handling, processing, storage, and treatment of hazardous waste."

Thus, Health and Safety Code section 25150.6 allows DTSC to adopt regulatory standards that vary from statutory provisions such as the hauler requirement, accumulation times, and the permit requirement, but does not allow the regulations to vary from non-management statutory provisions such as enforcement, hazardous waste source reduction plans, and fees. To clearly express this intent and authority, the regulations (in the 15-Day Notice of Changes) clarified the exemption to apply only to the "management requirements" of chapter 6.5 of the Health and Safety Code.

Another change to subsection (a) is the addition of the phrase "and shall be known as "universal wastes". This statement was formerly in paragraph (4), which was eliminated during a 15-Day Notice of Changes in favor of the simpler and clearer addition of the above statement to subsection (a).

Further changes were made to subsection (a)(4) to be consistent with changes made to the definition of M001 waste in the 15-Day Notice of Changes. (The M001 listing was changed; originally it included all mercury-containing motor vehicle switches, but now it covers only mercury-containing motor vehicle light switches.) The necessity for these changes is discussed in conjunction with the discussion for section 66261.50 below. Similarly, in response to comment, a change was made to subsection (a)(11)[3] to add "weighted tubing" to the entry for mercury dilators because weighted tubing is a separate class of mercury-containing medical device from dilators. The change was made to clarify that weighted tubing is also a universal waste in addition to similar devices known as "dilators".

Two new references are being added to the note at the end of the section (in the 15-Day Notice of Changes). Health and Safety Code section 25117.2 (definition of "management") is added because the new language in subsection (a) implements and brings consistency with this definition. Also, Health and Safety Code section 25214.5 is

[3] In the first 15-Day Notice of Changes, the paragraphs in subsection (a) were misnumbered; paragraphs that should have been numbered (11) through (13) were instead numbered (12) through (14). This error was corrected in the reissued 15-Day Notice, and in the final text of the regulations.

added because this section designated some of the mercury switches referred to in paragraph (4) as universal waste.

Other Nonsubstantive Amendments to Subsection (a) Section 66261.9:

- Paragraph (7):

Only mercury-containing pressure or vacuum gauges (pursuant to subsection 66273.7.4) are universal wastes. The words "mercury-containing" were inadvertently omitted from subsections (a)(7); the words were added to the final text.

- Paragraph (11):

Only mercury dilators and weighted tubing (pursuant to subsection 66273.7.8) are universal wastes. The word "mercury" was inadvertently omitted from paragraph (11) of subsection (a); the word was added to the final text.

Delete Subsection (d) of Section 66261.9:

Paragraph (4) was deleted because the phrase "and shall be known as "universal wastes" was moved to subsection (a) in the 15-Day Notice of Changes, as noted above.

Add Article 4.1:

Article 3 of chapter 11 contains the characteristics used to determine whether a waste is hazardous. Article 4 contains four lists of hazardous wastes that have been adopted from federal regulations. These proposed regulations will create California's first list of wastes that are hazardous regardless of whether they exhibit any of the hazardous waste characteristics in article 3 or whether they are federally listed and contained in Article 4. A new article 4.1 is added to chapter 11 to contain this new list, and other lists of hazardous wastes that may be adopted in the future.

Add Section 66261.50:

This new section 66261.50 enumerates the wastes that will be listed as hazardous wastes. Most wastes in each of the new listings would not be classified as hazardous waste for mercury under the toxicity characteristic. However, as discussed earlier, their (nonhazardous) management and disposal contribute significant amounts of mercury to the State's environment. The descriptions of some listed wastes include information on when they are considered generated.

M001

Most vehicles are so massive, relative to the weight of the mercury in their light switches, that they do not exceed mercury concentration thresholds for classification as hazardous wastes. This is because the thresholds apply to the whole waste, which is the entire vehicle being discarded, not just to the switch itself. DTSC is listing motor vehicles that contain mercury light switches as hazardous wastes to encourage handlers to remove the switches. DTSC estimates that the vehicles shredded annually in California contain between 0.75 and 1.5 tons of mercury. Refining the assumptions to estimate the amount of mercury from vehicle light switches yields approximately 1848 pounds of mercury. Of this amount, approximately 871 pounds finds its way into the nonmetallic waste ("fluff") generated by auto shredders. The remaining mercury is released to other environmental media (presumably, mainly to air). In light of the State's existing environmental contamination, the preventable release of almost one and a half tons of mercury from auto shredders is unacceptable.

In the original proposed regulations (45-Day Comment Period), this listing applied to all the mercury switches found in vehicles. It applied to tilt switches commonly used to activate trunk and hood lights, to mercury switches used in antilock brake systems (ABS), and to any other mercury switches found in motor vehicles. Vehicles and portions of vehicles from which mercury-containing switches had not been removed were also hazardous wastes under this listing. The listing description was changed in the subsequent 15-Day Notice of Changes in response to comments received from the automobile recycling associations. The change limited the listing to mercury-containing light switches in vehicle trunks and hoods, and vehicles from which such switches have not been removed. (A vehicle becomes a listed hazardous waste when any person decides to crush, shred, or bale the vehicle or sent it for crushing, shredding, or baling.)

Comments received from the automobile recycling/dismantling industry pointed out that there are readily available documents that provide very good descriptions of the locations and numbers of trunk and hood light switches and that these switches are readily accessible. The industry also commented that there is no clear guide to the presence or absence of the other types of mercury-containing switches, some of which are specific to certain parts suppliers and/or installed after sale of the vehicle (such as car alarm switches.) Because it is difficult or impossible to know the number and location of mercury switches in a vehicle and thus whether they have been located and removed, the recycling industry requested that the listing be limited to the clearly accessible and well documented mercury-containing lighting switches.

To avoid regulating intact vehicles as hazardous wastes, a vehicle that contains mercury light switches is considered "generated" as a listed hazardous waste only when someone decides to crush, bale, shear, or shred it. To encourage the removal of mercury light switches, vehicles from which all light switches have been removed are not included in the listing description. Discarded vehicles from which all mercury light switches are not removed are included in the listing, and could be managed as

universal wastes or as fully regulated hazardous wastes. Anyone intending to crush, bale, shred, or shear such vehicles without a hazardous waste facility permit would first need to remove all mercury-containing light switches.

The effective date of the listing is delayed until January 1, 2005, to be consistent with a deadline in Public Resources Code section 15029. This section prohibits the sale of vehicles containing mercury light switches manufactured after January 1, 2005. The delay will also allow time to educate the regulated community on the impending change in the hazardous waste status of vehicles that contain mercury switches, and on the advantages of and procedures for removing switches.

This listing may be expanded in a future rulemaking as information about the existence and location of other mercury switches in specific vehicle models becomes available. The vehicle recycling industry would need this information in order to find and remove the mercury switches.

M002

This listing covers all mercury switches other than those in vehicles. It also includes mercury flame sensors, which are used in some gas-powered household appliances to prevent the flow of gas when a flame is not present. A non-inclusive list of switch types is provided to help the regulated community identify the general types of switches covered by the listing. As with the M001 listing, this listing includes products that contain mercury switches and flame sensors, but excludes products from which all mercury switches and flame sensors have been removed. Again, DTSC's intent is to encourage the removal of intact switches from products before they undergo processing that may release their mercury to the environment. Discarded products from which all mercury switches are not removed could be managed as universal wastes or as fully-regulated hazardous wastes. Thus, anyone intending to treat a product that contains one or more mercury switches (for example, by crushing a used washing machine that contains a mercury tilt switch to facilitate recovery of the steel) without a hazardous waste facility permit would first need to remove all switches.

The effective date of the listing was originally (in the 45-Day Public Notice) delayed until February 9, 2004, which coincided with the date of the reduction in the quantity of batteries, lamps, and thermostats that a CESQUWG may dispose (pursuant to Cal. Code Regs., tit. 22, § 66273.8). The delay was extended until 2006 in the subsequent 15-Day Notice of Changes. The effective date was extended because comments indicated that, unlike with most vehicle switches, there is no comprehensive guidance available identifying specific models of appliances with mercury switches, identifying their location, and giving removal instructions for the switches. The additional two years will allow the recycling industry to develop such guidance so that the switches can be located and removed prior to crushing or shredding the appliances. The delay will also give generators time to prepare to properly manage, and ultimately recycle all products with mercury switches.

M003

This listing covers all lamps with intentionally added mercury, regardless of whether they exhibit a hazardous waste characteristic. A lamp's mercury content is not a reasonable basis for classifying it as hazardous or nonhazardous. One reason is that the weight of a lamp's glass and metal components can affect whether or not the lamp exceeds hazardous waste thresholds for mercury. For example, compared with the standard T8 fluorescent lamps, smaller diameter T5 lamps use less glass and aluminum in their manufacture. Consequently, a T5 lamp that contains the same amount of mercury as a T8 lamp is more likely to exceed hazardous waste concentration thresholds for mercury than is the T8 lamp. Further, variables other than a lamp's mercury content may affect its impact on the environment. For example, if one type of lamp contains less mercury than another, but also produces less light or has a shorter life, using more of the lower-mercury lamps may not result in a net decrease in the mercury entering the environment.

The originally proposed regulations (45-Day Comment Period) incorporated all "mercury-containing" lamps, with specified exceptions, into the listing. It was changed in the subsequent 15-Day Notice of Changes to lamps "with intentionally-added mercury," again with specified exceptions. This change was made in response to comments pointing out that the ever increasing sensitivity of modern analytical devices would eventually reveal small traces of mercury in all lamps, both naturally occurring mercury from the raw materials used to manufacture the lamps and trace amounts deposited from the air. The comments asserted that the original language would ultimately identify all lamps as M003 unless the listing was limited to intentionally-added mercury.

One alternative to using the current concentration thresholds to classify lamps would be to replace the thresholds with a formula that considers a lamp's mercury dose, light output, and length of life. However, in light of the State's serious mercury contamination problem, listing all mercury-containing lamps as hazardous wastes will be more protective of public health and the environment. Once it becomes effective, the listing will remove any confusion in the regulated community about which mercury-containing lamps are hazardous. It will also avoid the continued release of mercury to the environment that occurs when discarded lamps are broken during handling. The additional requirements for the generators of lamps not currently classified as hazardous wastes will be small; all newly classified hazardous waste lamps will be eligible for management under DTSC's universal waste management standards.

Most waste products that contain lamps are included in this listing description, but products from which all lamps have been removed are not. The listing also does not include liquid crystal displays (LCDs) that are backlit with mercury-containing lamps, or products that contain LCDs. These products are not included because the difficulty of separating a mercury-containing lamp from the rest of the display may make the

recycling of the lamps impractical, and also because mercury-free alternatives to the mercury-containing lamps in LCDs are not yet widely available. The 15-Day Notice of Changes clarified that vehicles that contain mercury-added lamps are not covered by the M003 listing (i.e., the presence of mercury-added lamps would not necessarily make a waste vehicle a hazardous waste). This change was made because information on the makes and models of vehicles that contain mercury-added lamps is not readily available to DTSC or to auto recycling firms. Persons who voluntarily remove mercury-added lamps from vehicles may manage the waste lamps as universal wastes, however.

Delay in Listing Effective Date

Under DTSC's existing Universal Waste Rule, all hazardous waste lamps, batteries, and thermostats generated by households and limited quantities generated by CESQUWGs are exempt from management as hazardous or universal waste. The exempt quantity for CESQUWGs will be reduced to 30 lamps and 20 pounds of batteries per month, effective February 9, 2004. Both the household and CESQUWG exemptions will be phased out after February 8, 2006. After that date, all hazardous waste lamps will be subject to management as universal waste under chapter 23.

Currently, one of the three major brands of fluorescent lamps is classified as non-hazardous waste under California's STLC/TTLC criteria. Regardless of who generates them, these waste lamps may be disposed in non-hazardous waste landfills in unlimited quantities. The two other major manufacturers produce lamps that are classified as hazardous waste in this state. Some of these waste lamps must be managed under the standards for universal waste lamps, while others (those produced by households and CESQUWGs) are temporarily exempt, and may be disposed in municipal landfills.

Non-hazardous waste landfill operators have instituted load checking programs, in which some incoming loads of garbage are checked for the presence of prohibited materials such as hazardous wastes. However, the landfill staff responsible for checking loads may not be able to determine the origin of a load of garbage that contains fluorescent lamps. Further, they may have difficulty distinguishing discarded lamps that are currently classified as hazardous wastes from those that are not. As a result, monitoring compliance by individual fluorescent lamp generators with the current requirements that apply to them is very difficult.

DTSC originally proposed to delay the effective date of the listing of mercury-containing lamps as hazardous wastes until February 9, 2006, to coincide with the sunset of the household and CESQUWG exemptions. On that date, all discarded mercury-containing lamps would have been classified as hazardous wastes. The delay of approximately three years was intended to allow time to educate the generators of lamps that currently are not hazardous about the change in their status.

In the 15-Day Notice of Changes, DTSC reduced the delay by making the listing effective in 2004. The date was changed in response to comments that the three-year delay was too long and was not needed to educate the public that every fluorescent tube was regulated as hazardous waste. Note that the effective date for the listing will precede the sunset of the household and CESQUWG exemptions. Thus, while currently nonhazardous lamps will become hazardous and eligible for the Universal Waste Rule standards in 2004, persons eligible for the household and CESQUWG exemptions will continue to be able to dispose of these lamps as nonhazardous solid waste until the 2006 sunset of the exemptions. Those exemptions will allow time for smaller generators to prepare for the proper disposition of all mercury-containing lamps and for the development of the collection infrastructure for smaller generators such as households and CESQUWGs. Evidence in the record and information DTSC gathered during preparation of the Universal Waste Rule demonstrate there is already adequate recycling capacity for the waste lamps generated in California.

M004

This listing applies to a range of mercury-containing products whose manufacture and sale are banned, effective January 1, 2003, by Public Resources Code section 15027. The listing becomes effective on January 1, 2004, one year after the effective date of the statutory ban on the manufacture and sale of these products. Some of the products banned by the statute may currently be classified as hazardous wastes, while others are already included in other listed waste categories. Listing M004 is intended to capture any mercury-added novelty that would not otherwise be identified as hazardous waste.

Mercury-added novelties fall into several categories:

- Novelties with liquid mercury;
- Novelties with mercury switches;
- Novelties with button-cell or other mercury-containing batteries;
- Novelties painted with mercury-containing paint; and
- Novelties with mercury-containing lamps.

Novelties with switches or lamps would be hazardous under listings M002 and M003, respectively; therefore, they are not included in this listing. Novelties with liquid mercury would likely fail the TTLC and be classified as hazardous wastes under the toxicity characteristic (unless they are quite large[4]). However, novelties that contain mercury button-cell batteries or mercury-containing lamps, as well as novelties painted with mercury-containing paint, may not have enough mercury to exhibit the toxicity characteristic.

[4] A novelty with a single switch containing one gram of mercury and weighing less than 110 pounds would fail the TTLC; a novelty with one mercury switch and weighing up to 1100 pounds could potentially fail STLC.

Delay in Listing Effective Date

This listing will become effective one year after sale, manufacture, and distribution of mercury-added novelties is banned. This one-year delay will not affect mercury-added novelties classified as hazardous wastes under existing hazardous waste identification criteria; it applies only to novelties with mercury concentrations below current regulatory thresholds. The delay will allow time to educate generators of discarded novelties not currently classified as hazardous waste (mostly households) about the coming changes in how they must classify and manage the novelties.

Chapter 11, Article 5: Categories of Hazardous Waste
Amend Subsection (a) of Section 66261.101:

This section lists the criteria a waste must meet to be classified as non-RCRA hazardous waste. Mercury-containing wastes listed in article 4.1 of chapter 11 that are not federally hazardous are classified by the regulations as non-RCRA hazardous wastes. Paragraph (4) of subsection (a) of this section is amended to include the listing of a waste in article 4.1 as a criterion for classification as non-RCRA hazardous waste.

Amend Subsections (b) and (c) of Section 66262.11:

This section specifies the procedure for determining whether a waste is hazardous. After determining, pursuant to subsection (a), that the waste is not excluded from the definition of hazardous waste, the generator is required to determine whether the waste is listed in article 4 or in Appendix X of chapter 11. If the waste is not excluded and does not appear on either list, the generator must then determine whether the waste exhibits any of the four hazardous waste characteristics.

These proposed regulations will classify wastes listed in article 4.1 of chapter 11 as hazardous whether or not they exhibit a hazardous waste characteristic. Therefore, subsection (b) is amended to require generators to determine whether a waste is listed in article 4 or article 4.1 prior to determining whether the waste exhibits a characteristic. Subsection (c) is also amended to make clear that the generator of a waste listed in article 4.1 will not be required to determine whether the waste exhibits a characteristic.

Amend Subsection (g) of Section 66264.1:

Chapter 14, section 66264.1, et seq., contains standards for owners and operators of hazardous waste transfer, treatment, storage, and disposal facilities. Subsection (g) lists persons who are not subject to the requirements of chapter 14. Paragraph (12) of subsection (g) of section 66264.1 exempts persons who manage hazardous wastes listed for this exemption from regulation under chapter 14. Instead, these persons are regulated under the universal waste requirements in chapter 23. The originally

proposed regulations (45-Day Public Notice) designated the ten new universal wastes, and included all mercury-containing lamps.

The format of this subsection was simplified to improve the clarity and readability of the regulations in the subsequent 15-Day Notice of Changes. Rather than present a long list of universal wastes, the section now refers the reader to section 66273.9, the list of definitions in the actual Universal Waste Rule regulations in Chapter 23. Not only does this change simplify the text of this section and sections 66265.1, 66268.1, and 66270.1, it also reduces the need for further modifications to these sections if new universal wastes are designated in the future.

The treatment, storage, and disposal facilities that receive these new universal wastes will remain subject to the requirements in chapter 14, but handlers (including generators and offsite consolidators) and transporters of these wastes will be exempt.

Amend the reference citation for section 66264.1.

Health and Safety Code section 25118 was added as a reference statute for this section. This statute was added because the exemptions in subsection (d) apply to "persons" as defined in Health and Safety Code section 25118.

Amend Subsection (d) of Section 66265.1:

Chapter 15, section 66265.1 et seq., contains standards for owners and operators of interim status hazardous waste transfer, treatment, storage, and disposal facilities. Subsection (d) of section 66265.1 lists persons who are not subject to the requirements of chapter 15. Paragraph (15) of subsection (d) exempts persons who manage hazardous wastes on a specified list from regulation under chapter 15. Instead, these persons are regulated under the universal waste requirements in chapter 23. Changes identical (other than numbering) to section 66264.1 were proposed to clarify and simplify this section and have been made in the final regulations. See the discussion of section 66264.1 for an explanation of the changes.

Nonsubstantive Amendment to Paragraph (15) of Subsection (d) of Section 66265.1:

The word "persons" was inadvertently added twice in the 15-Day Notice of Proposed Post-Hearing Changes. The first occurrence of "persons" is struck out in the final text.

Amend the reference for section 66265.1. Health and Safety Code section 25118 was added as a reference statute for this section. This statute was added because the exemptions in subsection (d) apply to "persons" as defined in Health and Safety Code section 25118. This section implements this definition.

Amend Subsection (g) of Section 66268.1, Purpose, Scope, and Applicability:

This section sets the basic applicability of the land disposal restrictions/treatment standards regulations of chapter 18. Existing regulations exempted specified wastes from this chapter, including universal wastes. The originally proposed regulations (45-Day Public Notice Period) listed the existing universal wastes and added descriptions of the newly added mercury-containing universal wastes. Changes identical (other than numbering) to section 66264.1 were proposed in the 15-Day Notice of Changes to clarify and simplify this section and have been made in the final regulations. See the discussion of section 66264.1 for an explanation of the changes.

Amend the Authority Citation for Section 66268.1.

Health and Safety Code 25150.6 was added as an authority citation in the 45-Day Public Notice. Section 25150.6 authorizes DTSC to exempt universal wastes, including the ones added in this rulemaking, from the requirements of chapter 18.

Amend the Reference Citation for Section 66268.1.

Health and Safety Code section 25118 was added as a reference statute for this section. This statute was added because the exemptions in subsection (d) apply to "persons" as defined in Health and Safety Code section 25118. This section implements this definition.

Amend Subsection (c) of Section 66270.1, Purpose and Scope of These Regulations:

This subsection is amended by revising paragraph (2) and subparagraph (E). The originally proposed regulations (45-Day Public Notice Period) listed the existing universal wastes and added descriptions of the newly added mercury-containing universal wastes. Persons who manage these wastes are exempt from the hazardous waste permit requirements of chapter 20 and are instead subject to the requirements of chapter 23. Changes identical (other than numbering) to those in section 66264.1 have been made to clarify and simplify this section in the final regulations. See the discussion for section 66264.1, above, for explanation of these changes.

Amend the authority reference for section 66270.1:

Health and Safety Code section 25118 was added as a reference statute for this section. This statute was added because the exemptions in subsection (d) apply to "persons" as defined in Health and Safety Code section 25118. This section implements this definition.

Amend Chapter 23, Standards for Universal Waste Management:

Amend Article 1:

Article 1, section 66273.1 et seq., contains the scope and applicability of chapter 23, as well as applicable definitions. These regulations amend article 1 by adding applicability sections for ten new mercury-containing universal wastes. In most cases, DTSC is requiring recycling of the designated mercury-containing wastes as a condition of universal waste management. (If the wastes are not recycled, they are subject to full hazardous waste management.) This requirement is included for several reasons:

- Recycling conserves the State's resources and avoids mining of new mercury with the attendant environmental impacts of mining.
- Mercury is very difficult to sequester permanently. It does not form stable long lasting, insoluble compounds. Thus, disposal of mercury-containing products in landfills can create long-term problems. The U.S. EPA treatment standard for mercury is recycling – implying that no effective technology in use can permanently sequester mercury from the environment.
- The California Legislature, in Health and Safety Code section 25179.4, states that the second priority for DTSC's hazardous waste regulatory program, after source reduction (not producing hazardous waste in the first place), is to encourage recycling of the hazardous waste.

Amend Subsection (a) of Section 66273.1, Scope:

This section discusses the scope of chapter 23, which contains standards for universal waste management. Ten new universal wastes are added by these regulations. Paragraph (3) of subsection (a), which lists lamps regulated under chapter 23, is amended to add a reference to mercury-containing lamps listed in the 'M' list in section 66261.50. This change clarifies the paragraph and makes it consistent with section 66261.50. Paragraphs (5) through (14) are added, listing the ten new universal wastes that will be regulated under chapter 23. Two changes were made to this list in the 15-Day Notice of Changes. Paragraph (5) (motor vehicle mercury-containing light switches) was changed to conform to the changes made in the 15-Day Notice of Changes to the listing for M001. Also, the term "weighted tubing" (mercury-containing medical devices separate from, but similar to, dilators) was added to paragraph (12), to clarify that weighted tubing is also a universal waste.[5] This change makes paragraph (12) consistent with section 66273.8.

[5] It was brought to DTSC's attention that the category of products referred to in the 45-Day Public Notice as "dilators" included products that are properly referred to as "weighted tubing." The phrase "and weighted tubing" was added to the name of this category, to correct this error in nomenclature.

Amend Subsection (a) of Section 66273.5, Applicability—Lamps:

This section lists the lamps that are covered under chapter 23. Section 66261.50 of these regulations will designate all mercury-containing lamps as hazardous wastes, and consequently, all mercury-containing lamps will be subject to regulation under chapter 23. Discarded products that contain mercury-containing lamps are also subject to chapter 23.

Several paragraphs and subparagraphs are added to subsection (a):

(a)(1): This subparagraph states that lamps that exhibit a characteristic of a hazardous waste are covered by chapter 23. This is an existing provision that was amended and separated from subsection (a) as paragraph (1). The change, made during the 15-Day Notice of Changes, clarifies that until the M003 listing takes effect, only lamps that exhibit a hazardous characteristic are eligible for universal waste management.

(a)(2)(A) and (B): These new provisions add both mercury-added lamps (meeting the listing description of M003 in section 66261.50) and products that contain these lamps to the list of objects covered by chapter 23. The provision clarifies that after the effective date of the M003 listing, February 9, 2004, all mercury-added lamps will be eligible for universal waste management. This change is necessary to be consistent with the operative date contained in the listing description for M003. See the discussion of section 66261.50 for an explanation of the necessity for the change to that date.

Amend Subsection (b) of Section 66273.5:

Subsection (b) establishes exceptions to the inclusion of lamps in chapter 23. It lists lamps that are not covered by chapter 23. Subsection (b) was modified in the 15-Day Notice of Changes to remove the word “lamps” after the word “following” because the exceptions below now address not only lamps, but also products containing lamps.

Currently, paragraph (2) exempts lamps that do not exhibit a hazardous waste characteristic from chapter 23. It is amended to clarify that a lamp must also not meet the M003 listing description (i.e., it must not contain mercury) to be exempt from chapter 23. This updates paragraph (2) to be consistent with the new M003 listing. Paragraph (3) is amended to clarify that lamps not destined for an authorized recycling facility are fully regulated hazardous wastes, and are not eligible for the streamlined universal waste management requirements in chapter 23.

A new paragraph (4) is added (during the 15-Day Notice of Changes) to clarify that vehicles that contain mercury-added lamps are not covered by chapter 23 unless the vehicles exhibit a characteristic of a hazardous waste. This exception is necessary because there is very little information available about which lamps in motor vehicles contain mercury and how to remove them prior to dismantling. However, this exception

may be removed in a future rulemaking if comprehensive information is developed showing the types and locations of mercury-containing lamps in vehicles and which vehicles contain these lamps.

Chapter 23 applies to a vehicle that contains mercury-added lamps only if the entire vehicle exhibits a characteristic of a hazardous waste. In other words, if the vehicle exhibits a hazardous characteristic, it is a hazardous waste and may be managed as a universal waste.

A new paragraph (5) has been added (during the 15-Day Notice of Changes), which states that vehicles that are crushed with mercury-containing lamps inside are not eligible for management under chapter 23. If they exhibit a characteristic of a hazardous waste, the crushed vehicles must be managed under the general hazardous waste control regulations. This paragraph is necessary to clarify that once it is crushed, a vehicle that exhibits a hazardous waste characteristic because it contains mercury-added lamps may not managed as universal waste.

Add Section 66273.7.1, Applicability—Motor Vehicles that Contain Mercury Switches and Switches Removed from Motor Vehicles:

This section discusses the applicability of chapter 23 to mercury-containing motor vehicle light switches and vehicles that contain them. It states that the universal waste management requirements of chapter 23 apply to discarded automotive mercury light switches and to discarded vehicles and portions of vehicles that contain mercury light switches. Both the switches and the vehicles that contain them are newly listed as hazardous wastes in listing M001 of section 66261.50. The vehicle becomes listed when any person decides to crush, bale, shear, or shred it. The listing originally incorporated all mercury-containing vehicle switches. It was modified in the 15-Day Notice of Changes to include only mercury-containing vehicle *light* switches. The necessity for that change was discussed earlier in the discussion of new section 66261.50. Changes are being made in subsections (a)(2)(A), (b)(3), (b)(5), (c), and (c)(2) to be consistent with the change in the listing description.

Subsection (a) specifies the switches that are subject to universal waste management. On January 1, 2005, the M001 listing will make discarded mercury-containing motor vehicle light switches, and vehicles that contain them, hazardous wastes. From the date these regulations become effective until December 31, 2004, universal waste requirements will apply to mercury light switches that are removed from motor vehicles and that exhibit a hazardous characteristic. After the M001 listing becomes effective, universal waste management standards will also apply to vehicles and switches covered by the listing. This will ensure that the handlers of the affected vehicles and switches will not be required to manage them under full hazardous waste management requirements, provided they comply with universal waste management standards.

Subsection (b) lists categories of vehicles and switches not covered under chapter 23. These include switches that are not wastes; switches that do not contain mercury; vehicles from which all mercury light switches have been removed; switches that will not be recycled; and vehicles from which all mercury light switches have not been removed that are crushed, baled, shredded, or sheared. Handlers are given a strong incentive to remove the mercury light switches from vehicles prior to processing them, and to recycle removed mercury switches: vehicles that are processed without having had all mercury light switches removed and switches that are not destined for recycling are fully regulated as hazardous wastes.

Subsection (b) discusses vehicles that are not subject to regulation as universal wastes; however, in order to be considered a candidate for universal waste, the waste must first be classified as a hazardous waste. Vehicles from which all mercury-containing light switches have been removed do not meet the listing description of M001. Therefore, they would not be eligible for management as universal waste. A vehicle with other mercury switches remaining would likely not contain enough mercury to exhibit a hazardous waste characteristic due to its mercury concentration. That is, the amount of mercury in the switches remaining in the vehicle is small in comparison to the weight of the vehicle, such that, if the mercury contained in the switch were distributed over the weight of the vehicle, it would most likely not exceed the current mercury regulatory threshold, TTLC.

A non-substantive change was made in response to a comment received from the 15-Day Notice of Changes. This change inserted the word “light” in front of “switches” in paragraph (3) of subsection (b). This change fixes an oversight by DTSC and conforms paragraph (3) with the changes presented in the 15-Day Notice of Changes to subparagraph (A), paragraph (2) of subsection (1), and the M001 listing in section 66261.50.

A change was made to paragraph (5) of subsection (b) in the 15-Day Notice of Changes, in response to comments. This change states that vehicles that have been shredded, crushed, or baled but still contain mercury switches must be managed as hazardous waste only if they exhibit a characteristic of a hazardous waste. The listing was adopted to provide an incentive for vehicle recyclers to remove the switches prior to recycling the metal. Light switches are removed by the automobile recycler prior to shipment to an “automobile shredder,” where the car is shredded and different metals recovered separately. The change was made so that entire batches of scrap metal would not be identified as hazardous waste simply because a single light switch had not been removed.

Under this approach, an auto recycler (one who dismantles the cars, selling usable parts and shipping the remainder to the auto shredder) must remove the switches or ship the vehicle as a hazardous waste. When the auto recycler complies with switch removal, the vehicle is then scrap metal and can be shredded. However, there is no way for the actual scrap metal recycler (the auto shredder) to tell if the lighting switches

on crushed or baled vehicles have been removed. This change allows the metal recycler to manage the crushed or baled vehicle and shredded scrap metal from the vehicles as scrap metal. However, if the resulting vehicle or shredded scrap metal has sufficient mercury (or other hazardous constituents) to exhibit a characteristic of a hazardous waste, it would pose a more direct and imminent threat and would have to be managed as a hazardous waste.

Subsection (c) discusses when vehicle switches and vehicles that contain them become universal wastes. A used mercury switch becomes a universal waste when a handler removes it from a vehicle and decides to discard it. A vehicle that contains mercury switches becomes a universal waste when a handler decides to crush, bale, shred, or shear it. An unused switch that is destined for recycling becomes a universal waste when the handler decides to discard it. The 15-Day Notice of Changes added the word "light" in front of "switches" to be consistent with the change in the M001 listing. The change was made to subsection (c) and paragraph (2) of subsection (c).

Add Section 66273.7.2, Applicability—Products that Contain Mercury Switches and Switches Removed from Products:

Non-automotive mercury switches and products that contain them are designated as hazardous wastes elsewhere in these regulations (waste 'M002,' in section 66261.50). As noted earlier, the shredding of large appliances and other mercury-containing products is a significant source of mercury in California's nonhazardous waste stream.

Subsection (a) specifies the non-automotive mercury switches subject to universal waste management. On February 9, 2006, the M002 listing will designate discarded non-automotive mercury switches, and discarded products that contain them, as hazardous wastes. From the date these regulations become effective until February 8, 2006, universal waste requirements will apply to mercury switches and products containing them that are hazardous wastes under existing criteria (i.e., that exhibit the toxicity characteristic). After the M002 listing becomes effective, universal waste management standards will apply to all non-automotive mercury switches and products with such switches.

In the 15-Day Notice of Changes, the year in paragraph (2) of subsection (a) was changed from 2004 to 2006. After February 8, 2006, products that contain non-automotive mercury switches and do not exhibit a hazardous characteristic become eligible for management as universal wastes. This change conforms this paragraph to the same change in the effective date of the M002 listing. For discussion of the necessity for this change, see the discussion of section 66261.50 above.

Subsection (b) lists categories of switches and products not covered under chapter 23. These include:

1) switches that are not wastes;
2) switches that do not contain mercury;
3) products from which all mercury switches have been removed;
4) mercury switches not destined for recycling; and
5) waste products that are crushed, baled, shredded, or sheared from which all mercury switches were not first removed.

State statute requires that mercury switches be removed from appliances, which are included as products in the M002 listing, prior to shredding, crushing, or baling. Mercury switches are identified as “materials requiring special handling” in Public Resources Code section 42167, subdivision (e). Public Resources Code section 42175 requires persons managing used appliances to remove all such materials prior to transfer to a person who shreds or bales them.

A change was made to subsection (b)(6) in the 15-Day Notice of Changes to eliminate baled or shredded appliances from regulation as universal waste even if one or more mercury switches had not been removed from products, such as appliances, prior to baling or shredding. Instead, if the resulting shredded or baled scrap metal exhibits a characteristic of a hazardous waste, it must be managed under the general hazardous waste standards rather than the universal waste standards. This change is parallel to that made for automobiles that are shredded or baled without removing all of the light switches and is made for the same reasons. Both changes were made to avoid classifying large amounts of shredded or baled scrap metal as hazardous waste because of a small number of switches that were not removed due to inadequate knowledge of which switches contain mercury or the removal was inadvertently missed prior to shredding or baling. However, if the scrap metal contains enough mercury (or any other hazardous constituent) to exhibit a characteristic of a hazardous waste, it must be managed as a hazardous waste. Thus, the regulation balances the need to recycle metals with the need to keep mercury out of the environment.

Handlers are given an incentive to remove mercury switches from products, such as appliances, that contain them prior to processing them, and to recycle non-automotive mercury switches: as with vehicle mercury light switches, non-automotive mercury switches not destined for recycling and appliances processed without having had all mercury switches removed are fully regulated as hazardous wastes. Crushed, baled, shredded, and sheared products are singled out from other products with mercury switches for full hazardous waste regulation because, like motor vehicles, they are commonly processed to recover their scrap metal.

Another non-substantive change was made in response to a comment received during the 15-Day Notice of Changes. This change replaced “2004” with “2006” in paragraph (3) of subsection (b). Failure to show this change during the 15-Day Notice of Changes was an oversight by DTSC. The change is non-substantive because it does not affect the duties of any person under these regulations and brings consistency with the M002 effective date in section 66261.50 and its applicability as a universal waste in subsection

(2) of paragraph (a). Subsection (2) of paragraph (a) allows management of waste products with non-automotive mercury switches as universal waste on or after February 9, 2006, whether or not they exhibit a hazardous characteristic, because these products become listed as M002 hazardous wastes on that date. [Until the M002 listing takes effect, discarded products that contain non-automotive mercury switches and that exhibit a hazardous characteristic may be managed as universal wastes, pursuant to subsection (a)(1).]

Subsection (c), which discusses when non-automotive mercury switches are considered generated, is based on similar language in the applicability sections for the existing universal wastes. The designation as universal wastes of discarded products from which mercury switches have not been removed is intended to serve as an incentive for handlers to remove the switches (when feasible), to avoid managing the entire products under chapter 23.

Nonsubstantive Amendment to Paragraphs (3) and (6) of Subsection (b) of Section 66273.7.2:

The term "non-automotive mercury switches" is used throughout subsection (b) of section 66273.7.2. Section 66273.7.2 deals only with non-automotive mercury switches. The word “non-automotive” was inadvertently omitted from paragraphs (3) and (6) of subsection (b). These omissions are corrected in the final text.

Add Section 66273.7.3, Applicability—Dental Amalgam wastes:

Silver amalgam restorations are widely used by dentists, and DTSC recognizes that the decision to use amalgam or another material is appropriately made by dentists and their patients. However DTSC does establish the standards for managing amalgam waste, because it is hazardous waste. Amalgam waste exhibits the characteristic of toxicity because it contains both mercury and silver above the respective TTLCs.

Currently, some amalgam waste is exempt from hazardous waste regulation, while other amalgam waste is fully regulated. Larger scraps of dental amalgam that are recycled are exempt, pursuant to section 66261.6, subsection (a), paragraph (3), subparagraph (B). Smaller amalgam fines (less than 100 microns in diameter) are not exempt, and currently may be subject to full hazardous waste regulation. In order to facilitate the proper management of amalgam wastes generated by dental offices, DTSC is designating dental amalgam wastes, as described in proposed section 66273.9, as universal waste. Chapter 23 does not apply to:

1) dental amalgam that is not waste as described in chapter 11,
2) empty amalgam capsules,
3) waste restorative materials that do not contain mercury,
4) dental amalgam wastes not destined for recycling (these are instead fully regulated as hazardous wastes).

Subsection (a) lists amalgam wastes that are covered under chapter 23's universal waste requirements; subsection (b) lists wastes to which chapter 23 does not apply. Subsection (c), which discusses when dental amalgam waste is considered generated, is based on similar language in the applicability sections for the existing universal wastes.

Add Section 66273.7.4, Applicability—Mercury-Containing Pressure or Vacuum Gauges:

This proposed section applies the requirements of chapter 23 to persons managing pressure or vacuum gauges, as described in section 66273.9, unless:

1) the gauges are not wastes as described in chapter 11;
2) the gauges do not contain mercury, or
3) the gauges will not be recycled.

This section parallels the language found in the applicability sections for the existing universal wastes.

DTSC proposes to make universal waste management of waste pressure or vacuum gauges contingent on recycling. Persons opting not to recycle waste gauges would be subject to full hazardous waste regulation. This is due to the large amount of mercury contained in each gauge—up to 100 grams or more (equivalent to the mercury in 100 fever thermometers or 10,000 fluorescent tubes). Further, gauges that are RCRA hazardous wastes generated by persons subject to the federal hazardous waste program would be subject to land disposal restrictions and would have to be treated prior to land disposal. One of the required treatment processes for high mercury wastes is retorting—the same process used by mercury recyclers.

Subsection (c), which discusses when waste pressure or vacuum gauges are considered generated, is based on similar language in the applicability sections for the existing universal wastes.

Add Section 66273.7.5, Applicability—Mercury-Added Novelties:

Public Resources Code section 15027 bans the sale of mercury-added novelties, effective January 1, 2003. Mercury-added novelties are being designated as hazardous wastes elsewhere in these regulations (waste 'M004,' in proposed section 66261.50). To encourage the proper management of these products, DTSC is designating mercury-added novelties, as described in proposed section 66273.9, as universal wastes.

Subsection (a) specifies the discarded mercury-added novelties that are subject to

universal waste management. On January 1, 2004, the M004 listing will designate all discarded mercury-added novelties as hazardous wastes. From the date these regulations become effective until December 31, 2003, universal waste requirements will apply only to discarded novelties that are hazardous wastes under existing criteria (i.e., that exhibit the toxicity characteristic). After the M004 listing becomes effective, universal waste management standards will apply to all mercury-added novelties when they become wastes.
Subsection (b) lists categories of novelties not covered under chapter 23. These include:

1) mercury-added novelties that are not wastes, as described in chapter 11,
2) waste novelties that do not contain mercury,
3) waste novelties that contain liquid mercury and are not destined for recycling (these are instead fully regulated as hazardous wastes).

Subsection (c), which discusses when mercury-added novelties are considered generated, is based on similar language in the applicability sections for the existing universal wastes.

Add Section 66273.7.6, Applicability—Mercury Counterweights and Dampers:

These products contain significant amounts of mercury and are currently classified as hazardous waste and subject to full hazardous waste regulation. This proposed section applies the requirements of chapter 23 to persons managing mercury counterweights and dampers, as described in section 66273.9. Chapter 23 does not apply to:

1) counterweights and dampers that are not wastes as described in chapter 11;
2) counterweights and dampers that do not contain mercury;
3) waste products from which mercury counterweights and dampers have been removed; or
4) counterweights and dampers that will not be recycled.

This section parallels the language found in the applicability sections for the existing universal wastes. Subsection (c), which discusses when counterweights and dampers are considered generated, is based on similar language in the applicability sections for the existing universal wastes.

Add Section 66273.7.7, Applicability—Mercury Thermometers:

Mercury thermometers contain a gram or more of mercury each—enough to significantly exceed the 20 milligrams per kilogram TTLC for mercury. Mercury thermometers are currently fully regulated as hazardous wastes when discarded. This proposed section applies chapter 23's requirements to persons managing mercury thermometers, as described in section 66273.9. Chapter 23 does not apply to:

1) thermometers that are not wastes as described in chapter 11;
2) thermometers that do not use the expansion and contraction of a column of mercury to measure temperature, or
3) thermometers that will not be recycled.

This section parallels the language found in the applicability sections for the existing universal wastes.

The second condition for management of thermometers as universal wastes (that the thermometer must "use the expansion and contraction of a column of mercury to measure temperature") is intended to exclude thermometers whose only mercury is contained in a button-cell battery. Button-cell batteries, when discarded, are already hazardous wastes under existing criteria and are already eligible to be managed as universal waste under chapter 23.

Subsection (c) is necessary, in order to specify when mercury thermometers become wastes. It is based on similar language in the applicability sections for the existing universal wastes.

Add Section 66273.7.8, Applicability—Mercury Dilators and Weighted Tubing:

Similar to mercury thermometers, mercury dilators and weighted tubing contain a relatively large amount of mercury and significantly exceed the TTLC for mercury. Also, mercury thermometers, mercury dilators and weighted tubing are currently fully regulated as hazardous wastes when discarded. This proposed section applies the requirements of chapter 23 to persons managing mercury dilators and weighted tubing, as described in section 66273.9. Chapter 23 does not apply to:

1) dilators and weighted tubing that are not wastes as described in chapter 11;
2) dilators and weighted tubing that do not contain mercury, or
3) dilators and weighted tubing that will not be recycled.

This section parallels the language found in the applicability sections for the existing universal wastes.

The term "weighted tubing" was added throughout this section in the 15-Day Notice of Changes. It was added because commenters stated that weighted tubing was not a dilator even though it is a similar medical device. Because the two types of devices are similar in construction and materials and pose the same threats when mismanaged, weighted tubing was added to the list of wastes eligible for universal waste management and was added to this section.

Subsection (c) is necessary to specify when mercury dilators and weighted tubing become wastes. It is based on similar language in the applicability sections for the

existing universal wastes.

In paragraph (1) of subsection (c), the word “thermometers” was deleted in the 15-Day Notice of Changes. This word was inadvertently left in place in the original notice. The preceding section, 66273.7.7, actually addresses universal waste thermometers.

Add Section 66273.7.9, Applicability—Mercury-Containing Rubber Flooring:

At least one brand of mercury-containing rubber flooring—used mainly in gymnasiums—was manufactured with intentionally-added mercury. (To DTSC’s knowledge, mercury is no longer used in the manufacture of rubber flooring.) Some of this flooring has been tested and found to exceed the TCLP threshold for mercury: 0.2 milligrams per liter. Presently, this flooring is fully regulated as hazardous waste when discarded. This proposed section applies the requirements of chapter 23 to persons managing mercury-containing rubber flooring, as described in section 66273.9. Chapter 23 does not apply to:

1) mercury-containing rubber flooring that is not waste, as described in chapter 11, and
2) rubber flooring that does not contain mercury.

Subsection (c), which discusses when mercury-containing rubber flooring is considered generated, is based on similar language in the applicability sections for the existing universal wastes.

Add Section 66273.7.10, Applicability—Mercury Gas Flow Regulators:

Mercury gas flow regulators significantly exceed the TTLC for mercury and are currently fully regulated as hazardous wastes when discarded. This proposed section applies the requirements of chapter 23 to persons managing mercury gas flow regulators, as described in section 66273.9. Chapter 23 does not apply to:

1) mercury gas flow regulators that are not wastes, as described in chapter 11,
2) waste gas flow regulators that do not contain mercury, and
3) Mercury gas flow regulators that are not destined for recycling (these are instead fully regulated as hazardous wastes).

Subsection (c), which discusses when mercury gas flow regulators are considered generated, is based on similar language in the applicability sections for the existing universal wastes.

Amend Section 66273.8, Exemptions:

This section covers exemptions for households and small-quantity generators. Subsection (a) currently exempts households from managing universal waste batteries, lamps, and thermostats under the requirements of chapter 23 until February 8, 2006; subsections (b) and (c) exempt Conditionally Exempt Small Quantity Universal Waste Generators (CESQUWGs) from managing limited quantities of universal waste batteries, lamps, and thermostats under chapter 23 until the same date. Until these exemptions expire, households and CESQUWGs may manage and dispose of hazardous waste batteries, lamps, and thermostats as nonhazardous waste. Under the current regulations, households and CESQUWGs will become subject to the labeling, training, and accumulation time requirements applicable to small quantity handlers of universal waste beginning on February 9, 2006.

Section 66273.8, as originally proposed in the 45-Day Public Comment Period, has been renumbered and reorganized to improve clarity. In the 45-Day Public Notice, existing subsections (a), (b), (c), and (d) were renumbered as paragraphs (1), (2), (3), and (4) of subsection (a). The 45-Day Public Notice added a new subsection (b) to section 66273.8, and 15-Day Notice of Changes added a new subsection (c). The former subsections (e) and (f) were relettered as (d) and (e), respectively.

New subsections (b) and (c) permanently exempt households and CESQUWGs, respectively, from most universal waste handler requirements. Households and CESQUWGs are prohibited from disposing of universal waste as non-hazardous waste (except under the temporary exemptions discussed above), and are required to transfer their universal waste only to a handler or a destination facility. Neither households nor CESQUWGs may dispose of most universal wastes, even in a permitted hazardous waste landfill, except that a CESQUWG may transport mercury-containing rubber flooring or mercury-added novelties that do not contain liquid mercury to a hazardous waste landfill for disposal. These changes make the requirements for households, and other very-small quantity generators of universal wastes consistent with the existing requirements for Electronic Product Generators (EPGs). EPGs are persons who generate five or fewer CRT devices (primarily televisions and computer monitors) per year. They are exempted by current emergency regulations from most handler requirements. EPGs are required to transfer CRT devices to a CRT material handler or household hazardous waste collection facility, and are prohibited from disposing of or disassembling them.

The rationale for exempting households and CESQUWGs from universal waste handler requirements is that handler requirements are geared toward larger businesses and their employees. It will be more effective (and more protective of public health and the environment) to give a single, simple, message to households and CESQUWGs about these wastes: “don’t throw them away—get them to an appropriate destination facility.”

The following additional changes were also made in the 15-Day Notice of Changes:

- Subsection (a) was changed by adding “for specific universal wastes” because not all universal wastes are eligible for the temporary exemption that allows households and small generators to dispose to solid waste landfills.
- Paragraph (1) of subsection (a) was changed to clarify that the wastes themselves are granted exemption. This change is needed because the wastes leave the householder and enter the solid waste management system. Without this change, it would not be clear that the household wastes remain exempt through the solid waste management system.
- The conditional phrase in paragraph (1) of subsection (a) that requires recycling by a destination facility or disposal in a solid waste landfill is altered by removing the reference to recycling by a destination facility. It is not necessary to refer to recycling by the destination facility because sending the wastes to be recycled by a destination facility would constitute universal waste management by a householder and thus, that person would not require exemption.
- In subsection (b), the description of what the householder is exempt from is changed to “this chapter” to clarify that the only duties for the householder managing the waste are to comply with the conditions in paragraphs (1) through (3) of subsection (b). The reference to the exemption from Chapter 6.5 of division 20 of the Health and Safety Code is removed because all persons managing hazardous waste as universal waste under chapter 23 are already exempted from the management requirements of chapter 6.5 of division 20 of the Health and Safety Code in section 66261.9. It is not necessary to duplicate that exemption in this section.
- Subsection (b), paragraph (1) is changed to make the subject (“wastes”) singular and conform the verb to the number of the subject. This change is necessary because a householder might manage only one waste at a time, or might simultaneously manage multiple wastes.
- Subsection (b), paragraph (2) is modified to allow a householder to treat universal wastes in the same manner as allowed for other universal waste handlers, as specified in the waste management standards for small quantity handlers of universal waste, section 66273.13. This change is necessary to allow simple treatment such as removal of dead fluorescent tubes from fixtures and the removal, separation and management of mercury capsules independent from the body of the thermostat.
- New subsection (c) adds a new exemption and subsequent subsections are relettered to reflect that addition. The new subsection establishes a simplified management system for the smallest non-household universal waste generators, which requires only proper recycling or disposal (both at destination facilities) and allows simple treatment such as removal of dead fluorescent tubes from fixtures and removal, separation, and management of mercury capsules independent from the body of the thermostat. The separate exemption is necessary because the smallest businesses will manage universal wastes in a manner more similar

to a household than a larger business. Formal training and special management systems needed for larger businesses generating larger amounts of universal waste are not necessary for the smaller amounts of universal waste produced by households and the smallest commercial generators. One of the conditions is that the waste be recycled rather than disposed, but that exceptions are made for novelties that do not contain liquid mercury and mercury-containing rubber flooring because those universal wastes are not technically feasible to recycle.

Amend Section 66273.9, Definitions:

This section defines the terms used in chapter 23. Definitions of the wastes for which this proposal is adding universal waste standards are added to section 66273.9.

Additionally, further changes were made the subsequent 15-Day Notice of Changes:

- The definition of "conditionally exempt small quantity universal waste generator" has been revised to improve clarity and remove duplicative text. [Subparagraph (1)(A) is relettered as subsection (a); Subparagraph (1)(B) is relettered as subsection (b). Subparagraphs (2)(A) through (2)(D) are deleted.] The changes are non-substantive because the deleted quantity limits on the amounts of batteries, lamps, and thermostats that may be disposed of by a CESQUWG, along with the stepped reductions in these limits, are also found section 66273.8. Under the revised definition, a conditionally exempt small quantity universal waste generator is a person who meets the generation levels for the federal conditionally exempt small quantity generator found in 40 CFR section 261.5. A person who meets the revised definition of a conditionally exempt small quantity universal waste generator continues to be subject to the disposal limits in paragraphs (2) and (3) of subsection (a) of section 66273.8.
- The definition of "dilators" is changed by the addition of "and weighted tubing" in response to the comment that, while weighted tubing is similar in construction and hazard level to dilators, it is used for different purposes and does not dilate. [Note that subsection (l) of the definition of "Universal Waste" inadvertently was not changed to read "…and weighted tubing." This oversight is corrected in the final text.]
- The definitions of "large quantity handler of universal waste" and "small quantity handler of universal waste" are altered by changing the list of wastes subject to the quantity threshold (5000kg) from a specific list to a non-inclusive list with examples given. This clarifies the definition and avoids including a long, repetitive recitation of the new expanded list of different universal wastes.

Amend Article 2, Standards for Small Quantity Handlers of Universal Waste, and Article 3, Standards for Large Quantity Handlers of Universal Wastes:

Articles 2 (section 66273.10 et seq.) and 3 (section 66273.30 et seq.) specify universal waste standards applicable to small and large quantity handlers of universal waste. The waste management standards for small (section 66273.13) and large quantity (section 66273.33) handlers are identical. Both articles are amended to add waste-specific management standards for each of the new universal wastes added by this proposal. All of the management standards added by this proposal require universal waste handlers to manage each waste "in a way that prevents releases of any universal waste or component of a universal waste to the environment."

Universal waste management standards for wastes that contain similar amounts of mercury and pose similar risks during waste management have been consolidated. For the purpose of developing universal waste management standards, wastes have been grouped into categories based on several criteria:

1) The amount of mercury they contain;
2) The physical state of the mercury they contain;
3) Whether the mercury they contain is fully encapsulated within the product, or whether the product contains openings through which mercury could escape; and
4) Whether the mercury is encapsulated in glass or another fragile material that, if broken, could result in the release of mercury to the environment.

Amend Subsection (c) of Sections 66273.13 and 66273.33:

A change was made to subsection (c) during the 15-Day Notice of Changes. This change [added as paragraph (3)] allows a handler to remove waste lamps from fixtures. This change was made in response to comments that, when a lamp fails or a fixture is removed and discarded, the lamp and fixture could be considered a waste and removal of the lamp from the fixture would constitute treatment. Because there is no environmental reason to manage the fixture as hazardous waste (unless it contains a PCB ballast or other hazardous constituents that would be separately regulated), the lamp itself can be removed provided it is properly managed. This will minimize the amount of material managed as universal waste and, potentially, free the fixture up for recycling.

Add Subsection (d) to Sections 66273.13 and 66273.33:

These new subsections contain management standards for universal waste mercury switches and thermometers. Two categories of discarded mercury switches are designated as hazardous wastes in proposed article 4.1 of chapter 11, while discarded mercury thermometers are already classified as hazardous wastes under existing criteria. Universal waste management standards for all three of these wastes are

consolidated in these two subsections, because mercury switches from vehicles, those from other products, and mercury thermometers all contain similar amounts of mercury and pose similar risks during management.

The standards are intended to prevent the release of mercury from switches and thermometers to the environment. Subsection (d), paragraph (1) requires a handler to contain broken, damaged, or leaking switches and thermometers in a closed, structurally sound, undamaged, and non-leaking container with packing materials sufficient to protect them from breakage. Similar requirements in paragraph (2) apply to containers used to accumulate mercury thermometers and mercury switches that have been removed from vehicles or other products. The container standards for mercury switches and thermometers are based on the existing standards for mercury thermostats, which are similar in size and contain similar amounts of mercury.

Removal of Mercury Switches from Vehicles and Appliances

Subparagraph (A) of paragraph (3) allows, and contains standards for, the removal mercury switches from vehicles and other products. Following are examples of the requirements:

- Remove switches in a manner designed to prevent breakage;
- Have a mercury clean-up system available;
- Transfer any spilled mercury to an airtight container; and
- Formally train employees who remove mercury switches in proper waste handling and emergency procedures.

These requirements are intended to prevent releases of mercury to the environment and to prevent worker exposure to mercury vapors.

Subparagraph (A)7. of paragraph (3) requires handlers who remove mercury switches from vehicles and products to keep basic records of switch removal for three years. The information that must be retained is as follows:

a. The number of vehicles destined for crushing, baling, shearing, or shredding;
b. The number of appliances destined for shredding;
c. The number of vehicles or appliances counted in a and b that contain mercury switches;
d. The number of switches removed from the vehicles and appliances counted in c; and
e. The number of vehicles counted in c that were damaged to the extent that switches could not be removed.

These requirements are intended to document that switches are properly removed. No specific forms or format are specified for the required information, to give maximum

flexibility to the universal waste handlers who remove switches in how to document the required information.

Requirement to Remove Switches and Certification of Removal of Switches

The original (45-Day Public Notice) version of the regulations would have required, in subsection (d), paragraph (3), subparagraph (A)4., that the mercury switches be removed in an area that was well ventilated and monitored to ensure compliance with OSHA and Cal-OSHA exposure levels for mercury. This provision, and a similar provision in subsection (f), paragraph (2), subparagraph (E) for draining gauges, was removed in the 15-Day Notice of Changes in response to comment that:

- Switches are normally removed from vehicles and appliances outdoors in scrap yards where it is unlikely that mercury vapor exposure will exceed the occupational limits.
- Switches are robust containers and are well protected from accidental breakage unless subjected to high forces such as auto shredders and heavy landfill equipment. They are very unlikely to break during removal making the monitoring requirement unnecessary.
- OSHA and Cal-OSHA standards already require ventilation or respiratory protection for persons managing exposed elemental mercury.
- OSHA and Cal-OSHA standards apply independently from these regulations and, absent the monitoring requirement, they will continue to apply and be enforceable.

The rest of subparagraph (3)(A) was renumbered to reflect the deletion.

On January 1, 2005, the M001 listing in proposed section 66261.50 will take effect. On and after that date, mercury-containing motor vehicle light switches and vehicles that contain them will be designated as hazardous wastes. This designation applies to a vehicle that contains mercury light switches only when someone decides to crush, bale, shear, or shred it. Effective on the same date, subsection (d), paragraph (3), subparagraph (B) will require that all mercury light switches must be removed from a vehicle that contains them prior to processing the vehicle by crushing, baling, shearing, or shredding it. The text in the 45-Day Public Notice would have required a handler intending to crush, bale, shear, or shred a vehicle containing mercury (light) switches to remove all such switches, or to “verify” that they had already been removed. The word “verify” was replaced with “ensure” in the 15-Day Notice of Changes, because DTSC wanted to avoid any confusion with the (now deleted) certification requirement discussed below. The word “verify” may have implied that a handler was required to keep records beyond those required by paragraph (3), subparagraph (A).

In the originally proposed regulations, subsection (d), paragraph (3), subparagraph (B) referred to all mercury switches; but was changed in the 15-Day Notice of Changes to

conform to the M001 listing change. Further, a handler who takes or sends a vehicle or vehicles to another person for crushing, baling, shearing, or shredding would have been required, by originally proposed subsection (d), paragraph (3), subparagraph (C), to certify that all switches have been removed or have been verified to have been removed. However, the certification requirement was removed in the 15-Day Notice of Changes in response to the following types of comments:

Commenters stated that an automotive recycler cannot certify that all mercury-containing switches have been removed because:

- They do not know where all of the switches are located in the thousands of different year, make, and model vehicles they receive.

- Some switches cannot be removed due to damage that prevents removal such as a crushed hood or trunk lid.

Therefore, the proposed regulations were modified in the 15-Day Notice of Changes to apply only to mercury-containing vehicle light switches.

When the M001 hazardous waste listing takes effect, crushing, baling, shearing, or shredding a vehicle that contains one or mercury light switches will be considered treatment of a hazardous waste, and will require a permit. These removal requirements will prevent the release of mercury during the processing of scrap vehicles. However, the resulting baled or shredded scrap metal may be managed (i.e. stored, transferred, recycled, disposed) as non-hazardous scrap metal unless it exhibits a characteristic of a hazardous waste.

Add Subsection (e) to Sections 66273.13 and 66273.33:

These new subsections contain management standards for waste dental amalgam. Because this material is solid at room temperature, it poses different risks than the liquid mercury found in switches, thermostats, and thermometers. These differences are reflected in this subsection's waste management standards for handlers of waste dental amalgam. The standards for amalgam do not require handlers to have a mercury spill kit on hand, for example.

Amalgam fines smaller than 100 microns (or 1/250 inch) in diameter are currently fully regulated as hazardous waste. Due to stringent discharge limits imposed by their Regional Water Quality Control Boards, the providers of sewerage services in some parts of the state are requiring dentists to install traps to capture amalgam fines that would otherwise enter the drain. These subsections would allow universal waste management of single-use amalgam traps, as well as amalgam fines and sludges removed from reusable traps, lateral lines, etc. They would also allow universal waste management of extracted teeth with amalgam restorations as universal wastes.

Due to mercury's volatility, subsection (e), paragraph (1) of these two sections requires handlers to accumulate amalgam waste in airtight containers. Two other prohibitions in the waste management standards are also intended to prevent the release of amalgam waste to the environment. Paragraph (2) prohibits handlers of universal waste amalgam from rinsing amalgam traps into a sink, and paragraph (3) prohibits them from placing amalgam waste into a medical waste container.

The proposed universal waste management standards for amalgam waste prohibit handlers from placing amalgam into medical waste containers because, in most cases, medical waste is incinerated. While medical waste incinerators are generally equipped with air pollution control devices designed to trap pollutants, some of the mercury in incinerated medical waste inevitably escapes to the atmosphere. Keeping it from being incinerated is a more effective strategy for preventing the release of mercury to the environment than is allowing it to be incinerated and then attempting to trap it.

Add Subsection (f) to Sections 66273.13 and 66273.33:

These new subsections contain standards for the management of universal waste gauges. These products may contain many grams of mercury, and they generally include openings through which mercury could potentially escape. Additionally, the mercury in a universal waste gauge is often found in a glass tube, which can easily be broken, allowing mercury to be released. The proposed management standards for handlers of universal waste gauges were developed with these factors in mind.

Handlers are required, by subsection (f), paragraph (1), subparagraph (A), to close all openings through which mercury could escape, in order to prevent spills or leaks of mercury. As a further precaution, subparagraph (B) requires that each gauge must be sealed in a plastic bag, which is then placed in a closed, structurally sound, compatible container that contains packing materials adequate to prevent breakage of gauges. Gauges must be kept upright during handling, accumulation, and transportation, in order to minimize the chance of mercury spills.

Subsection (f), paragraph (2) gives handlers the option of draining the mercury from universal waste gauges that they have generated (handlers may not drain the mercury from gauges that are received from other handlers, however). Because draining large numbers of gauges at a single consolidation site would increase the risk and potential size of mercury spills, only the handler who generates a universal waste vacuum or pressure gauge would be allowed to drain mercury from the gauge, and draining could occur only at the site where the universal waste gauge was generated.

Draining mercury from gauges is a fairly common practice. At least one manufacturer of mercury sphygmomanometers offers sphygmomanometer service kits, which include one or more one-pound bottles of mercury. As a part of maintenance, mercury is

drained from sphygmomanometers and replaced with fresh mercury from the kit. Because the sphygmomanometer will continue to be used after the mercury is changed, they are not considered wastes under current regulations and the draining activity is not considered hazardous waste treatment. However, a discarded sphygmomanometer would be classified as a hazardous waste, and draining mercury from it would currently be considered hazardous waste treatment requiring a permit.

The draining process itself poses risks of releases of mercury and of worker exposure to mercury vapors. For these reasons, subparagraphs (A) through (I) of paragraph (2) of subsection (f) of sections 66273.13 and 66273.33 require handlers who wish to drain mercury from gauges to comply with a number of requirements:

(A) Drain gauges over a containment device;
(B) Develop and follow written procedures for safely draining mercury;
(C) Keep a mercury spill clean-up kit on hand;
(D) Transfer drained mercury to an appropriate container;
(E) Train employees in draining procedures, waste handling, and emergency procedures;
(F) Store drained elemental mercury in an appropriate container;
(G) Place the container into a compatible secondary container;
(H) Keep records of the gauges drained; and
(I) Not accumulate more than 35 kilograms of drained mercury at any time.

Whether or not they drain liquid mercury from universal waste gauges, handlers are required [by subparagraphs (C) of paragraphs (1) and (2) of subsection (f)] to have a mercury clean-up system readily available, and to immediately transfer any spilled mercury to an airtight container. Handlers are required, by subsection (f), paragraph (3), subparagraph (A), to determine whether mercury that spills or leaks from universal waste gauges during management exhibits any hazardous waste characteristic. They must also determine whether absorbent materials used to clean mercury spills, and any other clean-up residues, exhibit a characteristic. If spilled mercury or cleanup residues are found to be hazardous, they are not universal wastes but are instead fully regulated hazardous wastes. However, drained universal waste gauges that exhibit a hazardous waste characteristic may continue to be managed as universal waste; drained gauges that are not hazardous may be managed accordingly.

Paragraph (2), subparagraph (E) was deleted in the 15-Day Notice of Changes for the reasons discussed for subsection (d), paragraph (3), subparagraph (A)4., above. The rest of the subparagraphs were relettered accordingly.

Add Subsection (g) to Sections 66273.13 and 66273.33:

These new subsections contain management standards for mercury-added novelties. As discussed earlier, the term “mercury-added novelty” is contained in Public

Resources Code section 15025. Public Resource Code section 15027 bans the manufacture and sale of these products, effective January 1, 2003. "Novelties" is a broad category encompassing products containing varying amounts of mercury, which may be in an elemental or an oxidized form. Some mercury-added novelties can appropriately be managed under the standards for one of the other types of universal waste.

These two subsections provide management standards for several categories of novelties:

- Novelties whose only mercury is contained in the battery or batteries;

Pursuant to subsection (g), paragraph (1), novelties whose only mercury is contained in batteries (and batteries removed from such novelties) will be subject to management under the standards for universal waste batteries in existing subsection (a) of 66273.13 and subsection (a) of 66273.33. After all batteries have been removed, if a novelty is not hazardous for any other reason, it may be managed as nonhazardous waste.

- Novelties that are painted with mercury-containing paint;

Spillage or leakage of liquid mercury is not an issue during the handling of novelties that are painted with mercury-containing paint. However, mercury could volatilize from painted novelties, causing potential inhalation risks and the release of gaseous mercury to the environment. Mercury-containing paint may also flake off of painted novelties. For these reasons, subsection (g), paragraph (2) of section 66273.13 and subsection (g), paragraph (2) of 66273.33 require universal waste handlers to accumulate mercury painted novelties in airtight containers.

- Novelties that contain free liquid mercury; and

Novelties that contain free liquid mercury (i.e., mercury that is not contained in a switch or other encapsulated device), may be fragile and may have openings through which mercury could escape. Because they pose risks similar to those of mercury gauges, the management standards proposed for this type of novelties in subsection (g), paragraph (3) are very similar to those for gauges. Handlers are required to pack them in undamaged, closed, structurally sound, and airtight containers with packing materials that are adequate to prevent breakage. Handlers must also keep a mercury cleanup system readily available while handling novelties that contain liquid mercury.

- Novelties that contain mercury switches.

Pursuant to subsection (g), paragraph (4), universal waste novelties whose only mercury is contained in a switch or switches are regulated under the standards for

universal waste switches and thermometers in proposed subsections 66273.13(d) and 66273.33(d).

Handlers are required, by subsection (g), paragraph (5), to determine whether mercury that spills or leaks from universal waste novelties during management exhibits any hazardous waste characteristic. They must also determine whether absorbent materials used to clean mercury spills, and any other clean-up residues, exhibit a characteristic. If spilled mercury or cleanup residues are found to be hazardous, they are not universal wastes but are instead fully regulated hazardous wastes. These requirements are similar to, and are based on, existing standards for handlers of universal waste batteries and thermostats.

Add Subsection (h) to Sections 66273.13 and 66273.33:

These subsections govern the management of universal waste mercury counterweights and dampers, which currently are fully regulated hazardous wastes. These items can contain large amounts of mercury, which is generally fully encapsulated within the product. Mercury counterweights and dampers are often less fragile than other types of mercury-containing products. However, due to the large amount of mercury that these products may contain, as well as the possibility that some may be breakable, a number of management requirements will be imposed on handlers of universal waste counterweights and dampers. Handlers will be required, by subparagraphs (1) through (4) of subsection (h), to:

- Recycle counterweights and dampers (no disposal will be allowed);
- Pack them with materials adequate to prevent breakage;
- Pack them in a closed, undamaged, structurally sound container that is compatible with mercury;
- Place leaking, spilling, or damaged counterweights or dampers in a sealed plastic bag in an airtight container; and
- Have a mercury clean-up system readily available.
- Manage spilled mercury and clean up residues that exhibit a hazardous waste characteristic as fully regulated hazardous waste.

These requirements are intended to prevent releases of mercury to the environment and to prevent worker exposure to mercury vapors.

Add Subsection (i) to Sections 66273.13 and 66273.33:

These subsections govern the management of universal waste dilators and weighted tubing. Several types of gastrointestinal and esophageal dilators and weighted tubing are used in certain medical procedures; some use mercury for weight. These devices may contain many grams of mercury, which is contained in a rubber tube. While not especially fragile, these tubes could rupture, releasing mercury. The standards for

universal waste dilators and weighted tubing are designed to minimize the possibility of such releases. Damaged or leaking dilators and weighted tubing are subject to additional packaging requirements, to ensure that liquid mercury and mercury vapors are contained. The requirements for small quantity handlers, in subparagraphs (1) through (4) of subsection (i) include:

- Packing dilators and weighted tubing with materials adequate to prevent breakage;
- Packing dilators and weighted tubing in a closed, undamaged, structurally sound container that is compatible with mercury;
- Placing leaking, spilling, or damaged dilators and weighted tubing in a sealed plastic bag in an airtight container; and
- Having a mercury clean-up system readily available.
- Managing spilled mercury and clean up residues that exhibit a hazardous waste characteristic as fully regulated hazardous waste.

All of these requirements are intended to prevent the accidental release of mercury to the environment during handling and transportation of dilators and weighted tubing. Note that the term “and weighted tubing” was added by the 15-Day Notice of Changes to this section and others in response to comment. The necessity for this change is explained in the discussion of the necessity for changes to section 66261.9 above.

Add Subsection (j) to Sections 66273.13 and 66273.33:

This subsection governs the universal waste management of discarded rubber flooring that contains mercury. Samples of such flooring, which was used in gymnasiums until the late 1970s, were tested and found to exceed the TCLP for mercury, making the flooring hazardous waste when discarded.

Mercury-containing rubber flooring is unlike the other mercury-containing wastes for which new management standards are proposed. Its mercury is not in a liquid form, and is not contained in a discrete component of the waste. Spillage of the mercury is, therefore, less of a concern than for the other new universal wastes. Further, pieces of waste flooring may be generated that are too large to fit in a drum or other common container. Consequently, the waste management standards in this subsection are minimal; they require only that flooring be managed “in a way that prevents releases of any universal waste or component of a universal waste to the environment. “

Add Subsection (k) to Sections 66273.13 and 66273.33:

These new subsections contain standards for the management of universal waste gas flow regulators. These devices, which were attached to older gas meters, may contain 100 grams or more of mercury. They generally include openings through which mercury could potentially escape. The mercury in a universal waste gas flow regulator

is usually found in a small cup, which can easily spill during removal. The proposed management standards for handlers of universal waste gas flow regulators were developed with the prevention of such spills in mind. Handlers are required by subsection (k), paragraph (1) to keep universal waste gas flow regulators upright during handling. As a further precaution, subsection (k), paragraph (2) requires that regulators must be sealed in a closed, structurally sound, compatible container.

Handlers of universal waste gas flow regulators are required, by subsection (k), paragraph (3), to have a mercury clean-up system readily available, and to immediately transfer any spilled mercury to an airtight container. Handlers are required by subsection (k), paragraph (4), subparagraph (A)1. to determine whether mercury that spills or leaks from universal waste regulators during management exhibits any hazardous waste characteristic. They must also determine whether absorbent materials used to clean mercury spills, any other clean-up residues, and drained gas flow regulators, exhibit a characteristic. If spilled mercury or cleanup residues are found to be hazardous, they are not universal wastes but are instead fully regulated hazardous wastes. If they are not hazardous, they may be managed accordingly.

Amend Sections 66273.14 and 66273.34:

These sections, which parallel language found in 40 CFR sections 273.14 and 273.34, specify waste-specific labeling requirements for universal wastes. Handlers of universal waste are required to label or mark universal waste or the containers of universal waste to clearly indicate the waste description with one of the following phrases: "Universal waste--___", "Waste ___", or "Used ___", with the blank filled in with the applicable type of universal waste such as battery(ies), thermostat(s), or lamp(s). These regulations add ten new categories of universal waste to chapter 23. New labeling standards, based on the existing standards for batteries, lamps, thermostats, and CRTs, are added for each new universal waste category. In addition to those for the ten new waste categories, labeling standards for the mercury drained from universal waste gauges are also added.

Subsection (f), paragraph (2) was added [and subsection (f) renumbered as subsection (f), paragraph (1)] during the 15-Day Notice of Changes to specify proper labeling for mercury drained from gauges. The language for the label parallels that language for labeling the other universal wastes.

The originally proposed regulation (45-Day Public Notice) had an additional subsection, (l). It applied to drained mercury. However, the only universal wastes from which mercury can be drained are gauges, so the language has been moved to subsection (f) paragraph (2), which establishes labeling language for gauges and provides consistency.

Subsection (i) was modified by adding “and weighted tubing” to “dilators.” The necessity for this addition is explained in the discussion for the changes to section

66273.7.8, which establishes the applicability of chapter 23 to mercury dilators and weighted tubing. The words "as appropriate" were added to this subsection because not all of the labeling options provided are applicable to all types of dilators and weighted tubing. Labeling a container of dilators as "weighted tubing" would not be appropriate, for example, nor would be labeling a container of weighted tubing as "dilators."

Amend Section 66273.19:

DTSC is adding a requirement to section 66273.19, to require small quantity handlers of the 10 newly-added universal wastes to comply with the same recordkeeping requirements that already apply to large quantity handlers of batteries, thermostats, and lamps. Under California's existing universal waste rules, small quantity handlers (persons who never accumulate 5,000 kilograms of universal waste) are not required to keep records of their shipments or receipts of universal waste batteries, thermostats, and lamps. Large quantity handlers are required to retain such records for three years from the date they ship or receive universal waste.

The requirement is added because most of the wastes in question contain relatively large amounts of mercury (several grams, or more). If even a small percentage of these products is improperly disposed, the mercury released would add to the State's already unacceptable level of environmental contamination with mercury. DTSC believes that this minimal recordkeeping requirement will impose a very small additional burden on small quantity handlers, while making it easier for State and local officials to verify that the affected wastes are being managed properly. The recordkeeping requirement will provide an incentive for handlers to comply with the other requirements in this section.

Add Sections 66273.21 and 66273.41:

These new sections pertain to the siting of universal waste handlers that accumulate mercury-containing universal wastes received from other handlers. Due to potential risks associated with the accumulation of large volumes of mercury-containing wastes at non-permitted consolidation sites, these sections list several criteria for offsite accumulation of the wastes. A universal waste handler who accumulates any of the ten new mercury-containing universal wastes anywhere other than at the site of generation must meet these criteria. The criteria are:

- Compliance with all applicable requirements for handlers of hazardous materials;
- Disclosure that mercury is being handled in all applicable business and use permitting applications;
- Compliance with the standards in section 66265.18, which pertain to locating facilities in a 100-year floodplain;
- Compliance with the seismic precipitation design standards in section 66265.25;
- Accumulation of the wastes only in areas that are zoned for commercial or industrial

uses; and
- Accumulation of the wastes at a location that does not pose site specific land use hazards or contain sensitive habitat area, based on a review of state and local planning documents and constraints mapping.

The criteria are intended to prevent accumulation of mercury-containing universal wastes at locations that are inappropriate due to incompatibility of the activity with local land use or zoning, or that are not designed to withstand flooding or earthquakes.

Nonsubstantive Change to Paragraph (8) of Subsection (a) of Sections 66273.21 and 66273.41:

The name of the new universal waste category “dilators” was changed elsewhere in the text of these regulations to “dilators and weighted tubing” in the 15-Day Notice of Changes (Table of Contents, sections 66261.9, 66273.1, 66273.7.8, 66273.9, 66273.13, 66273.14, 66273.33, and 66273.14), but subsections (a)(8) of sections 66273.21 and 66273.41 inadvertently were not changed. This oversight is corrected in the final text.

45-Day Public Notice
Comment Summaries and Responses

Mercury Waste Classification and Management Regulations: R-02-04 – 45 Day Notice Comment Summaries and Responses

General

CALPIRG Charitable Trust

H-2 *Current mercury contamination should be cleaned up.*

Cleanup of historic mercury contamination is outside the scope of this rulemaking. However, the difficulty of cleaning up existing contamination reinforces the need to prevent additional contamination, one of the objectives of this rulemaking. The Department of Toxic Substances Control (DTSC), the State Water Resources Control Board (SWRCB), the United States Environmental Protection Agency (U.S. EPA), and other local agencies are cleaning up sites contaminated with mercury as rapidly as funding and staff allows. The State is contaminated with mercury in many diverse and diffuse locations and cleanup will be long, difficult, and expensive.

H-3 *Manufacturers of mercury-containing products should be held accountable for the costs of reclaiming mercury and managing mercury waste.*

While this approach would go far towards funding collection and recycling efforts for mercury-containing wastes, such requirements are outside the scope of this rulemaking and outside the scope of the statutory authorities granted to DTSC.

H-4 *Safer alternatives to mercury use should be encouraged with economic incentives.*

The only economic incentives that DTSC has authority to establish are “back end” incentives such as regulating discarded mercury-added products as hazardous waste. This is one of the objectives of this rule. One of the criteria used to determine which discarded products should be listed in the new mercury listed wastes was the availability of mercury-free substitutes which, when spent, would not carry the label of “hazardous waste” unless they were identified as hazardous waste for characteristics or constituents other than mercury. DTSC does not have the statutory authority to provide economic incentives directly to manufacturers of mercury-containing products.

H-5 *The public has the right to know about mercury pollution to which they are exposed and to participate in decisions that affect the public health.*

Notifying persons about the nature and extent of mercury contamination in both the environment and in products is beyond the scope of this rulemaking. However, DTSC and the SWRCB have extensive lists of contaminated and potentially contaminated sites in the State. These lists are available both as printed documents through the DTSC Site Mitigation Program and on the internet. Note that DTSC does not have authority to require specific product labeling.

There is already an extensive public review and comment feature for both changes to the State’s regulations and to plans for mitigation of contamination. This document represents the DTSC’s response to the public involvement in the regulatory process. For site

cleanup, both the remedial action plans and the environmental assessment documents for the cleanups have extensive public involvement.

H-6 *Environmental contamination in California continues to threaten human health, particularly children. Disposal of products contributes significantly to this contamination. We enthusiastically support DTSC's efforts to reduce mercury in the waste stream, but even more rigorous policies are needed to eliminate mercury from use.*

This rulemaking represents a step towards controlling disposal of wastes with intentionally added mercury. By creating a need to manage mercury-added products in a more complex and expensive manner than non-hazardous products, it also provides some disincentive for the use of intentionally-added mercury. Note, however, that DTSC could have created a stronger disincentive for using mercury by requiring full hazardous waste management, but chose not to in order to ensure that products with mercury generated by the vast numbers of universal waste generators would not be illegally disposed in significant numbers. Any efforts to ban mercury from products or forbid its use are outside of the authorities granted to DTSC to adopt regulations.

Center for Environmentally Advanced Technologies

I-27 *California missed a golden opportunity to promote mercury reduction when it recently awarded a very large contract for high-mercury fluorescent lights. The state should use its procurement power to purchase the lowest-mercury lamps as an example to consumers.*

Procurement of products by the State of California (or any other entity) is outside of the scope of this rulemaking, which is intended to address classification and management of waste products with intentionally-added mercury. However, DTSC will work with other State agencies as part of an interagency California Environmental Protection Agency (Cal/EPA) Universal Waste Infrastructure Workgroup. One of the tasks of this group will be to develop suggested guidelines for purchasing products with intentionally-added mercury. These guidelines will suggest buying substitutes for mercury products whenever possible and minimizing the mercury content when substitution is impossible or undesirable (for instance, in substituting incandescent lamps for fluorescent tubes with the high energy penalty attached to incandescent lamps).

Clean Water Action

J-7 *The proposed regulations need to be bolstered by comprehensive education for producers and consumers and need to include stringent labeling requirements.*

DTSC and the California Integrated Waste Management Board (CIWMB) are co-chairing an effort to develop a robust infrastructure to collect and properly manage universal wastes generated by households and small businesses. Aggressive educational outreach will be one of the products of this workgroup. Note that stringent labeling requirements, while

they may dissuade customers from purchasing mercury added products, are outside the authority granted to DTSC.

Consumers for Dental Choice

K-15 *Request an extension of the comment period on the regulations.*

There has been a 45-Day Comment Period and three 15-Day Notices of Changes to the original proposal, as required by California's Administrative Procedures Act, giving commenters sufficient time to review and comment on the proposal. Note also that DTSC must adopt these regulations before January 1, 2003 when the authority granted by Health and Safety Code section 25150.6 to vary from statute expires. This real deadline precludes extended comment periods.

Michael Pinkerton

EE-1 *The proposal is a positive step, but mercury-containing products must also be collected and contained in a manner protective of public health.*

This proposal applies the Universal Waste Rule standards to management of the subject mercury-containing wastes. The Universal Waste Rule applies less prescriptive performance standards to facilitate simple and inexpensive management of universal wastes, but requires that universal wastes be accumulated, stored, and transported in containers that can fully contain the wastes and protect them from damage. While these requirements are somewhat open-ended, the solutions chosen by persons managing universal wastes must meet essentially the standards suggested by the commenter.

Hazardous Waste Listing - M003 - Support - Phase-In Date

OSRAM Sylvania

V-1.5 *In the proposed regulations, the exposure pathway focused on for mercury from fluorescent lamps is generally limited to landfills. It is important to note that mercury from lamps occurs first at the dumpster where improperly managed lamps are typically broken. These initial exposure pathways are not emphasized in DTSC's analysis and should be considered as an additional impetus for making the listing effective as soon as possible.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. DTSC aggress that leaching from landfills is only one pathway by which the mercury in broken lamps can enter the environments. Some mercury from broken lamps is also volatilized directly to air, and some can contaminate dumpsters, from which it can be washed out and contaminate surface waters or enter storm drains. These other pathways are discussed in DTSC's Final Mercury Report.

V-8 *DTSC should clarify the relationship between the Regulations for the Mercury Waste Classification and Management (R-02-04) and the proposed Electronic Hazardous Waste Regulations (R-01-06).*

The Mercury Waste Classification and Management Regulations (R-02-04) and the Electronic Hazardous Waste Regulations (R-01-06) both establish management standards for specific products designated as universal wastes. Thus, they both affect the same sections of existing regulations while also adding and/or affecting other separate sections. Neither package shows the changes being proposed in the other package because presentation of all the proposed changes in one package would create an extremely complex document with multiple sets of underlines, strikeouts, and other indications of the changes in the two packages. Combined display would create a patently unclear presentation that would adversely affect the ability of the regulated community to understand and comment on the proposed changes. Both packages address different types of waste and both packages stand alone without the other. Thus, only it is not necessary to show both sets of changes, it would be unclear.

Note, however, that sections being changed that affect both regulations such as the exemptions found in section 66273.8 have been reconciled so that the sections, as adopted, will be consistent. There will be nonsubstantive changes required to each package upon approval by the Office of Administrative Law (OAL) to meld the regulations together into the printed version of the effective code. DTSC intends to supply OAL with copies of melded text to ensure that the final printing of the code is correct. Changes to each package to accommodate the language of the other package will consist exclusively of renumbering existing and newly adopted subsections without making any substantive changes that would require additional public notice.

Robyn Martin

BB-5 *I wish to see legislation and funding for the reclamation and cleaning up of rivers, lakes and streams contaminated with mercury during the gold rush.*

DTSC acknowledges that the “legacy” wastes from the Gold Rush constitute a major source of mercury pollution in California. However, DTSC cannot adopt legislation and cannot establish funding or impose fees, taxes, or other costs to supply funding for mercury cleanup. This comment is also outside the scope of there regulations.

Sara Waters

GG-3 *The amount of pollutants in our environment escalates daily, while the attempts to regulate or remove pollutants are a slow and lengthy procedure.*

DTSC agrees with the commenter. However, the comment does not present any suggestions or arguments that are germane to this rulemaking. This rulemaking does not change any of the processes or requirements for site cleanup activities. Such changes will require extensive discussion and involvement of all stakeholders in the cleanup process

and are beyond the scope of this regulation.

Sensient Technologies

AA-1 *The proposed mercury and CRT regulations amend some of the same sections, inconsistently with each other. The department should thoroughly review each proposal to reconcile the differences.*

As discussed in comment V-8 above, incorporated herein, the proposals both change many of the same sections. Because neither includes the text of the changes proposed by the other rulemaking project, there are conflicts in numbering in some sections. As discussed above, these conflicts will be resolved with non-substantive changes by OAL upon approval of both regulation packages.

General - Adding New Wastes

CALPIRG Charitable Trust

H-12 *DTSC should establish a process to list, with public input, other products over time.*

Note that Health and Safety Code sections 25140 and 25141 both give DTSC adequate authority to adopt new listings of mercury-containing wastes for management as hazardous wastes. This authority already exists and is not scheduled to sunset. A petitioner desiring to add new wastes to the lists of hazardous wastes would petition under the Government Code. If the petition were successful, DTSC would rely on the authority of Health and Safety Code sections 25140 and 25141 to establish the new listings. Because DTSC would adopt any new listing by regulation, there would be the well understood and effective public review and comment process of the Administrative Procedures Act to ensure public involvement in addition to DTSC's pre-regulatory workshops and other consultations with stakeholders.

The existing petition process of the Administrative Procedures Act (Government Code Section 11340.6) supplemented by the criteria of proposed sections 66260.30 and 66260.33 establish processes for adoption of new universal wastes. However, after January 1, 2003 the authority of Health and Safety Code section 25150.6 would need to be reestablished in order to allow universal waste management of other wastes.

Clean Water Action

J-5 *There should be a mechanism to add new wastes (to the hazardous waste listing?) to encourage R and D on mercury-free alternatives.*

As discussed in the response to comment H-12 above, incorporated herein, there are sufficient processes and authorities in place for DTSC to add new wastes to the newly adopted hazardous waste listings. New statutory authority would be necessary to allow

management as universal waste.

Onyx Environmental Services

U-1 *We support DTSC's proposal to expand universal waste regulations to cover other mercury-containing wastes and to regulate low level mercury devices (as hazardous waste).*

DTSC acknowledges the support.

General – Education

Physicians for Social Responsibility, Los Angeles

W-7 *DTSC must sponsor or provide assistance and resources for an aggressive education effort to publicize the new standards. Households and smaller medical facilities are largely unaware that mercury-containing products are hazardous waste and must be managed accordingly.*

DTSC and the CIWMB are co-chairing a Cal/EPA effort to develop a robust infrastructure to collect and properly manage universal wastes generated by households and small businesses. Aggressive educational outreach will be one of the products of this workgroup. As with most important new regulation packages, DTSC will offer to deliver speeches and training sessions to businesses and associations that request them, provide fact sheets and guidance materials, offer generator and handler training classes through the California Compliance School, and train Certified Unified Program Agency (CUPA) staff that work directly with generators of universal waste.

General - Class I Landfill Disposal

Imperial County Planning/Building Department

P-1 *Mercury-containing hazardous waste can be disposed in the Clean Harbors Hazardous Waste Facility and this department looks forward to working with DTSC, the LEA, generators, and Clean Harbors staff to ensure proper hazardous waste disposal that protects public health and the environment.*

DTSC acknowledges the comment and will work with Clean Harbors and other persons managing universal waste to ensure proper management and ultimate disposition of all universal waste generated in the State. However, for reasons detailed in the Initial and the Final Statement of Reasons (FSOR) for these regulations, DTSC is allowing disposal to land as universal waste for only those universal wastes that cannot easily be recycled. For instance, rubber flooring with intentionally-added mercury may be disposed at a hazardous waste landfill. All other wastes with intentionally-added mercury addressed by these

regulations must be recycled at a destination facility in order to be managed as universal waste.

General – Enforcement

1000 E-mails

CC-4 *We need to have an enforcement plan to make sure products containing mercury are properly disposed.*

Violators of the universal waste rule are subject to the same enforcement program as other hazardous waste generators, transporters, and facilities. Article 8 of Chapter 6.5 of the Health and Safety Code provides for administrative, civil, and criminal enforcement, fines of up to $25,000 per day, per violation, and imprisonment for persons criminally convicted. Enforcement will be carried out primarily by the CUPAs for generators and DTSC for offsite handlers and transporters. The U.S. EPA can also enforce those portions of the State's Universal Waste Rule that are not broader in scope than the federal Universal Waste Rule after the State becomes formally authorized for the Universal Waste Rule and the petition process. The degree of enforcement, the amount of resources devoted to universal waste enforcement, and actual penalties assessed will be determined by the enforcing agency's priorities when compared with other work needed to discharge its responsibilities.

500 Faxes

DD-4 *DTSC should have an enforcement plan with real teeth, to assure that mercury-laden wastes do not continue to pollute our land, air and water in violation of the regulations.*

As discussed above in response to comment CC-4, incorporated herein, violators of the universal waste rule are subject to the same enforcement program as other hazardous waste generators, transporters, and facilities. Article 8 of Chapter 6.5 of the Health and Safety Code provides for administrative, civil, and criminal enforcement, fines of up to $25,000 per day, per violation, and imprisonment for persons criminally convicted.

In addition, persons that release universal wastes to the land are responsible for cleaning up the resulting contamination. The high costs of remediating mercury contamination will serve as an additional disincentive to improper management of universal wastes.

J-1 *Many of the affected wastes are already hazardous, but continue to be disposed improperly. The regulations lack a strong enforcement program/component.*

Violators of the universal waste rule are subject to the same enforcement program as other hazardous waste generators, transporters, and facilities. Article 8 of Chapter 6.5 of the Health and Safety Code provides for administrative, civil, and criminal enforcement, fines of up to $25,000 per day, per violation, and imprisonment for persons criminally convicted.

The large number of generators and handlers of universal waste and higher priorities presented by large volume, riskier industrial hazardous wastes have consumed DTSC's inspection and enforcement resources for many years. With the advent of the CUPA program and the ongoing success of the traditional enforcement program in achieving compliance with the hazardous waste control regulations, DTSC has chosen to adopt special regulations for universal waste and will direct resources toward implementing the Universal Waste Rule, including performing inspections and enforcement, with both DTSC and CUPA staff.

J-2 *A compliance certification program is suggested. Handlers would have to sign an affidavit certifying compliance and there would be criminal liability for violations.*

For these regulations, DTSC has chosen to implement the same regulatory model as used for general hazardous waste management. In this model, the State establishes regulatory standards, uses educational outreach to publicize the regulatory standards, and uses inspection and enforcement to assure compliance. DTSC has not elected to use a certification program because of the administrative overhead required to obtain, track, and verify certifications. DTSC has chosen, instead, to focus scarce resources on educational outreach and inspection and enforcement to gain compliance. However, as the program matures and additional resources become available, DTSC may utilize a compliance certification or an environmental management system to supplement the inspection/enforcement program. Note: CUPAs may choose to supplement their individual universal waste inspection/enforcement programs with self-certification and verification programs. Note there is already criminal enforcement authority that can be used in both a universal waste inspection/enforcement program and a certification program.

J-4 *Without an effective enforcement program, the regulations' objectives (encouraging pollution prevention, development of alternatives to mercury- laden products, and promoting recycling) will not likely be met.*

DTSC agrees with this assertion. See the responses to comments DD-4, J-1 and J-2, incorporated herein, for further discussion.

Lucas Associates

R-2 *The penalties for violations of hazardous waste disposal requirements are too severe for products that were heretofore not hazardous waste and for which it may not be apparent whether they contain mercury switches.*

DTSC disagrees with the commenter's assertion(s). While the maximum penalties that can be assessed under Health and Safety Code Chapter 6.5 may be construed by many as too severe, the maximum penalties are rarely imposed on violators of the hazardous waste control regulations. DTSC and CUPAs have significant flexibility to set penalties to reflect the intent of the transgressor, the severity of the threat to human health and the environment, the recalcitrance of the violator, and other factors. In responding to violations of the state's Universal Waste Rule, DTSC and CUPA inspectors can apply the DTSC

regulations in the California Code of Regulations, title 22 chapter 22, article 3, to set initial penalties appropriate for the violation.

Nancy Richler

HH-2 *I am in favor of an enforcement plan to make sure products containing mercury are properly disposed.*

Both DTSC and the CUPAs, in enforcing the hazardous waste control regulations, including the Universal Waste Rule, establish workplans for addressing different classes of persons managing hazardous waste. These workplans reflect national, State, and local priorities in hazardous waste enforcement. These plans focus limited inspection and enforcement resources to best reduce imminent and long term threats to human health and the environment. These work plans are developed on at least an annual basis and remain flexible to allow response to changing conditions or new revelations. Establishing such plans is beyond the scope of this rulemaking and is generally not appropriate for the rulemaking process.

Naomi Trejo

FF-4 *Laws are great, but not effective without enforcement. We need a plan to enforce companies to make sure products [comment abruptly ends here].*

Violators of the universal waste rule are subject to the same enforcement program as other hazardous waste generators, transporters, and facilities. Article 8 of Chapter 6.5 of the Health and Safety Code provides for administrative, civil, and criminal enforcement, fines of up to $25,000 per day, per violation, and imprisonment for persons criminally convicted. See responses to comments CC-4, DD-4, J-1, J-2, J-4, R-2, HH-2, and public hearing comment HD-4, incorporated herein.

Robyn Martin

BB-4 *DTSC should have an enforcement plan with real teeth to ensure that mercury-laden wastes do not continue to pollute our land, air and water in violation of the regulations.*

Violators of the universal waste rule are subject to the same enforcement program as other hazardous waste generators, transporters, and facilities. Article 8 of Chapter 6.5 of the Health and Safety Code provides for administrative, civil, and criminal enforcement, fines of up to $25,000 per day, per violation, and imprisonment for persons criminally convicted. See responses to comments CC-4, DD-4, J-1, J-2, J-4, R-2, HH-2 and public hearing comment HD-4, incorporated herein.

General – Support

1000 E-mails

CC-1 *I think the current proposal is a step in the right direction, but more must be done to protect our health from mercury contamination.*

DTSC acknowledges that additional efforts will be needed to ultimately reduce mercury contamination below levels that impact human and environmental health. However, the focus of this project is to address contributions of mercury from waste materials disposed to non-hazardous landfills. Thus, other actions to reduce mercury contamination are outside the scope of this rulemaking. Each project that contributes to the reduction in mercury must have a limited scope and focus, given the pervasive nature of mercury contamination and the large variety of sources of mercury in the environment.

500 Faxes

DD-1 *I support the proposal by DTSC to improve safeguards for wastes containing mercury.*

DTSC acknowledges the support.

AERC Recycling Solutions

A-1 *Expresses support*

DTSC acknowledges the support.

County Sanitation Districts of Los Angeles County

O-1 *The districts support diversion of mercury-containing wastes from the municipal waste stream and believe DTSC's proposed regulations will target mercury at its source and divert it from the municipal waste stream.*

DTSC acknowledges the support.

Naomi Trejo

FF-1 *I support DTSC's proposal, but even more steps should be made.*

DTSC acknowledges the support.

Physicians for Social Responsibility, Los Angeles

W-1 *If implemented, the new standards will be more protective of public health.*

DTSC acknowledges the support.

Robyn Martin

BB-1 *I support the proposal by DTSC to improve safeguards for wastes containing mercury.*

DTSC acknowledges the support.

BB-2 *It is very important that the proposed regulation not be weakened. In particular, all discarded mercury-containing light bulbs should be considered hazardous, as should discarded vehicles and appliances unless mercury switches are removed.*

DTSC has changed the regulations in the 15-Day Notice of Changes, but the changes have not weakened the regulations. The salient changes are the elimination of mercury switches in vehicles other than lighting switches from the M001 listing and the removal of the certification requirement for vehicles and appliances. The FSOR explains the necessity for these changes. While on the surface these changes may seem to weaken the proposal, they actually make the proposal more workable for the recycling businesses. Without these changes, there would have been a large disincentive to recycle vehicles and appliances. This would have resulted in higher rates of disposal rates to nonhazardous landfills and the general environment.

Sara Waters

GG-1 *I commend DTSC's current proposal to more strictly regulate the disposal of many products containing mercury.*

DTSC acknowledges the support.

USHIO Lighting Edge Technologies

Y-1 *We support the changes to the proposal (possibly from the proposal in the Draft Mercury Report?).*

DTSC acknowledges the support.

Hazardous Waste Listing - M002

Waste Management

Z-1 *If properly implemented, we believe these regulations will be helpful in ensuring that mercury-containing items are not improperly managed when commingled with solid waste.*

DTSC acknowledges the support.

Z-4 *The primary responsibility for characterizing and properly managing an inappropriate waste should fall upon the manufacturer or person who first generates the waste.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. Pursuant to section 66262.11 of title 22 of the California Code of Regulations, division 4.5, the generator of a waste is required to determine if the waste is hazardous. These regulations do not affect this existing requirement.

General – Opposition

1000 E-mails

CC-2 *The proposal does not adequately encourage the elimination of mercury from use in consumer products and fails to ensure that mercury in disposed products is collected and contained in a manner protective of public health.*

DTSC does not have the authority to ban the use of mercury in products. However, regulation of discarded products as hazardous waste does provide a disincentive for the use of those products as compared with mercury-free products. By listing vehicle light switches and vehicles with the switches as well as appliances with mercury switches, DTSC is creating a disincentive for using mercury switches. Note that State statute prohibits the use of mercury vehicle light switches after a delay period and that these switches will be phased out of use.

Other wastes addressed by this rulemaking are also being replaced by mercury-free products. Virtually all hospitals and clinics in the State have programs to remove all mercury-containing devices and replace them with mercury-free substitutes. Mercury thermometers are being replaced by electronic ones, mercury in dilators and weighted tubing is being replaced by powdered tungsten, mercury switches are being replaced by ball bearing contactors, and rubber flooring with mercury is no longer sold. The one product that will continue to contain mercury in the short term is lamps. Fluorescent tubes and other highly efficient lamps require mercury for operation and will continue to require mercury until light emitting diode lamps or other new energy efficient technologies replace them in the coming decades. Given that the largest contemporary source of mercury in the environment is emissions from fossil fuel power plants, use of energy efficient lighting is vital to reduction of mercury in the environment even given their mercury content. Note that this is why proper recycling of the mercury is vital for lamps and other devices that will continue to use mercury.

DTSC disagrees with the commenter's assertion that the regulations do not assure that mercury in discarded products is collected and managed in a protective manner. While the Universal Waste Rule lacks the prescriptive standards of the general hazardous waste

regulations, it will, as explained in the Initial Statement Of Reasons (ISOR), FSOR, and the Final Analysis and Findings under Health and Safety Code section 25150.6, provide superior ultimate reduction in environmental release of mercury from the subject wastes because it encourages more proper disposal and less illegal disposal. This will reduce the attendant releases of mercury directly to the environment.

General - Elimination of Mercury from Use – Products

1000 E-mails

CC-3 *We need to stop putting mercury in products in the first place. Through economic incentives, like an advanced disposal fee, we need to encourage manufacturers to take mercury out of products and to use alternatives.*

This rulemaking provides incentives to eliminate mercury in products by designating mercury-containing products as hazardous waste at the end of their lifespan. However, DTSC has no statutory authority to either ban the use of mercury or to establish fees, require take back programs, or to control the make up of commercial products before they become waste.

CALPIRG Charitable Trust

H-1 *Mercury use and release should be reduced and eliminated over time.*

DTSC concurs and is taking steps with this rulemaking toward that objective. However, DTSC can neither exceed its statutory authority by banning mercury, nor address every mercury waste issue in one rulemaking. This rulemaking represents a step toward the goals expressed by the commenter and will go far toward reaching those goals. Further regulatory efforts may be needed to improve the system if experience with implementing these regulations so indicates. Other actions are outside the scope of DTSC's authority.

Clean Water Action

J-8 *Address the use of mercury at its outset (source reduction), not just when it becomes waste.*

DTSC does not have the authority to ban the use of mercury in the proposed regulations. The regulations represent DTSC's best judgement of the way to provide disincentives for the use of mercury in products that become the wastes addressed by this rulemaking and to establish standards to prevent release of mercury in these products when they are discarded.

Maki Hsieh-Leonard

LL-1 *Please provide a logical explanation of how the complete elimination of mercury in*

consumer products, and the clean-up of disposed mercury would NOT be a solution to a safer and more healthy environment.

Complete elimination of mercury in consumer products and cleanup of existing mercury contamination will be a major advance in protecting the environment. However, this is outside the scope of DTSC's jurisdiction. DTSC cannot require elimination of mercury in products. These regulations represent an incremental step toward this goal that is both within the authorities granted to DTSC and is feasible to accomplish. Further steps will be taken in the future including cleanup of mercury contaminated sites and, potentially, other regulations addressing mercury-containing wastes. Complete elimination of mercury has already been accomplished in many products. Other environmentally beneficial products such as energy efficient mercury-containing lamps await future scientific and technical advances before their mercury can be eliminated.

Nancy Richler

HH-1 *I am in favor of stricter regulations for disposal of products containing mercury I would also like to see policy to encourage manufacturers to take mercury out of products and to use alternatives.*

See the response to comments CC-3, H-1, J-8, LL-I, and public hearing comment HC-3, incorporated herein, for exhaustive discussion of this issue.

Naomi Trejo

FF-2 *The proposal focuses on reducing the amount of mercury waste, but does not adequately encourage the elimination of mercury from use in consumer products.*

See the response to comments CC-3, H-1, J-8, LL-1, and public hearing comment HC-3, incorporated herein, for exhaustive discussion of this issue.

Peter de Lijser

JJ-1 *Despite the availability of alternatives and the evidence of mercury's adverse effects on children, it continues to be used in many products which, when disposed in landfills, may contaminate the environment and people.*

The comment's assertion is partially true. Many uses of mercury in products have been eliminated. Mercury remains essential to other products (energy efficient lighting). See the response to comments CC-3, H-1, J-8, LL-1, and public hearing comment HC-3, incorporated herein, for exhaustive discussion of this issue.

Sara Waters

GG-2 *The proposal needs to include that mercury needs to be eliminated from consumer products in the first place. It needs to be collected and contained in a manner*

protective of public health.

See the response to comments CC-3, H-1, J-8, LL-1, and public hearing comment HC-3, incorporated herein, for exhaustive discussion of the issue of elimination of mercury from consumer products.

This rulemaking requires that most of the products addressed be ultimately recycled in order to qualify for the simple and inexpensive universal waste management standards. However, with the decrease in the use of mercury in products, there will ultimately be an excess of recycled mercury that must be permanently sequestered from the environment. Sequestration is outside the scope of this rule but discussions (including DTSC representatives) have begun with the U.S.EPA in Washington.

General - Elimination of Mercury from Use – Vehicles

Institute of Scrap Recycling Industries, Inc.

Q-2 *Manufacturers have promised to stop using mercury switches by 1995, but failed to do so.*

State statute bans the sale of automobiles containing mercury lighting switches after January 1, 2005. DTSC can only enforce those standards placed into statute or adopted into regulation by authority of statute. See the response to comments CC-3, H-1, J-8, LL-1, and public hearing comment HC-3, incorporated herein, for exhaustive discussion DTSC's authorities for banning the use of mercury.

General - Elimination of Mercury from Use

CALPIRG Charitable Trust

H-10 *The proposal doesn't adequately encourage the elimination of mercury from use and fails to ensure that mercury in disposed products is properly collected and contained. Without adequate enforcement, the desired effects are not assured.*

See the response to comments CC-3, H-1, J-8, LL-1, and public hearing comment HC-3, incorporated therein, for exhaustive discussion of the issue of banning mercury from products. DTSC

agrees that regulation without enforcement is not as effective; however, this rulemaking creates opportunity for such enforcement.

Michael Pinkerton

EE-2 *Manufacturers and consumers should be discouraged from creating and purchasing*

all products containing toxic substances.

See the response to comments CC-3, H-1, J-8, LL-1, and public hearing comment HC-3, incorporated herein, for exhaustive discussion of the issue of banning the use of mercury and other toxic substances from use. The waste listings will provide a disincentive for use of mercury and ultimate proper management and recycling of mercury.

General - Mercury in the Environment

Center for Environmentally Advanced Technologies

I-13 *Mercury is a neurotoxin, and biomagnifies in the food chain. Food fish can have several orders of magnitude higher mercury levels than the water. Ten percent of American women of childbearing age risks giving birth to a baby with neurological problems due to in-utero mercury exposure. Thus, even small mercury releases pose significant risks, and reducing releases can have significant benefits.*

DTSC concurs with this assessment of the risks of mercury and in this rulemaking is taking steps to reduce mercury release.

I-14 *To understand the full impact of mercury from lighting, one must look at the entire life cycle and not just disposal. Releases can occur due to breakage during use and transportation, during manufacture, and at recycling facilities. Regulators must monitor recyclers.*

DTSC concurs that the impacts of any product on the environment can only be understood by considering the entire lifecycle of the product. However, DTSC's authority is limited to developing standards for management of wastes. DTSC has considered the entire lifecycle impacts of those mercury-containing products addressed in this rule that are not being replaced by mercury-free substitutes, and has crafted regulations that aim to gain the lowest total release of mercury to the environment. For instance, mercury-containing lamps are currently the most energy efficient lamps in common usage and may actually reduce total mercury releases to the environment. Production of energy from fossil fuels is the greatest ongoing source of mercury release and some claim the mercury released in producing electricity to power less efficient lamps releases more mercury than discarded fluorescent tubes.

The regulations balance the need for prescriptive management standards to prevent releases against the need to make proper management simple and inexpensive. Making management of lamps too expensive or complex will drive even more harmful illegal disposal. DTSC believes that the performance standards of the Universal Waste Rule are the best achievable balance between control of the wastes and the need to get the majority of the waste recycled.

DTSC agrees with the commenter that the recyclers need the closest scrutiny. This is the

reason the regulations require destination facilities, the recyclers and hazardous waste landfills to obtain authorization and comply with strict requirements.

I-15 *The higher the mercury content of lights and the more mercury used, the more mercury is likely to be emitted to air and deposited in lakes, streams, and estuaries.*

DTSC concurs that mercury content of lamps should be minimized. However, the true measure of minimization considers mercury content, lamp life, light output, and recycling rates. DTSC does not have sufficient information reasonably available to come to defensible conclusions about the relative lifespan of different lamps and thus the ultimate mercury release per lumen-hour.

Lacking sufficient dispassionate information to differentiate between different lamps, DTSC has instead determined that mercury release can best be minimized by requiring proper management and ultimate recycling of all lamps with intentionally-added mercury. This will prevent release from even the lowest mercury lamps.

Peter de Lijser

JJ-2 *The CDC estimates ten percent of women are at increased risk of miscarriage and birth defects, due to mercury in their bodies. Human activity accounts for 2/3 of today's mercury pollution.*

The facts stated in this comment are among the reasons why DTSC is adopting these regulations.

Fees - Advanced Disposal

CALPIRG Charitable Trust

H-13 *A differential advanced disposal fee would encourage use reduction and the development of alternatives, and would encourage recycling of products for which there are no alternatives.*

DTSC concurs that an advanced disposal fee would be one of a number of powerful and effective approaches to maximizing the recycling rate for mercury-containing wastes. However, DTSC does not have authority to establish advanced disposal fees, mandatory take back programs, toxic content taxes or fees, and many other effective approaches to promoting recycling and reduction of toxic constituents. This rulemaking represents DTSC's understanding of the most effective alternative for promoting recycling and proper management of mercury-containing wastes within the authority granted to DTSC.

Clean Water Action

J-3 *Commenter encourages DTSC to work with the legislature to develop an advanced*

disposal fee program for mercury-containing wastes such as lamps, appliances, and cars. The legislation should require assessment of new mercury-containing products that enter the market; should require manufacturers of mercury-containing products to pay the cost of disposing of the mercury; and should require manufacturers to take back nonessential mercury-containing products used in automobiles, such as thermostats and switches.

See the response to comment H-13 above, incorporated herein.

Naomi Trejo

FF-3 *We can stop the use of mercury in products through economic incentives, like an advanced disposal fee.*

See the response to comment H-13 above, incorporated herein.

Fees - Taxation of Toxic Products

Michael Pinkerton

EE-3 *All products containing toxic substances must be taxed, in a similar fashion to cigarettes and alcohol, to make them more expensive than less toxic alternatives.*

See the response to comment H-13 above, incorporated herein.

Fees – Recycling

500 Faxes

DD-5 *I hope the state in the near future will establish recycling fees for mercury-containing products.*

See the response to comment H-13 above, incorporated herein.

Robyn Martin

BB-6 *I hope the state in the near future will establish recycling fees for mercury-containing products.*

See the response to comment H-13 above, incorporated herein.

Universal Waste Management - Air Monitoring for Mercury

Sensient Technologies

AA-5 *The requirement for draining and switch removal to be done in well ventilated areas monitored for OSHA and Cal-OSHA Hg levels should be dropped: it's duplicative of OSHA and Cal-OSHA regs; monitoring is sometimes unnecessary and a waste of resources.*

DTSC concurs with this comment and has eliminated this provision in the 15-Day Notice of Changes.

Universal Waste Management - General Support

Electronic Industries Alliance

L-3 *The organization supports the regulation of certain mercury-containing equipment as universal wastes.*

DTSC acknowledges this support.

Physicians for Social Responsibility, Los Angeles

W-2 *Mercury-containing medical devices are regularly added to waste streams that contribute to mercury contamination. The organization supports the classification of these products "as universal or hazardous waste.*

DTSC agrees with the commenter's assertions and acknowledges this support.

Universal Waste - Petition Process to Add New Wastes

Waste Management

Z-2 *How is the proposed new petition process consistent with the expiration of the statutory authority (HSC section 25150.6) to add universal wastes?*

DTSC is responsible for implementing the State's federally equivalent hazardous waste program in California. The universal waste regulations are an element of that program. DTSC must incorporate the petition process in these regulations if it is to add the additional hazardous wastes (i.e., CRTs and CEDs) to the group of wastes that are allowed to be managed as universal waste and seek authorization for the regulations. (see U.E. EPA authorization checklists 142a and 142E). Thus, the petition process is necessary for authorization of the State's universal waste regulations. Health and Safety Code section 25150.6 authorizes DTSC to exempt certain hazardous waste management activities from

one or more of the State's requirements in Chapter 6.5 of the Health and Safety Code. DTSC is only allowed to adopt regulations that exempt hazardous waste management activities from requirements of chapter 6.5 if the regulations govern the management of a group of wastes specified in section 25150.6, subdivision (f), paragraph (1). The authority granted by section 25150.6 expires January 1, 2003, pursuant to subdivision (g). If or when, in the future, the Legislature again authorizes DTSC to exempt wastes from management requirements of Chapter 6.5, the petition process can be used to possibly allow additional wastes to be managed as universal waste.

Universal Waste Management - Recordkeeping Requirement for Small Quantity Handlers

OSRAM Sylvania

V-6 *DTSC should reconsider the imposition of new recordkeeping requirements on small quantity handlers of universal wastes. These requirements may be a disincentive to recycling--consider the unintended consequences.*

DTSC has decided to impose minimal recordkeeping requirements on some small quantity handlers to facilitate auditing of generators and subsequent enforcement, if necessary. As pointed out in earlier comments, regulations must be enforced to be effective. Without some level of recordkeeping, DTSC and CUPA inspectors cannot verify that a business has or has not properly managed its universal wastes by sending them to another handler or a destination facility. Thus, DTSC has determined that minimal recordkeeping is necessary to ultimately achieve the objectives of this rulemaking.

However, the recordkeeping requirement is imposed only on large and intermediate sized handlers of universal waste and is not imposed on the smallest businesses and households. These smaller types of entities are exempt from all universal waste standards except the requirement that the wastes be sent to a proper destination facility.

Only large quantity handlers are subject to recordkeeping under the federal Universal Waste Rule. These handlers have more than 5,000 kg of universal waste on site at any one time or about 11 tons. Under the federal rule, virtually all universal waste generators are excused from recordkeeping. Thus, an inspector cannot verify that these generators have properly managed their universal wastes.

DTSC has determined that the majority of handlers are more likely to properly manage their universal wastes if they can be held accountable for proper management. By having to provide at least rudimentary documentation of proper management, they are more likely to properly recycle their universal wastes. The commenter is most likely correct that recordkeeping can be onerous for the smallest generators of universal waste, those identified as conditionally exempt small quantity universal waste generators. There are also too many of these businesses for DTSC and the CUPAs to carefully inspect. Therefore, in order to facilitate proper recycling by these generators, DTSC has exempted

them from all but the requirement to send their universal wastes to a proper destination facility.

Universal Waste Management - Conditional Exclusion as an Alternative

Electronic Industries Alliance

L-7 *All mercury-containing waste electronic devices should be conditionally excluded, as U.S. EPA has done in its proposed rules.*

DTSC does not intend to make the recommended change to the proposal because the change would not be as protective of public health and the environment. Under a conditional exemption, no protective standards are in place to foster proper management (to prevent releases), to track large shipments, and to regulate the destination facilities. Note that a large percentage of the federal Superfund (cleanup) sites are former hazardous waste recyclers. DTSC does not want to add more contaminated sites to the superfund list.

L-7.1 *If electronic products are subject to solid waste management requirements, instead of being conditionally excluded, the regulations could discourage development of economic recycling efforts.*

The pre-recycling standards of the Universal Waste Rule are very simple and inexpensive performance standards and will not serve as a significant disincentive for recycling. The standards will, instead, create rudimentary tracking standards that will allow DTSC and the CUPAs to ensure that universal wastes are sent to a proper destination facility. Under the conditional exemption model, there is no paper trail to allow verification of recycling of the conditionally exempted wastes. Thus, the wastes can be discarded to the general environment without serious jeopardy if all identifiers of the generator are removed prior to discard.

Likewise, under a conditional exemption system, there is no regulatory control over the actual recycling operation. Recycling operations work with large quantities of hazardous materials. The marginal profits of these recyclers are small or non-existent, thus giving the recycler little incentive for proper and clean operation. Hazardous waste recyclers make up a large percentage of U.S. EPA's superfund list of the nation's most contaminated sites. The federal proposal is clearly based on compromise rather than environmental stewardship and will result in passing environmental degradation to future generations.

L-7.2 *Regulating electronics as universal waste, rather than conditionally excluding them, could stigmatize them as hazardous waste and make leasing property and obtaining insurance more difficult.*

DTSC completely disagrees with this contention. First, almost every business and household in the country generates one or more of the universal wastes. If a landlord is

not willing to lease to a hazardous waste generator, his property will stand empty. If an insurer will not insure a hazardous waste generator, it will not sell any insurance.

While there may be an argument that regulating electronics (and other universal wastes) as hazardous waste will make siting and insuring recycling facilities more difficult, that difficulty will reflect the level of risk associated with the physical act of managing and processing large volumes of hazardous materials. The actual physical hazards of the materials and their processing should rightly be understood by the lessor and the insurer.

L-7.3 *Conditional exclusion of electronic products is preferable to designating them as hazardous/universal waste because common carriers may be reluctant to carry hazardous waste (due both to the stigma of transporting universal waste and to the burdensome requirements). Members of the commenter's organizations have already encountered such reluctance.*

The standards in the regulations for universal waste transporters are simply the pre-existing U.S. Department of Transportation (DOT) rules applicable to the hazardous materials class in which the universal wastes have been placed. The standards are appropriate for transporting such hazardous materials and the U.S. DOT has deemed these standards necessary to ensure safe transportation. The same standards would apply regardless of whether the wastes are classified as universal waste or conditionally exempted.

The only standards beyond the U.S. DOT standards that apply under the Universal Waste Rule are the requirements for cleanup of any released universal wastes or universal waste constituents. DTSC doubts that any jurisdiction would allow spills of hazardous materials to remain without requiring cleanup and/or compensation for cleanup by local emergency responders. Thus, these or similar standards will apply regardless of the classification of the waste materials.

In the United States, there is excess capacity for transporting goods; large transportation firms have failed recently. DTSC has no information indicating that the “stigma” of the universal waste label will dissuade transporters from shipping universal wastes.

L-7.4 *Conditional exclusion of electronic products is preferable to designating them as hazardous/universal waste because the universal waste rule has not been implemented uniformly in all states.*

See response to comment L-7 for reasons why DTSC has rejected conditional exclusion. Other states’ regulation of hazardous waste is not always consistent with California. DTSC must determine the best way to protect public health and the environment on a case-by-case basis.

Micro Metallics Corporation

S-3 *Conditionally excluding from classification as solid waste products that are free of*

mercury switches and lamps will ensure switch removal prior to crushing of cars and products, and promote removal and recycling.

Under California law "solid waste" is defined in section 40191, subdivision (b), paragraph (1) of the Public Resources Code as not including hazardous waste. The authority to implement the definition of "solid waste" rests with the CIWMB. Thus, DTSC has no authority to exclude products free of mercury switches and lamps from classification as "solid waste" and cannot accommodate this comment. If the comment refers to the federal definition of "solid waste", DTSC has rejected the concept of conditional exclusion for the reasons cited in response to comment L-7, incorporated herein.

Universal Waste Management - Lamps - Recycling Requirement

AERC Recycling Solutions

A-3 *Require recycling of all mercury- containing lamps*

DTSC partially concurs with this comment. The regulations require recycling of all lamps with "intentionally-added mercury". Ever more sensitive analytical techniques are approaching the point where small traces of mercury can be found as unintentional constituents in most objects on the planet. Thus, the regulations apply only to lamps with intentionally-added mercury and lamps with incidental mercury content above existing toxicity characteristic thresholds.

A-4 *Copy other states approaches to lamps: Require or encourage recycling.*

Although DTSC has not completely copied any other state's approach to lamps, these regulations incorporate features found in many states' regulations because they require recycling of most mercury-containing lamps.

Californians Against Waste

F-1.2 *We support the designation as universal waste when recycled because it gives an incentive for recycling.*

DTSC acknowledges the support.

F-6 *Large generators should be required to provide a "compliance certification" of recycling to DTSC. Targeting the largest generators would deal with 80% of the lamps.*

DTSC agrees that requiring a "compliance certification" that lamps have been recycled would be a good alternative method for regulating generators. However, there is a wide variety of alternatives available for managing universal wastes. Initially, DTSC has chosen management standards that are generally substantially equivalent to the federal Universal

Waste Rule management standards. DTSC will be monitoring both compliance with the existing Universal Waste Rule and complaints detailing illegal disposal. The actual recycling rate at the State's lamp recyclers will be an important measure of the success of the program.

If the State's experience with the existing Universal Waste Rule shows that more prescriptive standards or a greater ability to track and verify would be more effective at diverting lamps and other universal wastes from landfills, alternatives such as the suggested compliance certifications may be adopted by future rulemakings.

F-7 *Ultimately, a front end financing mechanism is needed to ensure development and participation in a recycling system. DTSC should provide leadership on this issue in the Legislature.*

See the response to comment H-13 above, incorporated herein. DTSC and the CIWMB are co-chairing a Cal/EPA project to develop solutions for management of universal waste by smaller commercial and household generators. Establishing a front end financing mechanism is outside the scope of this rulemaking and DTSC's authority.

Universal Waste Management - Mercury-Containing Motor Vehicle

Northern California Auto Dismantlers Association

HF-2 *This organization is not sure whether dismantlers are expected to remove the mercury from the switches, or "take these switches out as they are."*

The regulations allow universal waste management after the switches are removed. However, universal waste management standards do not allow dismantling of the actual switch because switches are very difficult to dismantle without release of the mercury. Thus, dismantlers are simply expected to remove intact switches and send them, intact, to another handler or a mercury recycler.

Universal Waste Management - Mercury-Containing Motor Vehicle Switches - Certification of Removal

Institute of Scrap Recycling Industries, Inc.

Q-7 *A similar Certification program for CFC removal has afforded little protection. One false step by a mistaken or untruthful supplier (of vehicles or appliances) would subject a recycler to full hazardous waste liabilities.*

DTSC removed the requirement for certification of switch removal in the 15-Day Notice of Changes. By removing the certification requirement and limiting the removal requirement necessary to exit the M001 listing to light switches, the regulations allow simple

compliance without the threat that incorrect certification will subject scrap metal recyclers to full hazardous waste management standards.

State of California Auto Dismantlers Association

D-5 *The regulations should clarify that switches that are part of an assembly intended for resale are not waste and are not covered by the rule and listing.*

DTSC has accommodated this comment in changes in the 15-Day Notice of Changes.

D-6 *The auto dismantler should only be required to certify that the switches have been removed to the best of his knowledge. He cannot know where all the mercury switches are located.*

See the response to comments Q-7 above, incorporated herein.

D-6.1 *The certification should be allowed to be on the bill of lading or other existing paperwork.*

In the 15-Day Notice of Changes, DTSC eliminated the certification requirement.

Universal Waste Management - Mercury-Containing Motor Vehicle Switches - Safe Removal

State of California Auto Dismantlers Association

D-7 *Switches must be handled in a manner consistent with OSHA. Spills would have to be hazardous waste. There are many unanswered questions about removal containers, removal methods, liability, fire issues, and safety.*

DTSC concurs that switches must be handled in a manner consistent with OSHA and Cal/OSHA standards, as must all workplace activities in the state. However, spill residues must be handled as hazardous waste only if they exhibit a characteristic of a hazardous waste. There may, indeed, be other questions that the commenter would like answered, addressing the topics listed, but DTSC cannot answer these questions unless the

questions are identified. Note that DTSC has considered the issues above and has determined there is no need for further changes to the regulations.

Universal Waste Management - Existing Universal Wastes

Peter Cornelius

MM-1 *A battery recycle cart in a local hardware store wasn't being used and a photo shop*

would not take back batteries.

This comment raises serious issues that are being addressed by DTSC, but the issues are outside the scope of this rulemaking.

MM-2 *Raise awareness within the construction workers and provide an incentive for them to collect the switches and send them to well-published collection places. Suggest installing a box at each County Planning office--this is where contractors often go.*

This comment raises serious issues that are being addressed by DTSC, but the issues are outside the scope of this rulemaking. DTSC will keep these suggestions in mind and consider them in the joint Cal/EPA Universal Waste Infrastructure Workgroup, one of whose tasks is educational outreach.

MM-3 *Here's my battery 3-step proposal: make and enforce a law guaranteeing those consumers can return batteries of all kinds to any store, free of charge; establish a program for stores to recycle batteries in bulk; fund recycling with a levy on each battery.*

Although the commenter's suggestions have clear merit, the actions suggested are all beyond the statutory authority granted to DTSC and/or outside the scope of this rulemaking.

Price Consulting, Representing Appliance Recycling Centers of America

X-9 *The proposed regulations, while very broad in many respects, do not include temperature control devices in appliances. ARCA urges the department to add these devices to the proposed rules.*

Temperature control devices containing-mercury in all types of devices and structures were incorporated into the State's original Universal Waste Rule as "thermostats." All mercury-containing thermostats are also mercury switches and all mercury-containing thermostats would be eligible for either or both classes of universal waste under these regulations.

Hazardous Waste Listing - M002 – Enforcement

X-10 *The proposed regulations regarding mercury switches in appliances will only have a beneficial effect if the real problem--adequate inspections and enforcement to implement the law--is solved.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. Please see the responses to comments X-2, X-3, and X-7.

Universal Waste Management - Mercury-Containing Rubber Flooring

Lucas Associates

R-3 *DTSC should reconsider including floor mats in their definition of hazardous waste. Unlikely these products would have appreciable free mercury that would leach or disassociate into the environment.*

The floor mats contain mercury above the pre-existing TTLC and have been classified as hazardous waste when discarded since the waste classification rules were adopted in the early 1980's. Various issues including the potential to leach and direct exposure to humans and the environment were considered in establishing the TTLC for mercury. If the floor mats do not exceed existing hazardous waste criteria, they do not need to be managed as universal waste.

J-9 *Ultimate disposition of mercury-containing wastes out-of-state, where laws are weaker, is a concern. This could present an environmental justice issue.*

DTSC can only control recycling and management of universal wastes inside the State of California and other states must control recycling within their own states. Each state must work independently and with the federal government to promote environmental justice. Requiring recycling of mercury corrects imbalances in mercury exposure for both environmental justice communities near solid waste facilities and those communities relying on fish from the State's fresh waters for sustenance.

Sensient Technologies

AA-4 *It seems irresponsible to require recycling, in light of the fact that all recycling facilities (aside from lamp recyclers) are out-of-State. California should do everything possible to encourage in-state mercury recycling facilities.*

While it is important to encourage in-state facilities to manage the State's waste, DTSC has no authority to forbid out-of-state shipment of mercury-containing wastes. DTSC also cannot create recycling facilities. However, creation of a sure market for recycling resources will provide encouragement for siting of mercury recyclers in California or in the west. Necessary efficiencies of scale probably prevent siting of a mercury recycler in every state.

Cal/EPA Universal Waste Management - Recycling Requirement – Infrastructure Workgroup

Center for Environmentally Advanced Technologies

I-24 *DTSC's proposal doesn't promote the major infrastructure that would be needed to achieve high recycling rates. Funding an infrastructure is likely to be a growing*

problem, due to dwindling budgets. Several cities have been cutting back their recycling programs to save money. The commenter questions whether California can fund a recycling infrastructure that will ensure even a modest gain in lamp recycling rates.

DTSC does not have the authority to create infrastructure. The regulations themselves, by establishing a certainty that the wastes will be regulated, do promote establishment of infrastructure.

Note, however, that the Cal/EPA Universal Waste Infrastructure Workgroup will explore all the ways that Cal/EPA can promote infrastructure and will work with other stakeholders to explore both private and public sector options for infrastructure development.

USHIO Lighting Edge Technologies

Y-3 *All mercury-containing products should be managed properly, through an infrastructure that provides economically viable recycling.*

DTSC agrees that all products with significant amounts of mercury should be properly managed. However, increasingly sensitive analytical equipment will ultimately detect even a few atoms of mercury in virtually any material on earth. Materials with very low mercury concentrations do not need to be managed specially due only to their mercury content.

DTSC agrees that a robust infrastructure is needed. However, it need not be independently economically viable in the same manner that recycling of steel and aluminum waste is today. Mercury should not be released into the environment and some cost is acceptable for properly managing mercury in the same manner that additional costs are required for managing hazardous waste when compared to non-hazardous waste. Clearly, however, someone must pay for recycling mercury-containing wastes and identifying both who should pay and how to do it most efficiently will be explored with all the mercury waste stakeholders in the Cal/EPA Universal Waste Infrastructure Workgroup.

Dental Amalgam – General

California Citizens for Health Freedom

E-1 *Amalgam fillings should not be referred to as "silver". This is a deceptive*

See response to comment HG-7, incorporated herein.

E-2 *The ADA has a gag order on member dentists regarding the mercury content of fillings.*

This comment is not germane to this rulemaking.

Clean Water Action

J-15 *We support the prohibition on the placement of amalgam waste into medical waste containers.*

DTSC acknowledges and agrees with this comment. Amalgam waste may not be placed into medical waste containers and still be eligible to be managed according to the streamlined standards of the Universal Waste Rule.

Consumers for Dental Choice

K-11 *The public is angry. The legislature shut down the California Dental Board (CDB) for failing to enforce the 1992 (Dental Fact Sheet?) law. Advocacy groups are paying attention too.*

This comment is not germane to this rulemaking.

K-16 *When it leaves the mouth, dental amalgam is hazardous waste.*

The commenter is mostly correct. Note that hazardous waste dental amalgam that is not exempt as “scrap metal” (bits and pieces) may be managed as universal waste under this rulemaking.

K-17 *Those who generate this hazardous waste should pay for its proper disposal or, better, should stop using it.*

DTSC concurs that the generator of the amalgam waste is responsible for proper management of the waste.

K-18 *"The best way to stop pollution is at its source."*

DTSC has no authority to ban the use of specific products. DTSC can only regulate management of the material after it becomes waste.

K-2 *Each filling has enough mercury to "ruin" a 10-acre lake.*

DTSC has not verified this calculation. However, there is sufficient mercury and silver in dental amalgam so that waste amalgam that is not “scrap metal” would be a hazardous waste.

K-3.2 *The California Dental Association is being given special treatment in these regulations.*

DTSC disagrees but cannot refute this argument in detail without specific facts that support the allegation.

K-8 *Generators of hazardous wastes should pay for it.*

DTSC acknowledges the comment. Generators are responsible under both State federal and local law for "cradle to grave" management of their hazardous wastes.

K-9 *Dentists don't have to use mercury. Alternatives are used for middle class whites, but not for poor, minority patients.*

This comment is not germane to this rulemaking.

Dental Amalgam – Enforcement

Dental Amalgam - Universal Waste

California Citizens for Health Freedom

E-3 *Calling any amalgam waste "Universal Waste" leaves a big loophole that will be exploited to allow casual discharge of huge amounts of highly bioactive mercury waste to the POTWs, into the waters of the State, and into the food chain.*

DTSC disagrees with the commenter's assertion(s). Universal waste dental amalgam is not allowed to be discharged to the drains or anywhere else other than another handler or a destination facility. There are no loopholes that would allow illegal disposal; such disposal would be illegal and subject to hazardous waste enforcement.

California Dental Association

G-1 *CDA supports the proposed regulations and believes that management as universal waste will help prevent disposal to the land and the waters of the State.*

DTSC acknowledges this support.

Consumers for Dental Choice

K-5 *Cal/EPA is "ducking" the problem by recategorizing dental mercury as universal waste, rather than hazardous waste.*

The commenter's assertion is incorrect. Universal waste is hazardous waste under the State's laws and is eligible for special management standards.

Dental Amalgam - Discharge to Sewer

American Academy of Biological Dentistry

B-2 *Dentists should not be exempted from rules about disposal of mercury to the sewers.*

DTSC acknowledges this comment.

Dentists are not exempt from regulations concerning disposal of hazardous wastes and have never been. This rulemaking will simplify management of amalgam wastes, but will require recycling and will not allow disposal under the Universal Waste Rule.

California Citizens for Health Freedom

E-5 *There should be stiff fines and jail for violators.*

Violators of the universal waste rule are subject to the same enforcement program as other hazardous waste generators, transporters, and facilities. Article 8 of Chapter 6.5 of the Health and Safety Code provides for administrative, civil, and criminal enforcement, fines of up to $25,000 per day, per violation, and imprisonment for persons criminally convicted. See also responses to comments CC-4, DD-4, J-1, J-2, J-4, R-2, HH-2, and public hearing comment HD-4, incorporated herein.

Consumers for Dental Choice

K-1 *Dentists are the largest source of mercury in wastewater.*

DTSC has no information that would corroborate or deny this assertion. However, as discussed in the response to public hearing comment HG-2, the regulations adopted today will provide an incentive for proper disposal and a reduction in sewer disposal of waste amalgam.

K-10 *Dentists have failed to comply with Proposition 65 for 16 years. Is DTSC going to wait that long to stop dentists from discharging mercury in the sewer?*

DTSC acknowledges this comment. However, it does not make suggestions germane to the regulations being adopted and is outside the scope of this rule making.

K-12 *ADA and CDA are protecting dentistry from enforcement of hazardous waste laws.*

This comment is not germane to this rulemaking.

K-14 *Unless there is a law exempting dentistry from hazardous waste requirements, DTSC has "no right to create this exemption."*

There is no statute exempting dentists from the hazardous waste control requirements. Upon adoption of these proposed regulations, amalgam will be eligible to be managed under streamlined universal waste standards if it is recycled. If the amalgam is not to be recycled, the generators will be required to continue to comply with the general hazardous waste control regulations.

K-4 *Regulators don't act against dentistry. Dental associations in San Francisco, Northern Virginia, and Seattle have said they would act voluntarily (to reduce the discharge of mercury to the sewer?) but have not.*

This comment is not germane to this rulemaking.

Dental Amalgam - Toxicity

O-3 *DTSC should investigate whether dental offices are illegally discharging hazardous waste to sewers. A recent study found mercury in excess of the STLC of 20 mg/kg in dental waste water, even with amalgam removal equipment installed.*

DTSC acknowledges this comment. As understanding of the extent of mercury contamination in California increases, State efforts and initiatives will address mercury contamination, both historic and ongoing. However, this rulemaking addresses classification and management and does not address enforcement issues. Thus, the comment is beyond the scope of the rule.

Dental Amalgam - Ban

American Academy of Biological Dentistry

B-1 *Amalgam fillings are toxic. Dental amalgam fillings should not be put into Humans.*

The comment's suggestions are beyond the scope of both this rulemaking and the authority granted to DTSC.

B-5 *Abolish the use of dental amalgam by a certain date.*

See response to comment B-1, incorporated herein.

Consumers for Dental Choice

K-24 *Commenter submitted a Reuter's article, reporting a US Senate vote on a bill that would ban the sale of mercury fever thermometers. The Senate passed the bill and sent it to the House of Representatives.*

Mercury fever thermometers can no longer be sold in this State without a prescription so California has already taken the actions described in this article. However, the comment makes no suggestion or objection to the subject rulemaking and is not germane.

K-3.1 *Regulatory agencies have required removal of Hg from batteries, regulated other mercury users, but gives dentists a "free ride."*

DTSC only has authority to regulate mercury-containing products when they become waste. DTSC has no authority to ban mercury-containing products; thus, this comment is not germane to this rulemaking.

Shannon Gaida

KK-7 *We need to outlaw the use of mercury in tooth fillings, as more far-sighted countries have already done.*

See response to comment B-1, incorporated herein.

500 Faxes

DD-3 *All dentists should be required to use state-of-the-art amalgam separators for each chair, and clean them regularly.*

Generally, the composition of discharges to the sewers is enforced by the inspectors of the sewer agency. However, discharge of hazardous waste to the sewers in California constitutes illegal disposal of a hazardous waste because the State has not excluded mixtures of hazardous waste and domestic sewage from the definition of hazardous waste as has the federal government. However, DTSC is not addressing standards for sewer discharge or for treatment of amalgam containing wastewaters in this rulemaking. Discharges of hazardous waste can be addressed by existing DTSC and CUPA inspection and enforcement staff and can be prevented under existing law with no changes to these proposed regulations.

American Academy of Biological Dentistry

B-3 *Require that all dentists use separators to trap amalgam.*

See response to comment DD-3 above, incorporated herein.

B-4 *Voluntary compliance will not work (for above).*

See response to comment DD-3 above. Note that compliance with existing prohibitions on disposal of hazardous waste to unauthorized places is not a voluntary issue.

California Citizens for Health Freedom

E-4 *DTSC should require separator equipment in every dental office. Require all sinks and vacuums to be attached. Voluntary compliance has failed.*

See response to comment DD-3 above, incorporated herein.

E-6 *There must be field inspections of dentist's equipment.*

DTSC concurs that inspection of dentists by DTSC and CUPA staff could determine the regulatory status and the legality of their discharges to the sewers. However, this rulemaking does not address enforcement or enforcement priorities and the comment is outside the scope of this rulemaking.

CALPIRG Charitable Trust

H-9 *DTSC should require dental offices to adhere to strict guidelines for the kind of amalgam separator or trap used to collect the waste.*

See the response to comment DD-3 above, incorporated herein.

Clean Water Action

J-13 *Amend the proposal to require dentists to install amalgam separators.*

See the response to comment DD-3 above, incorporated herein.

J-14 *Require dentists to keep records of installation of pollution prevention equipment and amalgam use.*

See the response to comment DD-3 above. Note that DTSC is requiring simple recordkeeping and tracking of universal waste dental amalgam. DTSC has no authority, however, to require records of amalgam use because amalgam is a product until discarded, when it becomes a waste and enters the scope of DTSC's authority.

Consumers for Dental Choice

K-13 *American Academy of Biological Dentistry supports a mandate for amalgam separators.*

See the response to comment DD-3 above, incorporated herein.

K-6 *Dentists don't have to buy equipment and are not subject to registration or Reporting.*

See the response to comments DD-3 and J-14 above, incorporated herein.

K-7 *Amalgam separators cost only $3000, their gross per chair per day.*

See the response to comment DD-3 above, incorporated herein.

Robyn Martin

BB-3 *All dentists should be required to use state-of-the-art amalgam separators for each chair, and to clean them regularly.*

See the response to comment DD-3 above, incorporated herein.

Dental Amalgam - Education

California Citizens for Health Freedom

E-7 *DTSC should have dental education programs.*

DTSC will educate dentists and other persons managing universal waste dental amalgam about the proper management of waste dental amalgam. However, the comment is outside the scope of this regulation and educating consumers about the hazards of amalgam fillings is outside the scope of DTSC's authority.

Dental Amalgam - Documents Submitted

American Academy of Biological Dentistry

B-6 *Commenter submitted a copy of a resolution, by the National Black Caucus of State Legislators. The resolution recommends that states should enact laws informing consumers about the composition of silver amalgam fillings and their potential health effects, and that states should enact laws to provide patients on Medicaid and those with moderate income the option to choose alternatives to silver amalgam fillings.*

DTSC interprets this document to be a suggestion that DTSC undertake the actions described in the resolution. However, the actions are outside both the scope of this rulemaking and DTSC's authority to adopt regulations. Also, dentists are required by Business and Professions Code section 1648.15 to provide a Dental Materials Fact Sheet to new patients.

B-7 *Commenter submitted a document printed from a web site called ToxicTeeth.org. The document alleges that the American Dental Association has not been forthcoming about the potential hazardous of dental amalgam. The document suggests links between silver amalgam*

fillings and a number of human illnesses, including autoimmune diseases, and states that federal legislation banning dental amalgam is needed. Until such legislation is adopted, the document says, the public "must have the right to know about the mercury before it is placed into their teeth" and should be given the option of non-mercury fillings at the same cost as

See the response to comment B-6, incorporated herein.

B-8 *Commenter submitted 24 pages of data on the cost of silver amalgam and composite resin fillings. The first page has the heading "Average Cost Of Dental Care In All US Cities (Average Values).' Each of the other 23 pages contains data for the average and high fees for various types of dental restorations in various cities and counties in California. These pages appear to have been printed from the URL: www.bracesinfo.com.*

See the response to comment B-6, incorporated herein.

California Dental Association

G-2 *Commenter submitted a copy of a technical presentation titled 'Dental Mercury: Pollution Prevention & Waste Management Practices For The Dental Office." The presentation compares the effect on mercury discharges of mercury to the sewer under several scenarios. Without BMPs or amalgam separators, an office doing 7 amalgam fillings per day would discharge 3.6 grams of mercury per day. Adding a vacuum separator would reduce this amount by 0.5 grams to 3.1 grams per day. BMPs without a separator would reduce the discharge by 2.8 grams to 0.8 grams per day. BMPs and a separator together would reduce the discharge to 0.4 grams per day, while doing all of the above in addition to replacing the "wet" cuspidor with a "dry" cuspidor would reduce the discharge to only 50 milligrams per day. The presentation suggests that absent BMPs, separators would cause only a modest reduction in the mercury going to the sewer.*

The information presented is very interesting and suggests that there are solutions to help dentists to reduce their mercury discharges. However requiring Best Management Practices (BMPs) and separators is outside the scope of this rulemaking. See also the response to comment DD-3, incorporated herein.

Consumers for Dental Choice

K-19 *Commenter submitted a copy of a press release from his organization, accusing Cal/EPA of adopting a "don't ask, don't tell" policy toward dentists who place amalgam fillings. The press release criticizes DTSC because the proposed mercury regulations do not require dentists to install amalgam separators, and cites a recent report entitled "Dentist the Menace?" that*

found dental offices to be the largest source of mercury in the nation's wastewater.

See the response to comment DD-3 above, incorporated herein. Cal/EPA does not have a "don't ask, don't tell" policy toward dentists and mercury discharges. The fact that there has not yet been aggressive enforcement of the prohibitions on illegal disposal by dentists, results from the distribution of scarce enforcement resources at the state and local level (CUPAs also regulate hazardous waste generators), not from any agency's policies.

K-20 *Commenter submitted a copy of a letter from the American Academy of Biological Dentistry, commenting on the proposed regulations. The letter was also received directly from this organization, and its comments are summarized and responded to separately.*

See the responses to comments from the American Academy of Biological Dentistry, commenter B.

K-21 *Commenter submitted a document with the heading "Information from Global Mercury Assessment." The document summarized requirements imposed in various countries to control the release of amalgam (primarily for installation of amalgam separators).*

DTSC interprets this comment to be requesting that DTSC incorporate similar standards into this rulemaking. See the response to comment DD-3, incorporated herein.

K-22 *Commenter submitted a press release from the United Nations Environmental Programmer, announcing a UN meeting on the environmental health impacts of mercury. The document briefly discusses the risks of mercury, its behavior in the environment, human use and release of mercury, and government regulation to control mercury. The meeting was held from September 9 through 15 in Geneva, Switzerland.*

DTSC acknowledges receipt of this information. Note that the facts referred to in this document are the same facts that form the scientific basis for this rulemaking.

K-23 *Commenter submitted an article from the Associated Press, discussing a UN meeting on the environmental health impacts of mercury. The document briefly discusses the risks of mercury, its behavior in the environment, human use and release of mercury, and government regulation to control*

See response to comment K-22 above, incorporated herein.

K-25 *Commenter submitted a report entitled "Dentist the Menace?" which finds those dental offices are the largest single source of mercury in wastewater treatment plant. The report recommends several measures to reduce the discharge of dental mercury, including Best Management Practices (BMPs) and requiring the use of amalgam separators.*

See the response to comment DD-3 above, incorporated herein.

K-26 *Commenter submitted copies of a petition to ban the use of mercury in dentistry, with 15 pages of signatures. The petitions appear to be in support of a bill in the U.S. Congress: "Watson-Burton Bill #4163."*

DTSC interprets this comment to be a suggestion to ban the use of mercury in fillings, an action which is beyond the scope of these regulations and DTSC's authority to adopt regulations.

Hazardous Waste Listing - General

1000 E-mails

CC-5 *We need to be able to add new products to the list, which is not inclusive of all mercury-containing products used in California. DTSC needs an established process for considering the addition of other products.*

DTSC is adopting a petition process for designating new universal wastes in this rulemaking. While the addition is necessary to allow the State to become RCRA authorized for wastes already added to the list of universal wastes, DTSC will not be able to allow management of additional wastes in a manner that varies from statute in the future without re-establishment of the statutory authority of Health and Safety Code section 25150.6.

500 Faxes

DD-2 *The regulations should not be weakened, particularly in regard to the listings of mercury-containing lamps and discarded appliances and vehicles with mercury switches.*

DTSC acknowledges these comments. However, as explained in the FSOR, DTSC removed the certification requirement (15-Day Notice of Changes) because it would require firms to certify that all switches have been removed when there could be switches that the dismantler was aware of left in the vehicle. For the same reason, the listing description was limited to only vehicle light switches. Switches whose presence or absence would not be apparent include original equipment switches such as some antilock brake switches and after-market switches such as theft alarm switches. Detailed guidance, equivalent to the type of guidance available for light switches, is not available for these other types of switches.

Californians Against Waste

F-1.1 *We support the proposal that virtually all mercury-containing products be*

managed as hazardous waste when disposed.

See the response to public hearing comment HC-2, incorporated herein.

Electronic Industries Alliance

L-1.1 *The organization is concerned that the proposed regulations will result in the imposition of new regulatory requirements on non-hazardous electronic products that are already being diverted from the municipal waste stream for recycling. Adding universal waste management requirements to these products could actually discourage recycling. Instead of listing these products, DTSC should pursue voluntary options, including generator education, development of collection events.*

DTSC is placing no new requirements on non-hazardous electronic products with the possible exception of large assemblies such as automobiles and very large appliances with only one or two mercury switches. Virtually all the other products addressed by these regulations are currently identified as hazardous wastes due to their intrinsic chemical makeup. That is, their mercury (or other constituents) make the hazardous wastes under existing law.

DTSC has determined that voluntary efforts will not succeed in diverting a significant amount of mercury from the solid waste stream because there is no economic incentive to do so and businesses are primarily motivated by profit.

Note that education and outreach are not proposed in these regulations, but will be part of DTSC's implementation of the regulations.

L-1.3 *DTSC should carefully consider the policy and precedential impacts that the new hazardous waste listings will have on the state's hazardous waste management program before finalizing these regulations.*

DTSC has considered all aspects of these regulations known to DTSC and to various stakeholders, including issues raised by the commenters for the regulations, and has determined that the chosen alternative, as modified by the 15-Day Notice of Changes, is the best alternative. As a precedent, the listing will act as a model for any future rulemakings that address wastes that pose a hazard and meet the criteria for designating universal waste.

Onyx Environmental Services

U-3 *All mercury-containing devices should be managed as hazardous wastes to reduce the estimated 17.3 tons of mercury disposed in non-hazardous waste landfills in 2000. DTSC should not allow disposal of low mercury lamps for another three years, as proposed, when recycling capacity and technology already exist. DTSC should consider a 6-month delay, instead.*

DTSC is adopting these regulations to reduce the amount of mercury going into, and being released from, non-hazardous waste landfills. However, as explained in the response to public hearing comment HC-2, DTSC is regulating discarded products with intentionally-added mercury under the new listings rather than all discarded products containing any mercury.

DTSC has carefully planned the activities necessary to develop infrastructure to handle universal wastes from households and smaller businesses and has determined that the February 9, 2006 date is appropriate. Six months delay would not allow sufficient time to even gain the interest and cooperation of the various stakeholders in mercury waste management, let alone come to conclusions and implement the chosen actions. Note that low mercury lamps would become hazardous wastes effective February 9, 2004 and large quantity handlers will be required to manage them as hazardous waste or universal waste. Households and small businesses will not be subject to the same requirements until 2006.

Waste Management

Z-3 *A solid waste facility or service provider who unknowingly receives hazardous waste items, including mercury-containing items, should have responsibility and liability limited to: load checks; customer notification of unacceptable wastes; gate signs.*

The liabilities of a solid waste facility or service provider for the inadvertent receipt of universal waste are no different than they are for the inadvertent receipt of hazardous waste. The rules that would address these liabilities are not being changed in this rulemaking; thus, the comment is outside the scope of this rulemaking.

Hazardous Waste Listing - M001- Support

J-16 *DTSC should consider an entire vehicle with switches inside as hazardous waste.*

DTSC acknowledges this support. Note, however, that this classification as hazardous waste has been modified so that vehicles are hazardous waste (based on mercury) only if all the mercury-containing light switches have not been removed. The reasons for these changes are detailed in the FSOR.

Hazardous Waste Listing - M001 - Opposition

California CUPA Forum Board/HW TAG

N-2 *In designating scrap automobiles as hazardous waste based on failure to remove mercury switches, the regulations are too inclusive. The listing seems to*

conflict with the scrap metal exemption and is too difficult for CUPAs to enforce.

DTSC has partially accommodated this comment by modifying the classification so that vehicles are hazardous waste only if all the mercury-containing light switches have not been removed. The reasons for these changes are detailed in the FSOR. The listing does not conflict with the scrap metal exemption because the listing is later enacted and would, where applicable, supersede the scrap metal exemption. Note that the scrap metal exemption is intended to apply to scrap metal that offers hazards only due to the metal being recycled rather than due to other constituents (e.g., free-flowing oil or mercury-containing switches). This regulation is consistent with and supplements the scrap metal exemption.

DTSC does not agree that this regulation is too difficult for the CUPAs to enforce. DTSC is developing (and many other organizations have developed) documents identifying which vehicles contain mercury-containing light switches, their location, and removal procedures for the switches. It will be simple for the CUPAs to verify whether or not switches have been removed from particular vehicles. Note that DTSC also gives (and will continue to give) extensive training to the CUPAs on new program directives.

Institute of Scrap Recycling Industries, Inc.

Q-10 *The proposal would not require automakers to disclose the uses and locations of mercury switches.*

The comment is correct. DTSC does not have authority to order auto manufactures to disclose the uses and locations of mercury switches because DTSC's authority extends to hazardous wastes, not products.

Q-11 *"The rulemaking also falls short of various administrative procedures, including reasonable estimates of implementation costs and negative effects on California businesses. . . .. Fortunately, the Department is required to consider alternatives, which (the commenter's) (proposed model) legislation provides. The model legislation would require auto manufacturers to establish a fund to replace mercury switches, collect, and properly manage them. It would also order a phase out of the mercury switches.*

DTSC has met all administrative requirements for these regulations, including estimating implementation costs and negative effects on California businesses. It has used all information reasonably available, as required by statute, to determine such impacts. The proposed model legislation could not be considered as an alternative because the solutions presented are beyond DTSC's authority to adopt regulations. Note that the legislature has already ordered a phase out of at least some of the mercury-containing switches (light switches).

Q-3 *U.S. automakers have shown that without facing any consequences for their poor design choices, they will not design products for recycling.*

Because DTSC can not adopt regulations governing products that are not yet waste, this comment is beyond the scope of DTSC's authority to adopt regulations.

Q-4 *The organization's adopted a policy last year that recommends that "to the maximum extent practical," mercury switches be removed from end-of-life vehicles before delivery to scrap recyclers.*

DTSC interprets this comment as stating that the actions detailed above are appropriate and should supplant or be duplicated in the regulation. DTSC has partially concurred with this suggestion by limiting the M001 listing to mercury-containing vehicle light switches that can be practicably removed (those in vehicles that cannot be removed due to accidental damage do not trigger this listing). However, DTSC has chosen to make the listing mandatory because it believes that voluntary recommendations will not achieve the objectives of this rulemaking, given the economic incentives to leave the switches in place.

Q-5.1 *Placing the financial burden for mercury switch recovery on consumers will not encourage manufacturers to avoid using hazardous materials in the future.*

DTSC finds that the comment is at least partially true. However, DTSC does not have authority to establish fees, deposits, mandatory take backs, and/or other incentives for eliminating the use of hazardous materials in vehicles and other products. DTSC has authority to establish classification and management standards for hazardous wastes and can only use those standards to act as incentives or disincentives for manufacturers to avoid hazardous material usage. Such incentives or disincentives occur because the product becomes a hazardous waste at the end of its lifetime and the consumer must manage the waste in a more expensive manner than the way non-hazardous products are managed. The incentive comes because the consumer can be expected to avoid products that will be more expensive to dispose, all other factors being equal.

Q-6 *The proposal would be unworkable and would harm the recycling industry by imposing unreasonably broad and burdensome classification requirements that wouldn't promote Design for Recycling.*

DTSC disagrees with the commenter's assertion. First, DTSC has partially accommodated the commenter's objections to the proposed regulations by limiting the scope of the M001 listing. See the response to public hearing comment HD-2 and the FSOR for the M001 listing, incorporated herein, for further discussion.

Q-8 *The listing would put scrap recyclers at a competitive disadvantage with companies that produce the same commodities from raw materials. Also, recyclers would be stigmatized as hazardous waste handlers, facing unfair suspicion and inappropriate community opposition.*

DTSC agrees that there will be slight increased costs for production of scrap metal to substitute for raw materials. The economic analysis that accompanies these regulations

indicates, that any increased costs for recycled metal would be minor and DTSC does not expect that these costs would upset the recycled metals market.

Note that all vehicle dismantlers are already generating and handling other hazardous wastes and would not be newly identified as hazardous waste handlers due to these regulations. Dismantlers handle waste oil, waste fuels, lead-acid storage batteries, air bag canisters, and other hazardous wastes outside of these regulations.

Note also that the auto shredder would not be handling hazardous waste unless they accept vehicles from which the mercury-containing light switches have not been removed, as required by these regulations. An auto shredder practicing due diligence would require that all dismantlers sending vehicles for shredding remove the subject mercury-containing light switches, along with the other hazardous materials found in waste vehicles.

Q-9 *No other state has taken the drastic and unwise step of inappropriately classifying end-of-life vehicles as hazardous waste.*

DTSC has not found another state that has duplicated the listing of end of life vehicles with mercury-containing light switches that are practical to remove. However, DTSC does not agree that this action is either unwise or drastic. The presence or absence, location, and removal methods for mercury-containing light switches in most vehicles are set forth in many documents, including documents that DTSC is preparing in response to the Legislature's mandate to do so. DTSC believes that it is simple and minimally burdensome to remove these switches and that the listing is the most effective means of ensuring removal within the authority granted to DTSC.

Physicians for Social Responsibility, Los Angeles

W-4 *The voluntary provision that mercury switches be removed from vehicles prior to crushing is not sufficiently protective of public health. We strongly support listing of vehicles containing mercury switches as hazardous waste.*

DTSC acknowledges this support. However, the requirement has been limited to removal of mercury-containing light switches as discussed in the FSOR discussion of the M001 listing.

Hazardous Waste Listing - M001 - Opposition - Documents Submitted

Institute of Scrap Recycling Industries, Inc.

Q-5 *Model legislation (submitted with the comment) requires vehicle manufacturers to establish and fund a system for removal and management of mercury switches and to ban sale of vehicles with any mercury component. The bill will provide fair compensation, and as a result would encourage high capture rates.*

DTSC acknowledges this comment. DTSC has reviewed the model legislation and determined that no regulatory change is necessary. While DTSC believes its goals are laudable, the scope of the model legislation is beyond that of these regulations. Further, DTSC lacks authority to adopt legislation or to regulate products before they become wastes. These regulations adequately address the aspects of the model legislation that are within their scope. The aspects of the model legislation that are included in this proposal are:

1. Ban on the Sale of Vehicles with Mercury-Containing Switches

In the August 9, 2002, 45-Day Public Notice of these regulations, the M003 listing description included any mercury-containing switch in a motor vehicle, including switches in antilock braking (ABS) systems, ride stabilization systems, after-market alarm systems, etc. The listing description was modified in the 15-Day Notice of Changes to apply only to mercury-containing motor vehicle light switches. This modification makes the M001 Listing consistent with Senate Bill (SB) 633. SB 633, (chapter 656, statutes of 2001) added section 15029 to the Public Resources Code, which states: “No person may sell or offer for sale in this state a vehicle manufactured on or after January 1, 2005, that contains a mercury-containing motor vehicle light switch, as defined in Section 25214.5 of the Health and Safety Code, mounted on the hood or trunk.”

Other types of motor vehicle mercury switches were not included in SB 633 due to insufficient information as to which makes and models include such switches, and variability in the types of switches (mercury or non-mercury) used within the same year, make, and model of a vehicle. DTSC may revise the M001 listing to include other mercury-containing motor-vehicle switches in a future rulemaking, when more information is available on which vehicles contain them. While vehicles that contain mercury switches other than light switches will not be identified as a M001 listed hazardous wastes under the revised proposal, if such switches that are voluntarily removed from a vehicle, they may be

managed under new universal waste management standards for switches and thermometers.

2. System for the Removal and Management of Mercury-Containing Motor Vehicle Light Switches

These universal waste management standards provide a workable system for the removal and management of mercury-containing motor vehicle light switches. Their requirements are designed to protect public health and the environment from mercury releases, while imposing a minimal additional regulatory burden on persons who handle switches and vehicles that contain them. Although DTSC lacks authority to assess fees or provide other funding for the handling of removed mercury-containing motor vehicle light switches, universal waste management provides vehicle recyclers and other handlers of these switches with flexibility that will reduce the cost of proper management using universal waste standards rather than full hazardous waste standards while still enhancing

protection of public health and the environment.

Hazardous Waste Listing - M002

Price Consulting, Representing Appliance Recycling Centers of America

X-1 *It is unclear whether the proposed regulations address the mercury found in major appliances. We seek clarification on this basic point.*

The M002 Listing does apply to mercury found in switches (including switches in thermostats) and flame sensors in major appliances. Effective February 9, 2006, a discarded appliance that contains a mercury switch or flame sensor is a hazardous waste until said switch or sensor is removed.

X-6 *Do the proposed regulations cover appliances subject to the Metallic Discards Act? Does DTSC propose that a removed mercury switch can be managed as universal waste? How would we know that a crushed appliance should be managed as hazardous waste?*

The regulations do cover appliances subject to the Metallic Discards Act. Although the Metallic Discards Act requires the removal of mercury switches from an appliance "prior to crushing [it] for transport or transferring [it] to a baler or shredder for recycling," many appliances that contain mercury switches or flame sensors do not exceed hazardous waste concentration thresholds for mercury, due to their large mass. These regulations will designate any intact (i.e., not crushed, baled, sheared, or shredded) waste appliance that contains a mercury switch or flame sensor as a hazardous waste, whether or not its mercury concentration exceeds applicable concentration thresholds. Mercury switches that meet the M002 listing description (including appliances with mercury switches and the removed mercury switches) are eligible for universal waste management, pursuant to chapter 23 of the California Code of Regulations, title 22, division 4.5.

With regard to appliances that are crushed before all mercury switches have been removed, the regulations' text has been modified since the August 9, 2002, 45-Day Public Notice. In the original proposal, a product crushed without removal of all of mercury switches was classified as a hazardous waste. Subsection (b), paragraph (6) of section 66273.7.2 has been revised (15-Day Notice of Changes) to limit the applicability of the regulations to crushed appliances that exhibit a hazardous waste characteristic. It states that the regulations do not apply to: "Waste appliances and portions of appliances from which all mercury switches have not been removed and that are crushed, baled, sheared, or shredded. (<u>If they exhibit a characteristic of a hazardous waste in article 3 of chapter 11</u>, these appliances are regulated as hazardous wastes pursuant to chapters 10 through 16, 18, and 20 through 22 of this division.)"

X-8 *What additional requirements, if any, will be placed on persons who handle, transport, or store whole intact appliances that have been discarded by their owner*

under the Universal Waste Rule?

Persons who handle, transport, and store intact discarded appliances that contain mercury switches will be regulated as universal waste handlers, and universal waste transporters. The general standards for universal waste handlers are found in articles 2 and 3 of chapter 23 of the California Code of Regulations, title 22, division 4.5. In general, a universal waste handler must:

- Obtain an EPA Identification number (large quantity handlers only);
- Label universal waste with the date and identify of the waste;
- Contain releases;
- Perform only certain, limited treatment activities;
- Train employees;
- Transport universal waste using shipping papers (bill of lading);
- Send universal waste to a destination facility, another handler, or a foreign destination;
- Accumulate universal waste for no longer than one year;
- Not dispose of UW; and
- Retain records of shipments.

A universal waste transporter can be a common carrier, or a handler who self-transports his or her universal waste. In general, a universal waste transporter must:

- Use bill of lading;
- Comply with applicable Department of Transportation (DOT) labeling and placarding requirements for hazardous materials shipments;
- Clean up releases;
- Deliver universal waste to a destination facility, a handler, or a foreign destination; and
- Not treat or dilute waste, except in response to an emergency.

Specific requirements for handlers of universal waste mercury switches and thermometers are found in subsection (d) of sections 66273.13 (applicable to small-quantity handlers) and 66273.33 (applicable to large-quantity handlers).

Hazardous Waste Listing - M002 - Support

J-17 *I support considering an entire product with switches inside as hazardous waste.*

DTSC acknowledges this comment and agrees with the commenter's assessment of the impact of these regulations.

Hazardous Waste Listing - M002 - Opposition

State of California Auto Dismantlers Association

D-1 *Given the small amount of mercury in vehicle switches, the rule is not cost effective.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. While the mass of mercury in an individual mercury switch is only about one gram, DTSC does not concur with the commenter's assessment that this is a "small" amount of mercury. As documented in DTSC's recent Final Mercury Report (August, 2002) mercury is highly toxic. As the report shows, the U.S. Environmental Protection Agency has set its Reference Concentration (RfC) for elemental mercury at 0.3 micrograms (millionths of a gram) per cubic meter of air. The Agency for Toxic Substances and Disease Registry (ATSDR) has established Minimum Risk Levels (MRLs) for elemental mercury that are even lower than U.S. EPA's RfC.[1] Mercury is also very mobile in the environment and changes forms as it moves through different environmental media (soil, air, water). As documented in the Final Mercury Report, sulfate-reducing bacteria convert mercury to the highly toxic form methylmercury, which accumulates in the tissue of some fish and endangers the health of persons who consume contaminated fish. In addition, DTSC has calculated that between 0.75 and 1.5 tons of mercury are contained in the 700,000 vehicles that are shredded annually in California.[2] Some of this mercury is deposited in Class 3 (municipal) landfills; some is released to other environmental media during processing.

Given mercury's high toxicity, mobility in the environment, and tendency to accumulate in certain fish that are consumed by humans, the cost of removing mercury-containing motor vehicle light switches from end-of-life vehicles (which DTSC estimated at $6.50 per vehicle in the economic impact analysis for this rulemaking) is low. As noted in the response to comment Q-5, the M001 listing has been modified since the original 45-Day Public Notice to apply only to vehicle light switches and vehicles that contain them. Now, the listing does not apply to other types of automotive mercury switches, some of which are also the most

difficult switches to remove. This change reduces the costs that would have been borne by the handlers of end-of-life vehicles.

D-2 *There are too many models with too many different switches to ensure that all switches have been removed. The rule should apply only to hood and trunk lighting switches.*

DTSC has reviewed this comment and has changed the scope of the M001 listing to include only hood and trunk switches, as suggested by this commenter. However, the prime reason for this change is due to the scarcity of information on which vehicles contain non-lighting mercury switches, and where such switches are located in vehicles that

[1] DTSC Final Mercury Report. August, 2002. Page 40.
[2] DTSC Final Mercury Report. August, 2002. Page 85.

contain them. If more complete data becomes available on the use and location of other (non-lighting) mercury switches in vehicles, DTSC may, in a future rulemaking, revise the M001 listing to include them.

D-3 *The costs of recycling the switches is a major problem with this rule. The costs come from removal of the switch, dismantling and removal of the mercury capsule or, alternatively, shipment of the entire assembly to a recycler, or handling the assembly as a hazardous waste.*

As discussed in response to comment D-1, DTSC estimates the average cost of mercury switch removal at $6.50 per vehicle. Notwithstanding the commenter's belief that the costs for managing mercury switches will be unreasonably high, DTSC believes they will be modest, due to the flexibility inherent in universal waste management. The light switches that are affected by these regulations can be accumulated at the generator's site for up to one year, or may be transported to another, intermediate handler, who may consolidate switches from many handlers at a single location without a permit. Auto dismantlers need not "dismantle" the mercury capsule (nor may they, without a permit). Also, shipping as a "hazardous waste" is not required by the regulations; neither is a uniform hazardous waste manifest nor a registered hazardous waste hauler required when transporting universal waste switches.

The cost of recycling mercury switches is also modest. In the economic impact analysis for these regulations, DTSC cites pricing information from the mercury recycling industry; the cost for retorting (recycling) one 55-gallon drum of mercury switches is estimated to be $750. A 55-gallon plastic container can hold tens of thousands of mercury switches—more than any individual dismantler will likely generate in many years. The inclusion of these switches in the Universal Waste Rule allows offsite consolidation of mercury switches from many dismantlers at a single location, without a permit. Such offsite consolidation will reduce the per-unit recycling cost for mercury switches drastically.

D-4 *A rebate program similar to the bottle bill is needed. SCADA recommends that switches go to municipal solid waste landfills until the rebate program is in place.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. DTSC lacks authority to institute a rebate program for mercury-containing motor vehicle light switches; only the legislature can do this. As discussed above in the response to comment D-3, the costs of removing and managing mercury-containing motor vehicle light switches will be modest. As discussed in the response to comment D-1, up to 1.5 tons of mercury are released to the State's environment through the shredding of vehicles that are shredded. Thus, the suggestion in this comment is not feasible and would not help achieve the goals of the regulations.

D-8 *DTSC should partner with SCADA to develop a SCADA run program to replace this regulation. Use a concept similar to the storm water rule that allows group permits.*

DTSC has reviewed this proposal and determined no regulatory change is necessary.

While the listing of mercury-containing motor vehicle switches, and vehicles that contain them, as hazardous wastes is necessary, due to "the immediate or persistent toxic effects to man and wildlife and the resistance to natural degradation or detoxification mercury,"[3] DTSC welcomes the opportunity to work with SCADA to develop a program that will assist its members in complying with the requirements of these regulations.

Hazardous Waste Listing - M002 - Enforcement

Price Consulting, Representing Appliance Recycling Centers of America

X-2 *Existing law requiring removal of mercury switches from appliances is routinely ignored. Reasons: complying makes one a hazardous waste generator; there is little or no inspection or enforcement.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. Compliance with the requirements of Public Resources Code section 42175 is beyond the scope of this rulemaking. However, the M003 listing should improve compliance with the requirement to remove mercury switches from major appliances prior to recycling or disposing them. Appliances that contain such switches will become hazardous wastes when they are discarded, and a person who crushes, bales, shears, or shreds one without first removing the mercury switches would be treating a hazardous waste—an activity that requires a permit from DTSC.

X-3 *Recent legislation clarifies and expands DTSC's responsibility to enforce Public Resources Code 42175. Failure to remove mercury switches prior to crushing or baling is a violation of chapter 6.5; enforcement is the responsibility of DTSC and the CUPAs.*

See response to comment X-2, above. Compliance with the requirements of Public Resources Code, section 42175 is beyond the scope of this rulemaking. However, these regulations should lead to an increased compliance rate.

X-4 *DTSC and CUPAS have little or no capacity to enforce Public Resources Code 42175.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. See response to comments X-2 and X-3, above.

X-5 *Existing laws (requiring removal of mercury switches from appliances before crushing or shredding) are not working. In the real world, mercury switches are not generally removed form appliances any more than they are removed from vehicles.*

DTSC has reviewed this comment and determined that no regulatory change is necessary.

[3] Health and Safety Code section 25140.

See response to comments X-2 and X-3, above.

X-7 *The regulations need to ensure inspection and enforcement. They should address: the kind of inspections, by whom, who should be inspected, how frequently, what to look for, and penalties.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. Persons who generate wastes that meet the M002 listing description will be hazardous waste generators. As such, enforcement of the applicable universal waste management standards will primarily be the responsibility of the CUPAs. The CUPAs have ample inspection and enforcement authority for hazardous waste generators, pursuant to article 8 of chapter 6.5 of the Health and Safety Code. Inspection frequency is outside the scope of this rulemaking.

Hazardous Waste Listing - M003

Association of Lighting and Mercury Recyclers

C-6 *Phillips markets their bulbs as "trashable"*

DTSC acknowledges this comment. As non-hazardous waste, Philips tubes currently may be managed and disposed of in the municipal waste stream. DTSC has viewed Philips Lighting Company's Internet site,[4] which mentions that Alto lamps may be disposed of "conventionally," but also states that recycling them is "always the preferred method" of managing waste Alto lamps. While Philips encouragement of voluntarily recycling of Alto lamps is laudable, admonitions to voluntarily recycle low-mercury lamps cannot be expected to achieve the same rate of recycling as designating all waste mercury-added lamps as hazardous wastes and requiring recycling under the Universal Waste Rule.

C-7 *ALMR customers report high failure rates for Phillips alto lamps - thus, more mercury enters the environment*

DTSC has reviewed this comment and determined that no regulatory change is necessary. The comment is beyond the scope of the rulemaking. The hazardous waste listings in these regulations affect mercury-containing products that are capable of being recycled or that have mercury-free alternatives. The relative longevity of lamps of different brands was not a factor in developing the M003 listing. Philips has submitted laboratory data showing that, in an ongoing test, samples of Alto lamps have lasted longer than the industry median life. Other commenters have cited anecdotes of shorter life for Alto lamps. DTSC has not been provided with definitive data showing that Philips Alto lamps fail at a significantly higher rate than other brands of fluorescent lamps.

C-8 *Phillips has asserted that DTSC has no information establishing adequate recycling*

[4] URL: http://www.lighting.philips.com/nam/feature/alto/tech.php

capacity for California fluorescent tubes - this is incorrect. The ALMR letter supports existence of adequate recycling capacity for the 60 - 80% of tubes EPA estimates will be recycled.

DTSC has reviewed this comment and agrees with the commenter. Two commenters on the 45-Day Public Notice, both involved in the lamp recycling industry, have stated unequivocally that recycling capacity is already available for California's fluorescent lamps. (See response to comment T-9.1.)

Californians Against Waste

F-2 *With only 20% of lamps recycled, meaningful enforcement of the disposal ban is needed. The disposal of 60% to 80% of the lamps through illegal disposal and exemptions is a significant environmental risk.*

DTSC agrees with the commenter that enforcement of the recycling requirement for universal waste lamps is necessary, and that illegal disposal poses significant environmental risks. These regulations will facilitate the detection of illegal disposal because, after February 8, 2006, no mercury-added lamp can be legally disposed in California unless in a hazardous waste landfill. Any person who places mercury added lamps in a dumpster, garbage truck, or municipal landfill will be in violation of the regulations and subject to enforcement action. Both the CUPAs and DTSC have ample authority to enforce this requirement, pursuant to article 8 of chapter 6.5 of the Health and Safety Code.

The disposal of lamps by households and Conditionally Exempt Small Quantity Universal Waste Generators (CESQUWGs) between now and 2006 will result in some additional mercury releases. However, the exemptions are necessary in order to allow time for the development and implementation of a collection infrastructure for lamps and other universal waste generated by these entities. However in order to reduce the release of mercury, the number of lamps that a CESQUWG may dispose will be reduced to 30 lamps per month, effective in 2004.

F-3.1 *The package needs source reduction incentives.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. The listing of all mercury-added lamps provides a strong incentive for source reduction. It will encourage manufacturers who wish to market lamps that can be disposed as non-hazardous waste to develop and produce new types of high-efficiency lamps that are entirely free of mercury. The use of the TTLC to classify waste lamps as hazardous or nonhazardous does not provide this incentive. See the response to comments T-5, T-18, and T-24, incorporated herein, for a more detailed discussion of this point.

F-3.2 *Use the TTLC for marketing, labeling, procurement preferences, and other source reduction incentives.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. As discussed in the response to comment T-47, these regulations do not preclude lamp manufacturers from discussing the mercury content of their lamps or comparing the mercury content of the lamps produced by different manufacturers in their marketing efforts, provided manufacturers make clear that all mercury-added lamps are hazardous wastes and must be managed appropriately.

F-5 *There is nothing in the proposed regulations establishing education and enforcement to ensure proper management.*

As discussed in the responses to comment F-2, incorporated herein, DTSC and the CUPAs have ample authority to enforce the requirements of these regulations. In addition, DTSC plans education and outreach to the public and the regulated community, which will include fact sheets, presentations, and postings on the Department's Internet site.

Center for Environmentally Advanced Technologies

I-28 *We are not opposed to a recycling requirement, as long as it is combined with a strong mandate for source reduction. Examples: bans on products that exceed time diminishing thresholds, fees on high-mercury lamps to fund recycling, procurement specifications for low-mercury lamps, etc.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. As discussed in the responses to several earlier comments (notably, comments T-5, T-18, and T-24), incorporated herein, the regulations provide a strong incentive for source reduction. The commenter's specific suggestions are, however, beyond the scope of the rulemaking. DTSC has no authority to regulate the composition of products that are not wastes, nor to assess fees on products or adopt procurement specifications.

GE Lighting

M-2 *The listing should be limited to mercury-containing lamps with intentionally-added mercury.*

DTSC has reviewed this comment and agrees with it. It is not the intent of these regulations to classify lamps that contain minute amounts of mercury that are inadvertently introduced from raw materials, etc., as hazardous wastes. The words "intentionally-added" have been added to the M003 listing description in response to the comment. (See the 15-Day Notice of Changes)

M-5 *DTSC should highlight in the Final Statement of Reasons that most lamps purchased after the rule is finalized, but prior to the lamp listing going into effect, will be subject to the new listing.*

DTSC has reviewed this comment and determined that no regulatory change is needed. The ISOR stated that a lamp purchased today would likely not reach end-of-life until after

the effective date of the M003 listing.[5] The effective date of the listing was moved forward two years in the 15-Day Public Notice of Changes to February 9, 2004—less than one year after the date the regulations will take effect. Consequently, it is even less likely that a low-mercury lamp sold today would become a waste prior to the effective date of the listing.

OSRAM Sylvania

V-2 *DTSC should list "mercury-added" lamps, rather than "mercury-containing" lamps. As written, the listing would arguably cover lamps with trace amounts of mercury present in glass, metal, or other components.*

DTSC has reviewed this comment and agrees with it. The suggested change has been made in the final text of the regulations (See the 15-Day Notice of Changes). Please see the response to comment M-2, incorporated herein.

V-3 *DTSC should clarify that removal of "mercury-added" lamps from products does not constitute treatment of a hazardous waste, either in the final text or FSOR.*

DTSC has reviewed this comment and agrees with the commenter's suggestion. A new subsection (c), paragraph (3) has been added to sections 66273.13 and 66273.33, to clarify that removing lamps from structures or products is a universal waste handler activity, rather than a treatment activity.

V-7 *DTSC should highlight in the Statement of Reasons that the vast majority of mercury-added lamps currently being purchased will be subject to the new rules at their end-of-life, despite the delayed effective date of the listing.*

DTSC has reviewed this comment and determined that no regulatory change is needed. Please see the response to comment M-5, incorporated herein.

Hazardous Waste Listing - M003 - Support

AERC Recycling Solutions

A-2 *Include all mercury-containing lamps in the rule.*

DTSC has reviewed this comment and determined that no regulatory change is needed. The M003 listing applies to all lamps with *intentionally-added* mercury. The listing was not intended to apply to lamps with minute amounts of mercury that was not intentionally added. Please see the response to comment M-2, incorporated herein.

Association of Lighting and Mercury Recyclers

[5] Mercury Waste Classification and Management Regulations, ISOR, August 9, 2002. Page 11.

C-1 *The Association supports inclusion of all mercury-containing lamps in the regulations. The STLC, TTLC, and TCLP do not accurately assess the environmental threat of mercury.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. The regulations apply to all lamps with intentionally-added mercury. DTSC concurs that the unique properties and high toxicity of mercury, in addition to the fragility of mercury-

added lamps necessitate the listing of all such lamps as hazardous wastes when discarded, in order to minimize the release of their mercury to the environment.

C-2 *Lamps will break in dumpsters and the mercury will wash into the waters of the State. Mercury released from lamps prior to landfill will affect the State's ability to meet TMDLs. Mercury released from lamps prior to landfill will accumulate in waters, fish, and people.*

DTSC concurs with the commenter's assertions about the risks of disposal of mercury-added lamps in dumpsters. The Final Mercury Report discusses the environmental mercury cycle in some detail. Mercury's high vapor pressure, mobility in the environment, and bioaccumulation in fish and humans are some of the factors upon which DTSC's based its decision to develop and adopt these regulations.

C-5 *Phillips has presented misleading data asserting that ALTO lamps are recycled at a high rate. ALMR members report much lower levels of recycling for Phillips bulbs.*

DTSC has reviewed this comment, as well as Philips' assertions regarding the rate at which ALTO lamps are recycled, and concurs with the commenter that Philips' interpretation of the data provided by one lamp recycler is misleading. Please see the response to comment T-31, incorporated herein.

CALPIRG Charitable Trust

H-8 *We recommend against the delayed listing of mercury-containing lamps.*

DTSC has reviewed this comment, and others addressing the delay in the M003 listing. Statements by Onyx/Superior Special Services and the Association of Lighting and Mercury Recyclers in their respective comments on these regulations indicate that adequate capacity to recycle California's lamps, including low-mercury lamps, already exists. Therefore, in order to prevent the unnecessary release of mercury from the nonhazardous management and disposal of lamps that can be recycled today, DTSC has shortened the delay in the listing of mercury-added lamps from three years to one year. This change, which was part of the first 15-Day Notice of Changes, means that all waste lamps with intentionally-added mercury will be classified as hazardous waste in 2004, rather than 2006 as originally proposed.

Clean Water Action

J-10 *We support listing lamps and DTSC should not amend this component of the regulations.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. The scope of the M003 listing is unchanged from the original 45-Day Public Notice. The only modification to the listing is the addition of the words "intentionally added," to clarify that the listing does not apply to lamps containing tiny amounts of inadvertently incorporated mercury that is not necessary for the lamps' function. DTSC also reduced the delay of the effective date of the listing in the 15-Day Notice of Changes.

GE Lighting

M-1 *DTSC should act swiftly to finalize this proposal regardless of whether there are delays in finalizing the listing of other mercury-containing products.*

DTSC acknowledges this comment. DTSC must, by necessity, adopt these regulations by December 31, 2002 because its authority to adopt the universal waste portion (provided by Health and Safety Code section 25150.6) will expire. The regulations are being adopted in their entirety, before the expiration of this authority.

M-6 *We support DTSC's decision to regulate all mercury-containing lamps generated in California consistently.*

DTSC has reviewed this comment and determined that no regulatory change is necessary.

DTSC appreciates the commenter's support.

Osram Sylvania

V-1 *Commenter believes that the M003 listing meets the authority, consistency, and necessity standards in the APA.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. DTSC concurs with the commenter's assessment that the regulations meet all applicable requirements of the Administrative Procedure Act. See the response to comments T-22, T-23, T-24, and T-25, incorporated herein.

V-5 *DTSC should quickly finalize the rule for mercury-added lamps, even if the rule for other mercury-added products is delayed.*

DTSC concurs with this comment. Please see the response to comment M-1, incorporated herein.

Paul Hastings, representing OSRAM Sylvania

NN-3 *DTSC has shown the necessity for the proposed regulations. DTSC has concluded that nonhazardous status of some lamps creates an incentive for consumers to go to all nonhazardous lamps that are thrown away in the trash. California's experience with required recycling under the used oil program and Health and Safety Code section 25175 is that very high recycling rates can be obtained, especially by industry.*

DTSC concurs with this comment. Please see the response to comment V-1, incorporated herein.

NN-4 *Source reduction efforts will continue under the proposed rules. To the extent Philips calculated its mercury content to escape regulation "is not source reduction, but only regulation reduction."*

DTSC concurs with this comment. As discussed in the responses to several earlier comments (notably, comments T-5, T-18, and T-24), incorporated herein, the regulations provide a strong incentive for source reduction.

NN-5 *The TTLC is not required for classifying waste. The Department is free to use the TTLC, the STLC, the TCLP, the fish bioassay, or any other test it determines to be appropriate in determining what is hazardous waste.*

DTSC concurs with this comment. Section 25140 of the Health and Safety Code states: "The department shall prepare, adopt and may revise when appropriate, a listing of the wastes which are determined to be hazardous, and a listing of the wastes which are determined to be extremely hazardous." Subdivision (a) of section 25141 requires DTSC to "develop and adopt by regulation criteria and guidelines for the identification of hazardous wastes and extremely hazardous wastes." The hazardous waste listings in Appendix X of title 22 of the California Code of Regulations, division 4.5 (as well as the new hazardous waste listings included in these regulations) were adopted under the authority of section 25141. The hazardous waste characteristics in article 3 of title 22 of the California Code of Regulations, division 4.5 were adopted under the authority of Health and Safety Code section 25140. The commenter is correct that the legislature gives DTSC latitude in determining how wastes are classified as hazardous or nonhazardous.

NN-6 *The Department has adequately considered alternatives. Lowering the TTLC was rejected because listing lamps is clearer to consumers. Keeping the status quo provides no incentive to eliminate mercury altogether, and the TTLC promotes regulatory avoidance.*

DTSC has reviewed this comment and agrees with it. DTSC has adequately considered alternatives to these regulations, and has determined that none would be as effective in achieving the three objectives of the regulations:

- To encourage pollution prevention through the use of mercury-free alternatives to mercury-added products, when they exist;
- To encourage the development of mercury-free alternatives to mercury-added products when they are not already available; and
- To encourage the recycling of mercury-added products when they become wastes.

Please see the responses to comments T-4, T-15, T-19, T-26, and T-28, incorporated herein.

Physicians for Social Responsibility, Los Angeles

W-3 *PSR-LA strongly supports the classification of all fluorescent lamps as universal or hazardous waste, including low-mercury fluorescent lamps.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. The regulations will classify all intentionally-added fluorescent lamps as hazardous wastes or universal wastes. DTSC appreciates the commenter's statement of support.

USHIO Lighting Edge Technologies

Y-2 *The marketplace has been confused by recent attempts to differentiate some types of "low mercury content" fluorescent lamps--confusion we have had to overcome with our customers and prospects.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. DTSC agrees that the current disposal exemptions for fluorescent lamps generated by households and CESQUWG, combined with the fact that low-mercury lamps are currently not classified as hazardous waste, may lead to confusion among the purchasers of lamps, and the generators of waste lamps, as to the applicable management requirements. These regulations will regulate all mercury-added lamps consistently, removing the confusion about which requirements are applicable.

Hazardous Waste Listing - M003 - Support - Documents Submitted

Association of Lighting and Mercury Recyclers

C-9 *Commenter submitted a copy of November 1, 2001 letter to Peggy Harris, Chief of DTSC's State Regulatory Programs Division. This letter states: "the infrastructure is in place to recycle all lamps that can be diverted from landfills."*

DTSC has reviewed this comment, and a similar comment from Onyx/Superior Special Services (please see comment U-2). Both commenters are involved in the lamp recycling industry, and both state unequivocally that adequate capacity already exists to recycle California's fluorescent lamp waste. Based on these statements, and the State's

significant mercury contamination problem, DTSC is moving the implementation date for the M003 listing ahead by two years, to February 9, 2004. The existing temporary disposal exemptions will remain unchanged: until February 9, 2006, households and CESQUWGs may dispose of mercury-added lamps in the nonhazardous waste stream.

GE Lighting

M-7 *Supplemental comments submitted. GE calculates that 1081 pounds of mercury from lamps are landfilled annually in California. Under GE's assumptions, if all lamps had Philips' mercury levels and were landfilled, 1052 lbs. of mercury would be landfilled. If all lamps are classified as hazardous waste, 93 lbs. of mercury would be landfilled.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. DTSC has made its own calculations of the amount of mercury that would be released to the State's environment under various scenarios (see the tables in the appendix). DTSC's calculations are based on different assumptions than the commenter's, and consequently, the calculated amounts of released mercury also differ. However, DTSC's calculations and those of the commenter support the same conclusion: that regulating all mercury-added fluorescent lamps as hazardous wastes will reduce the release of mercury in California's environment more successfully than would retaining the use of the TTLC for classification of waste lamps. This is true even if all lamp manufacturers were to lower the mercury content of their products to match Philips' mercury levels.

M-8 *Commenter submitted a list of "Four Flaws in Philips Presentation Materials" [Referring to the written comments submitted by Nielsen-Merksemer on behalf of Philips].*
"1. The national number does not include Compact Fluorescent Lamps (CFLs) but the estimated number of lamps in California does include CFLs.
2. Philips solution will drive the recycling rate to 0%, not 50%.
3. Other states have achieved a 70% recycling rate, California can go at least this high if not higher.
4. Long Life Products were purposely not evaluated.
(Commenter includes a table showing the average amount of mercury in lamps sold in California, based on data for the sales of CFLs.)

DTSC has reviewed this comment and determined that no regulatory change is necessary.

1. It is unclear to DTSC what effect the inclusion of compact fluorescent lamps would have on the calculations to which this commenter refers.

2. DTSC agrees with the commenter that, to the extent lamp manufacturers reduce mercury content in order to escape the regulation as hazardous waste, the rate of (voluntary) recycling for the resultant "nonhazardous" lamps is likely to be lower than the rate of (mandatory) recycling of hazardous waste lamps.

3. The comments submitted by Nielsen-Merksamer on behalf of Philips Lighting Company cite a 70 percent recycling rate in the State of Minnesota, and DTSC believes that California will attain a similar rate through the combination of several ongoing efforts:

   - Enactment of these regulations, which will designate all mercury-added lamp waste as hazardous waste;
   - Establishment of the universal waste collection infrastructure workgroup, made up of representatives of DTSC, and the California Integrated Waste Management Board. The group was created to develop an infrastructure for the collection of universal wastes from households and Conditionally Exempt Small Quantity Universal Waste Generators. This infrastructure will be in place by February 9, 2006, when the current temporary disposal exemptions for small generators expire. The workgroup will be expanded in the future to include other stakeholders; and
   - DTSC's planned education and outreach activities that will begin immediately upon approval of these regulations.

4. The (Roux Associates, Inc.) data attached to the comments submitted by Nielsen-Merksamer does not make any distinctions between "long-life" and standard fluorescent lamps. It is not clear what the impact on Roux' calculations would be if longer-lived lamps were included.

Hazardous Waste Listing - M003 - Opposition - Adequacy of the Rulemaking File

Nielsen Merksamer, representing Philips Lighting

T-26.2 *The Department's Economic and Fiscal Impact Statement is deficient in its assessment of alternatives. Namely, there is no analysis of the most obvious alternative - reduction of the TTLC. What is the reason for this omission?*

DTSC has reviewed this comment and determined that no regulatory change is necessary. In adopting these regulations, DTSC made an initial determination, pursuant to subsection (a)(8) of section 11346.5 of the Government Code, that the regulations "would not have a significant, statewide adverse economic impact …." Pursuant to subsection (a)(13) of section 11346.5, DTSC must declare that no reasonable alternative it considered or that has otherwise been identified and brought to the attention of DTSC would be more effective in carrying out the purpose for which the action is proposed, or would be as effective as and less burdensome to affected private persons than the proposed action. DTSC has determined that the commenter's preferred alternative—lowering the TTLC would not be as effective at carrying out the purpose for which these regulations were proposed. The objectives of these regulations are as follows:

   - To encourage pollution prevention through the use of mercury-free alternatives to mercury-added products, when they exist;

- To encourage the development of mercury-free alternatives to mercury-added products when they are not already available; and
- To encourage the recycling of mercury-added products when they become wastes.

DTSC has seen no convincing evidence that the commenter's preferred alternative would be as effective as the M003 listing at achieving these objectives. Lowering the TTLC may encourage the use of very-low mercury lamps, but would do nothing to encourage the development of new types of mercury-free high efficiency lamps, nor would encourage the use of such lamps should they be developed. It is highly improbable that the retaining or lowering TTLC would promote the (voluntary) recycling of low- and very low-mercury lamps as effectively as will requiring all mercury-added universal waste lamps to be recycled. Further, the tables in the appendix show that more mercury would be released to the environment if the TTLC were retained than if it is replaced (for lamps only) by the M003 listing. If a TTLC of 15 milligrams per kilograms were adopted for lamps, and it resulted in very low-mercury lamps garnering a 100 percent market share (an improbable scenario), the release of mercury would only be less than under the M003 listing if the current 20 percent recycling rate (with most commercially-generated universal waste lamps required to be recycled) could be maintained on a strictly voluntary basis. Given that lowering the TTLC for mercury would be less effective at achieving the objectives of these regulations, DTSC is not required to compare the fiscal and economic impacts of this alternative to those of listing all mercury-added lamps as hazardous wastes.

T-44 *A commenter submitted a press release from the U.S. Attorney's office in New Hampshire, announcing the conviction and sentencing of an operator of a sham lamp recycling company, which claimed to be complying with state and federal laws but was not.*

DTSC has reviewed this document and determined that no regulatory change is necessary. The Universal Waste Rule does not allow transfer of universal waste lamps to a recycler who does not have a hazardous waste facility permit. The Universal Waste Rule prohibits handlers and transporters of universal waste from taking it "to a place other than a universal waste handler, a destination facility, or a foreign destination." A universal waste handler or transporter who violates this requirement is subject to enforcement action by DTSC or the local CUPA.

Paul Hastings, representing OSRAM Sylvania

NN-10.1 *Commenter incorporated as a comment a 9-page document that appears to have been printed from GE's web site. The document is a press release, announcing GE's earnings for the first quarter of 2002. The company earned $3.518 billion, of which $540 million was from lighting.*

DTSC has reviewed this document and determined that no regulatory change is necessary. According to the document's figures, lighting represented approximately 15

percent of GE's revenue during the first quarter of 2002. DTSC has no information on whether or how the classification of low-mercury fluorescent lamps as hazardous wastes will affect the earnings of GE's Lighting Division. The submitted document is not germane to and is outside the scope of the rulemaking.

NN-10.2 *Commenter submitted a press release from the U.S. Attorney's office in New Hampshire, announcing the conviction and sentencing of an operator of a sham lamp recycling company, which claimed to be complying with state and federal laws but was not.*

DTSC has reviewed this document and determined that no regulatory change is necessary. The Universal Waste Rule does not allow transfer of universal waste lamps to a recycler who does not have a hazardous waste facility permit. Please see the response to comment T-44, incorporated herein.

NN-11 *Commenter incorporated as a comment a 4-page document titled "The Truth about TCLP-Passing Lamps." The document, on Osram Sylvania stationery, states that "currently available fluorescent lamps that pass the TCLP do not do so simply by lowering the mercury dose. Such lamps instead rely on the properties of other unique lamp components . . ." which reduce ionized mercury to the elemental form (which is much less soluble in the TCLP extracting solution). "Removal of the unique components will generally cause the lamp to fail the TCLP." The document argues that the use of additives that allow lamps to pass the TCLP is "permissible." The document claims that iron cathode shields used only in Philips lamps are not necessary for lamp operation and are not used by GE or Osram Sylvania in their lamps; these shields could, arguably, be considered "additives." The fourth page of the document contains three graphs of TCLP results for various types of lamps, with and without iron shields.*

DTSC acknowledges receipt of this document; however, it is not germane to this rulemaking. Higher-mercury fluorescent lamps are currently classified as hazardous waste in California due to their total mercury concentration, even when they have a leachable mercury concentration below 0.2 milligrams per liter, as determined by the TCLP or California's Waste Extraction Test (WET). Under the proposal, all mercury-added lamps will be classified as hazardous wastes when discarded, even when their total mercury concentration is below the TTLC and their leachable mercury concentration is below the TCLP and/or STLC. The use of iron shields, ascorbic acid, or any other additive designed to affect its TCLP or WET results will not change the hazardous classification of mercury-added lamp waste under these regulations.

NN-12.1 *Commenter incorporated as a comment a bar graph showing mercury concentration in TCLP extracts, titled "TCLP With and W/O Cathode Guards F32T8/TL835."*

DTSC acknowledges receipt of this document; however, it is not germane to this rulemaking. The use of iron shields, ascorbic acid, or any other additive designed to affect

its TCLP or WET results will not change the hazardous classification of mercury-added lamp waste under these regulations. Please see the response to comment NN-11 above, incorporated herein.

NN-12.2 *Commenter incorporated as a comment a photocopied photograph of a truck trailer with a large sign on the side reading "California's only non-hazardous fluorescent lamp." The lamp is labeled 'ALTO' on its left end, and part of the name 'Philips' can be seen on the lower right side of the page.*

DTSC has reviewed this document and determined that no regulatory change is necessary. The photograph shows that Philips has touted, in its marketing efforts, the fact that Alto lamps are currently not classified as hazardous wastes in California. Presumably, Philips has determined that the nonhazardous status of waste Alto lamps in California will enhance sales of these lamps. Three types of potential customers might be influenced to purchase Alto lamps by the sign shown in the photograph:

- Persons who have an "environmental ethic" that impels them to buy the lowest mercury lamps available, in order to minimize the use and release of mercury; these persons would be very likely to voluntarily recycle Alto lamps;
- Persons who wish to avoid compliance with universal waste management standards, but who may voluntarily recycle Alto lamps if it is convenient to do so; and;
- Persons who lack an "environmental ethic," but wish to avoid universal waste management requirements, including the requirement for lamp recycling.

Philips suggests that many of its customers fall into the first two categories, but DTSC has not been provided with compelling evidence to support that presumption. Philips has submitted data from a lamp recycler suggesting that Philips Alto lamps are recycled at a disproportionately high rate, as compared to competing lamps. The Association of Lighting and Mercury Recyclers has cited a letter from another recycler suggesting that Philips lamps are underrepresented in the population of lamps it recycles. Please see the response to comment T-31 and T-45, incorporated herein.

NN-12.3 *Commenter incorporated as a comment a graph with the heading "T8 PHILIPS ALTO Fluorescent Lamps Mortality Curve - Weibull." 'Percent surviving' is plotted against 'Operating Hours." A dark line labeled "Industry Standard Median Life 20,000 Hours' crosses the intersection of 50% surviving on the Y-axis and 20,000 hours on the X-axis. A horizontal line labeled "Philips Production Lamps" shows no lamp failures at 16,262 hours. Some hand written notes are also on the page.*

DTSC has reviewed this document and determined that no regulatory change is necessary. Lamp life is not currently considered in the classification of waste lamps as hazardous or nonhazardous, nor will it be under the M003 listing. Please see the responses to comments T-21 and T-43, incorporated herein.

NN-12.4 *Commenter incorporated as a comment a bar graph with the heading "Competitive Lamp Testing Median Life 35 lamps per each Mfg." The bar for OSI (presumably Osram Sylvania) shows the shortest median life; the bar labeled GE shows a longer median life, and the bar labeled PLC (presumably Philips lighting Company) reaches the top of the scale on the Y-axis. The caption reads: "OSI 3 lamps still burning, GE all lamps failed, PLC 11 Lamps still burning (21212 hrs), Test Started 1998."*

DTSC has reviewed this document and determined that no regulatory change is necessary. Lamp life is not currently considered in the classification of waste lamps as hazardous or nonhazardous, nor will it be under the M003 listing. Please see the responses to comments T-21 and T-43, incorporated herein.

NN-12.5 *Commenter submitted a partially illegible copy of a newspaper article, the subject of which appears to be the financial performance of General Electric. A legible portion of the article states that GE's lighting business has performed poorly and speculates that the company might divest itself from its lighting and major appliance businesses.*

DTSC has reviewed this document and determined that no regulatory change is necessary. DTSC has no information on whether or how the classification of low-mercury fluorescent lamps as hazardous wastes will affect the financial and is outside the scope of performance of GE's Lighting Division. The submitted document is not germane to and is outside the scope of the rulemaking. Please see the response to comment NN-10.1 above, incorporated herein.

NN-12.6 *Commenter submitted a document that is mainly in German. It appears to be a patent for a low-pressure discharge lamp. An English abstract reads in part: "The invention relates to a low-pressure discharge lamp with at least one supporting element (12) placed inside a discharge vessel (10). Said supporting element is provided with a mercurial coating…."*

DTSC acknowledges receipt of this document; however, it is not germane to this rulemaking. The use of ascorbic acid or any other additive designed to affect its TCLP results will not change the hazardous classification of mercury-added lamp waste under these regulations. Please see the responses to comments NN-11 and NN-12.1, incorporated herein.

NN-13 *Commenter submitted a press release by the National Electrical Manufacturers Association (NEMA) dated April 26, 2002. The document states that a recent survey of its members by NEMA's lamp section found that the use of mercury in lamps and the average mercury level in a standard four-foot fluorescent lamp have been reduced to 8.9 tons and 8.3 milligrams, respectively.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. The reduction in the use of mercury in lamps by all manufacturers is documented in

DTSC's Final Mercury Report. However, in spite of this reduction, hundreds of kilograms of mercury continue to be released to the environment annually through the nonhazardous management and disposal of waste fluorescent lamps. Please see the response to comment T-5, incorporated herein.

NN-14 *Commenter submitted a document titled "Maine Fluorescent Lamp Study Final Report." The report summarizes the results of testing of new and used samples of 10 models of fluorescent lamps produced by the three major lamp manufacturers. Lamps were subjected to the Toxicity Characteristic Leaching Procedure (TCLP) and were also analyzed for their total mercury content. The TCLP results for each lamp model (passing or failing) were compared with manufacturer claims. The lamps' TCLP results were also evaluated to determine whether they were predictive of total mercury content. "Results indicated that lamps that are represented as TCLP-compliant have total mercury results similar to their non-compliant counterparts. These results suggest that the disposal ban on all mercury-added lamps is appropriate."*

DTSC has reviewed this document and determined that no regulatory change is necessary. In California, a waste that does not exceed the TCLP for any hazardous constituent (or the STLC, as determined by the WET) nevertheless exhibits the toxicity characteristic (and is classified as a hazardous waste) if the total concentration of any hazardous constituent exceeds the TTLC.[6] Consequently, whether or not the leachable mercury concentration in a fluorescent lamp is predictive of its total mercury concentration is less important in California than in other States, where the TCLP is the only basis for the toxicity characteristic. Nevertheless, the recommendation of this report is consistent with the approach taken in these regulations: to classify all waste mercury-added lamps as hazardous wastes and require the generators of such lamps to be recycle them in order to take advantage of the reduced management standards of the Universal Waste Rule.

NN-15 *Commenter incorporated as a comment a June 14, 1999 letter from Ronald Pilorin of DTSC's Human and Ecological Risk Division (HERD) to Peter A Bleasby of Osram Sylvania. The letter states that the nonhazardous concurrence for Philips ALTO lamps issued by DTSC in 1997 does not constitute an endorsement of that brand of lamps, and that any use of the concurrence as an endorsement for ALTO lamps would be inappropriate and beyond the scope of the concurrence, and not condoned or approved by DTSC. A copy of DTSC's June 24, 1997 letter to Philips Lighting Company, concurring that the ALTO lamps sampled were not hazardous waste, was attached to Mr. Pilorin's 1999 letter.*

DTSC has reviewed the two letters submitted by the commenter and determined that no regulatory change is necessary. The nonhazardous concurrence issued to Philips Lighting Company for its waste is not, and was never intended to be, an endorsement of Philips Alto lamps. As stated in Mr. Pilorin's 1999 letter, any implication that DTSC endorses

[6] Pursuant to article 3 of title 22 of the California Code of Regulations, division 4.5.

Philips Alto lamps would be beyond the scope of the nonhazardous concurrence, and would not be condoned by DTSC.

NN-7 *Commenter incorporated a 4-page document titled "Lamp Recycling in California" as a comment. The document describes changes in the regulation of fluorescent lamps in California and the reduction in the use of mercury in the manufacture of lamps. It argues for the abolition of the use of the TTLC for classification of lamps as hazardous or nonhazardous waste, in favor of a requirement that all non-residentially generated lamps be recycled. The document argues that the current use of the TTLC to classify lamps leads to arbitrary classification and creates a "perverse" regulatory incentive for consumers to purchase lamps that can be thrown away. The document also argues that the current system will lead to shorter-lived, less efficient lamps that will not be recycled, and will harm the lamp recycling industry.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. In general, DTSC concurs with this document's assessments of the advantages of requiring the recycling of all mercury-added lamps over allowing low-mercury lamps to be disposed of as nonhazardous waste. DTSC agrees that lamps marketed as "nonhazardous" (and therefore, as legal to throw away) are likelier to be disposed of in the municipal waste stream at end-of-life than are lamps that are required to be recycled.

In the appendix, DTSC calculates the amount of mercury that would be released under various scenarios using data submitted by Phillips. The calculations show that, if waste lamps were to continue being classified as hazardous or nonhazardous using the TTLC, and if the other two major manufacturers reduced their lamps' mercury content to Philips' levels, the amount of mercury released to the environment would still be approximately 240 kilograms per year. This value is based on the unlikely assumption that the current 20 percent recycling rate would not fall (although recycling would be strictly voluntary, as all three manufacturers' lamps would be nonhazardous waste when discarded). If, instead, all mercury-added lamps were classified as hazardous waste when discarded, all lamps were manufactured with the higher mercury level currently found in Osram-Sylvania and GE lamps, and the lamp recycling rate were to increase to 62 percent (not an unreasonable scenario, given that at least one State has attained a recycling rate of 70 percent), mercury releases would be reduced to approximately 240 kilograms per year—less than if all lamps were manufactured to Philips' specifications. DTSC expects to achieve a recycling rate of 70 percent or more, in part through education and outreach to the regulated community and the CUPAs, in part through enforcement, and in part through its ongoing collaboration with other stakeholders to develop a collection infrastructure for lamps and other universal wastes generated by households and CESQUWGs. Even if the lamp recycling rate did not surpass 70 percent, the amount of mercury released would be reduced to approximately 187 kilograms per year.

DTSC does not necessarily agree that the current system will lead to shorter-lived, less efficient lamps. While some commenters have alleged that Philips lamps are plagued by short life due to their low mercury content, Philips has provided data in its comments

showing that samples of its Alto lamps exceeded industry standards for median lamp life. While not definitive, this data suggests that Alto lamps' longevity may not be adversely affected by their reduced mercury content. Also, no commenters provided data demonstrating that the TTLC has led to reductions in the efficiency of lamps. However, to the extent that their non-hazardous classification under the TTLC provides an incentive for consumers to purchase lamps that they may throw away, retaining the TTLC for lamps would encourage the preventable release of mercury to the environment through non-hazardous waste management and disposal. Note that the recycling requirement will not be limited to non-residential generators of mercury-added lamp waste, as the document recommends; the requirement will also apply to household generated lamps. Households will be exempt from the other management standards applicable to universal waste handlers, provided they recycle their lamps at a permitted facility. Other household-generated hazardous wastes are similarly exempted from most management requirements, but may not be disposed of in the non-hazardous waste stream.

NN-8 *Commenter incorporated as a comment a 1-page document titled "Land Disposal Policy Mercury-Containing Lamps." The document, on Osram Sylvania letterhead, argues that all non-residentially generated fluorescent lamps should be recycled. Four reasons for the recommendation are provided: fewer lamps will break when packaged for recycling than when lamps are disposed; several states have already partially or totally banned lamp disposal as solid waste, and other states are considering similar measures; most states "have expressed a preference that all mercury-containing lamps be recycled"; and generators of legally-disposed lamps may become liable for cleanup of landfills that later become Superfund sites. The document also recommends that households use household hazardous waste collection programs to discard lamps.*

DTSC has reviewed this comment and determined that no regulatory change is required. DTSC generally agrees with the commenter's rationale for suggesting that all waste mercury-added lamps be recycled. These regulations, for the most part, are consistent with the document's recommendation. The exception is that recycling will also be required for residentially-generated lamps (please see the response to comment NN-7, above).

Household hazardous waste collection programs will likely be an element of the universal waste collection infrastructure currently being developed.

NN-9 *Commenter incorporated as a comment a 14-page document that appears to be part of a catalog of Osram-Sylvania lamps. Various data is provided in seven "Product Information Bulletins," for seven lamp categories. Data includes information on lamp life, light output, wattage, size, color, etc. Products included are compact fluorescent lamps, high-pressure sodium lamps, and fluorescent tubes.*

DTSC has reviewed the submitted document and has determined that no regulatory change is necessary. The document illustrates the variety of lamps available on the market, many of which contain mercury. It shows that a lamp's mercury content is not a

reasonable basis for classifying it as hazardous or nonhazardous. As discussed in the ISOR, factors such as lamp life, size, color, and light output are not taken into account when concentration is the only basis for making a hazardous waste determination. (Please see the response to comment T-18, incorporated herein.)

Hazardous Waste Listing - M003 - Support - Phase-In Date

Californians Against Waste

F-4 *The commenter objects to extending the exemption for M003 out to 2006. This time period will provide a disincentive for manufacturers and other stakeholders to work together on legislation to establish a funding mechanism to ensure recycling.*

DTSC has reviewed this and other similar comments, and has decided to make the M003 listing effective in 2004, rather than 2006. (Please see the responses to comments HB-3 and HB-4, incorporated herein.) As discussed in the response to public hearing comment M-8, DTSC has formed a workgroup to develop and implement a collection infrastructure for universal wastes generated by households and Conditionally Exempt Small Quantity Universal Waste Generators. This workgroup is composed of representatives of DTSC and the CIWMB, and will be expanded to include other stakeholders in the future. The collection infrastructure the workgroup develops could recommend fees to fund recycling, but such fees would have to be imposed by the legislature, because neither DTSC nor CIWMB has authority to impose such fees.

General - Enforcement

F-8 *Incentives and enforcement are needed to promote source reduction, recycling and aggressively enforce existing/proposed disposal ban.*

<u>Incentives</u>

DTSC has reviewed this comment and determined that no regulatory change is necessary. The hazardous waste listings in section 66261.50 of these regulations promote source reduction and recycling:

- When mercury-free substitutes for listed products already exist, the proposal encourages their use, because mercury-free products are not subject to the hazardous waste listing;
- When mercury-free alternatives are not yet available, the proposal encourages their development because, these alternatives would not be subject to the hazardous waste listing; and
- When a listed mercury-containing waste is generated, the proposal encourages recycling over disposal by allowing simpler, less stringent management as universal waste.

See the responses to comments T-5, T-24, and several others, for further discussion.

Enforcement

By designating discarded mercury-added products as hazardous wastes, these regulations make these wastes subject to the enforcement provisions of California's Hazardous Waste Control Law. These provisions are found in article 8 of chapter 6.5 of the Health and Safety Code. Persons who fail to manage the new mercury-containing universal wastes pursuant to chapter 23 of title 22 of the California Code of Regulations, division 4.5, are also subject to enforcement provisions of article 8. Please see the responses to comments CC-4, DD-4, J-1, J-2, J-4, R-2, HH-2, FF-4, and BB-4.

Both DTSC and the local Certified Unified Program Agencies (CUPAs) have authority to enforce the requirements applicable to persons who manage the universal wastes added by these regulations, including the newly-listed wastes. One requirement for most of these new universal wastes is that they ultimately be recycled. Handlers who manage these wastes under the reduced requirements of chapter 23 and then fail to recycle them are in violation of chapter 23, and are subject to enforcement.

Clean Water Action

J-11 *Phase in listings immediately for large quantity generators.*

DTSC has reviewed this and other similar comments, and has decided to make the M003 listing effective in 2004, rather than 2006. Both small and large quantity handlers of universal waste will be required to manage low-mercury lamps pursuant to the requirements of chapter 23 of title 22 of the California Code of Regulations, division 4.5, including the requirement that universal waste lamps be recycled. Please see the responses to public hearing comments HB-3 and HB-4, incorporated herein.

Onyx Environmental Services

U-2 *There is no reason to delay the listing of lamps until 2006. Buyers of low mercury lamps already know that other brands are Hazardous Waste; the collection infrastructure and capacity already exist; all tubes should be Hazardous Waste within 6 months of regulation's adoption.*

DTSC has reviewed this and other similar comments. DTSC believes that making the M003 listing effective six months after the adoption of the regulations would not provide sufficient time for education and outreach on the change in the regulatory status of low-mercury fluorescent lamps. However, a one-year delay will provide adequate time for these activities. Therefore, DTSC has decided to make the M003 listing effective in 2004, rather than 2006. Please see the responses to public hearing comments HB-3 and HB-4.

Hazardous Waste Listing - M003 - Support - Authority to Adopt, Necessity

Paul Hastings, representing OSRAM Sylvania

NN-1 *DTSC has ample authority to adopt the proposed regulations, vis-à-vis lamps, pursuant to HSC sections 25140 and 25141.*

DTSC has reviewed this comment and agrees with the commenter's statement. Please see the response to T-25.

NN-2 *The priorities mandated by HSC 25179.4 support, rather than constrain, DTSC's proposal. The proposed rule creates an incentive for the elimination of the use of mercury: listing lamps as hazardous waste.*

DTSC has reviewed this comment and strongly agrees that the regulations are fully consistent with the priorities of section 25179.4 of the Health and Safety Code. Please see the response to comment T-24.

Hazardous Waste Listing - M003 - Opposition

California CUPA Forum Board/HW TAG

N-1 *The proposed zero tolerance designated for mercury in fluorescent bulbs is too inclusive and would remove the incentive for businesses to switch to low mercury bulbs.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. As shown in the tables in the appendix, more mercury would be released to the State's environment if all of the lamps sold had Philips' reduced mercury levels than would be released under the M003 listing.

Center for Environmentally Advanced Technologies

I-1 *DTSC should delay adoption of the M003 listing to ensure the final regulations include effective mandates for mercury source reduction, as well as recycling.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. The regulations contain strong incentives for both source reduction and recycling, as discussed in the responses to comments T-5, T-24, and (briefly) several others. Therefore, no delay is needed to incorporate these elements.

I-10 *At best the proposal will likely stop further reduction in the level of mercury in lamps, because the incentive will be gone. At worst, it may cause mercury use in lamps to rise.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. DTSC has seen no evidence to suggest that the M003 listing will lead the manufacturers of lamps that already exceed the TTLC to increase the mercury content of their lamps, nor that Philips, the manufacturer of the low-mercury lamps that pass the TTLC, will increase the mercury content of Alto lamps to the point that they will fail the TCLP for mercury. As discussed in the ISOR and in the responses to comments T-19 and NN-9, a lamp's mercury concentration is not the only factor that determines its environmental impact. The number of lamps used and the frequency of lamp replacement are also critically important in the equation. Furthermore, as the tables in the appendix show, even if low-mercury lamps disappear from the California market, the increase in lamp recycling that will result from the designation of all waste fluorescent lamps as hazardous wastes will lead to a greater reduction in the release of mercury than would occur if all manufacturers were to reduce the mercury content of their lamps to Philips' level and the recycling rate remained unchanged (please see the response to comment NN-7).

I-11 *Recycling can reduce mercury releases, but there must be very high recovery rates, infrastructure, and enforcement--provisions for which the proposal does not provide. The burden for the large investments that would be needed would fall on financially strained state and local governments. Without these investments, the regulations have little chance to achieve their goal.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. DTSC agrees that the lamp recycling rate must be maximized in order to minimize the release of mercury to the State's environment. Through a combination of efforts, DTSC expects to achieve a recycling rate of 70 percent or more (please see the responses to comments M-8 and NN-7). Under these regulations, the generators of waste lamps will bear the modest costs of lamp recycling. The main costs to State and local governments will not be for implementing these regulations, but for complying with them by recycling their own low-mercury lamps when discarded. (Please see the fiscal and economic analyses prepared for this rulemaking.) Any noncompliance will be subject to enforcement.

As for the infrastructure, lamp recycling industry representatives have stated in their comments that the infrastructure and/or capacity to recycle California's waste fluorescent lamps, including its low-mercury lamps, is already in place (please see the responses to comments C-9 and U-2); DTSC is working to develop a collection infrastructure for lamps and other universal wastes generated by households and CESQUWGs (see responses to comments F-4 and M-8).

As discussed in response to comments F-2 and X-7, these regulations do not address enforcement, because DTSC and the CUPAs already have ample authority to enforce their requirements, pursuant to article 8 of chapter 6.5 of the Health and Safety Code.

I-12 *In order to be successful, the regulations should rely, first, upon source reduction, by getting manufacturers to use the lowest-mercury lighting technology available. This places the burden on the manufacturer, rather than the state and public.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. As discussed in the response to comment I-11, above, the costs of recycling lamps will be borne primarily by the generators of lamps, not by State or local government agencies. The M003 listing, first and foremost, promotes source reduction by providing an incentive to manufacturers to develop new types of high-efficiency mercury-free lamps. Manufacturers who succeed in developing and marketing such lamps will enjoy a marketing advantage over manufacturers of mercury-added lamps that are classified as hazardous wastes and subject to universal waste management and recycling. (Please see the responses to comments T-8 and T-24.)

I-17 *Commenter and "the entire environmental community" agree that source reduction must be first priority.*

DTSC has reviewed this comment and has determined that no regulatory change is necessary. These regulations promote source reduction by providing lamp manufacturers with an incentive to develop and produce new types of high-efficiency mercury-free lamps. See the responses to comment I-12, above, and comments T-8 and T-24.

I-18 *Reducing the use of mercury in products is the best way to prevent its release, especially in fluorescent lights that are subject to breakage. Source reduction should be the centerpiece of the new regulations.*

DTSC has reviewed this comment and has determined that no regulatory change is necessary. DTSC agrees that reducing the mercury used in lamps will reduce the release of mercury when lamps break. This is one reason why these regulations will be more environmentally protective than retaining the use of the TTLC for classifying waste lamps. The M003 listing will provide an incentive to all lamp manufacturers to develop new types of mercury-free lamps that will not be classified as hazardous waste at end-of-life; the TTLC provides no incentive for manufacturers to reduce their lamps' mercury concentration below 20 milligrams per kilogram. Also note the Statement of Reasons for the adoption of the TTLC did not mention reducing the concentration of contaminants as a goal. The TTLC may have led one lamp manufacturer to reduce the mercury content of its lamps to approximately 4 milligrams, but 70 percent of lamps sold continue to exceed the TTLC. These lamps are classified as hazardous waste and subject to the management standards of the Universal Waste Rule. These standards require that lamps be managed "in a way that prevents releases of any universal waste or component of a universal waste to the environment." Low mercury lamps that are not currently classified as hazardous wastes are not subject to this requirement. The M003 listing will require all mercury-added lamps to be managed "in a way that prevents releases of any universal waste or component of a universal waste to the environment." Consequently, fewer lamps will break and less mercury will be released.

As discussed in the responses to comments T-8 and T-24, these regulations provide a stronger incentive for source reduction than the TTLC does; as such, source reduction is the "centerpiece" of these regulations.

I-19 *Since the adoption of the TTLC in 1991, mercury use in lamps has dramatically declined (67 percent since 1990, according to NEMA data). Philips has taken a leadership role in this reduction, marketing lamps to take advantage of the fact that they pass TTLC. The TTLC is good public policy because it has encouraged Philips to do this--to "head the pack."*

DTSC has reviewed this comment and determined that no regulatory change is necessary. DTSC's Final Mercury Report documents the reductions in the average mercury content of lamps over the past 20 years.[7] However, DTSC does not agree with the commenter's attribution of these reductions to the adoption of the TTLC. (Note that the TTLC was promulgated in 1984, not 1991 as the commenter states). In the ensuing years, only one manufacturer (Philips Lighting Company) has produced fluorescent lamps with mercury concentrations below the TTLC; the other major lamp manufacturers, which account for approximately 70 percent of the fluorescent lamp market, have not followed suit. Assuming that the objective of the TTLC was to motivate manufacturers to reduce the mercury concentration in their lamps below 20 milligrams per kilogram (which is not the case---nowhere in the FSOR for the TTLC are fluorescent lamps even mentioned), then it has not been particularly successful, notwithstanding the commenter's assertion that it is "good public policy." It does appear that all three major lamp manufacturers have reduced the mercury dose in their lamps in order to meet U.S. EPA's TCLP for mercury. A check of their Internet sites reveals that all three major lamp manufacturers produce lamps that are marketed as "TCLP passing" or "TCLP compliant." Please see the response to comment T-5.

I-2 *These regulations replace the use of the TTLC for lamps with the M003 listing. The listings' reliance on recycling but not source reduction could inadvertently lead to an increase in the use of mercury in California.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. DTSC has not abandoned the TTLC for non-mercury lamps and many other hazardous wastes. However, DTSC has decided to list all mercury containing lamps as hazardous. These regulations do not rely on recycling to the exclusion of source reduction. They promote source reduction by providing manufacturers with an incentive to develop and market new types of highly energy efficient lamps that use no mercury and promote recycling by requiring it as a condition of universal waste management. Please see the response to comment T-24 for further discussion of how the regulations promote source reduction and support the priorities of Health and Safety Code section 25179.4.

Listing mercury-added lamps as hazardous wastes in California will not cause lamp manufacturers to drastically increase the mercury content of their products, because doing so may make the lamps exceed the TCLP. Most States use the TCLP to classify waste lamps as hazardous or nonhazardous. Even if the mercury content of some fluorescent lamps were to be increased somewhat, lamps that contain more mercury may not have a

[7] DTSC Final Mercury Report, page 51.

greater adverse impact on the environment if the increased mercury results in longer life (and consequently, less frequent disposal). See the response to comment T-16 for further discussion of why these regulations will not result in large increases in the use of mercury in the manufacture of fluorescent lamps.

I-20 *Philips lamps have less than half the mercury of their competitors. They have offered to share their technology with competitors. The new regulations should spur these competitors to lower their mercury to Philips' level.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. Despite Philips' offer to share its technology with its competitors, and despite the fact that the TTLC for mercury has been in place for almost 20 years, Philips' competitors have opted not to reduce the mercury content of their lamps to match Philips' (see the response to comment T-6). As shown in the appendix, even if all lamps were manufactured with Philips' mercury levels, approximately 240 kilograms would be released to the State's environment through the nonhazardous management and disposal (assuming that the voluntary recycling rate would not fall below the current value of 20 percent).
These regulations do, in fact, "spur" all lamp manufacturers to develop and produce new types of high-efficiency; mercury-free lamps that will not be subject to hazardous waste classification or universal waste management. See response to comment T-5.

I-21 *If the other manufacturers lowered their mercury to Philips' levels, mercury use could be reduced by nearly 3000 lbs over ten years.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. DTSC does not know how the commenter derived the 3,000 lbs figure; if the commenter's assertion is correct it is, nevertheless, misleading. More meaningful than the possible reduction in mercury use by lamp manufacturers is the reduction in mercury releases to the State's environment that will result from these regulations approximately 4,686 lbs, based on the tables in the appendix. The tables in the appendix show that approximately 400 kilograms of mercury per year are currently released through the nonhazardous management and disposal of fluorescent lamps. These regulations and other ongoing efforts are expected to significantly increase the lamp recycling rate. Assuming that California's recycling rate rises to that of Minnesota—70 percent—and even if low-mercury lamps were to disappear from the market, the annual release of mercury would be reduced to approximately 187 kilograms. The annual reduction in the release of mercury would be approximately 213 kilograms; the reduction over ten years would be approximately 2,130 kilograms (4,686 lbs).

I-23 *Roux Associates' study concludes that source reduction is far more effective in reducing mercury releases than recycling. If Philips' competitors lowered their mercury content to equal Philips', California could reduce mercury releases by 43 percent, assuming no change in recycling rate. If mercury levels remained the same as today, recycling would have to increase by 57 percent to achieve the same reduction.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. By DTSC's calculations (see tables in the appendix), the amount of mercury released to California's environment would be reduced by approximately 39 percent if all lamp manufacturers were to reduce the mercury content of their lamps to Philips' levels. However, Philips' competitors are not likely to match Philips' mercury levels. In the more than 5 years since its Philips introduced its TTLC-passing lamps, no other manufacturer has been induced to make the mercury reductions that Philips has. DTSC sees no reason to expect that these manufacturers would make such reductions in the future if mercury-added lamps were to continue to be classified using the TTLC.

Through a combination of efforts, DTSC believes that a recycling rate of 70 percent or higher is attainable. These regulations, which will require recycling of all mercury-added lamps that are managed as universal wastes, are critical to achieving a high lamp recycling rate. Several other factors will help to increase lamp recycling:

- Public education and outreach by DTSC;
- The collection infrastructure for universal wastes generated by households and CESQGs, which is currently being developed; and
- The sunset of the current household and CESQUWG temporary disposal exemptions.

As the tables in the appendix show, even if Philips were to leave the California market or increase the mercury dose of its lamps to that of its competitors, significantly less mercury would be released in a scenario where 70 percent of lamps are recycled (approximately 186.53 kilograms) than in the scenario where all lamps are manufactured with Philips' mercury levels and the current 20 percent recycling rate remains unchanged (approximately 240.60 kilograms).

I-25 *Source reduction places the burden on manufacturers to invest in technology, whereas recycling burdens the state and consumers.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. These regulations promote both source reduction and recycling. They promote source reduction by encouraging manufacturers to develop new types of highly efficient mercury-free lamps; manufacturers will bear the costs of developing and producing these lamps, but these costs will be passed on to lamp purchasers. They promote recycling by requiring lamps that are managed under the reduced requirements of the Universal Waste Rule to be recycled. The costs of recycling will be borne by the generators of mercury-added lamp waste.

I-26 *DTSC should include rules and incentives to require all manufacturers to use the lowest-available mercury technology and credit and encourage further reductions.*

DTSC has reviewed this comment and determined that no regulatory change is needed. DTSC has no authority to regulate the formulation of products, or the technology used to manufacture products. However, DTSC can provide indirect incentives to manufacturers

to eliminate the use of hazardous substances such as mercury. These regulations provide such an incentive. Please see the response to comment T-24, incorporated herein.

I-29 *The regulations should be withdrawn and replaced with a program with source reduction as its centerpiece. The current proposal says "mercury content really doesn't matter." By promoting mercury reduction in lamps, California can be a positive model for the nation. The commenter offers to "work with the Department to achieve this aim."*

DTSC has reviewed this comment and determined that no regulatory change is needed. The listing of mercury-added lamp waste as hazardous waste will promote source reduction as the top priority waste management practice by promoting the development of high-efficiency, mercury-free lamps. Until such lamps are available, the regulations require mercury-added lamps that are managed under the Universal Waste Rule to be recycled. These regulations say, “low-mercury lamps that are disposed of in the nonhazardous trash are more harmful to the environment than higher mercury lamps that are recycled.”

I-3 *Source reduction will achieve the greatest benefit at the lowest cost. DTSC should take the time to develop a set of source reduction measures, with input from stakeholders.*

DTSC has reviewed this comment and determined that no regulatory change is needed. The listing of mercury-added lamp waste as hazardous waste will promote source reduction. Please see the response to comments I-25, I-29, and T-24, incorporated herein.

I-4 *2400 lbs. of mercury are contained in lamps sold annually in California. Mercury is highly toxic, due to its tendency to biomagnify in food fish. Thus, it is imperative to reduce the use of mercury as much as possible.*

DTSC has reviewed this comment and determined that no regulatory change is needed. DTSC does not have the authority to regulate the use of mercury in products.

DTSC calculates that approximately 1,156 lbs of mercury are contained in the lamps sold annually in California.[8] Nearly 200 lbs of this mercury is contained in low-mercury lamps. DTSC discusses the toxic and bioaccumulative nature of mercury in some detail in its Final

[8] Seventy-five million lamps are consumed per year in California [2.2 lamps per capita, per year (source ALMR) times 33.8 million people (source: US Census 2000)]. Thirty percent of these lamps are Philips Alto, which contain 4.01 milligrams of mercury each, on average (see tables in the appendix; source of data used in calculations: Roux Associates). The remaining 70 percent are other brands, and contain 8.29 milligrams of mercury each, on average (see tables in the appendix; source of data used in calculations: Roux Associates).

Philips Alto: 75 Million lamps x 30% x 4.01e-6 kilograms/lamp x 2.2 pounds/kilogram = **198.5 pounds**
Other Brands: 75 Million lamps x 70% x 8.29e-6 kilograms/lamp x 2.2 pounds/kilogram = **957.5 pounds**
Total: 198.5 lbs + 957.5 lbs = **1,156 lbs**

Mercury Report. Philips Lighting Company has stated that the TTLC for mercury induced it to develop low-mercury lamps. The argument that retaining the TTLC will lead to lower mercury levels in all lamps is weak, because the other major lamp manufacturers have not followed Philips' lead for more than five years after Philips TTLC-passing lamps were introduced. Even if one accepts the argument that the TTLC provides an incentive for all lamp manufacturers to lower the mercury concentration in their lamps below 20 parts-per-million (or below a revised TTLC of 15 parts-per-million), once they did so, manufacturers would have no incentive to make further reductions in mercury use.

These regulations provide manufacturers with an incentive to develop new types of high efficiency lamps that eliminate the use of mercury altogether. If one's goal is to reduce the use of mercury "as much as possible," reducing its use to zero would be the ultimate measure of success.

I-5 *Minimizing the levels of mercury in products prevents releases to the environment throughout the life cycle of the product (from "cradle to grave").*

DTSC has reviewed this comment and determined that no regulatory change is needed. As discussed in the response to comment I-4, these regulations encourage the eventual elimination of mercury from high efficiency lamps. As discussed in the response to comment I-29, until such mercury-free lamps are available, allowing low-mercury lamps to be disposed of in the nonhazardous trash will cause the release of more mercury than requiring them to be recycled as universal waste.

I-6 *Due to its emphasis on source reduction, California's regulatory program has resulted in dramatic reductions in the use of mercury in lamps--67 percent since 1990.*

DTSC has reviewed this comment and determined that no regulatory change is needed. DTSC noted the reductions in the use of mercury in lamps in its Final Mercury Report. All three major lamp manufacturers have lowered the mercury content of their products, in order to avoid having them classified as hazardous waste under the TCLP, when discarded. The TCLP is, and will continue to be, the basis for determining whether fluorescent lamps are hazardous wastes in most states. The M003 listing provides an incentive for the development of new mercury-free lamps that, if they eventually supplant mercury-added fluorescent lamps, will lead to a total elimination in the use of mercury in high-efficiency lamps.

I-7 *If all manufacturers adopted Philips' low-mercury lamp manufacturing technology, the State could reduce the mercury used in lamps by nearly 3000 pounds over 10 years.*

DTSC has reviewed this comment and determined that no regulatory change is needed. This comment is essentially the same as response to comment I-21, incorporated herein.

I-8 *The TTLC encourages consumers to buy low-mercury lamps, knowing they can*

throw them in the trash. This incentive, which the listing would replace, has driven the reduction in mercury used in lamps in California.

DTSC has reviewed this comment and determined that no regulatory change is needed. See the discussions in the ISOR, FSOR and the responses to comments I-10, NN-9, and T-18 for discussion of the problems with relying on a lamp's mercury concentration as the sole factor for assessing its environmental impact.

I-9 *The regulations don't replace the TTLC with other source reduction mandates or incentives.*

DTSC has reviewed this comment and determined that no regulatory change is needed. The responses to many comments illustrate the ways in which these regulations provide a stronger incentive for source reduction than does the current use of the TTLC for classification of lamps. See, in particular, the responses to comments T-18 and T-24, incorporated herein.

Mid-West Wholesale Lighting Corporation

PP-1 *We purchase Philips Alto lamps because they are the only ones that pass the TTLC.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. If the commenter chooses Alto lamps out of concern for the environment, DTSC presumes that it will continue to use them, whether or not they are hazardous wastes at end-of-life. If the commenter purchases Alto lamps because they can be disposed of as nonhazardous waste, the disposal of each low-mercury lamp causes the release of approximately four milligrams of mercury that would not be released if the lamps were recycled, as these regulations will require. If all of the approximately 22.5 million Alto lamps sold annually in California were managed and disposed of as nonhazardous waste, nearly 200 lbs of mercury would be released to the State's environment per year.[9]

PP-2 *Philips is essentially being punished for its innovation, and we are being penalized for being environmentally responsible.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. These regulations are being adopted to prevent the release of mercury into California's already contaminated environment, not to "punish" Philips. The calculations in the tables in the appendix illustrate that the classification of all mercury-added waste lamps will prevent the release of thousands of grams of mercury to the State's environment.

Hazardous Waste Listing - M003 - Opposition

Nielsen Merksamer, representing Philips Lighting

[9] See the footnote to the response to comment I-4 for the calculation.

T-1 *Philips Lighting Company strongly opposes the proposed regulations, insofar as the proposal lists all mercury-containing fluorescent lamps as hazardous.*

DTSC has reviewed this comment and has determined that no regulatory change is necessary to address it. The Initial Statement of Reasons and Final Statement of Reasons (ISOR and FSOR) for these regulations demonstrate their necessity. Briefly, DTSC has determined that all mercury-added waste lamps should be classified as hazardous waste and diverted from nonhazardous waste management and disposal. This determination is based on the following facts, which are documented in DTSC's Final Mercury Report:

- California's environment is heavily contaminated with mercury in some locations;
- Mercury is a persistent, bioaccumulative, and toxic substance;
- The high levels of mercury in some waters in California have led to the contamination of sport fish with methylmercury, a highly toxic organomercuric compound;
- The levels of methylmercury in some fish species in some of the State's waters are so high that the Office of Environmental Health Hazard Assessment has advised the public to limit or eliminate the consumption of these fish;
- The disposal of products with intentionally-added mercury contributes additional mercury to the State's already contaminated environment; and
- Of the mercury-added products that are managed and disposed as non-hazardous waste, lamps are one of the largest contributors of mercury to the State's environment;

Based on information and data submitted by the commenter regarding the volumes of lamps and the concentrations of mercury currently in lamps, DTSC determined, as summarized in the tables located in the appendix:

- The non-universal waste management and disposal[10] of mercury-added lamps results in the preventable release of several hundred kilograms of mercury to California's environment annually;
- Approximately 70 kilograms of mercury is released to the State's environment from the waste management and disposal of low-mercury lamps that are currently classified as nonhazardous waste.

Additionally, DTSC determined that sufficient capacity exists to recycle all mercury-containing fluorescent lamps and that classifying all mercury-containing waste lamps as hazardous waste will promote source reduction, product substitution and recycling.

[10] Non-universal waste management and disposal includes disposal of exempt household and small quantity generator fluorescent lamps disposed in municipal landfills; illegal disposal of fluorescent lamps into municipal landfills; and disposal of lamps into hazardous waste landfills.

Hazardous Waste Listing - M003 - Opposition – Consistency with Health and Safety Code section 25179.4

T-2: *The proposed listing contradicts Health and Safety Code section 25179.4, which requires DTSC to promote source reduction before recycling in new programs it develops and in carrying out Chapter 6.5.*

DTSC has reviewed this comment and has determined no regulatory change is necessary. The proposal is consistent with Health and Safety Code section 25179.4. The proposal promotes source reduction and recycling. It also discourages disposal of hazardous waste to land. The consistency of this proposal with section 25179.4, and the overall Health and Safety Code, is discussed below in detail.

For reasons explained in the Initial and Final Statement of Reasons and response to comment T-24, incorporated herein, DTSC has complied with Health and Safety Code section 25179.4. Regulating all mercury containing fluorescent tubes as hazardous waste will encourage further efforts to develop hazard-free alternatives. From this standpoint, the regulations will achieve the Legislature's primary objective of protecting public health and the environment while also promoting eventual source reduction.

The commenter misconstrues the meaning and application of Health and Safety Code section 25179.4 to limit classification (listing) of waste. Section 25179.4 states:

"In ... *carrying out this chapter*, the department shall promote the following waste management practices in order of priority:..."

(a) Reduction of hazardous waste generated.
(b) Recycling of hazardous waste.
(c)Treatment of hazardous waste.
(d) Land disposal of residuals from hazardous waste recycling and treatment.

To give meaning to the term "reduction of hazardous waste generated" in subdivision (a) of section 25179.4, DTSC must first carry out Chapter 6.5 of the Health and Safety Code and determine what is a hazardous waste as defined and governed by Health and Safety Code section 25117, 25140 and 25141.

Philips incorrectly interprets section 25179.4, subdivision (a) to override all other provisions, including mandates, of Chapter 6.5. Carried to its logical conclusion, this interpretation would require (or authorize) DTSC to de-regulate or fail to regulate, as hazardous waste, all waste that meets the hazardous waste listing criteria (see Health and Safety Code sections 25117, 25140 and 25141) merely because the product (*prior* to becoming a waste) is the least hazardous of the available options for its intended use. This interpretation would clearly undermine and run counter to the Legislature's primary objective in enacting Chapter 6.5-- protection of public health and the environment from potential hazards posed by the management of hazardous waste.

DTSC must first and foremost carry out the mandates of the chapter. To the extent there is flexibility to choose between various options and strategies and still meet the mandates, DTSC is required by section 25179.4 to promote all four listed practices, with source reduction as the preferred option, land disposal as the last resort, and recycling and treatment falling in-between.

Adoption of regulations that list fluorescent tubes and other mercury-containing waste as hazardous waste and specifying standards for their management are a fulfillment of the mandates found in sections 25140, 25141 and 25150, subdivisions (a) and (e). Health and Safety Code section 25179.4 does not allow DTSC to use any of the four listed priority practices to ignore or override any of the goals or mandates specifically spelled out in Chapter 6.5.

The overall intent of Chapter 6.5 of the Health and Safety Code is articulated in Health and Safety Code section 25101(a), which states:

" In order to protect the public health and the environment and to conserve natural resources, it is in the public interest to establish regulations and incentives which ensure that the generators of hazardous waste employ technology and management practices for the safe handling, treatment, recycling and destruction of their hazardous waste prior to disposal." (Emphasis added.)

Health and Safety Code section 25140 states:

The department shall prepare, adopt and may revise when appropriate, a listing of the wastes which are determined to be hazardous, and a listing of the wastes which are determined to be extremely hazardous... (Emphasis added.)

Health and Safety Code section 25141 states, in part:

(a) The department shall develop and adopt by regulation criteria and guidelines for the identification of hazardous wastes and extremely hazardous wastes.

...
...

(Emphasis added.)

Health and Safety Code section 25150 states, in part:

(a) The department shall adopt, and revise when appropriate, standards and regulations for the management of hazardous wastes to protect against hazardous to the public health, to domestic livestock, to wildlife, or the environment.

...
...

(e) The department shall adopt, and revise when appropriate, regulations for the recycling of hazardous waste to protect against hazards to the public health, domestic livestock, wildlife or the environment, and to encourage the best use of natural resources.

(Emphasis added.)

The commenter's interpretation of Health and Safety Code 25174.9 also contradicts section 25105, which states:

"No provision of this chapter shall limit the authority of any state or local agency in the enforcement or administration of any provision of law which it is specifically permitted or required to enforce or administer." (Emphasis added.)

Philips' interpretation of section 25179.4 would essentially nullify the various other provisions of Chapter 6.5 discussed above. Indeed, by treating subdivision (a) as a virtual absolute, rather than a preference, it nullifies subdivisions (b), (c) and (d) of section 25179.4. This would violate a long established cannon of statutory construction, which is that a statute should not be interpreted to bring out an absurd result. (*See*, *e.g*. Santa Clara County Local Transp. Authority v. Guardino (Howard Jarvis Taxpayers' Ass'n) (1995) 11 Cal.4th 220, 12 Cal.4th 344d, 45 Cal.Rptr.2d 207, 902 P.2d 225, as mod. on rehg. (Dec. 14, 1995); Re-Open Rambla, Inc. V. Board of Sup'rs (1995) 39 Cal.App.4th 1499, 46 Cal.Rptr.2d 822, review den. (Jan. 24, 1996))

Interpreting section 25179.4 to nullify, rather than harmonize with, other provisions of Chapter 6.5 would also violate the rule that whenever possible, potentially conflicting provisions should be reconciled in order to carry out the *overriding legislative purpose* as gleaned from a reading of the entire act. (*See, e.g.* Russell v. Stanford University Hosp. (1997) 15 Cal.4th 783, 64 Cal.Rptr.2d 97, 937 P.2d 640; Viking Ins. Co. V. State Farm Mut. Auto. Ins. Co. (1993) 17 Cal. App.4th 540, 21 Cal.Rptr.2d 590).

In conclusion, DTSC is authorized by sections 25140 to list mercury containing tubes as hazardous waste. Listing the tubes will create an incentive for manufacturers to develop mercury-free tubes (thus reducing the amount of hazardous waste generated). Allowing the listed tubes to be managed under the streamlined universal waste requirements (as opposed to full hazardous waste requirements) if the generator recycles will promote recycling. Both of these outcomes are consistent with Health and Safety Code section 25174.9. Philips' claim that section 25174.9 bans listing of lower mercury tubes is not supported by the plain language of the statute and conflicts with the Legislature's stated intent of Chapter 6.5 and the mandates within Chapter 6.5. This type of conflict contradicts well established rules of statutory construction. DTSC rejects the comment's assertion that the regulation package is not consistent with Health and Safety Code section 25174.9.

Hazardous Waste Listing - M003 - Opposition – Compliance with the Administrative

Procedure Act (APA)

T-3: *The proposed regulations do not meet some of the six APA standards for regulations.*

DTSC has reviewed this and other similar comments and responds to them in detail, below in response to comments T-22, T-23, T-24, T-25, T-26, T-26.1 and T-48 incorporated herein by reference.

Hazardous Waste Listing - M003 - Opposition – Consideration of Alternatives

T-4: *DTSC has failed to seriously review and consider fully authorized, consistent, and necessary alternatives to its deficient proposal*.

DTSC has reviewed this comment and has determined no regulatory change is necessary. DTSC has the authority to adopt regulations to list hazardous waste pursuant to Health and Safety Code section 25140. In addition, DTSC has determined that no alternative it considered or that has otherwise been identified and brought to the attention of DTSC would be more effective in carrying out the purpose for which the actions are proposed, or would be as effective as and less burdensome to affected private persons than the proposed regulations.

Hazardous Waste Listing - M003 – Opposition

T-5: *Philips' use of "source reduction manufacturing processes" is the main reason that the mercury content of lamps has been so dramatically reduced. DTSC's proposal will stop rewarding these processes. Without the TTLC, Philips would never have invested in source reduction technology and the amount of mercury in all manufacturers' lamps would not have been reduced as it has. All efforts to develop and deploy "technology to achieve greater source reduction" will "immediately halt" if DTSC makes the TTLC inapplicable to fluorescent lamps.*

DTSC has reviewed this comment and determined no regulatory change is necessary. The commenter claims the TTLC has caused reductions in the amount of mercury used in lamps and "investment in source reduction technology" would never have occurred if not for California's TTLC for mercury. DTSC believes the TCLP, rather than the TTLC, has led lamp manufacturers to lower the mercury content of their products, in order to avoid having them classified as hazardous waste under federal law.

Other evidence introduced by Philips also contradicts this comment. An attachment to the comment (a January 28, 2002 letter from Mr. Paul Walitscky, C.H.M.M., Manager of Environmental Affairs for Philips Lighting contradicts the commenter's assertions. On the first page of the letter, Mr. Walitsky states: "Philips' commitment to producing a product safer for the environment *predates* government regulation of mercury lamps." He further

states that Philips' ALTO lamps were introduced "years before" hazardous waste lamps were regulated under the federal Universal Waste Rule.

These regulations will not remove the incentive for manufacturers to develop and deploy "source reduction technology." The listing of discarded mercury-added lamps as hazardous wastes will, in fact, provided a stronger incentive for source reduction than does the current mercury TTLC. Manufacturers wishing to market lamps that will not be subject to universal waste management when they become wastes will have a new "bright line" of zero parts-per-million at which to aim. If the 20 parts-per-million TTLC has encouraged one lamp manufacturer to lower the mercury content of its products in order to escape hazardous waste classification, the new hazardous waste listing will provide a strong incentive for manufacturers to develop classes of energy efficient lamps that are entirely free of mercury. Development of new, mercury-free lamps ("product reformulation") is source reduction, as envisioned by the legislature in the Hazardous Waste Source Reduction and Management Review Act of 1989 (Health and Saf. Code, section 25244.14(e)(2)(D).

DTSC's support for, and encouragement of, source reduction remains strong. Pursuant to the Hazardous Waste Source Reduction and Management Review Act of 1989, any hazardous waste generator who routinely generates more than 12,000 kilograms (26,400 pounds) of hazardous waste during a calendar year is, and will continue to be, required to prepare and implement a source reduction plan, which includes selection of source reduction measures and setting of numerical source reduction goals. The proposed regulations in no way affect these requirements.

Lamps are consumable products that have a finite life. When lamps ultimately become waste, the amount of mercury used in their manufacture currently determines whether they are classified as hazardous or nonhazardous waste. These regulations will designate low-mercury lamps that do not exceed the TTLC for mercury as hazardous wastes. The regulations will not change the volume of waste lamps generated – only how lamps are classified and managed. The proposal promotes research and development on high efficiency mercury-free lamps; the eventual development and marketing of such lamps will yield a real reduction in the generation of hazardous waste.

DTSC acknowledges that the reduced use of mercury in lamps by the major lamp manufacturers has reduced the amount of mercury that enters the environment when lamps are managed and disposed of as nonhazardous waste[11]. All three major lamp manufacturers have stated that they have made large investments in manufacturing technology, which have allowed them to achieve these reductions. However, as documented in DTSC's Final Mercury Report, in many areas of the State, California's environment is unacceptably contaminated with mercury. Allowing fluorescent lamps,

[11] The majority of the fluorescent lamps not being recycled as universal waste are disposed to a municipal landfill either (1) under the temporary disposal exemptions for households and small quantity generators or (2) illegally disposed. However, DTSC does not have detailed information that would allow definitive conclusions.

even those with reduced mercury levels, to be managed and disposed of as nonhazardous waste will allow the preventable release of thousands of grams of mercury to the State's environment.

The fact that the majority (approximately 80 percent) of fluorescent lamps are disposed of in the nonhazardous waste stream highlights the inadequacy of the current regulatory scheme at reducing the preventable release of mercury from this source. A multifaceted strategy is needed if the amount of mercury released to the environment through the disposal of lamps is to be significantly reduced. The listing of all mercury-added lamps as hazardous wastes is one element of such a strategy. The other elements include the sunset of the existing disposal exemptions for lamps generated by households and very small quantity generators, the requirement that all universal waste lamps be recycled, the establishment of a lamp collection infrastructure and public education.

Hazardous Waste Listing - M003 – Opposition

T-6: *Philips' manufacturing process that enables its lamps to pass the TTLC "is neither proprietary nor secret." Manufacturers in Europe employ similar technology. "Has the Department made any effort to ascertain the reason for this dissimilar behavior?"*

DTSC has reviewed this comment and has determined that no regulatory change is necessary. As discussed above, all of the major lamp manufacturers have stated that they have invested in manufacturing technology to reduce the amount of mercury used in their lamps. While DTSC acknowledges that these reductions are environmentally beneficial, the final Mercury Report and response to comment T-5 above document that California still has a very serious mercury contamination problem. Also, DTSC has no authority to regulate the use of hazardous materials in manufacturing processes. Lamps fall under DTSC's regulatory purview only when they become wastes. This comment is beyond the scope of the rulemaking.

Hazardous Waste Listing - M003 - Opposition - Suggested Alternative

T-8: *If the TTLC is kept in place for lamps, and is lowered to 15 parts-per-million, "99% of our lamps will pass the revised standard."*

T-27*: Instead of the M003 listing, the TTLC for mercury should be lowered from 20 to 15 ppm.*

The commenter makes this comment to support an alternative proposal for the classification of mercury-added lamps. Rather than designating all lamps with added mercury as hazardous wastes, the commenter proposes to lower the TTLC for mercury from the current value of 20 parts per million to 15 parts per million as an alternative the M003 listing. DTSC considered and discussed this alternative in the ISOR. DTSC has determined that this alternative would not be as effective at promoting reductions in the amount of mercury entering the environment, the use of mercury-free alternatives to

mercury-added products, or recycling. Development of mercury-free alternatives, which these regulations promote, will yield a real reduction in the amount of hazardous waste generated.

Data included in the commenter's submittal indicate that TTLC-passing Philips ALTO lamps have a 30 percent market share. The other lamp manufacturers, taken together, represent 70 percent of the fluorescent lamp market. Because Philips ALTO lamps are the only TTLC-passing fluorescent lamps, these percentages show clearly that most lamps currently sold do not meet even the current TTLC for mercury, 20 milligrams per kilogram. DTSC does not share the commenter's confidence that lowering the TTLC for mercury by 25 percent will induce the manufacturers of higher-mercury lamps to further lower their products' mercury content. If these manufacturers will not (or cannot) reduce their use of mercury to meet the current 20 parts-per-million threshold, there is little reason to expect that they would do so if the threshold were lowered to 15 parts-per-million.
DTSC is not discarding the TTLC. The commenter's suggestion does not take into consideration its impact on generators of waste streams other than discarded lamps. Lamps represent a very small fraction of the total mass of waste generated annually in California. Lowering the TTLC for mercury would affect many other waste streams, some of them very large. These wastes would be classified as hazardous or nonhazardous based on the lowered TTLC value and many would exceed it. These wastes (including soils, sludges, ash, etc.) would become subject to full hazardous waste regulation.

Regulating these diverse waste streams could tax the State's hazardous waste transportation, treatment, recycling, and disposal capacity without supporting the three objectives of these regulations: encouraging pollution prevention through the use of mercury-free products; encouraging development of products that use alternatives to mercury; and encouraging mercury recycling.

The regulations' intent is to curtail the preventable release of mercury during the management and disposal of products that meet one or both of the two following criteria: they can be recycled and/or have mercury-free alternatives available. Classifying high-volume, low mercury waste streams other than the products identified by DTSC as meeting these criteria would not support the regulations' objectives.

If a lower TTLC value applicable only to waste lamps were established, the inclusion of other low-mercury wastes that are not products, have no alternatives, and cannot be recycled would be avoided. However, even if this alternative proposal were modified to apply only to lamps, preventable releases of mercury would occur (70 kilograms according to the commenter's data. See the response to comment T1). DTSC's conclusion that the alternative would be less effective at promoting the goals of this rulemaking than the proposed hazardous waste listing would remain unchanged.

Lowering the TTLC would not require lamp manufacturers to lower the total concentration of mercury in their lamps. Listing all mercury-containing lamps and allowing them to be managed as universal waste only if recycled will promote manufacturers to develop

mercury-free alternatives and increased recycling. Because recycling technologies and capacity already exists, the proposed approach better promotes recycling, thus reducing the amount of mercury entering the environment much more effectively than simply lowering the TTLC.

Hazardous Waste Listing - M003 - Opposition

T-9: *DTSC relies exclusively on recycling of lamps to reduce mercury releases. This reliance contradicts two of three stated objectives of the regulations: encouraging the use of mercury-free products, use of mercury alternatives, and recycling.*

DTSC disagrees with the commenter's assertion that the proposal does not promote its stated objectives. In the case of lamps, the proposal promotes recycling (objective 3) by requiring it for lamps that are managed as universal wastes. The somewhat higher cost and compliance with universal waste management standards provide an incentive for lamp manufacturers to develop new types of high efficiency, mercury-free lamps (objective 2). If and when they are developed, the fact that such lamps would not be subject to the proposal's hazardous waste listing will motivate the users of electric lighting to purchase the newly developed mercury-free lamps (objective 1).

DTSC believes that the regulatory approach contained in this proposal strikes a balance that will promote proper management and recycling of waste fluorescent lamps while preserving the incentive to use energy efficient forms of lighting. For some of the listed wastes, mercury-free substitutes that meet all of the performance specifications of their mercury-containing counterparts are already available (e.g., mercury-free switches). By contrast, while mercury-free lamps are currently available, they are not equivalent in performance to fluorescent lamps. These regulations will provide an incentive that does not now exist for the development of new types of mercury-free lamps that meet all of the requirements of users of fluorescent lamps.

Hazardous Waste Listing - M003 - Opposition

T-9.1: *The Department proposes to exchange quantifiable reduction in mercury use for the unsupported promise of a 'robust' recycling marketplace.*

The adequacy of the lamp recycling marketplace is not an "unsupported promise," but a reasonable expectation based on available information and the ongoing efforts of DTSC and other State agencies. As discussed earlier, the regulations do not replace or de-emphasize reductions in the use of mercury in lamps in favor of recycling. The proposal promotes source reduction above recycling (as discussed in response to comment T-5), but also promotes recycling above disposal; both will reduce releases of mercury into the environment.

The classification of all mercury-added lamps as hazardous wastes, in conjunction with the

requirement that hazardous waste lamps be recycled in order to be eligible for management as universal waste will provide a powerful incentive for recycling of waste lamps, rather than disposing of them. This incentive for recycling will, in turn, lead to an increase in demand for the already available lamp recycling services. The Universal Waste Rule provides handlers with flexibility in managing hazardous waste lamps, and lowers barriers to the growth of the existing lamp collection and recycling infrastructures. DTSC believes that these infrastructures will expand and new businesses will be established in response to the increased demand for recycling services, such as collection, storage, and transportation, which will result from the adoption of these regulations.

Representatives of the lamp recycling industry have stated that their industry already has the capacity to recycle all fluorescent lamps generated in California[12,13]. Because the industry's capacity is already ample, larger-quantity handlers are already required to recycle universal waste lamps. The collection infrastructure for lamps produced by households and very-small quantity generators still needs to be developed, to feed the existing recycling infrastructure. For this reason, under the Universal Waste Rule, households and Conditionally Exempt Small Quantity Universal Waste Generators (CESQUWGs) are temporarily exempt from the requirement to recycle their hazardous waste lamps (including the low mercury lamps affected by these regulations). During the period of time these temporary exemptions are in effect, DTSC is working with other State agencies (notably, the California Integrated Waste Management Board) to develop and implement the needed collection infrastructure for smaller generators.

Hazardous Waste Listing - M003 - Opposition

T-10 *The proposal does nothing to promote 'nonmercury-containing products' or 'the development of products that use mercury alternatives.' The objectives could be met if the Department promoted the use of low-level lamps and discouraged the used of needlessly high-level lamps.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. The proposed listing of all mercury-added lamps as hazardous wastes promotes the development of mercury-free lamps; the existing protocol for classifying waste lamps does not. The response to comments T-8 and T-24, incorporated herein, demonstrate how the proposal promotes mercury-free alternatives more effectively and better meets the objectives.

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[12] ". . . The infrastructure is in place to recycle all lamps that can be diverted from landfills." (Source: November 1, 2001 letter from Mr. Paul Abernathy, Executive Director of the Association of Lighting and Mercury Recyclers to Ms. Peggy Harris, Chief of the State Regulatory Programs Division of the Department of Toxic Substances Control.)

[13] ". . . Current technology and capacity exist to recover the mercury from [low level mercury lamps]." (Source: September 27, 2002, letter from Mr. Kevin D. McGrath, Senior Manager of Environmental Affairs, Onyx Environmental Service, L.L.C., to Ms. Joan Ferber, Regulations Coordinator, Environmental Analysis and Regulations Section of the Department of Toxic Substances Control.)

T-11 *The State has failed to enforce the Metallic Discards Act (Chapter 849, Statutes of 1991). The commenter is aware of no enforcement actions pertaining to this program. "On what basis does the Department believe its proposed recycling program will flourish when a similar program has foundered?"*

DTSC has reviewed this comment and has determined that it is not germane to the rulemaking. DTSC and the CUPAs have extensive, effective, inspection and enforcement programs. Hazardous waste generators are inspected periodically, primarily by the CUPAs in whose jurisdiction they operate. The CUPAs and DTSC also conduct inspections in response to complaints.

The commenter has identified the Metallic Discards Act recycling requirement as a program that has floundered. It should be noted, however, that there is an important difference between the Metallic Discards Act and these regulations: the authority for enforcement. The requirement to remove mercury switches (and other "materials that require special handling") from major appliances is found in section 42175 of the Public Resource Code, which was, until recently, enforced by the California Integrated Waste Management board and its Local Enforcement Agencies. Only when a mercury switch (or other hazardous material) was removed from a major appliance would it become a hazardous waste and the person removing the switch would become a hazardous waste generator. Only then did the person enter the enforcement jurisdiction of the CUPAs and DTSC. Under these regulations, the listed wastes are hazardous wastes; failure to manage them in accordance with applicable requirements (either as universal waste, pursuant to chapter 23 of division 4.5 of Title 22 of the California Code of Regulations or the full hazardous waste management requirements) would subject persons generating and managing them to enforcement by DTSC or the CUPAs.

T-12 *The Legislature has twice rejected the proposal the Department now advances: AB 751 (Jackson) in 2001 and AB 712 (Migden) in 2002. "It is inconceivable that the Department would adopt a policy that has been twice discarded by the Legislature."*

DTSC has reviewed this comment and determined that it is not germane to this rulemaking. Regulations are governed by the Administrative Procedure Act and dictate the rulemaking adoption process. Bills introduced by members of the Legislature follow a different process to become law. DTSC has demonstrated that the regulations meet the requirements of the Administrative Procedure Act. The responses to comments T-19, T-22, T-23, T-24, T-25, T-26 and T-26.1 provide some details regarding the Administrative Procedure Act and these regulations.

The commenter has mischaracterized these two bills. The regulations, as they affect fluorescent lamps, are very similar to AB 751, but distinctly different from AB 712. The commenter may be suggesting that M003 is not consistent with the intent of the Legislature. However, DTSC must base its regulations on the Legislature's intent as expressed in legislation that is successful; it would be unreasonable to attempt to ascertain the Legislature's intent from bills that were never fully voted on, such as the ones

submitted by the commenter. Furthermore, the legislature's actions on bills, which address similar subjects (lamps), but differ substantially in content and requirements (e.g., establishment of fees), are not relevant to DTSC's decisions in this rulemaking. The M003 listing is being adopted under the authority provided by Health and Safety Code section 25140, which clearly does reflect the intent of the Legislature.

Hazardous Waste Listing - M003 - Opposition - Suggested Alternative

T-13: *Keeping the TTLC for lamps will prevent more mercury from being released than will requiring all lamps to be recycled, particularly if the TTLC is reduced to 15 ppm.*

DTSC has calculated the amount of mercury that would be released to the State's environment under various scenarios, including the one proposed by the commenter. Because they pass the current TTLC of 20 milligrams per kilogram, the concentration of mercury in the Philips ALTO lamps was used as a starting point in DTSC's calculation of the hypothetical impact of reducing the mercury content of all fluorescent lamps to meet a revised TTLC of 15 milligrams per kilogram. These calculations show that even under the optimistic assumption that all lamp manufacturers would reduce the amount of mercury to 75 percent of the current average dose used in Philips ALTO lamps, approximately 180 kilograms of mercury would nevertheless be released to the State's environment (assuming that the current 20 percent lamp recycling rate remained unchanged). DTSC's calculations are summarized in the tables in the appendix. Please note there is no evidence that all manufacturers would actually lower mercury content to 15 ppm.

Additionally, the existing TTLCs were established based on applying risk assessment models available at the time, not on hazardous waste objectives. There is no scientific risk-based assessment for reduction of the TTLC to 15 parts per million, which would be subject to an external scientific peer review in accordance to Health and Safety Code section 57004. Also see response to comment T-8.

T-14: *TTLC is a foolproof test upon which customers rely to distinguish truly low-level mercury lamps from needlessly high-level mercury lamps.*

As discussed earlier, the proposed regulations do not preclude lamp manufacturers from referring to the mercury content of their products in their marketing programs. See the response to comment T-20, incorporated herein. The total amount of mercury released to the environment by "low-level" lamps is not low.

T-15 *DTSC's first two objectives (pollution prevention through use of nonmercury products and development of products that use mercury alternatives) are inappropriate for lamps. Source reduction should come first.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. The proposed listing of all mercury-added lamps as hazardous wastes promotes source reduction through the development of mercury-free lamps; the TTLC does not. The

response to comments T-8 and T-24, incorporated herein, discuss in some detail the ways in which the proposal supports the objective of the regulations.

Hazardous Waste Listing - M003 - Opposition - Suggested Alternative

T-16: *Without a TTLC-like threshold, lamps manufacturers will compete based on characteristics such as longevity; they will produce longer-lived lamps by adding more mercury. "Thereafter, one can hope the extremely high-level mercury lamp may be recycled."*

DTSC has concluded that listing mercury-added lamps as hazardous waste in California will not cause lamp manufacturers to drastically increase the mercury content of their products, because doing so would make the lamps exceed the TCLP regulatory limit and become a federally regulated universal waste in all states. All three major manufacturers produce lamps that pass the TCLP and most States use the TCLP to classify waste lamps as hazardous or nonhazardous. It would not be cost effective for manufacturers to produce higher mercury lamps for sale only in California, when a large majority of fluorescent lamps are sold in other states. Furthermore, even if the mercury content of some fluorescent lamps were to increase, lamps that contain more mercury would not necessarily have a greater adverse impact on the environment if the increased mercury content is offset by increased lamp life and, consequently, less frequent disposal. DTSC will not simply “hope” for recycling. The proposed regulations will require recycling if waste lamps are to be managed under the reduced requirements of the Universal Waste Rule. Persons who fail to properly recycle universal waste lamps will be subject to enforcement by their CUPA or DTSC.

Hazardous Waste Listing - M003 - Opposition

T-17 *DTSC's proposal has led lamp manufacturers to claim that the TTLC is being discarded. "How would the marketplace and other manufacturers respond if the Department proposed a reduction in the TTLC? Would such an announcement induce other manufacturers to modernize their manufacturing processes? The Department must seriously investigate this alternative."*

DTSC has no knowledge of such claims. Generators are responsible for classifying their waste and managing it properly. As mentioned earlier in the response to T-8, incorporated herein, the TTLC is not being “discarded”—only its use for classification of four categories of discarded mercury-containing products is being eliminated. As discussed in response to comment T-5, classification of mercury-added lamps as hazardous wastes will serve as an incentive for the development of new types of very efficient mercury-free lamps; by contrast, DTSC has no reason to conclude that lowering the TTLC would induce the manufacturers of lamps that already exceed the existing TTLC of 20 milligrams per kilogram to further lower the mercury content of their lamps. Notwithstanding the commenter’s presumption that they have not yet done so, these manufactures claim that

they have invested substantial sums of money to modernize their production processes, and that further reductions in their lamps' mercury dose would compromise their performance and reliability.

In the original August 16, 2002, 45-Day Public Notice, DTSC considered the alternative of lowering the TTLC for mercury. DTSC concluded that this option would be less effective at promoting the objectives of the regulations than would the designation of discarded mercury-added products as hazardous waste. See the responses to comments T-8 and T-27 for a more detailed discussion.

T-18 *The TTLC has induced Philips "to produce a remarkably low-level lamp." Lowering the TTLC for mercury would induce Philips to lower the mercury level in its lamps even more. "On the basis of this evidence, the Department must continue to give top priority to source reduction. It has no authority to abandon a demonstrably successful program."*

As discussed in the ISOR, mercury concentration does not, by itself, determine the environmental impact of the mercury in a fluorescent lamp. Other variables (e.g., the lamp's life, fragility, and light output) affect the number of lamps used, the likelihood of breakage, and the frequency of disposal. The most environmentally protective approach is to prohibit the non-hazardous waste management and disposal of all mercury-added lamps, as this proposal does. To date, the TTLC has not induced the manufacturers of most lamps sold in California to make the mercury reductions that Philips has. Listing all mercury-added lamps as hazardous waste will promote the development of new types of highly efficient mercury-free lamps. This will be an incentive for source reduction, as envisioned by the Legislature.

Contrary to the commenter's assertion, the listing of mercury-added lamp waste as hazardous waste will promote—not abandon—source reduction as the top priority waste management practice. As discussed in more detail in the responses to comments T-5 and T-8, incorporated herein, the listing of mercury-added lamps provides an incentive for the development of mercury-free high efficiency lamps that does not exist under the existing system, while reducing the release of mercury into the environment.

T-19 *[The ISOR states that "DTSC believes a lamp's mercury content is not a reasonable basis for classifying it as hazardous or nonhazardous." Reasons given include that the weight of the lamp's non-mercury components determine whether or not it exceeds mercury concentration thresholds; and that other factors, such as differences in lamp life and light output are not taken into account when concentration is the only basis for making a hazardous waste determination.] This discussion is 'extraordinarily cursory' and "a modest adjustment to the TTLC would address this purported problem." The rationale for listing discarded lamps as hazardous wastes given in the ISOR is, "as a matter of law, . . wholly inadequate . . .."*

DTSC has reviewed this comment and determined that no regulatory change is necessary.

The discussion in the ISOR clearly and succinctly describes DTSC's rationale for replacing the existing concentration-based system for classifying discarded mercury-added lamps with a listing that designates all such lamps as hazardous wastes. The commenter has not provided information that DTSC's conclusion to list mercury-added lamps rather than using a mercury concentration threshold is an inadequate basis for classifying discarded mercury-added lamps as hazardous or nonhazardous. As to the adequacy of the ISOR: it complies with the requirements of subdivision (b), paragraph (1) of Government Code section 11346.2, in that it states "…the specific purpose of each adoption … and the rationale for the determination … that each adoption … is reasonably necessary to carry out the purpose for which it is proposed." Pursuant to subsection (b), paragraph (3) of section 11346.2, "reasonable alternatives to the regulation" (including the one favored by the commenter) and DTSC's "reasons for rejecting those alternatives," are also adequately discussed in the ISOR.

T-20 *Ending the use of the TTLC for lamps will create confusion. The TTLC has precise and growing meaning in the marketplace and is achieving quantifiable results.*

DTSC has reviewed this comment and has determined that no regulatory change is necessary to address it. DTSC disagrees with the commenter's assertion that the listing of discarded mercury-added lamps as hazardous waste will create confusion. In fact, for determining the management requirements that apply to lamps, the current situation is more confusing than the proposal. Currently, some of the lamps on the market are classified as hazardous wastes when they reach end-of-life, while others are not. Some generators (non-household generators of more than 100 kilograms of hazardous waste per month) are required to manage and recycle hazardous waste lamps as universal wastes, others (households and Conditionally Exempt Small Quantity Universal Waste Generators) are not. Under the proposal, the current confusion will be removed: management requirements for all mercury-added lamps will in the long term be the same.

Regarding the meaning of the TTLC in the marketplace: although all waste low-mercury lamps will be classified as hazardous waste under the proposal, lamp manufacturers will not be precluded from using the mercury content of their lamps for marketing purposes. Manufacturers of low mercury lamps could continue to market their lamps as such, provided they make clear that lower mercury levels do not exempt their lamps from the applicable universal waste management and recycling requirements.

The commenter does not elaborate on what "quantifiable results" mean within the context of the TTLC. DTSC assumes that the "quantifiable results" to which the commenter refers are increased sales of TTLC-passing Philips lamps. To the extent that some customers purchase these low-mercury lamps in order to avoid managing and recycling them as universal wastes, these "results" are of dubious environmental benefit, as compared with DTSC's proposal, which would prohibit the disposal of any mercury-added lamp as of February 9, 2006. DTSC has calculated that even if the mercury content of all of the lamps sold in California were reduced to meet the TTLC, approximately 240 kilograms would be released to the State's environment through the management and disposal of

lamps (assuming the current lamp recycling rate of 20 percent remained constant).[14]

T-21 *Suggestions that Philips lamps have shorter lives due to their lower mercury content is false, refer to attached laboratory test data. "Allegations to the contrary are false and should not be directly or indirectly incorporated into the record, absent independent verification. The record contains no evidence that any such effort has* been made."

DTSC has reviewed this comment and determined that no regulatory change is necessary. DTSC has made no allegations regarding the longevity of Philips lamps. Any such assertions made by commenters on the proposal must be included in the record, pursuant to subdivision (b), paragraph (6) of Government Code section 11347.3.

Hazardous Waste Listing - M003 - Opposition – Necessity Standard

T-22: *The proposed regulations don't meet the necessity standard, vis-à-vis Health and Safety Code section 25179.4. Rather than being necessary to "effectuate the purpose" of this section, they contravene it.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. Pursuant to Government Code section 11349, to demonstrate "necessity," "the record of the rulemaking proceeding demonstrates by substantial evidence the need for a regulation to effectuate the purpose of the statute … that the regulation implements, interprets, or makes specific, taking into account the totality of the record. For purposes of this standard, evidence includes, but is not limited to, facts, studies, and expert opinion." The commenter asserts that the listing of mercury-added lamps contradicts Health and Safety Code section 25179.4, and therefore cannot effectuate the purpose of that statute. However, as shown in the responses to earlier comments (refer to response to comment T-5, incorporated herein), the proposal to list mercury-added lamps as hazardous wastes promotes, first and foremost, source reduction, and is therefore fully consistent with the priorities in section 25179.4. The proposal is also consistent with section 25179.4 for the reasons stated in response to comment T-2, incorporated herein.

The listing of mercury-added lamps also meets the necessity standard for Health and Safety Code section 25140. The listing implements Health and Safety Code section 25140, which requires DTSC to prepare and adopt a "listing of the wastes which are determined to be hazardous…." Section 25140 also authorizes DTSC to revise this listing "when appropriate." When identifying wastes to be listed pursuant to section 25140, DTSC is required to consider "the immediate or persistent toxic effects to man and wildlife and the resistance to natural degradation or detoxification of the wastes." DTSC's Mercury Report documents mercury's toxicity and persistence in the environment, and discusses the State's mercury contamination problems. The "facts, studies, and expert opinion" cited in the report fully satisfy the Administrative Procedure Act's "necessity" standard.

[14] See the tables in the appendix for calculations.

T-23: *The proposed regulations don't meet the authority standard. DTSC doesn't have the authority to replace the classification of lamps pursuant to TTLC, which supports Health and Safety Code section 25179.4, with a hazardous waste listing that opposes section 25179.4.*

DTSC has reviewed this comment and has determined that no regulatory change is necessary. First, Philips has not produced evidence that classification of lamps pursuant to the TTLC supports section 25179.4. Second, as discussed in response to comments T-2 and T-22, Health and Safety Code section 25140 requires DTSC to list wastes as hazardous wastes and authorizes DTSC to revise the list as appropriate. As discussed in the response to comment T-24, the proposed listing of mercury-added lamps as hazardous wastes is consistent with and promotes Health and Safety Code section 25179.4, rather than contradicts it. As discussed in response to comment T-2, even if the proposal did not promote source reduction, section 25179.4 does not nullify DTSC's obligations to carry out

other mandates within Chapter 6.5 of the Health and Safety Code, such as the mandate to list waste in section 25140.

Hazardous Waste Listing - M003 - Opposition – Consistency Standard

T-24: *The proposed M003 listing doesn't meet the APA's consistency standard, because it conflicts with Health and Safety Code section 25179.4 by promoting recycling over source reduction.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. DTSC disagrees with the comment. The listing of mercury-added lamps as hazardous waste is, in fact, completely consistent with section 25179.4's hierarchy of waste management practices.

Designating all discarded mercury-added lamps as hazardous waste will provide a stronger incentive for source reduction (reduction in generation of hazardous waste) than exists currently under the TTLC. Philips Lighting Company has stated that it has lowered the mercury content of it fluorescent lamps in direct response to California's TTLC for mercury. Other statements by Philips contradict this claim (See response to comment T-5). However, the other two major lamp manufacturers have failed to make similar reductions. The listing of all mercury-added waste lamps as hazardous waste will provide an incentive to all lamp manufacturers to develop and produce mercury-free high efficiency lamps as alternatives to mercury-added fluorescent lamps.[15] Provided mercury-free high efficiency lamps do not meet any other hazardous waste criteria, such lamps would not be hazardous wastes when discarded, and therefore would not be subject to hazardous waste or universal waste management requirements. By developing such lamps, manufacturers

[15] DTSC is aware of at least one company that is working to develop a mercury-free, energy efficient lamp: a Swedish company called LightLab AB (information available at URL: http://www.lightlab.se/index.htm).

would gain a valuable marketing advantage with both environmentally conscious consumers and those who simply wish to avoid having to comply with hazardous or universal waste management requirements.

After source reduction, recycling is the waste management practice that would be promoted next by the listing of mercury-added lamps as hazardous wastes. Handlers of waste mercury-added lamps would be required to recycle them in order to take advantage of the reduced requirements of universal waste management, including longer waste accumulation time limits, exemption from use of a registered hazardous waste hauler and hazardous waste manifest, and offsite consolidation of waste without a hazardous waste facility permit. Persons wishing to dispose of mercury-added lamps as hazardous waste rather than recycling them would be subject to the more stringent and more numerous requirements for fully regulated hazardous wastes—a strong incentive to recycle waste lamps rather than dispose of them.

DTSC's objectives for these regulations are fully consistent with Health and Safety Code section 25179.4, and all of the following objectives are met by the proposal:

- When mercury-free substitutes for listed products already exist, the proposal encourages their use, because mercury-free products are not subject to the hazardous waste listing; [reduction in generation of hazardous waste]
- When mercury-free alternatives are not yet available, the proposal encourages their development because, these alternatives would not be subject to the hazardous waste listing; [reduction in generation of hazardous waste] and
- When a listed mercury-containing waste is generated, the proposal encourages recycling over disposal by allowing simpler, less stringent management as universal waste.[recycling]

Hazardous Waste Listing - M003 - Opposition - Authority to Adopt

T-25: *The proposal conflicts with subdivision (f) of section 25150.6 of the Health and Safety Code, which gives DTSC the authority to modify waste management practices for 'hazardous waste lamps.' "Clearly, the statutory reference embraces (and codifies) the distinction between hazardous and nonhazardous lamps. The Department has no authority to subsequently erase the distinction."*

DTSC has reviewed this comment and determined that no regulatory change is necessary. Health and Safety Code section 25150.6 does not preclude DTSC from adopting additional lists of hazardous waste under the authority of section 25140. Health and Safety Code section 25140 requires DTSC to adopt "a listing of the wastes which are determined to be hazardous . . ." and authorizes DTSC to revise the listing "when appropriate."

Subsection (f) of section 25150.6 authorizes DTSC to exempt the management of certain specific hazardous wastes from the requirements of chapter 6.5 of the Health and Safety Code and instead regulate the management activity under the universal waste

management standards in Chapter 23 of Division 4.5 of Title 22 of the California Code of Regulations. DTSC may regulate as universal waste an eligible waste that is hazardous because it appears in a listing adopted pursuant to section 25140. In this case, low-mercury waste lamps will be identified as hazardous wastes in a listing adopted pursuant to section 25140 and, because they will be classified as hazardous wastes, these lamps will be eligible to be classified and managed as universal wastes. Sections 25140 and 25150.6 provide separate and distinct authorities. Section 25140 requires DTSC to list wastes as hazardous wastes and authorizes DTSC to revise the lists; section 25150.6 authorizes DTSC to exempt eligible hazardous wastes from certain management requirements.

DTSC is not "erasing the distinction" between hazardous and nonhazardous waste lamps. These regulations identify waste lamps with intentionally-added mercury as hazardous wastes, but waste lamps that do not meet the M003 listing description (i.e., those that contain no intentionally-added mercury) and do not meet any of the criteria adopted pursuant to Health and Safety Code section 25141 will continue to be classified as nonhazardous wastes. The distinction between hazardous and nonhazardous waste lamps will continue to exist.

T-26: *DTSC didn't adequately consider alternatives, including lowering the TTLC threshold for mercury, "the alternative compelled by Health and Safety Code section 25179.4." One of the criteria used to evaluate alternatives—availability of mercury-free substitutes—is not applicable.*

DTSC considered several alternatives to this proposal, including the one favored by the commenter, and concluded that none would be as effective in achieving the three objectives of the regulations listed in response to comment T-24, incorporated herein.

The response to comment T-8, incorporated herein, discusses why the listing of mercury-added lamps as hazardous wastes will be more effective at achieving these objectives than lowering the TTLC for mercury from 20 to 15 milligrams per kilogram, as the commenter proposes.

T-26.1: *DTSC's discussion of the rejected alternative of revising hazardous waste thresholds is legally deficient, not supported by rigorous analysis.*

DTSC has reviewed this comment and has determined that no regulatory change is necessary. The rationale for rejecting the commenter's preferred alternative—lowering the TTLC for mercury—remains valid: this alternative would not be as effective at achieving the objectives of the regulations. The ISOR and FSOR fully and adequately analyze the alternative. The response to comment T-8 discusses why the listing of mercury-added lamps as hazardous wastes will be more effective at achieving these objectives. The tables in the appendix illustrate that less mercury will be released to the State's environment if all mercury-added lamps are listed as hazardous wastes than would be released under the rejected alternative of lowering the TTLC. All of these documents demonstrate the rejection of the alternative is legal and supported by thorough, rigorous

analysis.

Universal Waste Management - Recycling Requirement - Infrastructure

T-28: *"There is no evidence in the record, including the discussion of alternatives, about the status of California's nascent recycling infrastructure or the ability, or inability, of the Department to enforce recycling."*

There is evidence in the record (statements by two commenters involved in the lamp recycling industry—see response to comment T-9.1) that the capacity to recycle California's fluorescent lamps already exists. Additionally, in preparing the Universal Waste Rule (UWR), DTSC found there are several firms operating fluorescent tube recycling facilities in California. Additional firms broker tubes to out-of-state facilities. Also, in preparation of the UWR, industry sources indicated to DTSC that existing facilities could expand capacity to accommodate the increased number of tubes that would be sent for recycling once the full UWR regulations came into effect. The recycling facilities have been reported as operating well below capacity due to the number of exemptions afforded to generators under existing regulations. The recyclers can expand capacity by adding equipment and workers, so expansion of supply of recycling services could be accomplished without increases in recycling fees (See, Economic and Fiscal Analysis for R-97-08: Universal Waste Rule, November 16, 2000).

Article 8 of Chapter 6.5 of the Health and Safety Code provides DTSC and the CUPAs with authority to enforce the requirements applicable to universal waste handlers, including the requirement to recycle lamps. The current proposal does not affect the existing administrative, civil, or criminal enforcement authorities; therefore, the comment is beyond the scope of the rulemaking.

Hazardous Waste Listing - M003 - Opposition

T-29 *DTSC 'concludes' that designating discarded mercury-containing lamps as hazardous waste will 'ultimately' result in the release of less mercury. "Use of the word 'ultimately' is curious and legally suspect." DTSC "believes that mere 'designation' will 'ultimately' achieve greater benefit. When? Why? The law does not permit conjecture of this nature, particularly when the alternative is specifically measurable progress."*

By "ultimately," DTSC means that the reduction in the amount of mercury released to the State's environment will not be fully realized immediately. The statement that the listing of mercury added lamps will ultimately lead to the release of less mercury is not based on conjecture, but on the delayed implementation dates of key elements of the proposal: 1) the listing for large quantity generators does not become effective until January 1, 2004; and 2) households and Conditionally Exempt Small Quantity Universal Waste Generators will be allowed to continue managing and disposing of some mercury-added lamps as non-

hazardous wastes until February 9, 2006, while the State's lamp collection infrastructure for smaller generators is developed. The tables in the appendix show the net amount of mercury that would be released through the nonhazardous management and disposal of mercury-added lamps under different scenarios. The calculations show that if California achieves the 70 percent lamp recycling rate that already exists in Minnesota[16], the net amount of mercury released to the State's environment (approximately 186.5 kilograms) would be less than under the optimistic scenario that the mercury dose in all of the lamps disposed of in California could be reduced to Philips' levels (assuming the current 20 percent recycling rate remained unchanged).

The effect of designating all mercury-added waste lamps as hazardous wastes will not be insubstantial. Currently, many lamps can be, and are, discarded in the nonhazardous trash and are subject to minimal management requirements. As hazardous waste, improper management and disposal of all mercury-added lamps will be illegal. Generators of hazardous waste lamps will be required to choose from one of two management options: full hazardous waste management, including recycling or disposal at a permitted hazardous waste facility, or management under the reduced requirements of the Universal Waste Rule, including mandatory recycling at a permitted lamp recycling facility. DTSC presumes that most lamp handlers will opt for the reduced universal waste management requirements, which include recycling. Philips has not produced, and DTSC is not aware of, any other evidence of an alternative that is "specifically measurable progress" toward reducing mercury contamination caused by disposal of florescent tubes.

Hazardous Waste Listing - M003 - Opposition - Suggested Alternative

T-30: *Manufacturers of lamps that are below 15 ppm mercury should be required to actively assist their customers in recycling their very low-level lamps.*

DTSC has reviewed this comment and has determined that it is beyond the scope of this rulemaking. DTSC lacks the authority to require manufacturers to assist their customers in recycling low-level mercury lamps, although DTSC agrees that the manufacturers of lamps with any amount of added mercury should be encouraged to do so. Such assistance could be in the form of product labels, educational signage at retail establishments, retail take-back, etc.

Hazardous Waste Listing - M003 - Opposition - Documents Submitted

T-31: *In a letter submitted by the commenter, a lamp recycler "reveals that Philips' lamps are recycled at a rate - 36% - that nearly doubles the 20% figure identified in the record." The commenter attributes this statement to "Philips active promotion of recycling" and the "environmental ethic" of its customers. "Clearly the combination of*

[16] January 28, 2002 letter from Mr. Paul Walitsky, C.H.M.M., Manager of Environmental Affairs for Philips Lighting Company to Mr. Ed Lowry, Director of the Department of Toxic Substances Control, page 3.

source reduction and recycling is a very successful program." The commenter states DTSC "must investigate this phenomenon, before it decides to abandon such a program."

The “phenomenon” to which the commenter refers is misleadingly characterized. The reported 36% at one recycler cannot be directly compared to the 20% discussed in the rulemaking record. Furthermore, this observation by a single lamp recycler does not reflect the recycling industry as a whole, as can be seen in the comments submitted by Mr. Paul Abernathy of the Association of Lighting and Mercury Recyclers. In his letter, Mr. Abernathy quotes a different lamp recycler as saying that only five percent of the lamps it handles are Philips Alto lamps. Despite the commenter’s claim that the purchasers of Philips lamps have an “environmental ethic” that the buyers of other lamps lack, it is not clear whether the nonhazardous status of Philips Alto lamps, combined with Philips’ efforts to promote recycling, have led to a higher recycling rates for Philips lamps than for those classified as hazardous waste in California.

DTSC does not find that maintaining the nonhazardous status of low-mercury lamps and encouraging voluntary recycling would be more protective of the State’s environment than listing all mercury added waste lamps as hazardous waste and mandating recycling as a requirement for universal waste management. Nor does DTSC share the commenter’s view that, in encouraging the development of mercury-free high efficiency lamps, this proposal provides less of an incentive for source reduction than retaining the use of the TTLC for classifying waste lamps. Rather than “abandoning” source reduction and recycling, this proposal strengthens the incentives for these activities.

T-32: *Commenter submitted a list of awards received by Philips for environmental stewardship.*

DTSC acknowledges receipt of this document. DTSC has reviewed the document submitted and has determined that no regulatory change is necessary.

T-33: *The commenter submitted a copy of an earlier letter from Mr. Paul Walitsky, C.H.M.M, Manager of Environmental Affairs for the Philips Lighting Company, to Mr. Ed Lowry, Director of the Department of Toxic Substances Control, dated January 28, 2002. The letter was submitted to comment on DTSC's Draft Mercury Report. It supports statements in the report that fluorescent lamps cannot be manufactured without mercury, that the use of mercury in lamps has been reduced in recent years, etc.*

DTSC acknowledges receipt of this document. DTSC has reviewed the document submitted and has determined that no regulatory change is necessary. The comments contained in the letter are summarized and responded to below.

Paul Walitsky, C.H.M.M., Manager, Environmental Affairs, Philips Lighting Company

T-33.1 *Philips thanks DTSC for the opportunity to testify at the November 19, 2001*

Mercury Workshop and recognizes DTSC staff for their "excellent work" on the Draft Mercury Report. This letter is intended to supplement the hearing testimony of Ms. Patricia Becker of Philips "with further comment on the report's recommendations and on several statements made in the report. We look forward to continue to work with the department on the most effective measures to reduce mercury release to the environment from fluorescent lamps."

DTSC thanks Philips for participating in the mercury workshops and acknowledges and appreciates Philips' supportive statements. Each of Philips' comments is responded to individually, below. DTSC welcomes the opportunity to work with Philips on proposals to reduce pollution.

T-33.2 *The Draft Mercury Report notes the reductions in the use and release of mercury. The use of mercury in lamps has also steadily dropped, mainly due to Philips, which has reduced the mercury content of it lamps by over 90 percent since the mid-1980s. ALTO lamps now have one-third as much mercury as the 1999 lamp industry average.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. DTSC has documented the reductions in mercury use cited by the commenter.

T-33.3 *Philips commitment to producing a product safer for the environment predates government regulation of mercury in lamps. Years before the USEPA added non-TCLP compliant lamps to the Universal Waste Rule, Philips developed and introduced the ALTO family of lamps." Philips developed machinery for encapsulating mercury, allowing accurate dosing of lamps and minimizing worker exposure to mercury; Philips coats its tubes to prevent mercury starvation. Philips has offered to share these methods with other lamp manufacturers. One East Coast specialty lamp manufacturer has accepted and has lowered its lamps' mercury content by 80 to 90 percent.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. The comment does not directly address these regulations. Philips may be submitting it as a comment on this rulemaking to support its position that the TTLC should be retained because, arguably, it promotes source reduction.

DTSC documented the reductions in mercury use cited by the commenter in its Draft and Final Mercury Reports. DTSC has concluded that the TTLC does not provide a strong incentive for further reductions in the use of mercury in lamps. Now that Philips has developed lamps that pass the TTLC, the TTLC no longer serves as an incentive for Philips to make further mercury reductions (although they may choose to do so for other reasons). The TTLC has not motivated the other two major lamp manufacturers to lower their products' mercury content in order to produce non-hazardous lamps; in the more than

five years since Philips introduced TTLC passing lamps, its major competitors have chosen not to follow Philips lead.[17]

The tables in the appendix show that using the M003 listing to classify waste lamps will reduce the release of mercury to California's environment more than continuing to use the TTLC.[18] Further, the M003 will be more effective at promoting the objectives of these regulations than retaining use of the TTLC for lamps.[19]

T-33.4 *Philips lamps meet all industry specifications including lamp life, as shown in data from ongoing tests; Philips will update DTSC on test results. None of the 60 test lamps has failed after 12,500 hours; 8 to 10 percent failure rate is expected.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. More recent data from the same lamp life tests was submitted with Mr. Erbin's comments on the 45-day public notice for theses regulations and again with his comments on the 15-day notice of proposed changes. As discussed in the responses to several other comments,[20] lamp life is not currently considered in the classification of waste lamps as hazardous or nonhazardous, nor will it be under the M003 listing.

T-33.5 *"It is impossible to make a fluorescent lamp without using some amount of mercury." Fluorescent lamps are energy efficient, which helps lower California's electricity demand; some of this demand is met by burning coal, which causes mercury releases. Philips objects to the proposal to regulate all mercury-containing waste as hazardous waste. [Note: This was the regulatory recommendation made in the Draft Mercury Report, upon which Mr. Walitsky was commenting. These regulations designate only four categories of discarded mercury-containing products as hazardous wastes.] Regulating all mercury-containing waste as hazardous wastes would not emphasize source reduction's benefits and would create unintended consequence, which might include increased lamp mercury content.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. The Draft Mercury Report accurately stated that fluorescent lamps cannot be made without some mercury. However, other types of high efficiency lamps may be developed in the future that do not use mercury. As discussed in the response to comment T-24, DTSC is aware of at least one company that is working to develop a mercury-free, energy efficient lamp. While high-efficiency mercury-free lamps are not yet widely available, the modest requirements and costs of universal waste management have not dissuaded people from using fluorescent lamps already classified as hazardous in California. Most of the lamps sold are already subject to these costs and requirements.

[17] See responses to comments I-4, I-19, and T-36.
[18] See responses to comments I-10, I-21, I-23, M-7, N-1, PP-2,T-13, T-26.1, T-26.2, T-29, and T-52.
[19] See responses to comments H-7, NN-6, Q-1, T-17, T-26, T-26.1, and T-27.
[20] See responses to comments NN-12.3, NN-12.4, T-40, and T-43.

The responses to comments T-5 and T-24 illustrate that the M003 listing promotes source reduction. Classifying waste lamps using the M003 listing in place of the TTLC would not likely lead to significant increases in the mercury content of fluorescent lamps, because such increases would cause lamps to fail the TCLP for mercury, which is used in many states to classify lamps as hazardous or nonhazardous. See the response to comment T-16 for discussion.

T-33.6 *Any regulatory structure for mercury in fluorescent lamps should focus on source reduction because source reduction is readily achievable, as shown by Philips. "We believe other manufacturers have not adopted these low-mercury processes simply because they prefer not to incur the expense of process changeover."*

DTSC has reviewed this comment and determined that no regulatory change is necessary. The responses to comments T-5 and T-24 illustrate that, notwithstanding the commenter's suggestion to the contrary, the M003 listing does focus on source reduction. If lamp manufacturers "prefer not to" change their manufacturing processes to allow them to use less mercury in their lamps, DTSC lacks the authority to require them to do so. DTSC's authority extends to products when they become wastes, but not to the products themselves.

T-33.7 *Recycling is unlikely to achieve reductions equal to source reduction. It is unlikely that California's recycling rate could go from the current 25 percent to Minnesota's 70 percent, "even with a serious and funded effort."*

DTSC has reviewed this comment and determined that no regulatory change is necessary. DTSC has determined that the M003 listing, in conjunction with other ongoing efforts, will reduce mercury releases more than retaining the use of the TTLC for classifying lamps, even if the TTLC were lowered. See the response to comment T-29 for discussion. DTSC does not share the commenter's pessimism about the possibility of achieving a lamp recycling rate of 70 percent, or higher, in California. The factors that will enable California to match—and even surpass—Minnesota's lamp recycling success are enumerated in the response to comment I-23.

T-33.8 *Due to their fragile and unwieldy nature, fluorescent lamps are more vulnerable to breakage than most waste products. "If other lamps were required to meet DTSC's TTLC threshold, California would enjoy a 66 percent source reduction in mercury content in the two-thirds of the market not served by Philips products, at no expense to the state or its consumers.*

DTSC agrees that fluorescent lamps are fragile, and release their mercury when they break. This fact supports the M003 listing, which would designate all mercury-added lamps as hazardous wastes and as universal wastes if recycled. Lamps that are managed in compliance with these requirements will be much less likely to break than lamps that are managed and disposed of as nonhazardous wastes. Existing universal waste management standards require universal waste lamps to be managed "in a way that prevents releases of any universal waste or component of a universal waste to the

environment." Universal waste lamps must be contained in containers that are closed, structurally sound, and adequate to prevent breakage.

As discussed in the response to comment T-36.6, above, DTSC cannot require lamp manufacturers to reduce their lamps' mercury content to Philips' levels.

T-33.9 *The designation of all mercury-containing waste as hazardous waste [the now-abandoned proposal to which this letter was addressed] will have "serious unintended consequences." "For fluorescent lamps, there is no viable alternative to mercury even for creative manufacturers to adopt…. The change proposed by DTSC will do absolutely nothing to encourage source reduction, recycling, ore compliance with the rules for managing hazardous waste. If fact it will remove any incentive they might have to reduce their end-of-life handling costs by meeting the TTLC standard."*

DTSC has reviewed this comment and determined that no regulatory change is necessary. These regulations are substantially different from the proposal in Section 6 of the Draft Mercury Report. Any "serious unintended consequences" that may have resulted from a proposal abandoned before these regulations were proposed are not germane to this rulemaking.

Rather than regulating all mercury-containing wastes as hazardous wastes as noted in the Draft Mercury Report, these regulations designate four categories of discarded products as hazardous wastes. The products were chosen based on two criteria: they have a mercury-free substitute available, or they are capable of being recycled. Mercury-added lamps meet the second criterion: they are capable of being recycled. In comments addressed specifically to this rulemaking, other commenters have raised the concern that these regulations do not adequately promote source reduction. DTSC has addressed each of these comments separately.

T-33.10 *Simply put, there are two ways for Philips' competitors to erase the market advantage we have earned by producing a low-mercury lamp: reduce the amount of mercury they use and meet the TTLC, or try to get all lamps treated equally, regardless of their mercury content. Last year, they supported unsuccessful legislation that, while seemingly well-meaning, took them of the hook for any further reductions by requiring all lamps to be handled as hazardous waste. We are very concerned that DTSC's proposal to regulate all mercury-containing wastes as hazardous waste will have the same unintended effect.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. DTSC does not endorse products, and these regulations were developed without regard to any marketing advantages or disadvantages that they might confer on any brand of products. DTSC has determined that the M003 listing would be the most effective means

to achieve the objectives of these regulations and would reduce the release of mercury more than continuing the use of the TTLC to classify lamps.[21]

T-33.11 *DTSC should investigate the likelihood that a major lamp manufacturer is now considering marketing a lamp that will achieve longer life (36,000 hours compared to 20,000 hours) by significantly increasing the amount of mercury in the lamp. The calculation is simple: if all lamps are hazardous waste no matter how little mercury they contain, then a company will have no incentive to reduce mercury content and instead will choose to market its product based on the consumer-friendly standard of lamp life, even if it means putting more mercury in the lamp.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. As discussed in the response to comment T-33.5, the majority of lamps are purchased in states other than California, where the TCLP continues to be used to classify lamps as hazardous or nonhazardous. As discussed in the response to comment I-2 increasing the mercury content of a lamp may not cause the release of more mercury to the environment if the added mercury results in longer life (and consequently, less frequent disposal). Companies will also have an incentive to keep mercury content low enough to pass the TCLP. See response to comment T-33.5, incorporated herein. Also see the response to comment T-16 for further discussion.

T-33.12 *Philips urges the department to give stronger consideration to source reduction as the most effective way to reduce mercury release to the environment from discarded fluorescent lamps. DTSC should reconsider the value of a "bright line" threshold like the TTLC, which creates an incentive for companies to pursue source reduction. Philips believes a review of the TTLC is justified, but if a more stringent standard is determined necessary, we hope the department will use it as a technology-forcing prod to industry… rather than a clearly unattainable goal that creates a disincentive to source reduction—a Best Attainable Control Technology (BACT) standard that companies should be required to meet.*

DTSC has reviewed this comment and determined that no regulatory change is needed. As discussed in the response to comment T-33.3, DTSC has concluded that the TTLC does not provide a strong incentive for further reductions in the use of mercury in lamps. In contrast, as discussed in the response to comment T-5, the M003 listing does provide an incentive for source reduction. Manufacturers wishing to market lamps that will not be subject to hazardous or universal waste management when they become wastes will have a new "bright line" of zero parts-per-million at which to aim.

DTSC interprets the commenter's suggestion for a BACT standard for lamps as a suggestion to ban, in California, the sale of lamps that use more mercury than Philips ALTO lamps, or that are manufactured by processes other than those employed by Philips. As noted in the responses to several other comments, DTSC lacks authority to take such action. DTSC cannot dictate how lamps are manufactured or whether they may be sold in

[21] See responses to comments I-10, I-21, I-23, M-7, N-1, PP-2,T-13, T-26.1, T-26.2, T-29, T-33.3, and T-52.

California. Through mechanisms like the M003 listing, however, DTSC can provide incentives for the development of new products that are more environmentally benign than currently available products.

T-33.13 *Philips supports universal waste management of fluorescent lamps, but believes it should be available only to those lamps that meet a BACT-like performance standard. Again, source reduction will not be achieved unless an incentive exists for manufacturers to reduce mercury content. Philips would not object to having its lamps subject to the Universal Waste Rule, provided that other lamps not manufactured to Philips' specifications were ineligible for universal waste management [and therefore would be fully-regulated as hazardous wastes].*

DTSC has reviewed this comment and determined that no regulatory change is needed. The Universal Waste Rule applies only to lamps that are hazardous wastes. Limiting the applicability of universal waste management to low-mercury lamps would very likely result in greater releases of mercury through the illegal disposal of higher mercury lamps. The situation would be similar to the years prior to the adoption of the federal and state Universal Waste Rules—most lamps would be fully regulated as hazardous wastes, but the requirement to manage them as such would be widely ignored.

T-33.14 *Philips would welcome greater recycling of fluorescent lamps. In our experience, Philips lamps are recycled at a slightly higher rate than other lamps, partly because we encourage and assist our customers to do so, partly because they choose them for their low-mercury content and are motivated to handle them in an environmentally responsible manner. DTSC could increase lamp recycling by enforcing current rules; many more lamp changeout vendors and building managers would recycle, because it would be cheaper than hazardous waste disposal. Absent enforcement, we caution DTSC against assuming that recycling will occur. A recycling infrastructure and a commercial and household customer outreach program will be needed and an effective recycling program will not occur without funding.*

DTSC has reviewed this comment and determined that no regulatory change is needed. DTSC agrees that regulation without enforcement is not as effective; however, this rulemaking creates opportunity for such enforcement. No generator of a mercury-added lamp will be permitted to dispose of the lamp in the nonhazardous trash, regardless of the type of lamp or the type of generator. Consequently, DTSC and CUPA enforcement staff who find lamps in a dumpster or garbage will know that a violation has occurred.

It is currently difficult to detect violations against persons who manage universal waste lamps because some classes of generators (households, CESQUWGs) may legally temporarily dispose of any type of lamp in the trash (until 2006).

DTSC has been working with CIWMB to develop an infrastructure for collection of universal wastes, including lamps, from households and CESQGs. This workgroup will be expanded to include other stakeholders in the future. The collection infrastructure the

workgroup develops could involve fees to fund recycling, but such fees would have to be imposed by the legislature, because neither DTSC nor CIWMB has authority to impose such fees.

T-33.15 *Technical comments specific to the Draft Mercury Report: On page 4 (Executive Summary) and Page 76, the report cites Air Resources Board data to show that 450 pounds of mercury emission into the air in 2000 came from broken fluorescent tubes. The number is too high. It appears that the Air Resources Board assumes that about 10 percent of the mercury vaporizes when a lamp is broken, when in fact, at room temperature, only about one percent of mercury is in the vapor state and the rest is liquid. In considering that there is 75 million fluorescent tubes disposed in 2000, an average 22.8 milligrams of mercury per lamp, and the rate of 24 percent of the tubes recycled, the 450 pounds equals 15.7 percent, that is 15.7 times more than the vapor pressure of mercury would create.*

DTSC has reviewed this comment and determined that no change to the regulations is necessary. The purpose of the Draft (and Final) Mercury Report is to established the scientific basis for the regulations. Debating the derivation of emissions of mercury due to fluorescent lamps would not change the fact that there are mercury releases, whether to air, land or water, due to fluorescent lamp breakage. Nor would the conclusion of the report and the scientific basis of the regulations change; that is, mercury is a toxic, persistent and bioaccumulative chemical substance. The regulations will prevent additional releases of mercury from certain wastes from entering the environment. Thus, no change to the regulations is necessary.

Note that the Air Resources Board collects, estimates, and forecast emission inventory data throughout California. These data are used to estimate the quantity of emissions from different types of emission sources such as point sources, area sources, and mobile sources. In addition to the emission inventory data itself, this includes methodologies to derive emissions. The Air Resources Board has developed the emission data for DTSC's Draft Mercury Report and refined the emission data in the Final Mercury Report according to their criteria.

T-33.16 *Technical comments specific to the Draft Mercury Report: Based on newer numbers, there is 10 to 20 pounds of mercury discharged into the San Francisco Bay that may be attributed to lamps rather than 22 to 286 pounds per year of mercury, both airborne and waterborne, from breakage of fluorescent tubes in landfills in the region that was cited from the San Francisco Regional Water Quality Control Board study (pages 4 and 77 of the Draft Mercury Report).*

DTSC has reviewed this comment and determined that no change to the regulations is necessary. The purpose of the Draft (and Final) Mercury Report is to established the scientific basis for the regulations. Debating the derivation of emissions of mercury due to fluorescent lamps in this region would not change the conclusion of the report or the scientific basis of the regulations; that is, mercury is a toxic, persistent and

bioaccumulative chemical substance. The regulations will prevent additional releases of mercury from certain wastes from entering the environment. Thus, no change to the regulations is necessary.

Note that the commenter has not provided any basis for its newer numbers, nor the assumptions used to generate them and how they would differ with the study done by the San Francisco Regional Water Quality Control Board.

T-33.17 *Technical comments specific to the Draft Mercury Report: Disagrees with the statement regarding the rate of decrease has slowed in the use of mercury in lamps, but has increased based on the National Electrical Manufacturer's Association (NEMA). Philips believes that it is possible to reduce the industry average of 11.6 milligrams mercury per lamp by more than 50 percent.*

DTSC has reviewed this comment and determined that no change to the regulations is necessary. DTSC acknowledges this information; however, it would not change the fact that there are preventable releases of mercury in the environment from fluorescent tubes as shown in the tables in the appendix. The purpose of the Draft (and Final) Mercury Report is to established the scientific basis for the regulations. This information would not change the conclusion of the report or the scientific basis of the regulations; that is, mercury is a toxic, persistent and bioaccumulative chemical substance. Thus, no change to the regulations is necessary.

T-33.18 *Technical comments specific to the Draft Mercury Report: The 25 percent market share of nonhazardous lamps cited in the report is not unreasonable and may be low. It is confusing and misleading to put the word nonhazardous in quotation marks. DTSC should qualify the word rather than suggest it with punctuation.*

DTSC reviewed this comment to the Draft Mercury Report and determined that no change to the regulations is necessary as it is not germane to the rulemaking. Note that the purpose of the Draft (and Final) Mercury Report is to established the scientific basis for the regulations. This information would not change the conclusion of the report or the scientific basis of the regulations; that is, mercury is a toxic, persistent and bioaccumulative chemical substance. Thus, no change to the regulations is necessary.

T-34: *Commenter submitted laboratory data documenting that mercury dosing in Philips T8 and T12 lamps is very precise.*

DTSC acknowledges receipt of this laboratory data. The data submitted is not germane to the rulemaking.

T-35: *Commenter submitted copies of 3 bills: AB 751 (2001), which would have designated all mercury-added lamps as hazardous waste; AB 712 (2002) which would have assessed a fee on lamps at point of sale to fund recycling; and SB 1922 (2002), in which the legislature refers to the STLC/TTLC.*

The first two of these three bills (AB 712 and AB 751) were submitted to support the commenter's assertion that the Legislature has "twice defeated" legislation that contains the same proposal as these regulations. The third, SB 1922, is submitted to support the commenter's assertion that the Legislature supports and "statutorily relies" on the TTLC. See the response to comment T-12 for discussion of AB 712 and AB 751. SB 1922 does not directly address mercury-containing fluorescent tubes. As stated elsewhere in these regulations, DTSC is not discontinuing use of the TTLC for a variety of wastes.

T-36: *Commenter submitted analysis by Roux Associates, Inc. of the impact of listing all tubes as hazardous waste vs. not listing them and lowering the mercury TTLC. Based on its assumptions, the analysis shows not listing would reduce mercury release to the environment.*

DTSC has reviewed the submittal from Roux Associates, Inc. Dr. Lock's comments on the proposed regulations are responded to separately.

In general, DTSC does not agree with the assumptions used in calculating the impact of these regulations on environmental mercury loading in California, and in comparing the impact of DTSC's proposal with that of the commenter's preferred alternative. Specifically, the commenter has not supported the assumptions that 1) lowering the TTLC for lamps to 15 parts-per-million would induce Philips' competitors to reduce their use of mercury to meet it; and 2) that a significantly higher lamp recycling rate can be achieved without a recycling requirement for all lamps.

T-36.1: *Commenter submitted US Census 2000 population data and data on California's share of the US GDP, to support it calculations of mercury releases in California.*

DTSC acknowledges receipt of these documents. They were submitted to support the statements in the Roux Associates, Inc., document that California has 12 percent of the U.S. population and 13.5 of the U.S. Gross Domestic Products (GDP). The latter figure was used in Roux's calculations of fluorescent lamp usage in California.

T-37: *Commenter submitted copies of letters from States of Delaware and New Jersey, addressing the addition of ascorbic acid into lamps to help them pass TCLP. A Washington Post article on GE's use of ascorbic acid in its lamps was also submitted.*

DTSC acknowledges receipt of these documents; however, they are not germane to this rulemaking. The fluorescent lamps in question are currently classified as hazardous waste in California due to their total mercury concentration, not their concentration of leachable mercury as determined by the TCLP. Under the proposal, all mercury-added lamps will be classified as hazardous wastes when discarded, whether or not they contain ascorbic acid or other additives that affect the results of the TCLP.

T-38: *Commenter submitted copies of a patent obtained by GE for the addition of ascorbic acid to its lamps to reduce the formation of leachable mercury that can lead to failure*

of TCLP.

DTSC acknowledges receipt of these documents; however, they are not germane to this rulemaking. The fluorescent lamps in question are currently classified as hazardous waste in California due to their total mercury concentration, not their concentration of leachable mercury as determined by the TCLP. Under the proposal, all mercury-added lamps will be classified as hazardous wastes when discarded, whether or not they contain ascorbic acid or other additives that affect the results of the TCLP.

T-39: *Commenter submitted marketing documents from GE touting its low mercury, TCLP-passing lamps, claiming longer life and lower TCLP results than ALTO, DTSC's 25 tubes policy, etc.*

DTSC acknowledges receipt of these documents. However, they are not germane to the rulemaking. DTSC does not regulate the marketing of products. Generators are responsible for classifying their waste, using either their knowledge or testing. If a generator is misinformed by a manufacturer (or by anyone else) that a hazardous product is nonhazardous, the generator is not relieved of the responsibility to manage the waste as hazardous waste or as universal waste. Generators who fail to do, even as the result of misinformation about the hazardous status of the waste, are subject to enforcement action. The proposed regulations will remove any question about which lamps are hazardous and which generators may dispose of them in the nonhazardous trash. All mercury-added lamps will be required to be recycled as universal waste, or disposed in a permitted hazardous waste landfill as fully-regulated hazardous waste.

T-40: *Commenter submitted GE Lighting "Selling guide" (used by Grainger Industrial Supply Company) which insinuates that Alto lamps are plagued by short life.*

DTSC acknowledges receipt of the documents. The commenter has submitted data to refute claims that Philips Alto lamps have shorter life than competing brands. Lamp life is not a factor in the classification of waste lamps currently, nor will it be under this proposal. Therefore, the accuracy of the GE claims is beyond the scope of this rulemaking.

T-41: *Commenter submitted a copy of a Stipulation and Order in a lawsuit by Philips against OSRAM Sylvania, in which OS agrees to stop saying its lamps have the lowest mercury, change its advertisements that say so, etc., and a press release announcing it.*

DTSC has reviewed the document submitted and has determined that no regulatory change is necessary. Under the proposal, all discarded mercury-added lamps will be classified as hazardous wastes. Claims by OSRAM Sylvania about the mercury content of its lamps are not germane to the rulemaking.

T-42: *Commenter submitted two letters (addressed as separate comments), from wholesale electric companies, objecting to the proposed replacement of the TTLC for lamps with the M003 listing.*

DTSC acknowledges receipt of the two letters. The comments contained in each letter are responded to separately.

T-43: *Commenter submitted laboratory testing report for lamp life testing of ALTO lamps, all 60 of which were still working after 17,904 hours. Charts provided showed ALTO lamps failing at much lower rate than industry standard median lives.*

DTSC has reviewed this comment and has determined that no regulatory change is necessary, as longevity of fluorescent lamps is not germane to this rulemaking. As stated the response to T-40, lamp life is not a factor in the classification of waste lamps currently, nor under this proposal.

T-44: *Commenter submitted a press release from the U.S. Attorney's office in New Hampshire, announcing the conviction and sentencing of an operator of a bogus lamp recycling company, which claimed to be complying with state and Federal laws but was not.*

DTSC has reviewed this document and determined that no regulatory change is necessary. The press release concerns an out-of-state recycling facility that was not authorized. State and federal officials investigated the case and federal agencies prosecuted. The operator was sentenced to prison. The press release demonstrates that U.S. EPA, the U.S. Attorney and state agencies can cooperate and successfully enforce environmental laws.

Under California's Universal Waste Rule, a destination facility is a facility that treats, disposes of or recycles universal waste. (Cal. Code Regs., tit. 22, § 66273.9). A destination facility that recycles universal waste must comply with the operating standards and permitting requirements of chapters 14 or 15 and 20 of the California Code of Regulations, title 22. (Cal. Code Regs., tit. 22 § 66270.60, subd. (b)) This means the Universal Waste Rule does not allow transfer of universal waste lamps to a California recycler that does not have a hazardous waste facility permit. A universal waste handler or transporter who violates this requirement is subject to enforcement action by DTSC or the local CUPA. Permitted facilities are inspected on a fairly regular basis by DTSC and are cited for violations if they are not in compliance with applicable laws, regulations and their permit. DTSC also instigates enforcement actions against facilities operating without proper authorization. Thus, systems are in place in California that should prevent an unauthorized facility similar to the one described in the press release from operating.

T-45: *Commenter submitted a letter from EPSI, a lamp recycler, stating that Philips ALTO lamps represented 36 percent of the lamps they processed.*

DTSC acknowledges receipt of the letter from Earth Protection Services, Incorporated (EPSI). In DTSC's opinion, the statement by EPSI that 36 percent of the lamps it recycles are Philips Alto lamps (which are currently not classified as hazardous wastes) is not a sufficient basis from which to conclude that low-mercury lamps are generally recycled at a

higher rate than higher mercury lamps. In a September 30, 2002 letter commenting on this proposal, Mr. Paul Abernathy, Executive Director of the Association of Lighting and Mercury Recyclers, states that Philips lamps represent a larger share of EPSI's business because its clients include firms that provide "group relamping" services and require recycling of all lamps they collect. Refer to response to comment T-31 and T-9.1 for additional discussion.

T-46 *Testimony at the hearing shows that many are dissatisfied with a requirement for lamp recycling without addressing recycling capacity and enforcement issues. The rulemaking record "is devoid of evidence regarding these two issues."*

The recycling capacity issue has already been resolved to DTSC's satisfaction. As discussed in response to comment T-9.1, two commenters have stated that the lamp recycling industry already has capacity for all of California's lamps if they were diverted from disposal today. Similarly, enforcement is not addressed in this proposal because violations of the requirements for universal waste are already subject to the enforcement of Article 8 of Chapter 6.5 of the Health and Safety Code. Persons who fail to properly manage universal waste are subject to civil or criminal penalties of up to $25,000 per day per violation. The CUPAs and DTSC have responsibility for enforcement of the universal waste requirements as they apply to generators of universal waste; DTSC has jurisdiction over universal waste transporters and destination facilities, as well as universal waste handlers who accept universal waste generated offsite. See response to comment T-28, incorporated herein.

T-47 *Many hearing participants want a bigger focus on source reduction, as HSC section 25179.4 requires. Philips supports the proposal by Californians Against Waste to retain the TTLC "for some useful purpose."*

As shown in these responses to comments, the M003 listing will provide a strong incentive for the development of high efficiency mercury-free lamps while preventing release of mercury to the environment through improper handling and disposal of mercury-added lamps. Although the TTLC will no longer be applicable to the classification of waste lamps as hazardous or nonhazardous, the TTLC will continue to be used in the classification of other (non-listed) wastes. These regulations do not preclude lamp manufacturers from discussing the mercury content of their lamps in marketing them, nor from comparing the mercury content of the lamps produced by different manufacturers (however, any mention of the TTLC in such marketing should contain a caveat that, regardless of their mercury concentrations, all mercury-added lamps are hazardous wastes and must be managed appropriately).

T-48: *"It is not possible to repair a deficient record by facile use of different words." The commenter has submitted "uncontradicted evidence" of the inadequacy of the proposal and record. Health and Safety Code Section 25179.4 is not permissive, as suggested by Mr. Weiner.*

DTSC has reviewed this comment and has determined that no regulatory change is

necessary to address it. The rulemaking record supports DTSC's regulatory proposals and complies with the requirements of the Administrative Procedures Act. As shown in the responses to earlier comments, the proposal is consistent with the priorities of Health and Safety Code section 25179.4. Pursuant to Government Code section 11346.9 subdivision (a) paragraph (3), DTSC has responded adequately to all of the "evidence" submitted as comments by the commenter to support his assertion that the record is deficient. DTSC does not agree the record is deficient. The commenter has not submitted "uncontradicted evidence" of the inadequacy of the proposal and the record. In fact, numerous items of evidence in the record contradict the commenter's claims. DTSC disagrees with the commenter's interpretation of Health and Safety Code Section 25179.4 and DTSC finds this proposal is clearly consistent with Section 25179.4. DTSC's analysis of section 25179.4, in relation to other statutes, is in response to comment T-2, incorporated herein.

Hazardous Waste Listing - M003 - Opposition - Suggested Alternative

T-49: *The commenter is willing to work with DTSC in devising a "proposal that meets the requirements of law" and prevents mercury pollution. Such a proposal must comply with Health and Safety Code Section 25179.4.*

DTSC has reviewed this comment and has determined that no regulatory change is necessary to address it. The proposal meets the requirements of law, promotes pollution prevention (reduction in generation of hazardous waste), and is fully consistent with Health and Safety Code section 25179.4. (See the responses to comments T-2, T-5, T-22, T-23, T-24, T-47, and T-48, incorporated herein, for more detailed discussion.)

T-50*: The current proposal abandons the most commonly used method of regulating environmental contaminates by a variety of state and federal agencies – prescriptive standards. The state's and nation's air and water quality laws are built on the foundation of establishing acceptable standards for exposure to contaminants…. Ironically, the record of this proceeding … demonstrates the [ubiquity] of this approach, which the Department proposes to abandon for lamps.*

DTSC has reviewed this comment and has determined that no regulatory change is necessary. A hazardous waste listing is, essentially a prescriptive standard. In the case of the M003 listing, if a manufacturer intentionally adds any mercury to its lamps, the lamps will be classified as hazardous wastes when they become wastes—the numerical standard is zero. Some of the numerical standards for mercury to which the commenter refers are currently being exceeded in California. As documented in DTSC's Final Mercury Report, the San Francisco Bay is, in some places, contaminated with mercury above the Ambient Water Quality Criterion of 50 nanograms (billionths of a gram) per liter. As documented in the Final Mercury Report, mercury is mobile in the environment. Lamps that break during management or that are disposed of as nonhazardous wastes release mercury that can be transported to parts of the State that already exceed "acceptable exposure standards" for mercury. The improper management and disposal of mercury-added lamps elsewhere in the State may, therefore, contribute additional mercury to already-contaminated regions of

California such as the San Francisco Bay.

T-51*: DTSC's record contains an egregious factual error. It states that Philips low-mercury lamps sell at premium price of 1.25 to 1.5 times the cost of other lamps. This is false! This fundamental error renders the Department's economic analysis deeply and, perhaps, irreparably flawed…. An elementary analysis of the industry would immediately reveal the magnitude of this error. It is utterly capricious to proceed on the basis of this error.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. DTSC's statement in the economic analysis for these regulations to the effect that Philips Alto lamps were more expensive to purchase than competing lamps was based on a spot check of the prices of various brands of lamps at a large home improvement retail store. Lamp prices were not a basis for the M003 listing, and the price of mercury-added lamps was not used in any calculations of the fiscal or economic impact of these regulations. Therefore, if the commenter's assertion that Philips lamps generally cost no more to purchase than the other major brands is true, DTSC's analysis of the economic impact of these regulations would, nevertheless, remain unchanged.

T-52: *Knowing there is no non-mercury alternative to fluorescent lamps, the Department may not simply "throw up its hands" and renounce the value of source reduction.*

DTSC has reviewed this comment and has determined that no regulatory change is necessary. With these regulations, DTSC is embracing, not abandoning, source reduction. These regulations promote the development of new types of high-efficiency lamps that do not use mercury; this type of source reduction—product reformulation—will, in the longer term, lead to the elimination of releases of mercury from the management and disposal of lighting waste. Until these new categories of lamps are available, maximizing the lamp recycling rate will minimize the release of mercury. This is another reason that the M003 listing is needed: in addition to the incentive it will provide for source reduction, it will help ensure the highest recycling rate possible. The tables in the appendix illustrate that reducing the mercury content of lamps without increasing recycling will reduce the release of mercury to approximately 240 kilograms per year, but increasing recycling rate to the 70 percent seen in the State of Minnesota will reduce mercury releases substantially more (to approximately 186.5 kilograms per year). See the response to comment T-5 for further discussion of how these regulations promote source reduction.

Hazardous Waste Listing - M003 - Opposition - Suggested Alternative

Roux Associates

QQ-1 *Classification of all fluorescent tubes as regulated mercury waste is both burdensome to the commercial consumer and unwarranted if the mandates of source reduction in the Resource Conservation and Recovery Act were more vigorously asserted.*

DTSC has reviewed this comment and determined, incorporated herein, that no regulatory change is necessary. Low mercury lamps that are destined for recycling are eligible for management under the Universal Waste Rule. The requirements for managing universal waste lamps are far from "burdensome." As discussed in the 45-Day Public Notice for these regulations, universal wastes (including lamps) may be managed under simple, reduced standards (as compared with full hazardous waste management requirements) that are appropriate for the hazards posed by the wastes. DTSC has determined that these regulations are necessary (see the responses to comments T-1 and T-22, incorporated herein, for discussion). The regulations also strongly support source reduction and pollution prevention (see the responses to comments T-5, T-18. and T-24, incorporated herein).

QQ-2 *This regulation would require every commercial establishment that uses fluorescent light fixtures to design, build and maintain a hazardous waste storage area, causing a financial and administrative burden.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. Contrary to the commenter's assertion, the Universal Waste Rule does not require handlers to design or build a hazardous waste storage area. The requirements that apply to handlers of universal waste lamps are found in subsections (c) of sections 66273.13 and 66273.33 of title 22 of the California Code of Regulations, division 4.5. The extent of these requirements is to: "contain any lamp in containers or packages that are structurally sound, adequate to prevent breakage, and compatible with the contents of the lamps. Such containers and packages shall remain closed and shall lack evidence of leakage, spillage or damage that could cause leakage under reasonably foreseeable conditions."

QQ-3 *The entire burden of environmental protection is placed unfairly on the consumer rather than holding the manufacturers accountable for responsible care of their products.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. DTSC lacks authority to adopt legislation or to regulate products before they become wastes. The commenter's statement that the "entire burden" of environmental protection is "unfairly" paced on consumers is a gross overgeneralization. In the particular case of lamps, DTSC has demonstrated the necessity to regulate all lamps with intentionally-added mercury as hazardous wastes, as it is authorized to do pursuant to section 25140 of the Health and Safety Code. Generators are, in general, responsible for classifying and managing hazardous waste properly; the existing requirements that give generators these responsibilities are unaffected by the proposed regulations.

QQ-4 *The benefits of source reduction . . . are totally ignored and all the emphasis is placed on a program that would be expensive to administer and police for compliance.*

DTSC has reviewed this comment and determined that no regulatory change is necessary.

With regard to mercury-added lamps, the benefits of source reduction will be more fully realized under these regulations than they are when lamps are classified under the TTLC. See the responses to comments T-5, T-18. and T-24 for discussion of how these regulations promote source reduction.

QQ-5 *The commenter's analysis "clearly illustrates that the proposed compulsory fluorescent tube recycling mandate is not an effective mechanism" for reducing the release of mercury. The effectiveness of recycling is questionable, and puts a significant burden on consumers. Manufacturers should bear responsibility for reducing the release of mercury to the environment.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. The commenter's analysis is based on highly implausible assumptions that:

- Dramatically higher recycling rates could be achieved if all lamps were nonhazardous and recycling were voluntary;
- Retaining the applicability of the TTLC to waste lamps would result in all lamps being manufactured with mercury concentrations below 20 milligrams per kilogram; and

- If the TTLC were lowered to 15 milligrams per kilograms, all manufacturers could (and would) produce lamps with mercury concentrations below this value.

In addition to basing his calculations on these speculative and unsupported assumptions, the commenter fails to take into account the effects of lowering the mercury content of lamps on lamp life (and the increase in lamp disposal that would result if lamp life were shortened by reductions in mercury dosage). Even if one assumes that the data submitted by Philips to support its assertions that Alto lamps last as long as their higher-mercury competitors, other major lamp manufacturers have stated that further reductions in mercury would compromise their lamps' performance and reliability.

DTSC disagrees with the assertion that the effectiveness of recycling is "questionable." The calculations in the appendix illustrate that if California attains the 70 percent recycling rate that is seen in the State of Minnesota, less mercury will be released to the State's environment than if all waste lamps were manufactured with Philips' mercury levels and the current 20 percent recycling rate remained unchanged. Nor does DTSC agree that recycling lamps places a "significant" burden on consumers. As discussed in the fiscal and economic analyses for these regulations, the costs for recycling are modest. Most lamps sold in the State are already subject to the Universal Waste Rule's recycling requirement. If the commenter is arguing that consumers should dispose of lamps as nonhazardous wastes to avoid these modest costs, DTSC strongly disagrees. The latter argument conflicts with the commenter's presumption that voluntary recycling would produce significantly higher recycling rates than would be by the Department's chosen alternative.

The M003 listing promotes pollution prevention by providing manufacturers with a strong incentive to develop new types of high-efficiency, low-mercury lamps. Manufacturers will

bear the costs of developing these lamps, which they will recover from the consumers who purchase them.

QQ-6 *The commenter requests that all sections of DTSC Regulation R-02-04 pertaining to any requirement for the recycling of all fluorescent tubes be vacated and replaced with language that focuses on source reduction as the most effective tool for reducing mercury releases to the environment.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. As discussed in the responses to comments T-5 and T-24, the M003 listing provides strong incentives for the development of new types of efficient, mercury-free lamps.

Sensient Technologies

AA-3 *We oppose the listing of all mercury-containing lamps as hazardous waste. Facilities pay more for low-mercury lamps so that they may dispose of them in the trash. Fewer will be sold if hazardous; since many lamps are improperly disposed, more mercury will go to environment.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. Even if low-mercury lamps were to be eliminated from the market in California, the increase in the lamp recycling rate that these regulations (along with other efforts discussed elsewhere—see the response to comment I-23) will produce will lead to greater reductions in the release of mercury to California's environment than would occur if the TTLC continued to be used to classify waste lamps (see the response to comment I-23), incorporated herein. Mercury-containing lamps that are illegally disposed are subject to enforcement action, fines and penalties.

Walters Wholesale Electric

OO-1 *TTLC is the best standard I know of by which I can buy truly low-level mercury lamps.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. DTSC presumes that Philips Lighting Company, which encourages the "environmental ethic" of its customers, will continue to advertise its lamps' low mercury content after the M003 listing becomes effective in 2004. The commenter will likely continue to have ample information on which to base lamp purchasing decisions. Any new classes of mercury-free, high-efficiency lamps developed as a result of the source reduction incentive provided by these regulations will undoubtedly be marketed as "mercury-free" and or "nonhazardous." Once such lamps become available in the market, environmentally concerned lamp purchasers such as the commenter will have a clear standard to use in deciding which lamps to purchase.

OO-2 *Recycling of mercury-containing materials is important, but in the event that it is*

overlooked, the acceptance of only truly low-level mercury lamps, such as Philips Alto is important in the state of California.

DTSC has reviewed this comment and determined that no regulatory change is necessary. DTSC has no authority to "accept" one brand of lamps but not the others. As discussed in response to comment OO-1, Philips will be free to continue to provide its customers with information on which lamps have the lowest mercury content. As discussed in comment I-23, these regulations are part of an ongoing effort that will ensure that the recycling rate is achieved.

Hazardous Waste Listing - M003 - Opposition - Documents Submitted

Center for Environmentally Advanced Technologies

I-30 *The commenter provided documents describing his organization: it mission statement, and brief biographies of its president and Board of Directors.*

DTSC has reviewed these documents and has determined that they are not germane to the rulemaking. No regulatory change is necessary.

I-31 *The commenter provided a copy of a U.S. EPA Waste Minimization newsletter, touting Philips' development of the Alto lamp, describing the lamps' innovations, and stating that Alto lamps are sold for the same price as competitors' lamps, in spite of their higher cost to produce.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. The document provided is not germane to the rulemaking. Lamp prices were not a basis for the M003 listing, and the incorrect information about the price of Philips lamps was not used in any calculations of the fiscal or economic impact of these regulations.

I-32 *The commenter submitted a copy of an article from the Washington Post's web site, dated Sunday, September 22, 2002. The article describes the increases in the nation's recycling rate over 15 years, recent drops in aluminum recycling, and cutbacks in the recycling programs of a number of cities across the country.*

DTSC has reviewed this article and determined that it is not germane to the rulemaking. No regulatory change is necessary. A lamp recycling rate of 70 percent or higher is attainable, as is already seen in Minnesota. The response to comment I-23 discusses the factors that will allow California to match or exceed Minnesota's success, incorporated herein.

Hazardous Waste Listing - M003 - Opposition - Suggested Alternative

Center for Environmentally Advanced Technologies

I-22 *Philips has proposed reducing the TTLC from 20 to 15 ppm. Philips would sell 15 ppm lamps throughout the nation, not just in California. Philips also has research and development underway to develop fluorescent lamps with only trace amounts of mercury. We cannot fathom why DTSC would not take advantage of Philips' progress, or why it would propose to impede further progress.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. Revising the TTLC is an option that was considered in the 45-Day Public Notice and was rejected, because it would not be as effective at promoting the objectives of these regulations: encouraging pollution prevention through the use of mercury-free products; encouraging development of products that use alternatives to mercury; and encouraging mercury recycling. (The first two objectives will reduce generation of hazardous waste. The third obviously promotes recycling.) The listing of all mercury-added lamp waste as hazardous waste provides an incentive for the development of new types of high-efficiency mercury-free lamps that revising the TTLC would not.

DTSC has no authority to regulate the formulation of lamps, nor is DTSC aware of the nature of Philips research and development efforts. The trace-mercury lamps that the commenter reports Philips is developing might or might not reduce the releases of mercury to the environment associated with currently-available lamps, depending on several of variables discussed in the response to comment T-18. The TTLC cannot be the reason that Philips is developing these lamps, because the existing Alto lamps are already manufactured with mercury concentrations below 20 milligrams per kilogram and therefore are not currently classified or regulated as hazardous wastes. Further reductions in mercury would not change the nonhazardous status of these trace-mercury lamps under the TTLC, nor would they change the status of the lamps under the M003 listing. Whatever Philips' motivation is for working on these new lamps, DTSC applauds their efforts. It is unclear, however, how the commenter proposes that DTSC should "take advantage of Philips' progress" in developing such lamps, nor how replacing the use of the TTLC for lamps with the M003 listing will remove a regulatory incentive where one does not currently exist.

Hazardous Waste Listing - M003 - Opposition - Authority to Adopt

Center for Environmentally Advanced Technologies

I-16 *Section 25197.4 (sic) says DTSC must promote specified waste management practice in order of priority. Source reduction is given top priority. The proposal not only fails to promote source reduction, but completely removes it.*

DTSC has reviewed this comment and has determined that no regulatory change is

necessary. Far from failing to promote source reduction, these regulations provide a stronger incentive for source reduction than exists currently. Please see the responses to comments T-5 and T-24 for discussion.

Hazardous Waste Listing - Questions for Clarification

Electronic Industries Alliance

L-5 *Will listings apply to products with trace amounts of mercury not intentionally added?*

No, the listings apply only to products with intentionally-added mercury, as discussed in the FSOR.

L-6 *Does the weight of the entire listed product apply toward thresholds (e.g., SQG/LQG threshold)?*

No, DTSC intends that only the items that will be managed as universal wastes (i.e., the removed switches, lamps, etc.) be counted toward applicable thresholds. Once the listed wastes have been removed from a vehicle or other product, the products are no longer subject to the listing description.

Hazardous Waste Listing - General Opposition

Electronic Industries Alliance

L-1 *We oppose listing currently nonhazardous mercury-containing waste as hazardous and universal waste. This is arbitrary, unsubstantiated by science, beyond DTSC's authority and is illegal. The listing would regulate products that do not pose a significant environmental risk, setting a "dangerous precedent."*

DTSC has reviewed this comment and determined that no regulatory change is necessary. Far from being arbitrary, the new hazardous waste listings are being adopted in response to a serious and well-documented problem: the contamination of California's environment with mercury. See the response to comment T-1 for discussion of the facts that led DTSC to develop these hazardous waste listings.

The facts upon which these regulations are based are well substantiated by science: the persistent, bioaccumulative, and toxic properties of mercury, as well as its mobility in the environment, are well characterized. In his review of the scientific basis for these regulations, Dr. A. Russell Flegal, Professor and Chair of the Department of Environmental Toxicology at the University of California, Santa Cruz, states that these regulations' listing of mercury-added products as hazardous wastes "is predicated upon extensively documented scientific evidence that (a) 'mercury is a toxic, persistent, and bioaccumulative

chemical substance' and that (b) there are substantial, on-going releases of industrial mercury through the consumption of consumer products in California. … Both of those predications have been affirmed at the national and international levels by numerous studies."

Adoption of the new hazardous waste listings is legal; DTSC is authorized to adopt these hazardous waste listings pursuant to section 25140 of the Health and Safety Code. See the response to comment T-23 and T-25 for discussion.

The management and disposal of mercury-added products as nonhazardous wastes definitely pose significant environmental risks. See DTSC's Mercury Report, the scientific peer review reports, the first paragraph of this response, and the response to comment T-1 for discussion.

L-1.2 *If DTSC considers electronic products that aren't currently hazardous to pose a significant risk, it should "revise the hazardous waste tests to better measure environmental risk through a formal rulemaking."*

DTSC has reviewed this comment and determined that no regulatory change is necessary. DTSC has determined that the management and disposal of certain electronic products as nonhazardous waste definitely do pose significant risks to public health and the environment. Consequently, DTSC is designating those products as hazardous wastes in these regulations. DTSC has authority to revise the existing hazardous waste thresholds, pursuant to Health and Safety Code section 25141, and also has authority to prepare lists of wastes that are determined to be hazardous, pursuant to Health and Safety Code section 25140. The hazardous waste listings that are part of this rulemaking are adopted under the authority of section 25140. DTSC has opted for the listing option, rather than revising the thresholds, because listing more effectively supports the three major objectives of these regulations: encouraging pollution prevention through the use of mercury-free products; encouraging development of products that use alternatives to mercury; and encouraging mercury recycling.

Institute of Scrap Recycling Industries, Inc.

Q-1 *The Department should defer the proposed regulations, at least the M001 and M002 listings, in favor of a legislative solution. The proposal would not achieve the Department's stated goals, and would have a detrimental impact on recycling and recycling companies.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. DTSC has determined that the listing will promote the objectives of the regulations (see the response to comment L-1.2, above). In response to comments received on the 45-Day Public Notice, DTSC has modified the regulations to retain the additional environmental protection they were intended to provide, while reducing their impact on recyclers. The auto dismantling industry commented that information on the location of mercury switches other than those in hood and trunk convenience lighting, is lacking, and proposed that the

M001 listing be limited to light switches; DTSC has incorporated this suggestion into the final text of the regulations. The dismantling and shredding industries commented that the certification of switch removal that was an element of the original proposal was problematic, because it would be difficult, if not impossible, to be certain that all mercury switches had been removed; DTSC incorporated the suggestion that the certification requirement be deleted. Other comments objected to the fact that vehicles and appliances crushed with switches inside would have been classified as hazardous wastes, citing cost and liability concerns; DTSC modified the regulations to clarify that only those crushed vehicles or products that exhibit a hazardous waste characteristic in article 3 of title 22 of the California Code of Regulations, division 4.5 will be hazardous wastes. DTSC has incorporated these suggestions from the recycling industry.

Lucas Advocates

R-1 *It may be impossible to identify the products and the switches covered by the regulations.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. As discussed in the response to comment Q-1, above, the scope of the M001 listing has been reduced to include only vehicle light switches that contain mercury. Some information on makes and models of vehicles that contain these switches, as well as information on switch locations, is available. Furthermore, DTSC is undertaking efforts to provide vehicle recyclers with "information about vehicle makes and models that contain mercury light switches and entities that provide mercury recycling services," as required by subdivision (a) of section 25214.7 of the Health and Safety Code.

Persons who crush major appliances for transport, or transfer them to balers or shredders for recycling are required by existing law (section 42175 of the Public Resources Code) to remove all "materials that require special handling," a category that includes mercury switches. The handlers of major appliances are already required to identify the appliances and switches that are subject to this existing requirement.

Information about other mercury-containing products is also available. The Internet contains information on many mercury-containing products, including switches covered by the M002 listing. Product manufacturers will also be an important resource for identifying affected products and switches.

Micro Metallics Corporation

S-1 *These listings will have serious adverse effects on recycling--both direct and indirect. Indirect: the stigma of hazardous waste classification; landlords and lenders often restrict hazardous waste activities, common carriers may not want to accept these waste for transport.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. The regulations will enhance, not hinder, recycling, by making it a condition for managing listed products under the reduced requirements for universal wastes. The ISOR for these regulations demonstrates their necessity. Any "stigma" associated with designation of a discarded mercury-added product as a hazardous waste is outweighed by the environmental benefits of diverting the product from nonhazardous waste management and disposal. Many handlers of the newly listed wastes already manage other hazardous wastes as part of their business activities. Many wastes generated in the recycling of vehicles (batteries, used oil, antifreeze, etc.) are already classified as hazardous, for example. DTSC believes that the commenter's concerns about landlords and lenders are overstated, in light of the fact that almost all businesses generate at least a small amount of hazardous waste.

Common carriers are free to accept or refuse to haul specific cargoes for a variety of reasons, but DTSC is not aware of any widespread instances of common carriers refusing to accept universal wastes for transport, either in California or nationally. Universal waste management allows many more transportation options than are available for other hazardous wastes; one option available to handlers who comply with applicable transporter requirements is to transport their own universal wastes.

See related discussions in response to comment L-7.2 and L-7.3.

S-2 *The proposal will increase the complexity and cost of managing products with mercury switches and lamps. Generator removal of switches will increase the risks of mercury release and worker exposure.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. As discussed in the 45-Day Public Notice for these regulations, universal waste management requirements are reduced from those that apply to other hazardous wastes. They are neither complex nor costly to comply with. The economic impact analysis for these regulations show that the costs to handlers is modest (see the response to comment D-1 for discussion of the costs associated with removal and recycling of mercury light switches from vehicles).

The standards for universal waste handlers in sections 66273.13 and 66273.33 of title 22 of the California Code of Regulations, division 4.5, require that mercury switches be removed "in a manner designed to prevent breakage." Several other requirements, designed to prevent and control accidental releases of mercury during switch removal are included in sections 66273.13 and 66273.33. These are:

- Ensuring that a mercury clean-up system is readily available;
- Immediately transferring spilled or leaked mercury to an airtight container;
- Thoroughly familiarizing employees who remove mercury switches with proper waste mercury handling and emergency procedures, including transfer of spilled mercury to appropriate containers;

- Accumulating removed mercury switches in closed, non-leaking containers that are in good condition;
- Packing removed mercury switches in the container with materials adequate to prevent breakage during storage, handling, and transportation; and
- Keeping records of the removal of mercury switches from vehicles and household appliances for three years from the date of removal.

Handlers who remove mercury switches from vehicles and appliances are also subject to applicable OSHA and Cal-OSHA requirements.

Sensient Technologies

AA-2 *Commenter disagrees with the designation of vehicles and appliances that contain mercury switches as hazardous wastes. Instead, DTSC should simply mandate that all mercury containing switches be removed prior to processing. This would be much simpler…*

DTSC has reviewed this comment and determined that no regulatory change is necessary. DTSC has no authority to establish standards for products or for wastes that are not hazardous wastes. Pursuant to Health and Safety Code section 25140, DTSC has prepared a listing of wastes (including mercury switches and products that contain them) that it has determined to be hazardous, based on the "immediate or persistent toxic effects to man and wildlife and the resistance to natural degradation or detoxification" of their mercury. The requirements to remove mercury switches from vehicles and other products are appropriate for the hazards that these switches pose to public health and the environment, particularly when they are left inside vehicles and appliances that are crushed, baled, sheared, or shredded.

Hazardous Waste Listing - Mixtures and Derivatives of Listed Wastes

Electronic Industries Alliance

L-4 *Would mixture and derived-from rules apply to newly listed wastes?*

DTSC has revised section 66261.3 of title 22 of the California Code of Regulations from the original proposal in the 45-Day Public Notice. The revised subsection (c)(3) of section 66261.3 states: "Waste consisting of only material derived from the treatment or recycling of one or more hazardous wastes listed in article 4.1 of this chapter is not a hazardous waste, provided the material does not exhibit any of the Mercury Waste Classification and Management characteristics identified in article 3 of this chapter, and does not meet any listing description in article 4.1 of this chapter." Pursuant to this subsection, materials derived from treatment or recycling of wastes listed in section 66261.50 would not automatically be classified as listed hazardous wastes, as is the case with federally-listed hazardous wastes.

However, in cases where a mixture meets one of the new listing descriptions added by these regulations (e.g., a vehicle that contains mercury-containing motor vehicle light switches, prior to treatment or recycling), the mixture (in this case the entire vehicle) is a listed hazardous waste. A vehicle from which all mercury-containing motor vehicle light switches have been removed would not be a listed hazardous waste, nor would a vehicle that is crushed, baled, sheared, or shredded with listed switches still inside [pursuant to revised subsection (c)(5) of section 66261.3]. However, crushing, baling, shearing, or shredding a vehicle with mercury light switches still inside is treatment of a listed hazardous waste, and as such would require a hazardous waste facility permit.

GE Lighting

M-3 *DTSC should clarify that the residuals from the recycling of mercury-containing lamps are not covered by the listing or subject to the derived from rule.*

DTSC has clarified this provision in the final text. See the response to comment L-4, incorporated herein.

OSRAM Sylvania

V-4 *DTSC should clarify in the regulations that the new listing does not trigger regulation of mixtures and derivatives of lamps. Commenter suggests language to add to the M003 listing.*

DTSC has clarified this provision in the final text. See the response to comment L-4, incorporated herein.

Generation of Hazardous Waste

GE Lighting

M-4 *DTSC should clarify the point of generation for mercury-containing lamps and that the removal of lamps from products or structures does not constitute treatment.*

DTSC has clarified this provision in the final text. A new subsection (c)(3) has been added to the standards for Small Quantity Handlers of Universal Waste in section 66273.13 and the standards for Large Quantity Handlers of Universal Waste in section 66273.33. It reads: “A small quantity handler of universal waste may remove universal waste lamps from a product or structure, provided the handler removes the lamps in a manner designed

to prevent breakage.” This clarifies that removal of lamps is a handler activity and not a treatment activity (handlers are precluded from treating universal wastes).

Exemptions – General

Clean Water Action

J-12 *End the household and CESQG exemptions sooner.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. These regulations reorganize section 66273.8 to make the exemptions for households and CESQUWGs from universal waste handler requirements permanent; however, the changes to section 66273.8 do not affect the temporary disposal exemptions that currently apply to these persons. The temporary disposal exemptions were established in the original Universal Waste Rule in order to provide time for development of a collection infrastructure for universal wastes batteries, lamps, and thermostats generated by households and CESQUWGs. While DTSC has been working with the CIWMB on a workgroup to develop this infrastructure, the existing disposal exemptions are still necessary.

Physicians for Social Responsibility, Los Angeles

W-5 *The timeline for sunset of disposal exemptions should be revised to July 1, 2004. CIWMB has surveyed each county and reports that no household hazardous waste (HHW) collection capacity shortfall currently exists.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. Household Hazardous Waste (HHW) collection events will likely be part of the collection infrastructure currently being developed by a workgroup composed of DTSC and CIWMB representatives; however work remains to be done before the infrastructure is developed and implemented. Please see the response to comment J-12 above, incorporated herein.

Exemptions – Lamps

AERC Recycling Solutions

A-5 *Do not allow temporary exemptions.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. See the response to comment J-12, above, for discussion.

Association of Lighting and Mercury Recyclers

C-3 *Lamps break in dumpsters and become an instant threat to human health and the environment. The M003 Listing should not be delayed until 2006.*

DTSC has reviewed this comment and similar comments (see comments C-8, C-9, and U-2, and responses). In these comments, lamp recycling industry representatives state that

their industry already has adequate capacity to recycle of California's fluorescent lamps that can be diverted from disposal. By DTSC's calculations, at the current rate of nonhazardous management and lamp disposal (approximately 80 percent, according to the Association of Lighting and Mercury Recyclers), approximately 420 kilograms of mercury enter the State's environment (see Table 1 in the appendix). For these reasons, the phase-in date for the M003 listing is being changed from February 9, 2006 to February 9, 2004.

C-4 *Exemptions will allow another 100 + million lamps to go to non-hazardous disposal.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. The phase-in date for the M003 listing is being changed from February 9, 2006 to February 9, 2004. See the response to comment C-3, above, for discussion.

Mercury Retirement

1000 E-mails

CC-6 *As we eliminated mercury's use in products, we need to have a concrete plan to collect used mercury, "retire" and contain it, taking it out of our environment and preventing future human exposure.*

DTSC agrees that the ultimate solution to prevent further environmental contamination with mercury is to take it out of commerce. While the uses of mercury in products is decreasing (and these regulations will provide incentives for further reductions), mercury is still needed in certain applications. DTSC is participating in an effort by the Environmental Council of States (ECOS) to address the issue of long-term storage (retirement) of mercury. This issue is national in scope and is beyond the scope of this rulemaking. However, before the mercury in discarded products can be retired, it must be reclaimed (recycled). Elemental mercury that is recycled as a consequence of these regulations will be ready for retirement, once a solution to the long-term storage of this toxic metal is developed.

500 Faxes

DD-6 *I hope the state in the near future will establish a process for the safe retirement and isolation of mercury that has been recaptured.*

Please see the response to comment CC-6, above.

CALPIRG Charitable Trust

H-11 *The language should reflect the intention to retire the mercury reclaimed from products. California should act quickly to ensure an effective collection infrastructure is in place (for mercury that is to be retired)…*

Please see the response to comment CC-6, above. It has been suggested (in comment W-6) that DTSC allow retirement as an alternative to recycling of mercury. However, as noted in the response to comment CC-6, reclamation of the mercury in products that contain it is a necessary before it can be retired. The Universal Waste Rule provides the handlers of these discarded products with flexibility in accumulating, transporting, and consolidating waste mercury-containing products prior to recycling. This flexibility allows use of existing infrastructures for some of these activities (existing businesses may accumulate universal waste, for example, and existing carriers—or handlers themselves—may transport universal waste). As noted above, DTSC and CIWMB are collaborating to develop an infrastructure to collect universal wastes (including mercury-containing wastes covered by these regulations) generated by households and CESQUWGs. Please see the response to comment CC-6, above, for discussion of mercury retirement.

J-6 *While recycling is preferable disposal, DTSC should focus on retirement in the long term.*

Please see the response to comment CC-6, above.

Physicians for Social Responsibility, Los Angeles

W-6 *DTSC should add retirement as an alternative to recycling to the text of each applicability section. Retirement will be explored under federal legislation (S. 351, Collins).*

Please see the response to comment CC-6, above. The commenter suggests that DTSC allow retirement as an alternative to recycling of mercury. However, as noted in the response to comment CC-6, reclamation of the mercury in products that contain it is a necessary before it can be retired. Recycling the mercury in products is, therefore, a necessary predicate to retirement, rather than an alternative.

W-8 *DTSC should place more emphasis on manufacturer responsibility and retirement. California should support S. 351. Manufacturer take-back should be mandatory. Nonessential mercury-added products should be banned. High capture rates should be required.*

Please see the response to comment CC-6, above, for discussion of mercury retirement. DTSC has no authority to regulate the formulation of products, to ban the use of mercury, or to require manufacturers to take back mercury-containing products. DTSC can require that mercury containing hazardous waste be recycled as a condition of universal waste management, which is what these regulations do.

Robyn Martin

BB-7 *I hope the state in the near future will establish a process for the safe retirement and isolation of mercury that has been recaptured.*

Please see the response to comment CC-6, above, for discussion of mercury retirement.

Hazardous Waste Classification

CALPIRG Charitable Trust

H-7 *Support classifying all mercury-containing waste as hazardous waste, with even more stringent standards for specific waste categories.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. In the Draft Mercury Report, DTSC proposed a regulatory approach similar to the one advocated by the commenter. In response to comments from a series of public workshops on the report and regulatory approach, DTSC narrowed the scope of the regulations to designate as hazardous waste discarded products with intentionally-added mercury that meet either or both of the following conditions: they are capable of being recycled, or have a mercury-free alternative available. These criteria support the three objectives of the regulations: encouragement of pollution prevention through the use of mercury-free products; development of products that use mercury alternatives; and recycling of mercury containing waste. See also the discussion of alternatives considered in the ISOR and FSOR.

Electronic Industries Alliance

L-2 *DTSC should clarify that unused products that contain mercury switches or lamps destined for recycling . . . are not subject to the proposed regulations.*

Unused products that become wastes are not categorically exempt from these regulations. If they are “discarded materials,” as defined in chapter 11 of title 22 of the California Code of Regulations, division 4.5, and meet one of the four listing descriptions in new section 66261.50, they are listed hazardous wastes. All four categories of listed wastes in the new hazardous waste listings added in these regulations are eligible to be managed as universal wastes, provided that they will be recycled.

Appendix to 45-Day Public Notice
Comment Summaries and Responses

The Effect of Market Share of Low-Mercury Lamps and Lamp Recycling Rate on Release of Mercury in California

Total Number of Spent Lamps*	Mercury Content of a Low-Mercury Lamp (kilograms) (Weighted average of T12 and T8 tubes)**	Mercury Content of a Higher-Mercury Lamp (kilograms) (Weighted average of T12 and T8 tubes)**
75,000,000	4.01E-06	8.29E-06

TABLE 1--Scenario 1: 20 percent recycling Rate for all lamps; Varying Market Share for Low-Mercury Lamps

Market Share of Low-Mercury Lamps	Market Share of Higher-Mercury	Mercury released annually from Low-Mercury Lamps (Kilograms)	Mercury released annually from Higher-Mercury Lamps (Kilograms)	Mercury Released from All Lamps (Kilograms)	
100.00%	**0.00%**	**240.60**	**0.00**	**240.60**	**<= This row shows the approximate amount of mercury that would be released if all lamps were manufactured with Philips' mercury concentrations (assuming 20% of all lamps recycled).**
90.00%	10.00%	216.54	49.74	266.28	
75.00%	25.00%	180.45	124.35	304.80	
50.00%	50.00%	120.30	248.70	369.00	
30.00%	**70.00%**	**72.18**	**348.18**	**420.36**	**<= This row shows the approximate amount of mercury released currently, with: 30% market share for Phlips (assuming 20% of all lamps recycled).**
10.00%	90.00%	24.06	447.66	471.72	
0.00%	100.00%	0.00	497.40	497.40	

*"The consumption rate of fluorescent tubes has been determined to be 2.2 tubes per year, per person. This factor has been widely used by U.S. EPA and others, and is consistent for California and nationally." (Source: Personal communication with Paul Abernathy, Executive Director of the Association of Lighting and Mercury Recyclers, April 26, 2001.) California's population of 33.87 million (Source: 2000 U.S. Census) was multiplied by 2.2 to calculated the approximate number of waste lamps generated annually in the State.

**Weighted averages for the mercury levels in Philips (low-mercury) fluorescent lamps and lamps produced by other manufacturers were calculated using data submitted by Roux Associates Inc. to comment on these regulations. According to table 1:A of Roux' submittal, on average: Philips 4-foot T-12 lamps contain 4.44 milligrams of mercury each; Philips 4-foot T-8 lamps contain 3.52 milligrams of mercury each; other manufacturers' 4-foot T-12 lamps contain 8.45 milligrams of mercury each; and other manufacturers' 4-foot T-8 lamps containt 8.10 milligrams of mercury each. The calculation of weighted average mercury levels in low-mercury lamps and higher-mercury lamps are shown in Table 4.

The Effect of Market Share of Low-Mercury Lamps and Lamp Recycling Rate on Release of Mercury in California

Total Number of Spent Lamps*	Mercury Content of a Low-Mercury Lamp (kilograms) (Weighted average of T12 and T8 tubes)**	Mercury Content of a Higher-Mercury Lamp (kilograms) (Weighted average of T12 and T8 tubes)**
75,000,000	4.01E-06	8.29E-06

TABLE 2--Scenario 2: Varying Lamp Recycling Rate for Higher-Mercury Lamps; No Market Share for Low Mercury Lamps

Rate of Recycling of Higher Mercury Lamps	Rate of Nonhazardous Disposal of Higher Mercury Lamps	Mercury released annually from Low-Mercury Lamps (Kilograms)	Mercury released annually from Higher-Mercury Lamps (Kilograms)	Mercury Released from All Lamps (Kilograms)	
20.00%	80.00%	0.00	497.40	497.40	
32.40%	67.60%	0.00	420.30	420.30	
61.40%	**38.60%**	**0.00**	**240.00**	**240.00**	**<= This row shows that *even if low-mercury lamps disappeared from the market*, less mercury would be released to the environment with a 61.4% lamp recycling rate than if the average mercury content of all lamps were equal to Philips' current average mercury content and were recyled at the current rate (approx. 20%). Minnesota reportedly has a 70 percent recycling rate.**
70.00%	30.00%	0.00	186.53	186.53	
80.00%	20.00%	0.00	124.35	124.35	
100.00%	0.00%	0.00	0.00	0.00	

*"The consumption rate of fluorescent tubes has been determined to be 2.2 tubes per year, per person. This factor has been widely used by U.S. EPA and others, and is consistent for California and nationally." (Source: Personal communication with Paul Abernathy, Executive Director of the Association of Lighting and Mercury Recyclers, April 26, 2001.) California's population of 33.87 million (Source: 2000 U.S. Census) was multiplied by 2.2 to calculated the approximate number of waste lamps generated annually in the State.

**Weighted averages for the mercury levels in Philips (low-mercury) fluorescent lamps and lamps produced by other manufacturers were calculated using data submitted by Roux Associates Inc. to comment on these regulations. According to table 1:A of Roux' submittal, on average: Philips 4-foot T-12 lamps contain 4.44 milligrams of mercury each; Philips 4-foot T-8 lamps contain 3.52 milligrams of mercury each; other manufacturers' other manufacturers' 4-foot T-12 lamps contain 8.45 milligrams of mercury each; andother manufacturers' 4-foot T-8 lamps containt 8.10 milligrams of mercury each. The calculation of weighted average mercury levels in low-mercury lamps and higher-mercury lamps are shown in Table 4.

The Effect of Market Share of Low-Mercury Lamps and Lamp Recycling Rate on Release of Mercury in California

Total Number of Spent Lamps*	Mercury Content of a Low-Mercury Lamp (kilograms) (Weighted average of T12 and T8 tubes)**
75,000,000	3.01E-06

TABLE 3--Scenario 3: Varying Lamp Recycling Rate; All Lamps Manufactured with 75 Percent of Philips' Current Mercury Levels

Rate of Recycling of "Extra Low"-Mercury Lamps	Rate of Nonhazardous Disposal of "Extra Low"-Mercury Lamps	Mercury released annually from "Extra Low"-Mercury Lamps (Kilograms)	Mercury Released from All Lamps (Kilograms)
20.00%	**80.00%**	**180.45**	**180.45**
25.00%	75.00%	169.17	169.17
50.00%	50.00%	112.78	112.78
70.00%	30.00%	67.67	67.67
80.00%	20.00%	45.11	45.11
100.00%	0.00%	0.00	0.00

<= This row shows that only in the improbable scenario that all lamps are manufactured to meet a revised mercury TTLC of 15 milligrams per kilogram and the current lamp recycling rate of approximately 20% does not drop, would less mercury be released to the environment than under the M003 listing (assuming California attans Minnesota's 70% lamp recycling rate).

*"The consumption rate of fluorescent tubes has been determined to be 2.2 tubes per year, per person. This factor has been widely used by U.S. EPA and others, and is consistent for California and nationally." (Source: Personal communication with Paul Abernathy, Executive Director of the Association of Lighting and Mercury Recyclers, April 26, 2001.) California's population of 33.87 million (Source: 2000 U.S. Census) was multiplied by 2.2 to calculated the approximate number of waste lamps generated annually in the State.

**The weighted average mercury level in Philips Alto low-mercury fluorescent lamps--4.01 milligrams per lamp--was multiplied by 0.75 to derive the average mercury content of lamps under a hypothetical scenario in which all lamps are manufactured with 75% of the mercury currently used in Alto lamps to meet a revised mercury TTLC of 15 milligrams per kilogram. The calculation of weighted average mercury levels in low-mercury lamps and higher-mercury lamps are shown in Table 4.

TABLE 4:
Calculation of Weighted Averages for the Mercury Content of Philips Lamps and non-Philips Lamps

A. Percentage of Tubes That Are T-8***	B. Percentage of T-8 Tubes That Are 4-Foot***	C. Percentage of Tubes that are 4-Foot T-8 (A x B)	D. Percentage of Tubes That Are T-12***	E. Percentage of T-12 Tubes That Are 4-Foot***	F. Percentage of Tubes that are 4-Foot T-12 (D x E)
40.62%	90.00%	36.56%	57.84%	73.00%	42.22%

Of the 4-Foot tubes sold, T-8 and T-12 Tubes have the following market share

G. Percentage of lamps that are 4-foot (C + F)	78.78%	H. Percentage of 4-Foot Tubes that are T-8 [(C/G) x 100 %]	46.41%	I. Percentage of 4-Foot Tubes that are T-12 [(F/G) x 100 %]	53.59%

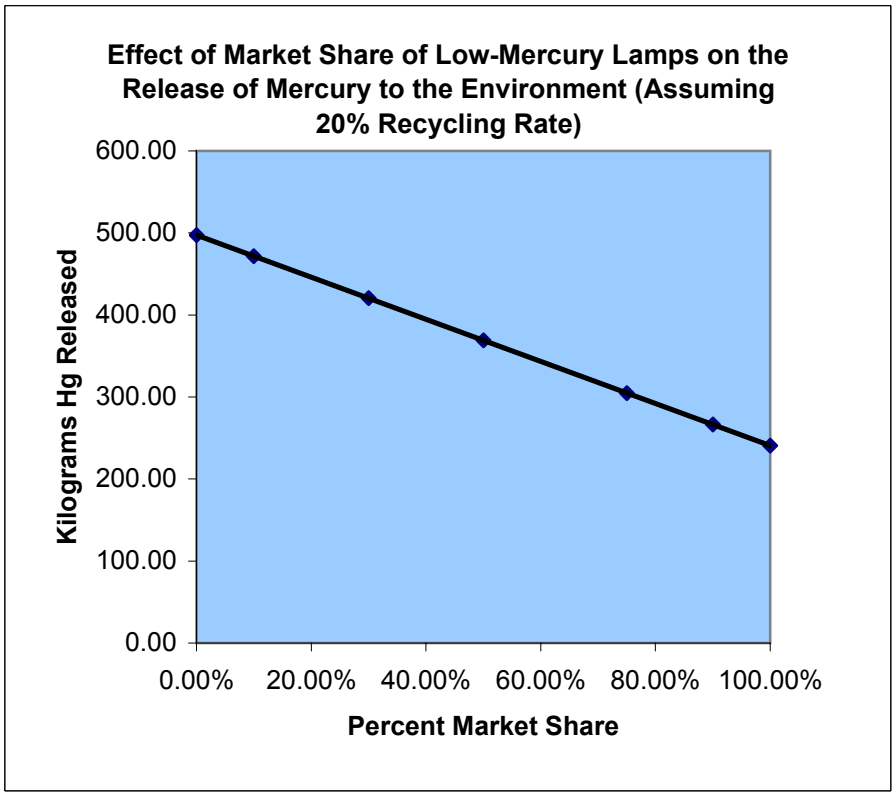
For the purpose of this approximation, it is assumed that the above percentages are the same for the three major manufacturers. The weighted averages of the mercury content of lamps are calculated below, using data on the mercury content of T-8 and T-12 lamps submitted by Roux Associates Inc. The majority of tubes sold (98.46 percent, according to Table 1:A of the Roux Associates, Inc., submission) are either T-8 or T-12 tubes, and the majority of T-8 tubes (90 percent) and T-12 tubes (73 percent) sold are 4 feet in length.

Other lamp configurations account for 21.22 percent of the lamps sold, according to the Roux Associates data. Of this percentage, 15.64 percent are T-12 tubes other than the 4-foot size, 4.06 percent are T-8 tubes other than the 4-foot size, and 1.54 percent are other sizes. For the purposes of this approximation, it is assumed that the weighted averages calculated based on T-8 and T-12 tubes are roughly representative of all lamps sold, including non-4-foot tubes.

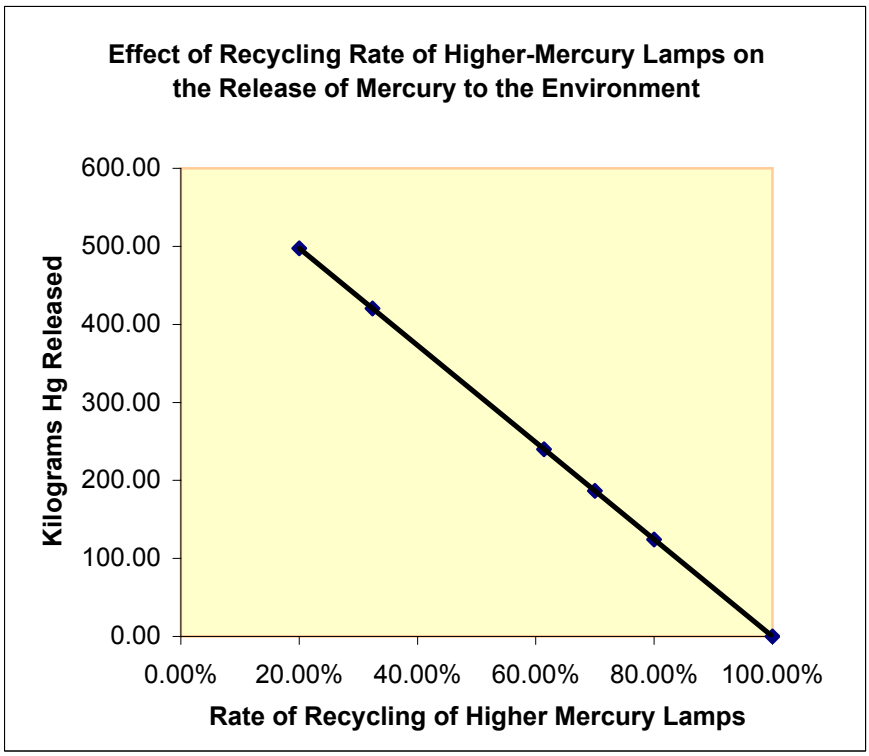
J. Average mercury content of Philips 4-foot T-8 Lamps	K. Average mercury content of Philips 4-foot T-12 Lamps	L. Weighted Average for Philips Tubes (J x H) + (I x K)	M. Average mercury content of non-Philips 4-foot T-8 Lamps	N. Average mercury content of non-Philips 4-foot T-12 Lamps	O. Weighted Average for Philips Tubes (M x H) + (N x I)
3.52	4.44	**4.01**	8.10	8.45	**8.29**

***Market share data for T-8 and T-12 lamps were obtained from the submittal by Roux Associates, Inc.

Market Share of Low-Mercury Lamps	Kilograms released from all lamps
100.00%	240.60
90.00%	266.28
75.00%	304.80
50.00%	369.00
30.00%	420.36
10.00%	471.72
0.00%	497.40



Rate of Recycling of "Higher Mercury"	Kilograms released from all lamps
20.00%	497.40
32.40%	420.30
61.40%	240.00
70.00%	186.53
80.00%	124.35
100.00%	0.00



Public Hearing Comment Summaries
And Responses

Mercury Waste Classification and Management Regulations: R-02-04 - Public Hearing Comment Summaries and Responses

HA *Osram Sylvania*

HA-1 *I'm here to support the proposed regulations as they apply to mercury-added lamps.*

DTSC acknowledges the commenter's support.

HA-2 *One of the reasons that recycling is stalled in the 20 to 25 percent range is the exemptions offered in various federal and state rules. Several states have recently swept away those exemptions, and California is now set to do the same*.

DTSC concurs with this comment. The State currently exempts households and the smallest commercial generators while collection and transport infrastructure is being built. These exemptions end in 2006.

Other lamps escape regulation by being classified as non-hazardous. In 2004, these lamps will also be classified as hazardous waste and will be required to be recycled. In this manner and using education and enforcement, DTSC expects to maximize the recycling rate for mercury-containing lamps to prevent release of any of their mercury into the environment.

HA-3 *The proposed regulations are supported by the sound research contained in DTSC's Draft Mercury Report.*

DTSC acknowledges the commenter's support for the findings of the Mercury Report.

HA-4 *Osram Sylvania supports recycling for all mercury-added lamps.*

DTSC acknowledges this support. All mercury-containing lamps must be recycled under these rules after February 8, 2004.

HA-5 *Osram Sylvania submitted separate written testimony supporting the regulations and pointing out seven areas for clarification*.

See the response to the written comments for the 45-Day Public Review and Comment Period for responses to Osram Sylvania's comments.

H-B *Association of Lighting and Mercury Recyclers*

HB-1 *We support these proposed regulations and are pleased that DTSC is considering factors that affect water quality, fish consumption, and human health.*

DTSC acknowledges the support and reiterates that these factors, as discussed in the Draft and Final Mercury Reports, are the factors that have led to these regulations.

HB-2 *We support inclusion of all mercury-containing lamps in this regulation without exception and without exemptions.*

DTSC acknowledges the support for the listing for all lamps with intentionally-added mercury. However, as discussed in further detail in the Final Statement of Reasons and the Final Analysis and Findings Required by Health and Safety Code section 25150.6, DTSC is allowing the existing household and small quantity exemptions to apply to all hazardous waste lamps. The exemptions exist to allow time for infrastructure to develop for collection and transportation of lamps from households and the smallest commercial generators. DTSC has determined that the delay is needed because requiring proper management (recycling) prior to development of infrastructure would, when households and small commercial generators were faced with few and expensive options for managing their wastes, lead to habitual and difficult to reverse illegal disposal in the solid waste stream or, worse, into the general environment.

DTSC is also delaying the effective date of the listing for lamps (M003) to allow time for educational outreach to persons currently using non-hazardous lamps. At least some of the persons using currently non-hazardous lamps purchased these lamps with the understanding that they could be disposed as non-hazardous solid waste. DTSC will need time to educate both these generators and the solid waste management industry that the lamps are regulated as hazardous waste under the M003 listing and that proper recycling is the required management technique.

HB-3 *We do not agree that the new listing of mercury lamps should be delayed until 2006. DTSC has not moved quickly enough on diverting mercury lamps from the garbage.*

DTSC disagrees that the listings should become immediately effective. However, this comment is being partially accommodated by moving the date forward by two years to 2004. DTSC has incorporated the delay because education is needed for both these generators and the solid waste management industry, about regulation of the lamps as hazardous waste under the M003 listing and that proper recycling is the required management technique. To immediately regulate these lamps without education outreach would brand many persons trying to properly manage their wastes as illegal disposers because the non-hazardous lamps were purchased, in at least some cases, with the understanding that they could be disposed as non-hazardous waste. Therefore, DTSC will retain the ultimate 2004 effective date to allow DTSC and the CUPAs time to educate generators and solid waste management facilities about the regulated status of these lamps.

HB-4 *If DTSC delays the M003 listing until 2006, "there is little hope of keeping another hundred million or so lamps out of the environment. We think this is unacceptable and we think you can do something about it."*

DTSC acknowledges that delay in the effective date of the M003 listing will allow numerous lamps to go legally to non-hazardous waste landfills. However, as discussed above in the response to Public Hearing comment HB-3, DTSC believes that the environment will ultimately be better protected with a delay in the M003 effective date. However, DTSC is shortening the delay period as discussed in Public Hearing comment HB-3 above.

H-C *California Public Interest Research Group*

HC-1 *We strongly support the department's assessment of the mercury problem.*

DTSC acknowledges the commenter's support on the mercury problem assessment.

HC-2 *Strongly supports "the department's proposal to classify all mercury-containing waste as hazardous waste."*

DTSC acknowledges the commenter's support for the general direction of these regulations. However, DTSC is only addressing a manageable subset of mercury containing wastes for several reasons:

> Each rulemaking must have a limited and defined scope to allow the rulemaking to be completed in a manageable timeframe. DTSC has limited the scope of this rulemaking to the objectives stated in the Final Statement of Reasons.
>
> The rulemaking is intended to identify as new hazardous wastes those mercury-containing wastes for which recycling is technically and economically feasible and/or for which mercury-free alternatives exist.

The rulemaking is limited to wastes with "intentionally-added" mercury because increasingly sensitive analytical techniques will find small traces of mercury in every object on the planet, while very small traces of mercury do not pose a significant hazard to human health and the environment.

HC-3 *The proposal does not adequately encourage the elimination of mercury from use in consumer products.*

See the response to comments CC-2 and CC-3, incorporated herein, for a discussion of DTSC's approach toward creating disincentives for mercury use and the limitations on DTSC's authority to force elimination of mercury from consumer products.

HC-4 *The proposal lacks adequate oversight and enforcement to ensure that mercury in disposed products is collected and contained in a manner most protective of public health.*

DTSC's and the CUPAs inspection and enforcement authorities are granted by Chapter

6.5 of the California Health and Safety Code and are not found in the implementing regulations. As discussed above in the response to comment DD-4, DTSC and the CUPAs have extensive authorities to enforce the Universal Waste Rule standards.

HC-5 *As an incentive for use reduction and the development of alternatives, the commenter recommends an advanced disposal fee. The fee would promote recycling of products with no alternatives and would help fund oversight and education. Generators of hazardous waste should be held financially accountable for its management.*

DTSC concurs that an advanced disposal fee would be one of a number of powerful and effective approaches to maximizing the recycling rate for mercury-containing wastes. However, DTSC does not have authority to establish advanced disposal fees, mandatory take back programs, toxic content taxes or fees, and many other effective approaches to promoting recycling and reduction of toxic constituents. This rulemaking represents DTSC's understanding of the most effective alternative for promoting recycling and proper management of mercury-containing wastes within the authority granted to DTSC.

HC-6 *A concrete plan for the collection and storage of retired mercury is necessary. Reclaimed mercury should be taken out of the environment as much as possible. The department's proposal and its language should reflect the intention to retire reclaimed mercury and take it out of commerce.*

Please see the response to comment CC-6.

HC-7 *California should act quickly to ensure an effective collection infrastructure is in place for mercury that is destined for retirement.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. To be eligible for management as universal waste, the waste mercury-containing products covered by these regulations must be recycled. The universal waste rule provides the handlers of these discarded products with flexibility in accumulating, transporting, and consolidating waste mercury-containing products prior to recycling. This flexibility allows use of existing infrastructures for some of these activities (existing businesses may accumulate universal waste, for example, and existing carriers—or handlers themselves—may transport universal waste). As noted above, DTSC and the CIWMB are collaborating to develop an infrastructure to collect universal wastes (including mercury-containing wastes covered by these regulations) generated by households and CESQUWGs. Please see the response to comment CC-6, incorporated herein, for discussion of mercury retirement.

H-D *Clean Water Action*

HD-1 *We're very pleased that the department has opted to bring all mercury-containing light bulbs, even those with low mercury content, into the regulatory domain.*

DTSC acknowledges the commenter's support.

HD-2.1 *I strongly support the decision . . . To consider an entire car to be hazardous waste until mercury-containing elements have been removed. This provides shredders or crushers with incentives to remove mercury switches and vehicle manufacturers an incentive to phase out mercury switches.*

DTSC acknowledges this support. Note, however, that this classification as hazardous waste has been modified so that vehicles are hazardous waste only if all the mercury-containing light switches have not been removed. The reasons for these changes are detailed in the FSOR.

HD-2.2 *I strongly support the decision . . . To consider an entire appliance to be hazardous waste until mercury-containing elements have been removed. This provides shredders or crusher's incentives to remove mercury switches and appliance manufacturers an incentive to phase out mercury switches.*

DTSC acknowledges this comment and agrees with the commenter's assessment of the impact of these regulations

HD-3 *The proposed regulations lack enforcement embedded into the regulations. Without strong enforcement mechanisms, there is little reason to believe the program will be realized.*

As discussed in the responses to comment DD-4 and Public Hearing comment HC-4, incorporated herein, the statutory authorities granted to DTSC and the CUPAs by Chapter 6.5 of the Health and Safety Code are sufficient to ensure compliance with the Universal Waste Rule.

HD-4 *A compliance certification program, like those used in other regulatory settings can ensure real reductions in mercury-containing wastes.*

DTSC has chosen to implement the same regulatory model as used for general hazardous waste management to implement these regulations. In this model, the State establishes regulatory standards, uses educational outreach to publicize the regulatory standards, and uses inspection and enforcement to assure compliance. DTSC has elected to not use a certification program because of the administrative overhead required to obtain, track, and verify certifications. DTSC has chosen, instead, to utilize

resources for educational outreach and inspection and enforcement to gain compliance.

HD-5 *I urge the department to proactively work with the State Legislature to develop an advanced disposal fee program for applicable products as soon as possible.*

See the response to Public Hearing comment HC-5 above, incorporated herein. Note that DTSC will work with the Legislature, as the Legislature requests, on any proposed legislation that offers improvements to prevention of mercury release to the environment.

HD-6 *Recycling has to be coupled with effective source reduction strategies and a permanent capture and retirement program for the mercury in products.*

Please see the response to comment CC-6, incorporated herein.

HD-7 *By focusing regulations solely on products that already have non-mercury alternatives, DTSC is creating a disincentive for the creation of new alternatives for other products in the future.*

DTSC is not creating a significant disincentive for development of alternatives to mercury use. Many other factors continue to provide strong incentives for mercury free alternatives to current mercury-containing products. Among other factors, worker safety and hazard communication, liability insurance, product stigmatization (as a “toxic” product), cost of managing mercury-containing hazardous waste from the production process, and potential classification of the product as hazardous waste due to mercury content provide powerful incentives for replacing the mercury.

HD-8 *The proposal to export mercury out-of-state for recycling has the potential for unintended consequences: environmental justice implications; difficulty in tracking; verification that the mercury is, in fact, recycled properly.*

Environmental justice issues arise out of land use and siting decisions rather than the recycling requirement for universal waste. In fact, because solid wastes are often managed in poor areas, removing hazardous constituents from the wastes would improve the environmental justice for those areas by eliminating release of mercury.

There will be difficulty in tracking universal wastes and in verifying that wastes are, indeed, recycled. New inspection and auditing techniques will be developed to address these issues. However, elimination of the prescriptive and complex standards for tracking and managing universal wastes is at the heart of the justification for adopting universal waste standards. This is because making management simpler and focusing the costs on ultimate recycling rather than intermediate management will give a better ultimate environmental result. Simpler management will minimize the incentives for illegal disposal. In other words, the State is “giving a little, to get a lot.” More stringent requirements for recordkeeping and manifesting may be imposed at a later date if

necessary.

H-F *Northern California Auto Dismantlers Association*

HF-.5 *The State of California Auto Dismantlers Association (SCADA) supports the voluntary removal of mercury-containing automobile trunk and light, hood light switches.*

DTSC has determined that voluntary efforts will not succeed in diverting a significant amount of mercury from the solid waste stream because there is no economic incentive to do so and businesses are primarily motivated by profit.

To ensure compliance, it is necessary to create a level playing field where persons in the same business face the same costs. Otherwise, a business that chose to properly remove and recycle mercury switches would be placed at a competitive disadvantage compared to those that do not. Given the competition and the small profit margin of most recycling industries, DTSC would expect firms to have an economic incentive to continue to not remove the switches unless every automobile recycling firm were faced with the requirement to remove the switches and was therefore, faced with the same costs.

HF-1 *The proposal to require removal of all mercury switches, recycling of all switches, and certification that all switches have been removed is not workable. A switch that is not recycled, and a vehicle from which all switches are not removed, would be considered hazardous waste. Dismantlers do not know which parts contain mercury switches. (The commenter brought various parts removed from vehicles that "may or may not contain mercury"--a climate control device, air bag sensors, a metering device for a vacuum.) Dismantlers have no information on which vehicles contain mercury. They are told that they will be provided the information, which "could impose a great deal of new information" on dismantlers, which they would have to provide to their employees.*

DTSC has partially accommodated this comment. In response to this and other comments, required removal of switches has been limited to hood and trunk mercury-containing light switches in the 15-Day Notice of Changes. Additionally, the certification requirement was deleted. See the response to comment Q-7 and Public Hearing comment HF-7 below.

HF-2 *The organization is not sure whether dismantlers are expected to remove the mercury from the switches, or "take these switches out as they are."*

Dismantlers are expected to remove intact switches and send them, intact, to another handler or a mercury recycler. The regulations allow universal waste management after the switches are removed. However, universal waste management standards do not

allow dismantling of the actual switch because switches would be very difficult to dismantle without release of the mercury.

HF-3 *Shipping "thousands and thousands of pounds" of whole autos (as hazardous waste?) would be very costly. Removing mercury switches may be excessively costly, if it takes a long time to do.*

To avoid shipping autos under the general hazardous waste standards, a person must only remove the hood and trunk light switches and manages them separately as universal waste. DTSC concurs that removing all switches may be costly; however, the 15-Day Notice of Changes limits the removal requirement to hood and trunk light switches, in intact hoods and trunks. There is sufficient documentation on the presence or absence, location, and removal methods for these switches to easily remove them. As discussed in the economic analysis used to develop the Form Std. 399 for this rulemaking, it takes little time to remove trunk and hood light switches. Removal of only those switches is neither time consuming nor excessively costly.

HF-4 *Unsure whether the requirement to remove mercury switches will affect employee training, Cal-OSHA involvement, and fire department involvement. The fire department is "going to be concerned about any potential fire hazards that are going to be created with the quantities of this collected in one area."*

The allowance to remove the mercury switches requires simple and informal employee training. Training would be needed simply to ensure that the switches are removed in the most efficient manner. Cal/OSHA rules must be followed for all workplace activities. Note that management of waste vehicles involves generation and management of other hazardous wastes (used oil, waste gasoline, lead-acid batteries) and Cal/OSHA rules for hazardous waste workers are triggered by those wastes even without this rulemaking. Mercury is not a flammable liquid and switch housings are plastic or metal and offer no fire hazards beyond other components of the autos. Other wastes such as used oil and gasoline offer more serious fire hazards. In the event of a fire that involved accumulated switches, a mercury emission hazard would exist and precautions should be taken to protect switches (and other wastes) from fire.

HF-5 *We don’t know the cost of complying with the proposed regulations.*

DTSC, in compliance with statutory requirements for rulemaking, has considered all reasonably available information about the costs of such management and has factored them into the economic analysis that accompanies this rulemaking. While the exact costs encountered by any specific individual managing these wastes may not be exactly reflected by the general estimates of costs, the cost estimates do constitute a good “ballpark” estimate of removal costs.

HF-6 *How can we possibly be expected to certify that all the mercury is out of the vehicles not knowing where it is?*

DTSC has accommodated this comment by removing the requirement that all mercury switches be removed in order for the vehicle to exit the M001 listing. Now, only the light switches in the hood and trunk must be removed prior to recycling. That requirement has been retained because there is much information available about which vehicles contain light switches, where the switches are located, and how to remove them.

HF-7 *Is there a mechanism to enforce the switch removal certification requirement? Would there be civil penalties for violations. Could there be jail time? Will the requirements "eventually cause us to shut down our businesses?" Who is going to be liable?*

The switch removal certification has been removed from the proposal in the 15-Day Notice of Changes. It was removed because the information available on the existence, location, number, and removal procedures for mercury switches in specific models of vehicle makes it virtually impossible to know if all the mercury-containing switches in the have been removed. Therefore, certification would have been very difficult and risky. For further discussion, see the Final Statement of Reasons.

HF-8 *Our insurance costs (which are already "extremely" high) will go up (as a result of these regulations) because there will be another (risk) factor.*

DTSC does not believe that managing switches as universal waste will add another risk factor that should increase insurance premiums for persons handling universal wastes. Unless a person is in the business of collecting and managing universal wastes from other handlers, the universal wastes are generated by the business regardless of the regulatory status of the wastes. For instance, an automobile scrap yard handles vehicles with mercury switches with or without these regulations. They also already handle other hazardous wastes. The regulations do not change the chemical hazards offered by the switches. They do, however, reduce the chance of contaminating properties with mercury released from the switches during crushing, baling, or shredding of the vehicles and should reduce risk based on that fact. However, DTSC does not regulate the behavior of insurance companies and can give no assurances that insurers will not raise premiums.

HF-9 *The proposal, as written, puts my business in such serious jeopardy that there's no way that I could ever see keeping my doors open and being willing to sign a certification that my vehicles are free of mercury. Further, some vehicles are so severely damaged that we cannot get to all of the (mercury-containing) parts.*

The certification requirement has been removed in response to this and other comments. See the response to Public Hearing comment HF-7.

HF-10 *Assuming that each car has two mercury switches (which the commenter felt is an overestimate, based on his vehicle inventory), and that a dismantler*

recycles 250 vehicles per year, "in a year I'd come up with less than a pound" of mercury. If there are 50,000 pounds of mercury in the environment, the contribution from automobile switches is very small.

While the amount of mercury in individual vehicles seems small, it is much larger in terms of its potential to pollute than is readily apparent. Each switch contains at least one gram of metallic mercury – an amount equivalent to that in approximately 500 to 1000 fluorescent tubes. The huge number of vehicles scrapped each year in California, releases about one ton of mercury each year. Given the ability of mercury to move through the environment into the waters of the State and its persistence in the environment, all sources of metallic mercury are significant and must be controlled.

HF-11 *Just transporting the mercury removed from vehicles to out-of-state recycling facilities would do more environmental damage, from the standpoint of fuel alone (than not removing the switches).*

DTSC does not agree with this statement and has seen no data or studies that would support this assertion. The actual mercury-containing switches are small and many switches can be packaged into a small box or plastic bottle. Once removed, they can be transported using any common carrier or package service that will accept this type of hazardous material. Thus, no special trips will be necessary to ship the removed switches and they should not constitute a significant fraction of any single load of cargo.

HF-12 *SCADA members handle approximately 25 percent of the vehicles in the state. And SCADA members are the dismantlers that would be most likely to comply with the regulations. How can we tell our membership that they should take on this liability and sign a certification? Anyone who would sign a certification would be signing something that they cannot know is true.*

The certification requirement has been removed in the 15-Day Notice of Changes in response to this and to other comments. See the response to Public Hearing comment HF-7 for further discussion.

HF-13 *The rule should be limited to hood and trunk switches, and the dismantlers should be required to certify only that they have removed all hood and light switches "to the best of our knowledge."*

The certification requirement has been removed in the 15-Day Notice of Changes in response to this and to other comments and the listing was changed to limit the listing to mercury containing light switches. See the response to Public Hearing comment HF-7 for further discussion.

HF-14 *California needs to implement a recycling program for mercury switches like the used oil and bottle recycling programs, where there's a reward for recovering the switches. Anyone removing a switch from a vehicle, even if the person is unlicensed or unregulated, would have an incentive to bring the*

switch in and get some sort of rebate.

DTSC concurs that such a deposit/rebate system would provide an incentive for proper management of mercury containing switches; it lacks authority to create such systems. This regulation creates as much incentive to remove switches as can be established administratively by DTSC. It does so by (correctly) identifying the switches and vehicles containing the switches as hazardous waste and by creating a simple and streamlined system for management of the switches after removal.

Only the Legislature can create such a deposit/rebate program.

HF-15 *In most mercury switches found in vehicles, the mercury is carefully encapsulated in substantial units. It's not likely that--if they were put into a landfill--there would ever be a problem with them leaking mercury.*

End-of-life vehicles with intact switches are not generally discarded in landfills. They are shredded, baled, crushed, or sheared into bits and pieces of scrap metal that can then be smelted into steel for new products. Plastic and "pot metal" switches can generally be expected to shatter and release their mercury in the scrap recycling process, both releasing mercury to the air and contaminating the scrap metal with mercury that is released to the air later when the scrap metal is smelted.

If switches were removed from the vehicles and then deposited into landfills rather than sent for recycling, many of the switches would be broken as the waste is spread into the landfill and covered with "daily cover" (dirt spread on top of the garbage every day by heavy equipment). Other switches would be entombed in the landfill to slowly degrade. Ultimately, all the switches in the landfill would corrode or other wise degrade releasing the mercury into the environment. Disposing of mercury switches (and other mercury containing equipment) into landfills, at best, simply delays release while recycling prevents release.

H-E *State of California Auto Dismantlers Association (SCADA)*

HE-1 *SCADA and its members want to work with DTSC to develop a workable program (for removing automotive mercury switches).*

DTSC will work with SCADA and other interested parties to generate quality guidance for switch removal.

HE-2 *There is speculation that there are mercury switches in antilock brake (ABS) systems. Currently, ABS systems are valuable commodities that are almost always removed from vehicles prior to crushing. But in the future, they may become a liability, instead of a commodity. (Therefore,) in order for this to be*

a workable regulation, we have to focus on regulating the product and not the industry.

DTSC does not have authority to regulate products or constituents used in products. DTSC can only regulate products when discarded by disposal or recycling to prevent environmental release of hazardous constituents. DTSC will provide information to the Legislature as requested and will advise the Executive Branch on any proposed legislation.

HE-3 *SCADA members are only responsible for 25 percent of the state's end-of-life vehicles. Therefore, in order for the regulations to work, we have to focus on the mercury switches themselves, and make the regulations feasible for everyone involved, not just auto dismantlers.*

The regulations address all discarded mercury-containing light switches regardless of who generates the switches. All waste vehicles, regardless of who manages them, are subject to the M001 listing and all removed switches may be managed as universal waste.

HE-4 *SCADA would like to investigate working with DTSC in implementing a SCADA-run program, much like the state's storm water program, where we have a group certification program.*

The certification requirement has been removed in the 15-Day Notice of Changes in response to this and to other comments. See the response to Public Hearing comment HF-7 for further discussion

Note that group certifications and other association actions are not necessary for this regulatory program because there are no plan approvals of submissions required. All that is required is that the mercury-containing light switches be removed and properly managed.

H-G *"Coalition of Health Related Organizations"*

HG-1 *We are concerned about the disposal of dental amalgam, which has been made little of. I am glad to see dental amalgam included in the new regulations.*

DTSC acknowledges the commenter's support.

HG-2 *Many dentists don't pay attention to the amalgam waste going down the drain. There is no oversight or inspection. Amalgam particles wind up going into public wastewater treatment programs, where they cannot be extracted. The amalgam goes either into the sludge, or into our waterways.*

Inclusion of amalgam wastes as universal wastes will make management of those wastes simpler and less expensive. With the growing focus on mercury in the waters of the State, more and more dentists will use various control devices such as amalgam separators to filter the amalgam fines from wastewaters. The existence of the Universal Waste Rule standards for waste amalgam will act as an incentive towards proper management and cessation of drain disposal.

Wastewaters containing more than miniscule amounts of amalgam will exhibit the characteristic of toxicity under section 66261.24(a)(2) for both mercury and, potentially, silver. As hazardous wastes, these wastewaters cannot be discharged to the sewers under Health and Safety Code section 25189.5. The wastewaters must be rendered non-hazardous prior to sewer discharge or the discharge is illegal disposal of a hazardous waste. Illegal disposal is a serious felony subject to both civil and criminal penalties.

HG-3 *Several organizations, including alloy manufacturers, put out misunderstandings about amalgam. They say it's very stable. It is relatively structurally stable in your mouth, but it is not inert. Amalgam in the mouth is constantly off gassing (mercury), which is diluted into saliva, beverages and food. A small quantity of mercury vapor from amalgam is inhaled with every breath. There are very good scientific papers published in peer review journals that those studies have revealed this.*

See response to comment B-1. Note that DTSC has no authority to regulate emissions from materials until the materials themselves become hazardous wastes. The definition of hazardous waste (Health and Safety Code section 25117) excludes uncontained gases from classification as hazardous waste.

HG-4 *"I would almost guarantee" that most dentists do not carefully and conscientiously trap amalgam and dispose of it as toxic waste.*

While this assertion may be correct, DTSC is not adopting regulations addressing enforcement actions. This comment makes no objections or suggestions that are germane to the regulations being adopted.

HG-5 *Commenter questions whether anyone is responsible for enforcing proper management of amalgam waste. How many people? How subject to budget cuts are they? Do they look only at paper work, or do they go and see if dentists actually have amalgam traps?*

DTSC and the CUPA inspectors are charged with ensuring proper management of hazardous waste, including dental amalgam. Water quality inspectors from the RWQCB and the Publicly Owned Treatment Works are responsible for ensuring that wastewater discharges are consistent with standards for those discharges. Inspection of dental clinics is only one of many priorities for inspectors, and enforcement is carried out according to the individual priorities of the inspecting agency. Note that this

rulemaking establishes new hazardous waste listings and special management standards for mercury-containing wastes and does not address enforcement issues.

HG-6 *It's important that dental offices be included with as much regimen and oversight as auto dismantlers or any other source of mercury.*

DTSC acknowledges this comment and will factor it into development of inspection priorities. However, development of such priorities is not within the scope of this rulemaking.

HG-7 *You have made a common error in referring to dental amalgam as "silver amalgam." The correct term is "mercury amalgam." This needs to be changed, because dental amalgam is approximately 50 percent mercury.*

The term “amalgam” is defined in Hawley’s “Condensed Chemical Dictionary”, 11th Edition, as:

“A mixture or alloy of mercury with any of a number of metals or alloys including cesium, sodium, tin, zinc, lithium, potassium, gold, and silver as well as with some nonmetals.

Thus, the term silver amalgam is a correct chemical description since the word “amalgam” refers to the mercury content and the word “silver” refers to the second component of the mixture.

HG -8 *Regarding the statement that amalgam or another material is appropriate and the decision to use amalgam is up to the dentist and their patients: Commenter states that “Patients currently are not given accurate full information” and the California State Dental Board was dissolved last year and a new board appointed in part because they refused to publish a consumer education folder with the truth about mercury amalgam.*

This rulemaking addresses classification and management of specified wastes containing mercury. Use of amalgam and consumer information about the use of amalgam fillings is not only beyond the scope of this rulemaking, it is also outside the scope of DTSC’s authority.

HG-9 *Commenter states that “dentists are not given accurate, truthful information” on amalgam from manufacturers and the dental associations and consequently believe there’s no harm in using amalgam.*

See the response to Public Hearing comment HG-8, incorporated herein.

HG-10 *Commenter states that DTSC needs to, as part of this rulemaking process, educate dentists [as to the effects of mercury in amalgam].*

See the response to Public Hearing comment HG-8. However, the commenter is correct in asserting that DTSC can educate dentists to the effects of mercury illegally discharged to the sewers. Educational outreach for these regulations may include this topic, among other topics.

HG-11 *Commenter makes an aside comment that when you drink or cook with fluoridated water, the fluoridated water causes mercury, lead, and other heavy metals to cross the blood-brain barrier. So by having it [mercury] going into rivers and streams and having that water fluoridated, people are being poisoned at a higher level.*

See the response to Public Hearing comment HG-8. Note that discharge of human waste to the sewers may include some mercury. However, DTSC expects that mercury in human waste, both liquid and solid, will be at very low levels that will not approach the thresholds for classification as hazardous waste.

HG-12 *Regarding the auto dismantlers' statement that they don't know where all the mercury is in the autos, commenter suggests that auto and auto parts manufacturers be required to send part numbers and all relevant data on parts [containing mercury] to the State. Then the State should disseminate the information to the public [and businesses] for use in identifying what needs to be removed, etc.*

While DTSC agrees that this action would allow much more effective removal of mercury switches from vehicles, DTSC does not have the authority to take the suggested action.

H-H2 Anita Vasquez-Tibau, California Director, representing Consumers for Dental Choice (CDC)

HH2-0 *CDC's position is that the mercury and dental filling issue is a huge global problem, as well as a state problem.*

See the response to Public Hearing comment HG-8, incorporated herein.

HH2-1 *One way to eliminate mercury in the environment is to start today by requiring mercury amalgam separators in all dental offices. Commenter asserts that this would eliminate a huge portion of the mercury going into the environment and that this requirement is already mandatory in Finland, Germany, Norway, Sweden, Switzerland, Canada, Denmark, France, and New Zealand.*

Generally, the composition of discharges to the sewers is enforced by the inspectors of the sewer agency. However, discharge of hazardous waste to the sewers in California constitutes illegal disposal of a hazardous waste because the State has not excluded mixtures of hazardous waste and domestic sewage as has the federal government. Nonetheless, DTSC is not addressing standards for sewer discharge or for treatment of

amalgam containing wastewaters in this rulemaking. Discharges of hazardous waste can be addressed by existing DTSC and CUPA inspection and enforcement staff and can be prevented under existing law with no changes to these proposed regulations. While DTSC cannot require the use of amalgam separators, it can provide authorization for the use of those separators. Note that authorization for use of separators is required by Health and Safety Code section 25201 if the wastewaters exhibit a characteristic of a hazardous waste. However, authorizing wastewater treatment is beyond the scope of this rule.

HH2-2 *The fishing industry in California is suffering from mercury contamination and that the dental business contributes the largest burden of mercury in wastewaters in the U.S. today. It is our obligation as a state to mandate that dental offices are required to have this mercury amalgam separators installed. The cost is minimal compared to the environmental issues that are created by their dental waste.*

See the response to Public Hearing comment HH2-1 above.

H-I Gene Erbin, Partner in the Law Offices of Nielsen Merksamer, representing Philips Lighting Company.

HI-1 *Opposes regulation because it essentially repeals the TTLC.*

These regulations do not repeal the TTLC. The TTLC will continue to be one of the criteria used to classify a variety of mercury-containing wastes as hazardous or nonhazardous. DTSC is not required to use the TTLC to classify all wastes as hazardous or nonhazardous. DTSC is also authorized, pursuant to section 25140 of the Health and Safety Code, to develop a listing of wastes that are determined to be hazardous, considering "the immediate or persistent toxic effects to man and wildlife and the resistance to natural degradation or detoxification of the wastes." See the FSOR for further discussion.

A number of mercury-containing wastes are already classified as hazardous wastes due to being listed in one of the four Resource Conservation and Recovery Act (RCRA) lists of hazardous wastes (Cal. Code Regs., tit. 22, ch. 11, art. 4). The four wastes that are newly-listed by these regulations were identified based on the three objectives of these regulations. See the FSOR and response to comment T-24 (45-Day Notice), incorporated herein, for further discussion on DTSC's objectives.

HI-2 *The proposed regulations violate Health and Safety Code Section 25179.4 because they fail to give top priority [or any priority] to source reduction.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. This comment is essentially similar to comments submitted in writing during the 45-Day Public Comment Period. The facts that the M003 listing of mercury is consistent with section 25179.4 of the Health and Safety Code and that it promotes

source reduction are discussed in detail in the responses to several of the 45-Day written comments. See, specifically, the responses to comments T-2, T-5 and T-24, incorporated herein.

HI-3 *Evidence in the rulemaking file is deficient in supporting DTSC's finding that universal recycling will be available in the near future.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. This comment is essentially similar to comments submitted in writing during the 45-Day Public Comment Period. See response to written comment T-28 (45-Day Notice), incorporated herein. The record contains substantial evidence from a major lamp recycling company (Onyx/Superior Special Services) and the Association of Lighting and Mercury Recyclers (ALMR), both of whom assert that adequate capacity already exists to recycle all lamps that can be diverted from California's municipal waste stream. Industry representatives also reported there is adequate capacity during the development of the Universal Waste Rule. DTSC considers the lamp recycling industry to be a reliable source of information about its own capacity. Also see the responses to comments C-8, C-9, and U-2, submitted during the 45-Day Public Comment Period, incorporated herein.

HI-4 *The regulations violate the Administrative Procedure Act (APA) standards of necessity, consistency and authority; and that the rulemaking file is deficient [in showing compliance with the APA standards].*

DTSC has reviewed this comment and determined that no regulatory change is necessary. This comment is essentially similar to comments submitted in writing during the 45-Day Public Comment Period. For discussion of why these regulations meet the APA standards cited by the commenter, see the responses to comments T-22, T-23, T-24 and T-25 in the 45-Day written comments and responses, incorporated herein.

HI-5 *DTSC failed to study alternatives, specifically the alternative of reducing the TTLC but not eliminating it.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. This comment is essentially similar to comments submitted in writing during the 45-Day Public Comment Period. DTSC evaluated the TTLC alternative in the ISOR and FSOR, incorporated herein, and rejected it. Also see the responses to comments Q-11, NN-6, T-4, T-19, and T-26.2 (45-Day Public Comment period), incorporated herein.

HI-6 *Two of DTSC's three objectives for the regulations are pollution prevention though the use of non-mercury alternatives and the development of products that use mercury alternatives. Commenter asserts that DTSC failed to meet those objectives for fluorescent lamps because fluorescent lamps <u>can</u> [transcript appears to be in error] be made without mercury.*

DTSC has reviewed this comment and determined that no regulatory change is

necessary. This comment is essentially similar to written comment T-9 submitted in writing during the 45-Day Public Comment Period. See the response to comment T-9 in the 45-Day written comments and responses, incorporated herein.

HI-7 *The [listing] criterion of availability of mercury-free substitutes does not apply [to fluorescent lamps] and DTSC's basis, therefore, for proceeding with the regulations is difficult to determine, based on the rulemaking record.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. This comment is essentially similar to comments submitted in writing during the 45-Day Public Comment Period. See the responses to comments T-9 and T-26 in the 45-Day written comments and responses, incorporated herein.

HI-8 *The DTSC assertion that people who purchase low level mercury lamps do so to avoid managing the lamps as universal waste, recycling them, or disposing them as hazardous waste is false. Cannot determine the basis for that statement in the rulemaking file. We have evidence in our submission that it's just the contrary.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. The commenter asserts that Philips' customers voluntarily recycle lamps at a higher rate than the purchasers of other brands, many of whom are required to recycle. As evidence to support this assertion, the commenter submitted a letter from EPSI, a lamp recycling firm, stating that stating that Philips ALTO lamps represent 36 percent of the lamps they process. DTSC finds this "evidence" less than persuasive. Another commenter refutes the suggestion that EPSI's experience is representative of recyclers in general (see comment C-5 in the 45-Day written comments and responses). See also the responses to comments T-31 and T-45, incorporated herein, for discussion.

HI-9 *Philips is submitting evidence into the rulemaking file indicating that their customers recycle at a rate almost double the average rate of 20 percent indicated in the record.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. This comment is essentially similar to written comment T-31 submitted in writing during the 45-Day Public Comment Period. See the response to comments T-31 and T-45 in the 45-Day written comments and responses, incorporated herein.

HI-10 *The study of alternatives is again deficient because the basis used for considering alternatives [feasibility of recycling and availability of mercury-free substitutes] do not apply to fluorescent lamps.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. The commenter has misinterpreted the way in which DTSC applied its two criteria (the availability of mercury-free substitutes and/or the feasibility of recycling) in

identifying products for inclusion in these regulations' new list of hazardous wastes. Discarded products that met either or both of the criteria were considered for inclusion.

With regard to the availability of mercury-free substitutes, this comment is similar to Public Hearing comment HI-7, above, and to comments submitted in writing during the 45-Day Public Comment Period. See the responses to comments T-9 and T-26 in the 45-Day written comments and responses, incorporated herein.

The commenter himself has made several statements, at the public hearing on these regulations and in writing, in which he has touted the recycling ethic of Philips ALTO purchasers. DTSC does not understand, therefore, the commenter's statement that the feasibility of recycling is not an applicable criterion for the listing of mercury-added lamps as hazardous wastes.

HI-11 *DTSC uses statements of conjecture and the word "believes" to support regulations and asserts that DTSC cannot, as a matter of law, rely on belief and conjecture [as a basis to proceed with the regulations].*

DTSC has reviewed this comment and determined that no regulatory change is necessary. These regulations are based on facts compiled in DTSC's Final Mercury Report, not on "belief and conjecture," as the commenter asserts. The facts that support the need for these regulations are summarized in the response to comment T-1 in the 45-Day written comments and responses. See also the response to comment T-29.

HI-12 *The economic fiscal impact incorrectly states that the Philips fluorescent tubes cost $1.40 more than other tubes, and that other parts of the documents say the tubes cost $1.25 to $1.40 more. The price of Philips tubes is the same as other tubes and that the rulemaking record is incorrect and inconsistent.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. This comment is similar to written comment T-51, submitted during the 45-Day Public Comment Period, incorporated herein. As noted in the response to comment T-51, DTSC's statement in the economic analysis for these regulations to the effect that Philips Alto lamps were more expensive to purchase than competing lamps was based on a spot check of the prices of various brands of lamps at a large home improvement retail store. Lamp prices were not a basis for the M003 listing, and the price of mercury-added lamps was not used in any calculations of the fiscal or economic impact of these regulations. Therefore, if the commenter's assertion that Philips lamps generally cost no more to purchase than the other major brands is true, DTSC's analysis of the economic impact of these regulations would, nevertheless, remain valid.

HI-13 *Philips doesn't know how DTSC can proceed on the basis of this record with [rulemaking that is] a dramatic departure from existing practice that is unwarranted under statute.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. This comment is similar to written comment T-48, submitted during the 45-Day Public Comment Period. The rulemaking record supports DTSC's regulatory proposals and complies with the requirements of the Administrative Procedure Act. As shown in the responses to earlier comments, the proposal is consistent with the priorities of Health and Safety Code section 25179.4. Pursuant to Government Code section 11346.9(a)(3), DTSC has responded adequately to all of the "evidence" submitted as comments by the commenter to support his assertion that the record is deficient.

The new hazardous waste listings in section 66261.50 of title 22 of the California Code of Regulations, title 22 are new, but are not a "dramatic departure from existing practice." As noted in the response to Public Hearing comment HI-1, California has already adopted the four RCRA lists of hazardous wastes (Cal. Code Regs., tit. 22, ch. 11, art. 4). Appendix X of chapter 11 of title 22 contains a list of nearly 800 wastes that are presumed to be hazardous unless they are determined not to be. As noted in the response to written comment T-22, section 25140 of the Health and Safety Code requires DTSC to adopt the listings and authorizes DTSC to revise lists of hazardous wastes. See also the response to written comment T-25 (45-Day Notice) for further discussion of DTSC's authority to adopt these regulations. There is ample evidence the regulations are warranted under statute.

Universal waste management and recycling of lamps is also not a "dramatic departure from existing practice." The Universal Waste Rule, adopted in March, 2002, already designates hazardous waste lamps as universal waste and provides management standards, including recycling.

HI-14 *Commenter suggests adopting the alternative proposed in their submission: reduction of the TTLC. This alternative would result in the quantifiable, immediate, measurable and verifiable reduction of the use of mercury used in lamps.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. This comment is similar to written comments T-13, T-16, T-26.2, and QQ-5, submitted during the 45-Day Public Comment Period. See also the responses to these comments for additional discussion.

H-J Teresa Pichay, representing the California Dental Association (CDA).

HJ-1 *The CDA supports DTSC's objective of recycling mercury-containing waste, and agrees with and supports the proposed regulations for dental amalgam waste.*

DTSC acknowledges the commenter's support.

HJ-2 *The best management practices DTSC will require dentists to follow [as part of the regulations] have been supported by research by Publicly Owned Treatment Works (POTWs) as being highly effective as a pollution prevention strategy.*

DTSC interprets this comment to be support for the conditions that DTSC has placed on the management of universal waste dental amalgam such as forbidding rinsing amalgam traps into sinks.

HJ-3 *Regarding other speakers' proposal for a requirement for amalgam separators, research done by the POTW[s] show that the amalgam separators only address one waste stream in the dental office, the dental unit, and do not address the sinks in the dental office.*

See the response to Public Hearing comment HH2-1 above. Note that discharge of hazardous waste to the sewers in California constitutes illegal disposal of a hazardous waste, regardless of whether it comes from an amalgam separator or from a sink.

HJ-4 *Use of the term "silver amalgam" does not need to be changed because it is a common chemical and metallurgical term that is not redundant. Use of the term "mercury amalgam", as proposed by other commenters, would be redundant because amalgam by definition means a mixture of metal with mercury.*

See the response to Public Hearing comment HG-7.

HJ-5 *Regarding a previous commenter's point about dental materials information provided to dentists and patients: Patients are receiving information from dentists regarding dental restorative materials, and effective this year, dentists are required to provide a dental materials fact sheet to patients on all types of dental materials.*

While DTSC appreciates this information, the comment and the previous comments referred to are both outside the scope of this rulemaking and are outside the scope of DTSC's authority to adopt regulations.

HJ-6 *The CDA preferred using the term "alternative" as opposed to "substitute" [when considering amalgam alternatives] because "substitute" implies an equivalency among the various dental materials [as opposed to equivalent function].*

While DTSC appreciates this information, the comment and the previous comments referred to are both outside the scope of this rulemaking and are outside the scope of DTSC's authority to adopt regulations.

H-K Bill Magavern, representing the Sierra Club California.

HK-1 *The Sierra Club supports maintaining the requirement that all mercury-containing light bulbs be classified as hazardous. The San Francisco Regional Water Quality Control Board says the breakage of fluorescent lamps is one of the largest sources of new mercury released into the San Francisco Bay.*

DTSC acknowledges the commenter's support.

HK-2 *The Sierra Club also supports the requirement that the entire car or appliance be classified as hazardous unless the mercury-containing switches are removed.*

DTSC acknowledges the commenter's support. However, note that the switch removal requirement has been limited to mercury-containing light switches for vehicles in response to comments. See the Final Statement of Reasons for further discussion.

HK-3 *The Sierra Club thinks DTSC should require using and regularly maintaining state-of-the-art amalgam separators in dentist offices.*

See the response to Public Hearing comment HH2-1.

HK-4 *The Sierra Club suggests that the 2006 effective date for fluorescent lamps to be classified as hazardous be moved up, at least for the large commercial buildings, to the date that the regulations go into effect.*

DTSC has partially accommodated this comment. The effective date for the M003 listing has been advanced to 2004 from 2006. Note that most spent fluorescent lamps are already classified as hazardous waste because they exhibit the characteristic of toxicity for mercury.

HK-5 *DTSC should work on packaging criteria for fluorescent lamps, possibly by requiring that the lamps be sold in a package into which they could be replaced when they're discarded.*

While the commenter's suggestion would be an effective answer to packaging waste fluorescent tubes, the action is beyond the scope of DTSC's authority to adopt regulations.

HK-6 *The Sierra Club suggests that DTSC develop a comprehensive enforcement plan to make sure that, even with this regulation, mercury isn't released into the environment.*

DTSC and the local enforcement agencies, the CUPAs, set priorities for enforcement actions based on many factors. However, this rulemaking is not intended to set enforcement priorities and the comment is beyond the scope of this rulemaking.

HK-7 *DTSC should establish a process to broaden this list [of products considered hazardous waste when discarded] so that DTSC doesn't have to go through a lengthy process to add products that will be considered hazardous when discarded.*

DTSC cannot adopt regulations without satisfying the requirements of the Administrative Procedures Act. Listing new products as hazardous waste establishes standards of general application which must be adopted as regulations.

HK-8 *DTSC should establish a process for the safe retirement and isolation of mercury waste.*

DTSC agrees that the ultimate solution to prevent further environmental contamination with mercury is to take it out of commerce. While the uses of mercury in products is decreasing (and these regulations will provide incentives for further reductions), mercury is still needed in certain applications. DTSC is participating in an effort by the Environmental Council of States (ECOS) to address the issue of long-term storage (retirement) of mercury. This issue is national in scope and is beyond the scope of this rulemaking. However, before the mercury in discarded products can be retired, it must be reclaimed (recycled). Elemental mercury that is recycled as a consequence of these regulations will be ready for retirement, once a solution to the long-term storage of this toxic metal is developed.

HK-9 *Even though DTSC doesn't necessarily have the authority to address this, DTSC should work with the legislature and other regulatory agencies to make sure that front end [product development] issues are addressed.*

DTSC is working with the Environmental Council of the States (ECOS) to develop a plan and funding for collection and retirement of recycled mercury.

HK-9.1 *A front end issue DTSC should address is banning mercury-containing products for which there are substitutes.*

DTSC has no authority to ban products. DTSC can only establish regulations governing the identification and management of hazardous waste.

HK-9.2 *Another front end issue DTSC should address is requiring labeling of all products that contain mercury.*

DTSC has no authority to establish labeling standards for products. DTSC can only establish regulations governing the identification and management, including labeling, of hazardous waste.

HK-9.3 *Another front end issue DTSC should address is putting recycling fees on the sale of products to fund a recycling infrastructure.*

DTSC has no authority to establish fees, deposits, or mandated takebacks for products. DTSC can only establish regulations governing the identification and management of hazardous waste. However, DTSC and the California Integrated Waste Management Board (CIWMB) are co-chairing an effort to develop a robust infrastructure to collect and properly manage universal wastes generated by households and small businesses.

H-L Joe Howley, Manager of Industry Relations and Environmental Marketing, representing GE Lighting.

HL-1 *GE Lighting supports the proposed regulations as they apply to mercury-containing lamps.*

DTSC acknowledges the commenter's support.

HL-2 *GE Lighting supports how the regulations will affect [management of] fluorescent lamps.*

DTSC acknowledges the commenter's support.

HL-3 *It is time for California to update the regulations from nearly 20 years ago and require the recycling of all mercury-containing lamps from commercial and industrial facilities. GE Lighting believes that the regulations on mercury-containing lamps should move forward, either together or separate from regulations affecting other mercury-containing products.*

DTSC is taking the actions suggested by the commenter and is going beyond the suggestion by applying these rules to all generators of waste lamps. Households and the smallest commercial generators become subject to the recycling requirement after a temporary disposal exemption.

HL-4 *GE Lighting requests that DTSC provide guidance to lamp users by clearly stating that any lamps purchased by commercial or industrial facilities in 2003 will be expected to be disposed in 2006 or later (due to three to five-year lamp life expectancy) and therefore are subject to the new recycling regulations.*

Note that the effective date of the M003 listing has been changed to 2004 in the 15-Day Notice of Changes in response to comment. DTSC will perform educational outreach to generators of waste mercury-added lamps in the future. However, DTSC will not

make the prospective statement that lamps purchased today will be hazardous waste by the time that they are spent.

HL-5 *Regarding why people purchase low mercury lamps: GE sells both traditional fluorescent lamps as well as low mercury lamps and in areas where the low mercury lamps can be landfill disposed, it's typically the only reason why people request this lamp type – to give them the option for landfill disposal and not recycling.*

DTSC acknowledges this information. However, DTSC has not reached any conclusions about why different people choose low or high mercury lamps and expects that some consumers will purchase low mercury lamps to be able to dispose of them as non-hazardous waste and others will purchase low mercury lamps to benefit the environment. The M003 listing is not predicated on either assumption.

H-M Mark Murray, Executive Director, representing Californians Against Waste.

HM-1 *It is important that DTSC update the regulations as they relate to mercury-containing products, and in general we support the direction that the regulations are taking.*

DTSC acknowledges the commenter's support. Note, however, that these regulations only address products after they become waste.

HM-2 *We believe that incentives and enforcement inherent in a regulatory structure respond to the need for 1) source reduction; 2) safe and effective recycling; and 3) aggressive enforcement of the existing and proposed expanded disposal ban.*

DTSC concurs with the commenter's understanding of the philosophy behind this rule. Enforcement will follow upon the establishment of this new regulatory structure for mercury-containing products, within the resource capabilities and other priorities of the hazardous waste enforcement agencies.

HM-3 *We support the approach in the proposed section 66261.50 [title 22 of the California Code of Regulations] to require virtually all mercury-containing products be managed as hazardous waste when discarded, while creating an incentive for recycling by classifying them as Universal Waste when safely recycled.*

DTSC acknowledges the commenter's support.

HM-4 *We strongly support the disposal ban for all fluorescent lamps containing any amount of added mercury.*

DTSC acknowledges the commenter's support.

HM-5 *The regulation package falls short in addressing the need for source reduction, real recycling, and meaningful enforcement of a disposal ban.*

Enforcement is not an issue addressed by this regulation. DTSC's enforcement authorities are contained in statute.

The regulations themselves, especially the new listings for mercury containing products, are an incentive for source reduction and represent the most aggressive steps DTSC can take to promote source reduction. DTSC cannot, for instance, ban the use of mercury in products. Likewise, these regulations strongly promote recycling of mercury from mercury-containing products by allowing universal waste management only if the products (except mercury-containing flooring) are recycled.

This comment makes no specific suggestions or objections that DTSC can analyze and take action on.

HM-6 *In the absence of source reduction incentives, the proposed expansion of the existing disposal ban may inadvertently remove the existing incentive for manufacturers to source reduce their products.*

Listing mercury-containing products as hazardous waste is an incentive in itself to eliminate the use of mercury. However, the listing for any amount of intentionally-added mercury may remove incentives to reduce the amount of mercury in any one product. While there is some validity to this argument, DTSC believes that the actual health threat of products with mercury disposed to the environment is of paramount importance given that mercury levels in many of the State's waters have already contaminated the aquatic food chain to the point where important sources of protein in our diet have mercury levels that trigger consumption warnings. One of DTSC's highest priorities is to ensure that wastes with high levels of mercury are not disposed in a manner that releases the mercury to the environment.

Additionally, DTSC's goal is not to reduce the amount of mercury in any product below a limit. DTSC's ultimate source reduction goal is the total removal of mercury from products. While reduced mercury lighting is less environmentally risky, it is not as desirable a goal as mercury-free lighting (all other factors being equal). Note that there are at least two new energy efficient alternatives to mercury-containing lamps approaching commercialization. Light emitting diodes are appearing in traffic lights, flashlights, and tail lights, and will soon be used as interior lighting. Likewise, new types of emission lighting using "leaky" cathodes are being tested and will soon be sold in Europe. Thus, DTSC's goal of zero mercury is not only feasible, but may be reached within the next decades.

The existing incentive to reduce mercury is the ability to make products where mercury content is below hazardous waste thresholds. Manufacturers can "game" these numbers by adding mass to other components or adding substances that interfere with the leaching tests. While the existing thresholds provide some impetus for source reduction, such impetus cannot be retained at the expense of the environment.

HM-7 *We support adding the M003 category to section 66261.50 [title 22 of the California Code of Regulations].*

DTSC acknowledges the commenter's support.

HM-8 *We strongly urge DTSC to retain the existing TTLC as a means of designating low mercury lamps for the purposes of product labeling, marketing, procurement, and other mechanisms to minimize levels of mercury in lamps and encourage consumer purchases of those lamps.*

The existing TTLC will be preserved for those products that do not contain recyclable mercury and for those products in which the mercury is not in metallic form or is not easily convertible to metallic form. Note that, as discussed in other responses, product labeling and marketing are beyond the authority of DTSC. Guidelines for purchase of products by the State of California are a potential product of the Cal/EPA Interagency infrastructure development workgroup.

It is important to stress however, that DTSC is not authorized to regulate products.

HM-9 *While we appreciate that the existing TTLC may no longer represent an appropriate threshold for determining waste management requirements, we urge DTSC to convene stakeholders to evaluate the existing TTLC threshold level in the context of a source reduction incentive system, and to develop additional source reduction incentives including, but not limited to, product labeling and public agency procurement preferences.*

DTSC acknowledges the comment, but the proposed actions are beyond the scope of this rulemaking.

HM-10 *Roughly 75-80% of all mercury lamps are being disposed in municipal landfills, either illegally or through the existing householder and small quantity generator exemptions. We strongly object to extending the householder and small quantity generator exemptions to 2006. We wouldn't want to stand in DTSC's way on it, but we are thinking 2004. With regard to small quantity generators, commercial generators, it's appropriate to close the loophole. For local agencies that need collection infrastructure, giving them until 2004 to develop some kind of mechanism for households is appropriate. But it should not be put too far out into the future.*

The 2006 date for the sunset of the conditionally exempt small quantity universal waste generator and household temporary exemptions was adopted in a previous rulemaking and is not being altered in this rulemaking. However, it is being newly applied to the wastes designated as universal wastes by this rulemaking.
DTSC has adopted the temporary exemptions to allow time for infrastructure to develop to collect and manage universal wastes generated by these numerous small entities prior to requiring them to recycle this waste. DTSC believes that requiring proper recycling for such small entities prior to developing a robust and widespread infrastructure for simple and cost-effective management would drive increased illegal disposal to the environment outside of landfills (where operators are now watching for universal wastes and rejecting loads containing them). Such environmental disposal clearly offers threats beyond those of disposal in an inappropriate, but more desirable, solid waste landfill.

For further discussion, see the Final Analysis and Findings Required by Health and Safety Code section 25150.6.

HM-11 *The regulation process has motivated stakeholders to try and work out a financing system to develop a collection infrastructure. It's got to happen through the legislative process but with an exemption date until 2006 some of that motivation may be lost. Making a shorter exemption period will motivate stakeholders to work together and work something into the next legislative session.*

DTSC believes that it will take until 2006 to be able to develop a plan, enact legislation or implement other alternatives, and actually implement the solutions at the collection agency level.

HM-12 *In order for the regulations to be successful, there is a need for public education and more aggressive enforcement. We don't think adoption of the regulations should be held up waiting for funding for these programs, but these kinds of programs are important.*

DTSC agrees that aggressive education and enforcement are vital to reaching a high recycling rate for the newly designated universal wastes. However, education and enforcement are beyond the scope of this rulemaking.

HM-13 *We support the notion of some kind of certification process for large generators of lamps, meaning big office buildings. It's appropriate that they have a management mechanism in place that ensures proper management and recycling, and it's appropriate for DTSC to require some kind of certification process and potentially assess a fee to pay for enforcement and public education.*

DTSC has chosen to implement the same regulatory model as used for general hazardous waste management to implement these regulations. In this model, the State

establishes regulatory standards, uses educational outreach to publicize the regulatory standards, and uses inspection and enforcement to assure compliance. DTSC has elected to not use a certification program because of the administrative overhead

required to obtain, track, and verify certifications. DTSC has chosen, instead, to utilize resources for educational outreach and inspection and enforcement to gain compliance.

HM-14 *There is a need for a front end financing mechanism to make sure [education and enforcement] devices are properly managed. This will take legislation but aggressive enforcement of the regulations, with some of the modifications we've suggested, will motivate stakeholders to work on a legislative package.*

While DTSC agrees that a "front-end" mechanism such as an advance disposal fee would be a good solution to the funding issues, such solutions are outside the authority of DTSC and would best be addressed by the commenters.

DTSC will enforce these regulations in accordance with its priorities for enforcement and its available resources.

H-N Charlie Brown, representing the Coalition to Abolish Mercury Dental Fillings.

HN-1 *Reports reviewed by a number of environmental groups and newspaper articles identify dentists and dental fillings as the largest source of mercury in wastewater.*

See the response to Public Hearing comment HH2-1, incorporated herein.

HN-2 *Each [amalgam] filling has a half a gram of mercury and the dental associations have a gag rule that tells dentists not to criticize/talk about the amount of mercury in the fillings.*

DTSC has designated waste amalgam as a universal waste to ensure that the mercury is properly managed by recycling. However, DTSC has no opinion about gag orders and regulation of the practice of dentistry, beyond dental waste management, is beyond the authority of DTSC.

HN-3 *These regulations are a step backward [because] you have no requirements [for dentists] at all and you are giving dentists a free ride [by not] making them buy [amalgam separator] equipment.*

See the response to Public Hearing comment HH2-1, incorporated herein .

HN-4 *The American Academy of Biological Dentistry, a research group, urges you to require every dentist to do that [buy/use amalgam separators].*

See the response to Public Hearing comment HH2-1, incorporated herein.

HN-5 *Please have them [the dentists] buy that equipment [amalgam separators].*

See the response to Public Hearing comment HH2-1, incorporated herein.

HN-6 *It's time for you to do your job; it's not a resource problem, it's the rule of compliance. [You should] require dentists to buy the equipment and report [to DTSC] whether they bought the equipment. This will do it for 95% of the dentists.*

DTSC has not included wastewater treatment in the scope of this rulemaking project. See the response to Public Hearing comment HH2-1. DTSC and the CUPAs will enforce these rules. The degree of enforcement will depend on the available resources and the priority of dental amalgam compared with other issues.

HN-7 *We hope that DTSC is not regulating dentists as a function of "professional courtesy" because they are too important. I don't think that should be a reason [for not regulating]. The legislature's very upset at the dental board for hiding the information about mercury, mercury amalgam.*

DTSC establishes enforcement priorities based on many factors such as available resources, the degree of deviation from proper waste management, the risk to the public and the environment, agreements with other agencies. Enforcement of the rules for amalgam management and proper treatment of wastewaters with dental amalgam fines will be factored into DTSC's enforcement workload.

HN-8 *This thing has got to be on the DTSC radar screen and the answer is not what [comments] the California Dental Association (CDA) filed with DTSC.*

See the response to Public Hearing comment HN-7 above, incorporated herein .

HN-9 *I do agree with the point CDA made that the equipment won't solve everything because the mercury goes into people and is excreted with they die, either when they are buried or incinerated [cremated]. So the answer is source reduction.*

As discussed in prior comments, DTSC does not have authority to regulate the practice of dentistry.

HN-10 *Start [source reduction] with the pregnant women and children by requiring a 20% reduction per year. That's the right answer; simply a five-year source reduction as you're doing with other people. Can dentists do it? Of course*

they can. Twenty-eight percent of them are mercury free now. The tripling process has been ongoing for fifteen years and is going to continue.

As discussed in prior comments, DTSC does not have authority to regulate the practice of dentistry.

HN-11 *I think the right answer is source reduction. Phillip Blum, supervising hazardous substances scientist with the State of California, filed comments with the Federal Drug Administration saying amalgam is so toxic it must be handled as hazardous waste. [Therefore] it's far too toxic to be safe in our bodies. Mercury does leach out of amalgam fillings, and therefore will poison people with amalgam fillings.*

As discussed in prior comments, DTSC does not have authority to regulate the practice of dentistry.

HN-12 *So we urge you to require [amalgam separator] equipment [by] January 1, 2003 and do a five-year phase out [of amalgam fillings].*

As discussed in prior comments, DTSC does not have authority to regulate the practice of dentistry.

HN-13 *Commenter requested an extension to the public comment period.*

DTSC has considered this request and will not extend the comment period. These regulations have been made available for a 45 day public review and comment period as required by the Administrative Procedures Act.

HN-14 *The other dental trade organization, as you know, supports a strong movement and supports a ban on mercury fillings.*

As discussed in prior comments, DTSC does not have authority to regulate the practice of dentistry.

H-O Pete Price, Price Consulting, representing Appliance Recycling Centers of America.

HO-1 *With respect to [the California Code of Regulations, title 22] section 66273.7.2 and designating an appliance as universal waste when it's discarded, DTSC should think through the process of what happens to an appliance when it's discarded and explain it [what discarded or waste means] a little better in the regulations.*

The element of discard is central to the entire body of hazardous waste control regulations and is well understood by the regulated community. Discard establishes the point at which a material becomes a waste and is set forth for the hazardous waste control regulations in section 66261.2 and in Health and Safety Code section 25124.

HO-2 *With respect to [the California Code of Regulations, title 22] section 66273.7.2, the regulations speak to mercury switches but not temperature control devices that include mercury. Does the term "mercury switches" include temperature control devices that include mercury? In existing law, Public Resources Code section 42175, not only mercury switches but temperature control devices that include mercury in appliances are required to be removed from appliances.*

DTSC agrees with this assertion. Note that such temperature control devices are known as "thermostats" and were designated as universal wastes in the previous rulemaking that established California's permanent universal waste regulations.

HO-3 *Regarding the requirement that appliances from which the mercury switches are not removed are not considered Universal Waste and must be managed under existing [hazardous waste] regulations: There are already laws requiring that mercury switches, other items controlling mercury, polychlorinated biphenyls (PCBs), chlorofluorocarbons (CFCs), and used oil, be removed from discarded appliances before being crushed or shredded for metal recycling. There is a presumption in the proposed regulations that the existing laws are being implemented and they are not.*

The existing laws address the legal requirements for recycling appliances. These regulations address classification of appliances if persons managing them fail to, or do not choose to, comply with the removal requirement. DTSC has established the necessity of such removal with the scientific facts demonstrating the risks of mercury-containing wastes to the environment

HO-4 *Under the existing laws, removed mercury switches are hazardous waste and anyone who removes the switches becomes a hazardous waste generator. While we require handlers to remove materials that require special handling, including mercury switches, no one wants to be a hazardous waste generator. You have to have some kind of plausible inspection and enforcement process to make sure that people are complying with the law. There is no apparent inspection or enforcement process for the existing law relating to appliances. We would like to see these regulations in some specifics address how DTSC is going to inspect and enforce requirements at facilities required to remove the mercury switches.*

DTSC's enforcement priorities and plans are not established in regulation and are clearly outside the scope of this rulemaking. .

HO-5 *We would like DTSC to wonder with us where do the other 4.9 million appliances that are discarded every year go?*

This comment does not seem to make a suggestion or assertion that can be responded to.

H-P Peter Weiner, partner in the law firm of Paul Hastings, Janofsky & Walker, representing OSRAM Sylvania.

HP-1 *We believe that the regulations as proposed by DTSC meet the Administrative Procedure Act requirements for showing authority, necessity, consistency, and non-duplication under Government Code section 11349.1.*

DTSC concurs with the commenter.

HP-2 *DTSC has documented what kind of environmental harm is caused by the release of mercury from breakage of fluorescent tubes, and deposition of other mercury into water and air.*

DTSC concurs with the commenter.

HP-3 *DTSC has evidence of mercury releases and the source of those releases, in this case, are fluorescent lamps. You reduce the source markedly when you reduce the presence of those lamps in a place where they can cause a release.*

DTSC concurs with this comment. Note that lamps are being listed in section 66261.50 for this reason.

HP-4 *[Health and Safety Code sections] 25140 and 25141 give DTSC the authority to identify which wastes are hazardous, which you have done in the proposed listing of all fluorescent lamps.*

DTSC concurs with this comment.

HP-5 *[Health and Safety Code section] 25179.4 says that in adding new programs, DTSC should emphasize source reduction and recycling. DTSC has said in the statement of reasons that you are doing just that, and that these criteria are consistent with section 25179.4.*

DTSC concurs with this comment. Note that this rulemaking is intended to accomplish:

First, source reduction by encouraging development of mercury free lamps.

Second, recycling by requiring the recycling of all mercury added lamps.

HP-6 *In revising the final regulations or making clarifications, DTSC may want to state that you've used two separate criteria, some to identify some products, some to identify others. Not everything is both capable of being recycled and has mercury-free substitutes.*

The commenter is correct. DTSC has indeed identified some universal wastes that cannot be reasonably recycled. Mercury-containing rubber flooring is one example.

HP-7 *In the case of fluorescent lamps, there are no mercury-free substitutes that are fluorescent lamps. However, in the case of street lighting, there are also some high sodium mercury-free substitutes available. So, I would say, that is the guiding light in your decision to list all lamps in terms of ultimate source reduction, because ultimately your objective is that manufacturers will develop sources of energy efficient lighting that will not use mercury. The alternatives may be called by another name but that doesn't mean it's not source reduction, which is what you're accomplishing.*

DTSC concurs that there are immediately available mercury-free substitutes for some street lighting. There are also two different types of mercury-free interior lighting that will ultimately offer mercury-free alternatives for energy-efficient interior lighting. In the near term, a Swedish firm is commercializing technology that utilizes a "leaky cathode" to produce mercury-free fluorescent lamps. In the next decade, light emitting diodes will emerge and the energy efficient lighting of choice.

HP-8 *Moreover, you are clearly emphasizing recycling and there is no requirement that you emphasize source reduction to the exclusion of recycling, or vise-versa.*

DTSC concurs with this comment. No agency is required to address every possible issue within their authority in every rulemaking.

HP-9 *The overarching theme of Health and Safety Code, beginning at section 25100 and section 6.5 [Chapter 6.5 ?] is protecting human health and the environment . That is what you are doing with these regulations because the goal is to reduce the amount of mercury going into the environment.*

DTSC concurs with this comment.

HP-10 *[Contrary to previous testimony] you have already addressed considering the alternative of reducing the TTLC and STLC under rejected alternatives.*

DTSC concurs with this comment. DTSC did consider changes to the TTLC and STLC in considering alternatives to these regulations. However, the scope of wastes affected and the scope of the scientific analysis is much larger for efforts that address general classes of waste than for efforts that address specific classes of waste.

Looking at all the alternatives, DTSC concluded that the chosen alternative, which is (in part) to list certain products with intentionally-added mercury and promote their recycling (by development of streamlined alternative management standards for recycling the newly listed wastes), was the best approach to the bounded subset of wastes addressed by this rulemaking.

HP-11 *You do say that DTSC believes that listing all mercury-containing lamps as hazardous waste would be more effective in reducing the amount of mercury going into our environment, etc. To address the legality of the statement, you may want to say that DTSC has concluded based on substantial evidence, that this is the case (studies in other states and evidence from the Bay Area Regional Water Quality Control Board).*

DTSC concurs with this comment. This response constitutes this statement in the official record of this rulemaking.

HP-12 *You could have reduced the TTLC to another number but [I don't think there] would have been more evidence as to why a number would have been better that the listing process. You've given people flexibility to use the universal waste rule and that flexibility reduces the fiscal impact and will result in ultimately more reduction than if you had strict TTLCs and required everything be handled under the hazardous waste rules.*

Based on substantial evidence in the record, including the Final Statement of Reasons discussion of alternatives, DTSC found that listing this narrow class of products with intentionally-added mercury was the best approach. Reasons for this include the incentive to completely eliminate mercury from the products and removal of the incentive to "game" the TTLC and STLC by adding mass to non-mercury components of the waste or using materials and other substances that interfere with the testing process causing it to give anomalously low results for mercury. For instance, increasing the wall thickness of glass in fluorescent tubes could reduce the proportion of mercury below the TTLC without actually reducing the amount of mercury. Adding iron components or ascorbic acid has been cited as a way to fool the leaching tests that estimate the potential for mercury to leach from the wastes. Thus, not only do the listing and the proposed universal waste management standards promote both elimination of mercury in lamps and recycling of those with mercury, it provides the best level of environmental protection by removing the thresholds as incentives for product changes that do not really eliminate the hazard posed by the wastes.

HP-13 *While it would be nice to have some product labeling or procurement preference requirements, it's not within DTSC's authority. DTSC does not have jurisdiction with regard to procurement preferences and those kinds of incentives, or with regard to any kind of advance disposal fee. Those are legislative issues.*

DTSC concurs with the commenter's assessment of the limitations of DTSC's authority.

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15-Day Public Notice
(11/5/02 – 11/20/02)
Comment Summaries and Responses

Mercury Waste Classification and Management Regulations: R-02-04 - 15-day Public Notice (11/5/02 – 11/20/02) Comment Summaries and Responses:

Commenter 15-A: Vale Cervarich

15-A-1: D*oes not understand the proposed regulation, but asks DTSC to keep mercury and other hazardous wastes away from people and ground water.*

DTSC finds the regulations are clear and understandable. In fact, the Universal Waste Rule has been developed to be a simpler and less complex approach to hazardous waste regulation. However, DTSC recognizes that many people have had little or no contact with regulations and do not understand the structure and content of regulatory standards. To this end, DTSC has simplified the duties for the smallest commercial generators and households to focus on a single standard: dispose or recycle the wastes at a proper (hazardous waste) facility. To facilitate understanding and compliance and thus obtain the intended environmental protection, the Cal/EPA Interagency Universal Waste Infrastructure Workgroup will develop extensive educational outreach including printed materials, classes, workshops, and press releases to educate the smallest generators and households prior to the sunset of the small quantity and household exemptions.

Commenter 15-B: Michael Adler (The Adler Group)

15-B-1: C*ommends DTSC for working to remove mercury from waste.*

DTSC acknowledges the comment.

15-B-2: W*hy are all mercury switches in cars not classified as hazardous waste?*

As explained in more detail in the Final Statement of Reasons for listing M001 (section 66261.50), including all switches in the listing would not be feasible because there is little information available about the presence, location, and numbers of other types of mercury-containing switches. Thus, a dismantler could not know where all the other switches are located and could unknowingly not comply with the regulation. However, as more information becomes available about the existence, number, and location of other mercury switches on specific models of automobile, DTSC can add further types of switches to the listing description in additional rulemakings. Note that these regulations do allow universal waste management of any mercury-containing switches removed from vehicles, not just mercury-containing light switches (that are included in the listing for M001).

15-B-3: W*hy wait till 2006 to classify non-automotive switches as hazardous waste?*

The effective date was further extended because there is no comprehensive guidance available identifying specific models of appliances with mercury switches, identifying their location, and giving removal instructions for the switches, as there is with most vehicle light switches. The additional two years will allow the recycling industry to

develop such guidance so that the switches can be located and removed prior to crushing or shredding the appliances.

15-B-4: Please *clarify of the status of mercury switches between February 8, 2004 and February 9, 2006. Was one of the dates was changed and not the other?*

Between the dates of 2004 and 2006 (in fact, between the effective date of the regulations and the 2006 date), mercury switches will be required to be removed from appliances prior to recycling, as they are today, and will be able to be managed as universal waste (rather than the current hazardous waste status). After 2006, the entire appliance, when discarded, will be a hazardous waste by operation of the M002 listing and will only cease being a listed hazardous waste when the switches are removed.

15-B-5: W*hy are medical products containing mercury (Thimerosal preservatives) not included in the proposed regulations?*

Medical products containing thimerosal (and other mercury-based preservatives) have not been listed for several reasons:

- There are no approved alternatives for these materials, a criterion for listing mercury containing wastes in this rulemaking.
- It is not possible to recycle thimerosal to recover the mercury. Disposal is the only management option.
- Thimerosal and other mercury-containing preservatives are used and disposed in miniscule quantities for each use (i.e.: doses of vaccine).

15-B-6: T*he State of California has failed its citizens in the past regarding mercury pollution in fish.*

This rulemaking represents an aggressive step forward in protecting both the fish and the humans and wildlife eating them. Past steps include cleanup of mercury mines and mercury pollution in rivers dating from the Gold Rush. This contamination is extensive and will be very difficult and expensive to remediate.

15-B-7: T*he proposed regulations are not strong enough and do not immediately ensure that all mercury wastes are disposed of properly.*

DTSC disagrees:

1. To allow for the development of infrastructure, householders and the smallest commercial generators are allowed to dispose of mercury–containing wastes until their exemptions sunset in 2006. The reasons for the temporary exemptions is discussed in

detail in the Final Analysis and Findings required by Health and Safety Code section 25150.6 and in the discussion of changes to section 66273.8 in the Final Statement of Reasons.

2. These regulations have not addressed all mercury-containing wastes. There remain some wastes that contain mercury, but are not identified as hazardous wastes under existing hazardous waste regulations. Every rulemaking must have a defined scope, as does this rulemaking, and the scope must be narrow enough to allow reasonable fiscal, economic, and scientific analysis that supports the rulemaking and can be completed within one year of the original notice to meet the Administrative Procedures Act deadlines for submission to Office of Administrative Law (OAL). Additionally, the scope of this rulemaking was limited to feasible mercury wastes that were recyclable and/or for which an alternative to mercury was available.

Commenter 15-C: Durk De Lu

15-C-1: O*pposed to the temporary disposal exemption for conditionally exempt small quantity universal waste generators found in section 66273.8. Please eliminate the exemption.*

DTSC is retaining the temporary disposal exemptions, both for households and for the conditionally exempt small quantity universal waste generators. These exemptions are being retained because they are necessary to allow time for infrastructure to develop for collecting and managing these wastes. As discussed in detail in the Final Analysis and Findings required by Health and Safety Code section 25150.6 and in the Final Statement of Reasons, DTSC believes that requiring proper disposal or recycling prior to establishing simple and reasonable alternatives would drive illegal disposal to the general environment. Such disposal is poses greater threats to the environment than disposal to non-hazardous waste landfills.

15-C-2: E*lectronic product generators should be required to maintain detailed information, including manifests, regarding their hazardous mercury waste storage and disposal.*

For reasons detailed in the Final Analysis and Findings required by Health and Safety Code section 25150.6 and the Final Statement of Reasons, DTSC has not applied detailed recordkeeping and manifesting requirements to persons managing universal wastes, including the mercury-containing wastes being designated as universal wastes in this rulemaking. DTSC believes proper recycling and disposal can be accomplished without the extensive recordkeeping and manifest requirements. If this belief is proven wrong, DTSC will, in a new rulemaking, change the required management practices to more closely track the practices and requirements for other hazardous wastes.

15-C-3: O*pposed to the elimination of the requirement that the area in which mercury switches are removed is well ventilated and monitored to ensure OSHA and CalOSHA compliance.*

DTSC has removed this provision in response to comment that:

- Switches are normally removed from vehicles and appliances outdoors in scrap yards where there is no danger of mercury vapor exposure beyond the occupational limits.

- Switches are robust containers and are well protected from accidental breakage unless subjected to high forces such as are created by auto shredders and heavy landfill equipment. They are very unlikely to break during removal making the monitoring requirement unnecessary.

- OSHA and Cal-OSHA standards already require ventilation or respiratory protection for persons managing exposed elemental mercury.

- OSHA and Cal-OSHA standards apply independently from these regulations and, absent the monitoring requirement, they will continue to apply and be enforceable.

15-C-4: O*pposed to the elimination of the requirement that a small quantity universal waste handler who processes motor vehicle waste certify that all mercury-containing switches have been removed prior to processing.*

The certification requirement was removed because commenters stated, and DTSC agreed, that an automotive recycler cannot certify that all mercury containing switches have been removed because:

- They do not know where all of the switches are located in the thousands of different year, make, and model vehicles they receive.

- Switches are added by owners and others after vehicles are sold that are not on the manufacturer's diagrams and other information regarding the vehicle (for instance, burglar alarm motion detector switches that can be mounted in many places on a vehicle).

- Some switches cannot be removed due to damage that prevents removal such as a crushed hood or trunk lid.

DTSC considered modifying the certification to require that a dismantler certify that all known mercury-containing switches that can practicably be removed, have been removed. However, a dismantler could then argue that he did not know of switches or

that switches were not practicable to remove for reasons of vehicle damage, corrosion, or other reasons. Because the purpose of the certification would then be "questionable", it would lose its enforcement value and would no longer be necessary. Thus, DTSC is not requiring certification.

15-C-5: B*elieve there is a contradiction in the proposed regulations because they state that some "mercury, residues, and/or other wastes" may not be hazardous.*

DTSC disagrees that there is a contradiction as stated by the commenter. The actual universal wastes contain mercury and must be recycled or properly disposed (as allowed for each universal waste). However, there are two types of waste derived from the universal wastes that may or may not be hazardous waste under existing hazardous waste characteristics:

1. Mercury and residues from recycling of the universal wastes designated in these regulations. The mercury itself, once recycled, is no longer a waste and may be reused. Thus, it cannot be regulated as a hazardous waste and still be reused. The residues from the recycling operation no longer contain the amount of mercury that they originally did because the recycling operation recovers most of the mercury, and leaves a residue from which further mercury cannot be recovered. At this point, the residues are non-hazardous unless they contain sufficient mercury or other hazardous constituents to be identified as hazardous wastes.

2. Residues of mercury-contaminated media resulting from release of mercury from universal wastes. These residues consist of materials such as contaminated soil or garbage in a dumpster in which fluorescent tubes have been broken. The mercury is no longer recoverable from the contaminated media and is no longer the original material listed as a universal waste. At this point, the residues are non-hazardous unless they contain sufficient mercury or other hazardous constituents to be identified as hazardous wastes.

Tom Tyler (Institute of Scrap Recycling Industries, Inc.)

15-D-1: Please *refer to the comments of September 30, 2002 submitted by Partnership for Mercury-Free Vehicles in response to the 45-day notice of the currently proposed regulations. Commenter included a copy of those comments as an attachment. Commenter also attached draft language of model legislation proposed by Partnership for Mercury-Free Vehicles*.

The comments made in September have been addressed with the remainder of the comments from the 45-Day Public Comment Period.

The draft legislation is interesting and would represent an effective step in eliminating use of mercury. However, DTSC cannot adopt regulations creating a fee, mandating

take-back or product stewardship, and cannot forbid the use of mercury in products or require phase-out of mercury. DTSC's hazardous waste authority extends to standards classifying and managing hazardous wastes and does not apply to products before those products become waste.

15-D-2: T*he proposed regulations will not achieve the stated objective of encouraging pollution prevention through the use of non-mercury containing products. In addition, the proposed regulations would create an illusory fix to the problem of mercury use and, therefore, hinder the adoption on legislation that the commenter believes is needed.*

DTSC disagrees with the commenter. While the proposed regulations do not, and can not, address every aspect of every product containing mercury, they do address products that contain mercury and have non-mercury substitutes. The identification of these products as hazardous waste and universal waste (characterized by some commenters as "stigmatizing" the products) illuminates their mercury content and drives users towards mercury-free alternatives, as does the added expense and difficulty of managing products as hazardous waste instead of indiscriminate disposal and management. Note that DTSC does not have authority to order a cessation of mercury use in products nor can it order substitution of mercury alternatives for mercury– potentially more effective options.

Moreover, adoption of these regulations does not hinder or impede the Legislature's ability to enact statutes that would address the problem in a different or more global manner.

As to whether the "fix" is "illusory", the new adopted listings require certain activities that mitigate the risks offered by non-hazardous disposal of mercury containing wastes. For instance, waste vehicles with mercury light switches could previously be shredded as non-hazardous waste because the amount of mercury in the switches was not enough to identify the entire vehicle as a hazardous waste. Listing the vehicle until the light switches are removed, as is done in this rulemaking, creates an enforceable duty to either remove the switches and manage them separately prior to shredding, or obtain a hazardous waste facility permit for the shredder – an obviously less desirable option. Thus, with some education and enforcement of vehicle recyclers, mercury switches will be removed from vehicles prior to shredding preventing the release of the mercury to the environment – a requirement that will benefit the environment and not an illusory change.

15-D-3: Please *"pursue the appropriate policy choice through legislation" and "not implement regulations that will complicate adoption of such legislation." Please support model legislation promoted by the Partnership for Mercury-Free Vehicles entitled "Mercury-Free Vehicle Act."*

DTSC is an administrative agency and does not enact laws through legislations. DTSC does study and comment to the Executive Branch of government on proposed legislation and provides information to the Legislature on request.

These regulations do not complicate adoption of legislation as discussed in the response to comment 15-D-2 above.

15-D-4: *Commenter describes how the "Mercury-Free Act" would achieve DTSC's objectives by requiring vehicle manufacturers to establish and fund systems for the removal and management of vehicle mercury switches.*

DTSC acknowledges that the "Mercury-Free Vehicles Act" is an important proposal for mercury reduction. Also, see response to 15-D-2.

15-D-5: T*he proposed regulations do not require automakers to disclose the uses and locations mercury switches and, therefore, places additional burden on those involved in vehicle recycling.*

DTSC acknowledges that such required disclosure could provide valuable information to vehicle recyclers and would aid in lessening total mercury pollution. However, such requirements are beyond the scope of the authorities granted to DTSC by statute.

DTSC agrees that requiring removal of the switches without information as to the presence, number, location, and removal methods for switches places an additional burden on vehicle recyclers. This is the reason, as explained in the Final Statement of Reasons for the M001 listing in proposed section 66261.50, that DTSC has changed the listing to apply only to mercury-containing vehicle light switches since such information exists about the light switches.

15-D-6: *Encourages the Department to set aside the current proposed regulations in favor of the comprehensive legislative solution.*

For the reasons discussed in the response to comments 15-D-1 – 15-D-4 above, DTSC has chosen to adopt the regulations.

Chuan-Hai Teh (Micro Metallics)

15-E-1: *"End of life electronics" currently dominate my business of metal recycling, sampling, and refining business.*

DTSC acknowledges this information.

15-E-2: I*ssues from the original proposal have not been adequately addressed in the current version.*

Because DTSC has not accommodated every comment presented from the

45-Day Comment Period, it is clear that many commenters will not agree with DTSC's decision on some comments and will feel that the response has been inadequate to some issues. However, the changes presented in the 15-Day Notice of Changes represent all the changes that DTSC has determined are necessary. For further discussion, see the responses to individual comments from the 45-Day Comment Period.

15-E-3: *Section 66261.3(c)(5) appears to create a "derived-from-rule" that sets an excessive standard for products derived from a hazardous waste. Of particular concern is the phrase "The material must not exhibit any characteristics identified in article 3." It may be impossible to for a derived-from product to be free of any hazardous characteristic; the hazardous constituent may be a recoverable product with marketable value.*

The commenter has misinterpreted this provision. This provision applies only to "waste" material residual to a recycling or treatment process. The materials that have been recovered and are usable products are not "waste", but "products", and are no longer hazardous waste. Thus, mercury recycled from vehicle light switches is close to 100% pure mercury and would certainly fail the TTLC for mercury, but is not waste and is therefore not hazardous waste and is not regulated under these regulations unless discarded.

However, there are instances when residual materials from one recycling operation may exhibit a characteristic of a hazardous waste, but still contain other recoverable constituents. Further recycling would then yield a recovered material, not regulated, and residual waste, regulated if it continues to exhibit a characteristic of a hazardous waste.

These residual materials are considered wastes and if they require further reclamation prior to recycling, they are regulated as hazardous waste unless these wastes meet the criteria for one or more of the exemptions from regulation for recycling in Health and Safety Code section 25143.2. In general, wastes being recycled by a "reclamation" process at an offsite facility are not exempt; if they were, the statutory exemption would pre-empt the statement in this regulation.

15-E-4: *The proposed regulations should be amended to allow recyclers continued access to legitimate recycling exemptions. The language identified in 15-E-3 (above) should be deleted, modified to reclassify or re-specify derived-from wastes, or an exemption should be added for "shipment for further recycling."*

As explained in the response to comment 15-E-3 above, the commenter's understanding of the provision in section 66261.3(c)(5) is partially incorrect. The suggestion will not be accommodated and DTSC will not modify this regulation to vary from the exemptions and standards of Health and Safety Code section 25143.2. That

statute, as discussed above, generally regulates hazardous wastes and residual materials from hazardous wastes that will be further reclaimed, as hazardous wastes.

No provisions of these regulations are intended to negate the recycling exemptions in Health and Safety Code section 25143.2.

15-E-5: T*here has already be an exodus of electronics manufacturing for California and over-regulating end-of-life scrap will only drive a growing recycling industry out of the state as well.*

DTSC does not agree that regulations have driven manufacturing out of State. Most electronic manufacturing is conducted in third world countries for other economic reasons and the research, development, and design work remains in the State regardless of our regulations.

DTSC also does not agree that the provisions of these regulations requiring removal of mercury switches from appliances (the only provisions that could affect electronics recycling) will drive businesses from California. In fact, these regulations will give scrap metal processing businesses some surety that their products and workplaces will not be inadvertently contaminated with mercury. Such mercury contamination would make their workplaces subject to expensive remediation, injure their employees, and make their products unsaleable.

Comment 15-F: Colin Burns

15-F-1: P*rotecting public health from mercury pollution is important and the proposed regulations are "a step in the right direction."*

DTSC acknowledges the support.

15-F-2: H*opes that "future directions include incentives to reduce mercury use in consumer products."*

DTSC agrees that this action would be environmentally protective; however, such actions are beyond DTSC's authority.

Commenter 15-G: Peter Bleasby (Osram Sylvania)

15-G-1: S*upports the amendments included in the 15-day language.*

DTSC acknowledges the commenter's support.

Commenter 15-H: Susan Lee (CALPIRG)

15-H-1: S*upports classifying all mercury containing wastes as hazardous waste but believes the proposed regulations do not adequately encourage the*

elimination of mercury from consumer products and fail to ensure that mercury in disposed products is collected and contained in a manner protective of public health.

DTSC agrees that eliminating the use of mercury from products would be environmentally protective; however, requiring such an action is beyond DTSC's authority. DTSC believes these regulations will divert specified mercury-containing wastes from landfills and promote the use of mercury-free substitutes. This promotion occurs due to the label of "hazardous waste" placed on mercury-containing products which, as stated by several commenters, complicates management of the products and creates a disincentive for their purchase.

DTSC disagrees that the regulations are inadequately protective and will fail to ensure that mercury in disposed products is collected and contained in a manner protective of public health. As discussed at length in both the Final Statement of Reasons and the Final Analysis and Findings required by Health and Safety Code section 25150.6, these regulations are much less prescriptive than the general hazardous waste control regulations. However, given the extremely large number of generators, DTSC has determined that these regulations will provide better ultimate environmental protection by diverting a larger percentage of mercury-containing wastes from both the landfills and disposal to the general environment, such as ditches, farmer's fields, etc. See the documents referred to above for further discussion.

15-H-2: T*he definition of "Mercury-containing motor vehicle light switch" should be expanded to include all mercury-containing switches in motor vehicles.*

The original proposal would have regulated all mercury-containing switches and required removal of all switches. However, in response to comments during the 45-Day Comment Period, DTSC limited the M001 listing to mercury-containing vehicle light switches and the definition was created to delineate the universe of switches covered by the M001 listing.

For further discussion of the reasons why DTSC cannot accommodate this comment, see the discussion in the Final Statement of Reasons of the changes M001 which explains why DTSC narrowed the scope of the listing, and therefore the removal requirement, to only light switches rather than all mercury-containing switches.

15-H-3: C*oncerned with "the delay in listing non-automotive mercury switches and any product that contains such switches" and believe that the delay will only increase the time during which more mercury containing waste may be improperly managed.*

DTSC has delayed the applicability of this listing for reasons detailed in the Final Statement of Reasons. In short, there is little information about the existence, location, and removal methods for most of the mercury-containing switches in appliances. This

information will be developed during the delay time to ultimately both facilitate removal and allow enforcement of the removal requirement. Requiring removal prior to developing information may drive recyclers to dispose to solid waste landfills without removing the switch and without recycling the products. Note that some of these products are currently non-hazardous because the mass of the product is high enough to offset the small amount of mercury in some switches and a person managing these products could legally dispose of them as non-hazardous waste without removing the switch. After the listing becomes effective, the appliances will have to be properly managed regardless of the mass of the appliance and the mass of mercury in the switches.

15-H-4: T*he phrase "manner designed to prevent breakage" should be defined; without an approved standard for removal and storage, breakage may result in improper disposal.*

For reasons detailed in the Final Statement of Reasons and in the Final Analysis and Findings required by Health and Safety Code section 25150.6, DTSC has determined that the performance standards of the Universal Waste Rule will offer better ultimate environmental protection than application of the prescriptive standards in the general hazardous waste control regulations. DTSC has chosen a performance standard, rather than a prescriptive standard, to allow appropriate flexibility in meeting this standard and to promote sufficiently protective hazardous waste management.

15-H-5: *"Lack of notice and the inherent time constraints of the current comment period made it difficult … to examine the proposed changes with the precision deserved."*

These regulations have been available for public comment for the full 45 days required by the Administrative Procedures Act and the changes to the original proposal have been available for public comment and review (for all but 58 commenters) for not one, but two 15-day comment periods (due to a mailing list error). Thus, the regulations have met all the Administrative Procedures Act requirements for public review and comment on the proposed regulations.

Commenter 15-I: Margaret Rosegay (law firm of Pillsbury Winthrop, representing auto shredders)

15-I-1: Please confirm my u*nderstanding of the legal implications of the proposed regulations. The text of the letter is attached.*

Question 1: *Please confirm that vehicles exit the M001 listing when crushed (or baled or shredded), even if all mercury containing light switches have not been removed prior to crushing.*

DTSC confirms that this is the intent of the changes made to sections 66273.13(d)(3)(B) and 66273.7.1(b)(5).

Question 2: *Please confirm that the language added as 66261.3(c)(5) is not intended to change the regulatory status of auto shredder residues.*

DTSC concurs that this provision is not intended to change the regulatory classification of auto shredder residues. These residues are waste generated by the metal recycling operation and are classified as hazardous waste if they exhibit a characteristic of a hazardous waste, a situation that will not change with this rulemaking. All characteristic wastes are subject to regulation under the hazardous waste control statutes and regulations. As wastes, auto shredder residues are classified and managed like any other wastes. Changing or otherwise affecting variances and re-classifications is beyond the scope of this rule.

Question 3: *Footnote 1: We believe DTSC, in section 66273.7.1(b)(5), did not intend to require that other mercury-containing automotive switches (other than vehicle light switches) be regulated under the M002 listing.*

This belief is correct because the M002 listing applies to “non-automotive mercury switches…”. Note, however, that if these mercury switches are removed from the vehicle and managed separately (as recommended by DTSC), they can be managed as universal waste rather than under the general hazardous waste regulations.

Question 4: *Footnote 2: Uncrushed vehicles received directly by the shredder would be classified as M001 waste if mercury-containing lighting switches were present and the shredder operator would have to remove the switches prior to shredding the vehicle*.

DTSC agrees. Otherwise, the shredder needs authorization to treat a hazardous waste.

15-I-2: Please insert *the word "light" after "mercury-containing" in section 66273.7.1(b)(3) to ensure consistency with the scope of the M001 listing.*

DTSC agrees change should be made. The change is a non-substantive and corrects an oversight by DTSC when it issued the 15-Day Notice of Changes. The change conforms paragraph (3) of subsection (b) to the other changes made to section 66273.7.1 and the M001 listing in section 66261.50 in the 15-Day Notice of Changes. The change is non-substantive because this subsection discusses which vehicles are *not* subject to regulation as universal wastes and the recommended change does not expand the universe of vehicles that would not be universal waste. In order to be universal waste, a waste must be a hazardous waste (“universal waste” is a subset of “hazardous waste”). Vehicles from which all mercury containing switches have been removed (as the text appeared in the 15 Notice of Changes) most likely do not contain enough mercury, when compared to the large mass of the vehicle, to be

characteristically hazardous for mercury. Thus, they could not be universal waste based on mercury-containing switches. Likewise, if all of the *light* switches have been removed (as the text reads with the recommended change), a vehicle is not a listed waste pursuant to the M001 listing. Therefore, it would not be a universal waste either. Thus, the change has no practical impact because a vehicle is not a hazardous waste based on mercury (and thus not a universal waste) if all switches have been removed or if only the light switches have been removed. However, the change is preferable to make the paragraph more precise, clear and consistent with the rest of the section and the listing.

15-I-3: Please remove t*he parenthetical at the end of subsection 66263.7.1(b) (5) to prevent inconsistencies with the exclusion of crushed vehicles from regulation as a universal waste.*

The comment will not be accommodated. A waste vehicle is a waste like any other waste and any waste that exhibits a characteristic of a hazardous waste is regulated as such subject to the regulatory standards, exemptions, and exclusions of the general hazardous waste control law. However, if the light switches have been removed, the vehicle is not classified as a hazardous waste due to meeting the listing description for M001 and would only be a hazardous waste if it contained sufficient hazardous constituents (for instance, lead from lead acid batteries) to exhibit a characteristic of a hazardous waste. This is a restatement of existing law and this conclusion is not derived from this rulemaking. The parenthetical is put into the regulation to clarify that removal of mercury-containing light switches eliminates classification due to meeting the M001 listing description, but the vehicle may still be hazardous waste for other reasons already found in existing law.

15-I-4: Please replace *"2006" in section 66273.7.2(b)(3) with "2004."*

DTSC agrees the recommended change should be made. The change is non-substantive and corrects an oversight by DTSC when it issued the 15-Day Notice of Changes. The change conforms the date in subdivision (b) to the effective date of 2006 in the M002 listing in section 66261.50 and the applicability of universal waste requirements in section 66273.7.2, subsection (a), paragraph (2). The change does not affect the duties of any person because a discarded product cannot be identified as a hazardous waste until it becomes listed as a M002 waste in 2006. Also, it can not become a universal waste until it is a hazardous waste. It would be more precise and provide consistency and clarity to conform the date in subdivision (b) to the effective date in subsection (a), paragraph (2) and the new effective date (2006) in the M002 listing.

15-I-5: Please amend *section 66273.7.2(b)(6), replacing the word "appliances" with "products" and the phrase "mercury switches" with "non-automotive mercury switches."*

The purpose of this paragraph is to tell the reader which materials cannot be managed as universal waste. End-of-life appliances are routinely crushed, baled, sheared, and/or shredded in the course of recycling to recover their scrap metal. DTSC has used the term “appliances” rather than “products” in this subsection because we are unaware of any product categories other than appliances that are commonly processed in this way. If in the future, DTSC becomes aware of other product categories that are crushed, baled, sheared, or shredded in the course of recycling, we may amend subsection (b) of section 66273.7.2 to exclude such products from universal waste management if they have been crushed without removing their non-automotive mercury switches.

The words "mercury switches" are replaced with "non-automotive mercury switches" for purposes of clarity and consistency. [The term "non-automotive mercury switches" is used throughout subsection (b) of section 66273.7.2; section 66273.7.2 deals only with non-automotive mercury switches.]

15-I-6: Please amend section *66273.9(e) by adding the word "light" to "switches" in the definition of Universal Waste and replace "as described in" with "in accordance with."*

This comment will not be accommodated. The M001 listing and associated removal requirement applies only to automotive “light” switches. However, any mercury-containing switches removed from motor vehicles are almost 100% certain to be identified as hazardous waste because they fail the TTLC. DTSC has chosen to allow management of all mercury switches, not just light switches, as universal waste to facilitate collection and shipment to a mercury recycler.

The term “as described in” is used to remain consistent with the federal Universal Waste Rule. This is necessary to comply with Health and Safety Code section 25159.5. Note that the sections referred to in section 66261.9, actually describe the universal wastes.

15-I-7: Please amend section *66273.9(f) by adding the word "light" to "switches" in the definition of Universal Waste and replaced "as described in" with "in accordance with."*

This comment will not be accommodated. Subsection (f) identifies any mercury switches found in <u>non-automotive</u> products as universal wastes. The word “light” is germane only to the M001 presumptive hazardous waste listing for <u>motor vehicle light switches and vehicles</u> that contain them, under specified circumstances.

See the response to comment 15-I-6 for further information.

The term “as described in” is used to remain consistent with the Federal Universal Waste Rule. This is necessary to comply with Health and Safety Code section 25159.5. Note that the sections referred to in section 66261.9, actually describe the universal wastes.

15-I-8: Please delete *the recordkeeping requirements of sections 66273.13 and 66273.33.*

DTSC is retaining these minimal recordkeeping requirements to allow basic tracking of universal wastes. Additionally, these recordkeeping requirements will provide evidence that universal wastes are being sent to a proper destination. This evidence will be helpful for the handler and an inspector from the CUPA or from DTSC.

15-I-9: Please amend section *66273.41 to replace "as described in" with "in accordance with."*

The term "as described in" is used to remain consistent with the Federal Universal Waste Rule. This is necessary to comply with Health and Safety Code section 25159.5. Note that the sections referred to in section 66261.9, actually describe the universal wastes.

Please also see response to comments 15-I-6 and 15-I-7.

15-J California Integrated Waste Management Board

15-J-1: *The effective date for M003, from 2006 to 2004, is not consistent with the existing universal waste regulations' exemption for households. The M003 listing does not provide for a householder exemption or reference the existing exemption in section 66273.8 and appears to say that households that dispose of mercury-containing lamps on or after February 9, 2004, must manage them as hazardous waste.*

DTSC disagrees with the commenter. These two dates are independent of each other and had originally coincided with each other. The change to 2004 reflects the hazardous waste *identification* date while 2006 is a universal waste *management* date that ends the temporary management and disposal exemptions for households and conditionally exempts small quantity universal waste generators (CESQUWGs). No change to the regulations is necessary to accommodate this comment.

On February 9, 2004, the effective date of the listing, all mercury-added lamps will become listed hazardous wastes, including those generated by households and CESQUWGs. However, the existing temporary disposal exemptions for these wastes will remain unchanged (section 66273.8): until February 9, 2006, households and CESQUWGs may manage and dispose of mercury-added lamps in the nonhazardous waste stream. Note that effective February 9, 2004, the exempt quantity of hazardous lamps for CESQUWGs will be reduced to 30 lamps. On February 9, 2006, all hazardous waste lamps will be subject to management as universal waste under chapter 23 or disposal as hazardous waste.

15-J-2: *In the M003 listing description, it is not clear if LCD backlights that contain mercury are regulated as hazardous waste or not, and if they are, they can be regulated as universal waste lamps. DTSC should resolve the confusion about the applicability of the hazardous waste requirement to LCD backlights, and clearly reference in the proposed regulations where and how they can be regulated.*

DTSC has reviewed this comment and determined that no regulatory changes are necessary to accommodate this comment. The M003 listing does not include liquid crystal displays (LCDs) that are back lit with mercury-containing lamps, or products that contain LCDs. Lamps eligible for universal waste management are defined in section 66273.9 and do not include the mercury-containing lamp contained in an LCD.

DTSC does not have information that would indicate if LCDs or the products with LCDs would exceed the TTLC for mercury. However, if the LCDs (if it were able to be separated from the product) or the product itself exceeded the TTLC, it would not meet the M003 listing description, nor qualify as a universal waste because it does not meet the definition of universal waste lamp. The LCD and/or product would be subject to hazardous waste management.

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External Scientific Peer Review Report Findings and Responses

General

University of California, Santa Cruz (Dr. Russell Flegal)

PR-UC-1: By necessity, the Mercury Report relies extensively on published and unpublished "gray literature" reports.

DTSC accepts this finding in part; however, no changes to the proposed regulations are necessary to accommodate this finding. Health and Safety Code section 57004, subdivision (d) allows the Department of Toxic Substances Control (DTSC) to accept the finding of the external scientific peer review, in whole or in part, and revise the scientific portions of the proposed rule accordingly. If DTSC disagrees with any aspect of the finding of the external peer reviewer, an explanation of the basis of its determination is needed, including the reasons why the scientific portions of the proposed rule are based on sound scientific knowledge, methods, and practices.

DTSC accepts that the Mercury Report relied extensively on published literature, but in part the finding regarding "gray literature." DTSC interprets "gray literature" as meaning personal communications and articles or reports not published in peer reviewed journals or its equivalents. DTSC interprets this finding to mean that peer reviewed, published specific information and data from journals would be the primary source of information and data for the report. DTSC in general agrees with this; however, "gray literature" was used "by necessity" as noted by the peer reviewer due to a lack of information and data in published articles that are specific to the needs of the DTSC's Mercury Report scope and purpose – to provide and support the scientific basis of the regulations.

Also, as discussed in response to PR-UC-6 below, the overarching finding of the peer reviewer is: "…the Mercury Report has accomplished its objectives of synthesizing existing scientific information on the magnitude of mercury contamination and the potentially adverse effects of that contamination in California to substantiate their proposed mercury regulations." Overall, the peer reviewer has found that the Mercury Report adequately provides the scientific basis of the regulations.

The scientific portions of the regulations are not changed by this finding, thus, no changes to the regulations are necessary as required by Health and Safety Code section 57004, subdivision (d).

PR-UC-2. The proposed recommendation in the Mercury Report to "list mercury-containing consumer products that can be recycled or have a non-mercury alternative as a hazardous waste when discarded is based on a large body of rigorously critiqued reports and articles in peer-reviewed scientific journals and their equivalents.

DTSC accepts this finding. No changes to the regulations are necessary to accommodate this finding. This finding supports the Mercury Report's use of rigorously

reviewed reports and articles, which does not affect the scientific basis of the regulations. Thus, there no changes to the regulations are necessary based on this finding.

PR-UC-3: The Mercury Report provided limited information on the effects and potential effects of mercury contamination in California by using linear extrapolations from national data that oversimplifies the complexity of the mercury problem and uses "gray literature," which lacks the credibility of peer reviewed scientific publications.

DTSC accepts this finding in part; however, no changes to the regulations are necessary to accommodate this finding pursuant to Health and Safety Code section 57004. Refer to PR-UC-1 regarding the use of "gray literature" and why the regulations are unaffected. DTSC accepts that the Mercury Report provided "limited information" on California using linear extrapolation, but qualifies it by noting that specific information was not available for California. This lack of California specific information is recognized by the peer reviewer in a similar finding to Section 5 of the Mercury Report. The scientific basis of the regulations that mercury is a toxic, bioaccumulative, and persistent chemical substance, is unaffected by this finding. Refer to PR-UC-6 regarding the finding that the Mercury Report substantiates the scientific basis of the regulations.

Note that while revising the Mercury Report (August 2002), based on this finding (and other findings regarding the Mercury Report), would provide additional information, data, and clarifications to the report, it would not change the conclusions of the report nor the scientific basis of the regulation: mercury is a toxic, persistent and bioaccumulative chemical substance. (Note that the two peer reviewers have substantiated the scientific basis.) Therefore, any revision to the Mercury Report to support the scientific basis of the regulations is not necessary and is outside of the scope of the rulemaking package, as well as Health and Safety Code section 57004.

PR-UC-4: More research on the extent of mercury contamination in California would provide a more compelling rationale for the proposed regulatory concept.

DTSC accepts this finding. However, additional research would not change the conclusion of the report or the scientific basis of the regulations; that is, mercury is a toxic, persistent and bioaccumulative chemical substance. The regulations will prevent additional releases of mercury from certain wastes from entering the environment. No changes to the proposed regulations are necessary to accommodate this finding as the peer reviewer has found that overall the Mercury Report substantiates the scientific basis of the regulations (PR-UC-6). See response to PR-UC-3 for discussion on revisions to the Mercury Report.

PR-UC-5: The Mercury Report is compromised by statements that are circumspect or incorrect.

DTSC accepts this finding in part. However, no changes to the proposed regulations are necessary to accommodate this finding because it does not affect the scientific portions of the regulations, and thus, the text of the regulations are not affected. The peer reviewer has identified specific examples in the Mercury Report of circumspect or incorrect statements (see the specific sections below). However, noted in PR-UC-6 below, the peer reviewer's report states that adequate scientific information is detailed in the Mercury Report to substantiate the proposed regulations.

DTSC accepts the findings regarding incorrect statements. DTSC accepts in part, the finding regarding "circumspect" statements. As the peer reviewer noted in his report, the statements "are attributed to the difficult task in preparing a report, although 125 pages long, that needs to be terse and readable to a diverse audience." In spite of these "circumspect" statements, the peer reviewer has found that the Mercury Report substantiates the scientific basis of the regulations (PR-UC-6).

Note that while revising the Mercury Report (August 2002), based on this finding (and other findings), would provide additional information, data, and clarifications to the report, it would not change the scientific basis of the regulations; that is, mercury is a toxic, persistent and bioaccumulative chemical substance. (Note that the peer reviewers have substantiated the scientific basis.) Therefore, any revisions to the Mercury Report to support the scientific basis of the regulations is not required and is outside of the scope of the rulemaking package, as well as Health and Safety Code section 57004.

PR-UC-6: "In spite of criticisms, the Mercury Report has accomplished its objectives of synthesizing existing scientific information on the magnitude of mercury contamination and the potentially adverse effects of that contamination in California to substantiate their proposed mercury regulations. Mercury is a "toxic, persistent, bioaccumulative chemical substance"; and it is a pervasive contaminant in the State of California, where the historic legacy of massive industrial mercury contamination extends over one and on-half centuries."

DTSC accepts this conclusion as the peer reviewer's overarching finding in support of the scientific basis of the proposed regulations and regarding the fact that the Mercury Report supports the regulations' goal to encourage pollution prevention (source reduction and recycling) in order to further control environmental releases. This overall finding substantiates the regulations.

Specific findings regarding specific sections, statements, suggestions for additional information, and clarifications are identified below with responses as they pertain to the regulations and Health and Safety Code section 57004, subdivision (d). Note, however, this overall finding substantiates the scientific basis of the regulations.

Health and Safety Code section 57004, subdivision (d) allows DTSC to accept the finding of the external scientific peer review, in whole or in part, and revise the scientific portions of the proposed rule accordingly. If DTSC disagrees with any aspect of the finding of the external peer reviewer, an explanation of the basis of its determination is

needed, including the reasons why the scientific portions of the proposed rule are based on sound scientific knowledge, methods, and practices.

Acceptance of this finding does not result in any changes to the scientific portions of the regulations, thus no regulatory changes are needed to accommodate this finding.

PR-UC-7: The regulations will proceed "regardless of a qualitative understanding of the potential impacts or benefits" and could be considered poor science and poor policy, but the benefits of a proactive response have been demonstrated for other elements.

DTSC accepts this finding in part and has determined that this finding does not result in any changes to the scientific portions of the regulations. Thus, no regulatory changes are needed to accommodate this finding. Note, as discussed in response to PR-UC-6, the peer reviewer determined, in spite of this finding, that adequate scientific information is present in the Mercury Report to substantiate the proposed regulations.

DTSC accepts the finding that there are benefits of a proactive response; but rejects the statement that regulations will proceed "regardless of a qualitative understanding of the potential impacts or benefits." Note that the "qualitative understanding of the potential impacts or benefits" that the peer reviewer is referencing is not within the scope of the Mercury Report. The Mercury Report provides the scientific basis for the regulations (which the peer reviewer substantiates), while the rulemaking package must demonstrate, among other elements, the necessity of the regulations, including economic and fiscal impacts. Before regulations are approved for adoption by the Office of Administrative Law, the "qualitative understanding of the potential impacts or benefits" must be shown as part of the rulemaking package.

PR-UC-8: From a scientific standpoint, the Mercury Report is best evaluated by its link to the characteristics of mercury (toxic, pervasive, bioaccumulative) to the disposal of waste and the implementation of the proposed regulations. The Mercury Report should address a number of questions (posed by the peer reviewer) regarding the toxic, persistent, and bioaccumulative nature of mercury that would support DTSC's regulatory proposal.

DTSC accepts this comment regarding the peer reviewer's method of evaluating the scientific basis of the regulations found in the Mercury Report. However, acceptance of this finding does not result in any changes to the scientific portions of the regulations, thus no regulatory changes are needed to accommodate this finding. Specific findings related to the peer reviewer's method of evaluating the Mercury Report were noted throughout the individual sections and are identified below. Responses are made as they pertain to the regulations and the requirement for an external scientific peer review found in Health and Safety Code section 57004.

Section 1: Nature and Extent of California's Mercury Contamination: A Summary

California State University, Chico (Dr. Marti Wolfe)

PR- CSU-1: Piscivorous (fish eating) wildlife is not protected by mercury fish advisories as they do not have alternate sources of food.

DTSC accepts this finding. Acceptance of this finding does not result in any changes to the scientific portions of the regulations, thus no regulatory changes are needed to accommodate this finding.

Health and Safety Code section 57004, subdivision (d) allows DTSC to accept the finding of the external scientific peer review, in whole or in part, and revise the scientific portions of the proposed rule accordingly. The scientific portion of the Mercury Waste Classification and Management is based on the finding that mercury is a toxic, persistent, and bioaccumulative chemical substance and in order to further control environmental releases, regulations to encourage pollution prevention (recycling and source reduction) are needed.

The peer reviewer's findings regarding mercury risks to wildlife reinforce and support DTSC's scientific basis for the regulations, specifically, that mercury (methylmercury) is a toxic, persistent, and bioaccumulative chemical substance. Thus, DTSC's scientific portions of the Mercury Waste Classification and Management Regulations do not require any revisions.

Note that while revising the Mercury Report (August 2002), based on this finding (and other findings), would provide additional information, data, and clarifications to the report, it would not change the scientific basis of the regulation: mercury is a toxic, persistent and bioaccumulative chemical substance. (Note that the peer reviewers have substantiated the scientific basis.) Therefore, any revisions to the Mercury Report to support the scientific basis of the regulations is not required and is outside of the scope of the rulemaking package, as well as Health and Safety Code section 57004.

PR-CSU-2: The wildlife values as they appear in the Federal Register should be included in Table 1-4: Summary of State and Federal, Water Quality Standards for Mercury.

DTSC accepts this finding. In accordance to Health and Safety Code section 57004, acceptance of this finding does not result in any changes to the scientific portions of the regulations, thus no regulatory changes are needed to accommodate this finding.

Adding the wildlife values to Table 1-4 adds information regarding wildlife mercury toxicity and supports the scientific basis of the regulations; that is, mercury is a toxic, bioaccumulative, and persistent chemical substance. See response to PR-UC-3 regarding revisions to the Mercury Report based on the findings of the peer reviewers.

University of California, Santa Cruz (Dr. Russell Flegal)

PR-UC-9: This section contains limited information on the sources and magnitude of mercury contamination in California and should compile a more thorough, quantitative assessment of the extent of mercury contamination in California,

specifically addressing the geology of California and the impact of its mercury mining activities.

DTSC accepts this finding in part; however, no changes to the regulations are necessary to accommodate this finding pursuant to Health and Safety Code section 57004. Section 57004 states that DTSC may revise the scientific portions of the regulations in response the peer reviewer's findings. Accepting this finding in part does not affect the scientific portion of the regulations; note also that the peer reviewer's report found that adequate scientific information is detailed in the Mercury Report to substantiate the proposed regulations (refer to PR-UC-6).

DTSC accepts this finding in part because although compiling additional information about mercury contamination in California due to mercury mining activities would add more information to the Mercury Report, it is not the main focus of the report. DTSC briefly summarizes the mercury mining contamination in California in the report, but the scope of the report focuses on assessing and preventing mercury contamination in the environment due to waste contribution. As mercury mining in California has ceased, the left over mining waste is a "legacy waste" issue and a clean up issue, which is not within the scope of the report nor the regulations. No revision to the Mercury Report (August 2002) is required to accommodate this finding and is also outside the scope of the rulemaking package and Health and Safety Code 57004 (refer to response to PR-UC-3 regarding revisions to the Mercury Report).

PR-UC-10: DTSC's Site Mitigation Program (CalSites) should be fully referenced.

DTSC accepts this finding. Full references would not affect the Mercury Report's discussions or conclusions and would not affect the scientific portions of the regulations, thus no regulatory changes are needed to accommodate this finding. See also response to PR-UC-3 regarding changes to the Mercury Report.

PR-UC-11: Original air data regarding elevated atmospheric mercury concentrations may be available through the Air Toxic "Hot Spots" Program (AB 2588) and may include mercury emissions from stationary sources (specifically, waste disposal sites) and may include elevated atmospheric mercury concentrations to substantiate DTSC's proposal.

DTSC rejects this finding. DTSC has determined that rejecting this finding does not affect the scientific portions of the regulations; thus, no changes to the regulations are necessary to accommodate the rejection of this finding. DTSC rejects this finding because the California Air Resources Board's mercury air monitoring program has approximately 25 stations statewide – enough to develop statewide trends, but not enough to assess the risk from a given facility (e.g., waste disposal sites). Note also that the Air Toxic "Hot Spots" Program (AB 2588) reports emission data, not atmospheric data. This finding, although rejected, does not affect the peer reviewer's conclusion that the Mercury Report substantiates the scientific basis of the regulations (PR-UC-6).

PR-UC-12: The Mercury Report contains a misstatement: "Because metallic mercury is liquid at room temperature, it is especially mobile in the environment." Mercury is mobile in the environment because of complex biogeochemical behavior, not due to physical properties.

DTSC accepts this finding in part. Physical mobility in the environment occurs through (mis)handling of metallic mercury (for example, in mercury switches and thermometers) and may result in spills that contaminate the ground. Spills near storm drains can also physically move to the water through the storm drains. The biogeochemical behavior is summarized in Section 2 of the Mercury Report. Acceptance of this finding in part does not result in any changes to the scientific portions of the regulations, thus no regulatory changes are needed to accommodate this finding.

See also response to PR-UC-5 regarding revisions to the Mercury Report.

PR-UC-13: Concentrations of mercury in municipal landfill leachate can exceed water quality standards and organiomercuric species of mercury have also been identified in municipal landfill gas.

DTSC accepts this finding. This finding lends support to the scientific basis for the regulations (mercury is toxic, persistent, and bioaccumulative) because mercury species have been detected in landfill leachate and landfill gas. No changes to the proposed regulations are necessary to accommodate this finding. See also response to PR-UC-4 regarding similar comments and discussions on revising the Mercury Report.

PR-UC-*14: A statement regarding methylmercury toxicity and subsections on Health Effects and Public Health require references, better references, and should include more recent epidemiological studies, which are described in NRC (2000) report.*

DTSC accepts this finding. Accepting this finding does not affect the scientific portions of the regulations or the text of the regulations. Note that the peer reviewer's findings lend support to DTSC's findings that mercury is a toxic, bioaccumulative, and persistent chemical and strengthens the scientific basis of the regulations. (Refer to the peer reviewer's overall finding that the Mercury Report substantiates the scientific basis of the regulations in PR-UC-6.) Thus, no changes to the proposed regulations are necessary to accommodate this finding. See also response to PR-UC-3 regarding revising the Mercury Report to incorporate the findings of the peer reviewer into the report.

PR-UC-15: The general reason for bioaccumulation is poorly described given that in part, the proposed regulations are based that mercury is a bioaccumulative substance. Bioaccumulation is well described in general terms by several authors, including Boudou and Ribeyre (1997). Organic onomethylmercury is produced from inorganic mercury (II), a process thought to be carried out primarily by sulfate reducing bacteria in anoxic sediments.

DTSC accepts this finding in part. However, no changes to the proposed regulations are necessary to accommodate this finding. Elaborating on the mechanism for bioaccumulation in the Mercury Report does not change the fact that mercury does bioaccumulate; thus, does not affect the scientific basis of the regulations, which includes that mercury is a bioaccumulative chemical. See also response to PR-UC-5 regarding revisions to the Mercury Report.

PR-UC-16. In subsection I-2-D-2, Persistence: the concept of persistence could be better developed by mentioning what is encompassed by the biosphere and showing how the extraction of mercury resources increases the amount of mercury in the biosphere.

DTSC accepts this finding. Acceptance of this finding does not result in any changes to the scientific portions of the regulations, thus no regulatory changes are needed to accommodate this finding. As noted above in PR-UC-15, the better development of persistence in the Mercury Report does not change the fact that mercury is persistent and does not affect the scientific basis of the regulations, which includes that mercury is a persistent chemical. See also response to PR-UC-5 regarding revisions to the Mercury Report.

Section 2: Mercury's Chemistry and Toxicology – Human and Environmental Hazards

California State University, Chico (Dr. Marti Wolfe)

PR-CSU-3: "Wildlife are often attracted to landfills and small mammals and birds cannot be excluded by fences designed to keep out humans and large mammals. Wildlife may therefore be more at risk from mercury-containing landfill leachate." This statement (finding) is accompanied by a number of journal articles that were referenced by the peer reviewer.

DTSC accepts this finding. The peer reviewer's findings regarding mercury risks to wildlife reinforce and support DTSC's scientific basis for the Mercury Waste Classification and Management regulations, specifically that mercury (methylmercury) is a toxic, persistent, and bioaccumulative chemical substance. Thus, DTSC's scientific portions of the Mercury Waste Classification and Management Regulations do not require revision.

See also response to PR-CSU-1.

PR-CSU-4: Additional information is needed on mercury methylation in fresh water environments.

DTSC accepts this finding; however, it does not affect the scientific basis for the regulations. Additional information on how mercury methylates in fresh water environments does not change the fact that mercury methylation occurs in fresh water environments and would not affect the scientific basis for the regulations (mercury is

toxic, bioaccumulative, and persistent). No changes to the proposed regulations are necessary to accommodate this finding. See also response to PR-UC-4 regarding a similar finding and revisions to the Mercury Report.

PR-CSU-5: In marine water mercury methylation and uptake, "marine organisms may be at less risk from methylmercury due to co-exposure to selenium, which is antagonist to methylmercury, therefore providing protection." This statement (finding) is accompanied by a number of journal articles that were referenced by the peer reviewer.

DTSC accepts this finding; however, it does not affect the scientific basis for the regulations. No changes to the proposed regulations are necessary to accommodate this finding. See also similar finding and response to PR-CSU-4. Revising the Mercury Report to accommodate this finding is not required as discussed in PR-UC-3.

PR-CSU-6: Methymercruy toxicokinetics: "The half-life of mercury in seabirds has been estimated to be about 60 days (Monteiro, 1965)." This statement (finding) is referenced by the peer reviewer.

DTSC accepts this finding; however, it does not affect the scientific basis for the regulations. This statement (finding) supports and reinforces the scientific basis of the regulations in that it reflects the toxicological effects of mercury in seabirds. Thus, no changes to the proposed regulations are necessary to accommodate this finding. See also response to PR-UC-3 regarding revisions to the Mercury Report.

PR-CSU-7: Methylmercury toxic effects delays have been observed in second generations mallards.

DTSC accepts this finding. The peer reviewer's findings regarding mercury risks to wildlife reinforce and support DTSC's scientific basis for the Mercury Waste Classification and Management, specifically that mercury (methylmercury) is a toxic, persistent, and bioaccumulative chemical substance. Thus, DTSC scientific portions of the mercury waste classification and management regulations do not require revision.

See also response to PR-CSU-1.

PR-CSU-8: Wildlife impacts: Inorganic mercury has the greatest effect on kidneys. Methylmercury is a potent embryo and nervous system toxicant. Symptoms of acute methylmercury poisoning in birds include reduced food intake leading to weight loss, progressive weakness in wings and legs, difficulty flying, walking and standing and inability to coordinate muscle movements. This statement (finding) is referenced by the peer reviewer (Scheuhammer, 1987).

DTSC accepts this finding. The peer reviewer's findings regarding mercury risks to wildlife reinforce and support DTSC's scientific basis for the regulations. Thus, DTSC regulations do not require revision.

See also response to PR-CSU-1.

PR-CSU-9: Wildlife reproductive effects are one of the most sensitive toxicological responses, causing effects at very low dietary concentrations. Effects from mercury (methylmercury) exposure include embryo lethality to sublethal behavioral changes in juveniles at low dietary levels, reduced hatchability (due to early mortality of embryos), eggshell thinning, reduced clutch size, increased numbers of eggs laid outside the nest, aberrant behavior of juveniles, and potentially impaired hearing of juveniles. These statements (findings) are accompanied by a number of journal articles that were referenced by the peer reviewer.

DTSC accepts this finding. The peer reviewer's findings regarding mercury risks to wildlife reinforce and support DTSC's scientific basis for the regulations. Acceptance of this finding does not result in any changes to the scientific portions of the regulations, thus no regulatory changes are needed to accommodate this finding.

See also response to PR-CSU-1.

PR-CSU-10: Both mercury and methylmercury cause chromosome breakage, which is mitigated by selenium as reported in a number of studies. Methylmercury compounds were more active than inorganic mercury salts. These statements (findings) regarding genotoxicity are accompanied by a number of journal articles that were referenced by the peer reviewer.

DTSC accepts this finding. The peer reviewer's findings regarding mercury risks to wildlife reinforce and support DTSC's scientific basis for the regulations. Acceptance of this finding does not result in any changes to the scientific portions of the regulations, thus no regulatory changes are needed to accommodate this finding.

See also response to PR-CSU-1.

PR-CSU-11: Wildlife reference doses should be included in Table 2-9: Reference Doses (RfDs) and Reference Concentrations (RfCs) for Methylmercury.

DTSC accepts this finding; however, it does not affect the scientific basis for the regulations. Adding the wildlife reference doses to Table 2-9 adds information regarding wildlife mercury toxicity and supports the scientific basis of the regulations; that is,mercury is a toxic, bioaccumulative, and persistent chemical substance. Acceptance of this finding does not result in any changes to the scientific portions of the regulations, thus no regulatory changes are needed to accommodate this finding. See response to PR-UC-3 regarding revisions to the Mercury Report based on the findings of the peer reviewers.

PR-CSU-12: The key points in Section 2 should include wildlife impacts and that methylmercury bioaccumulates in both marine and freshwater food webs.

DTSC accepts this finding; however, it does not affect the scientific basis for the regulations. Thus, no changes to the proposed regulations are necessary to accommodate this finding. See also related responses to PR-CSU-4 and PR-CSU-5.

University of California, Santa Cruz (Dr. Russell Flegal)

PR-UC-17. This section contains numerous incorrect or circumspect statements regarding mercury's chemistry and toxicology and contains information irrelevant to DTSC's objectives. For example, gallium and cesium are not the only liquid metals that are liquids at room temperature. Effectively synthesizing information from the recent report by the National Research Council (NRC, 2000), Toxicological Effects of Methylmercury would have prevented these statements.

DTSC accepts this finding in part and has determined that this finding does not result in any changes to, nor does it affect the scientific portions of the regulations. Thus, no regulatory changes are needed to accommodate this finding.

DTSC accepts this finding in part because although the peer reviewer's example regarding gallium and cesium may be correct, the information does not affect the scope of the Mercury Report or its conclusions to support the regulations.

See also response PR-UC-5 regarding incorrect or circumspect statements. Also refer to PR-UC-6 regarding the peer reviewer's overall findings and conclusions about the Mercury Report.

PR-UC-18. The NRC, 2000 report also addresses the scientific controversies and uncertainties about acceptable levels of mercury exposure, notably in fish. This is important because of the emphasis on the potential hazards of mercury poisoning from contaminated fish consumption.

DTSC accepts this finding. Accepting this finding does not result in any changes to the scientific portions of the regulations, thus no regulatory changes are needed to accommodate this finding.

This finding reinforces and substantiates the scientific basis of the regulations; specifically that mercury is a toxic and bioaccumulative chemical. Revisions to the Mercury Report to support the scientific basis of the regulations is not necessary and is outside of the scope of the rulemaking package, as well as Health and Safety Code section 57004. See also response to PR-UC-3 for additional discussion on report revisions.

PR-UC-19. This section contains incorrect references: e.g., National Academy of Scientists should be National Academy of Sciences and the "Toxicological Effects of Methylmercury" was written by a National Research Council committee, not the National Academy of Sciences. A reference used is not in a peer reviewed scientific journal or an equivalent (Jones and Slotton, 1995, which the commenter believes should be 1996).

DTSC accepts this finding. Correcting reference citations would not change the Mercury Report's conclusions or the scientific basis of the regulations. Thus, acceptance of this finding does not result in any changes to the scientific portions of the regulations and no regulatory changes are needed to accommodate this finding.

Revising the Mercury Report is outside the scope of the rulemaking, as well as Health and Safety Code section 57004. See also response to PR-UC-3 for additional discussion on report revisions.

PR-UC-20. This section should emphasize studies on the biogeochemical cycle of mercury in California rather than on national or global reports.

DTSC accepts this finding. Emphasis on studies on the biogeochemical mercury cycle in California would not change the conclusion of the report or the scientific basis of the regulations; that is, mercury is toxic, bioaccumulative and persistent. The regulations would prevent additional releases of mercury into the environment within DTSC's authority.

Acceptance of this finding does not result in any changes to the scientific portions of the regulations, thus no regulatory changes are needed to accommodate this finding.

Section 3: Sources of Mercury in California's Environment

University of California, Santa Cruz (Dr. Russell Flegal)

PR-UC-21. This section's discussion would be strengthened by adding additional citations and relying less on two references; one of the references does not appear in a peer reviewed journal or equivalent and the other a fact sheet prepared by the United States Geological Survey.

DTSC accepts this finding. Acceptance of this finding does not result in any changes to the scientific portions of the regulations, thus no regulatory changes are needed to accommodate this finding. The peer reviewer's finding indicates that this section would be strengthened, but not that the section is inadequate. In fact, the peer reviewer has found that the Mercury Report adequately substantiates the regulations (see PR-UC-6).

PR-UC-22. This section could make use of atmospheric data in a report from the San Francisco Estuary Institute and the study by Hornberger et al. (1999), which provides insights into the history of mercury deposition in San Francisco Bay.

DTSC accepts this finding. However, accepting this finding does not result in any changes to the scientific portions of the regulations, thus no regulatory changes are needed to accommodate this finding. Adding more information and data to the Mercury Report does not change its conclusions or the scientific basis for the regulations. See related discussion in above response to PR-UC-21.

Section 5: Waste Contribution to the Mercury Environmental Burden

California State University, Chico (Dr. Marti Wolfe)

PR-CSU-13: The Table 5-3A is confusing because no units are given.

DTSC accepts this finding; however this finding does not result in any changes to the scientific portions of the regulations, thus no regulatory changes are needed to accommodate this finding.

While revising the Mercury Report (August 2002), based on this finding, would provide additional clarity to the report, it would not change the scientific basis of the proposed regulations: mercury is a toxic, persistent and bioaccumulative chemical substance. Thus, the scientific basis of the regulations are unaffected by this finding.

PR-CSU-14: Include a discussion on compact fluorescent tubes with a calculation to determine the potential decrease of mercury wastes and emissions with the increased use of compact fluorescent lamps in Section 5.

DTSC accepts this finding. Acceptance of this finding does not result in any changes to the scientific portions of the regulations, thus no regulatory changes are needed to accommodate this finding.

See response to PR-UC-4 regarding additional research.

University of California, Santa Cruz (Dr. Russell Flegal)

PR-UC-23. Estimates of waste contribution to the mercury environmental burden in California are based on linear extrapolations of national estimates by the United States Geological Survey and the United States Environmental Protection Agency, presumably because there are insufficient data for California. The extrapolations should not be reported to three significant figures.

DTSC accepts this finding and has determined that this finding does not result in any changes to the scientific portions of the regulations. Thus, no regulatory changes are needed to accommodate this finding. As noted by the peer reviewer, insufficient data exist for California. See response to PR-UC-3 for a similar finding.

PR-UC-24. Mercury data specific to California are derived from "personal communications" or "gray literature" with incomplete citations (e.g., Barron 2001), rather than publications in peer reviewed scientific journals or equivalents. Thus, DTSC's efforts to address mercury wastes in California are constrained by the unknown magnitude of those wastes.

DTSC accepts this finding in part and has determined that this finding does not result in any changes to the scientific portions of the regulations. Thus, no regulatory changes are needed to accommodate this finding.

DTSC accepts the finding regarding "gray literature" in part. See response to PR-UC-1 regarding the use of "gray literature."

PR-UC-25. The Key Points uses conclusions based on national assessments; more appropriate would be California specific information, such as 150 year duration of mercury mining operations in California, the amount of mercury derived from that activity, the amount of mercury imported into the state. This information would provide a better perspective of the historic legacy of mercury production in the state.

DTSC accepts this finding in part and has determined that this finding does not result in any changes to the scientific portions of the regulations. Thus, no regulatory changes are needed to accommodate this finding. This finding is a common theme throughout the peer reviewer's findings on the Mercury Report – more specific information on California is needed. See response to PR-UC-9 regarding mercury mining in California as it relates to the Mercury Report and the regulations.

PR-UC-26. The California waste-derived air emissions from the California Air Resources Board (Table 5-2) are not well referenced.

DTSC accepts this finding in part and has determined that this finding does not result in any changes to the scientific portions of the regulations. Thus, no regulatory changes are needed to accommodate this finding.

The report references the California Air Resources Board as the source of this information. In addition, it developed the emission data for DTSC's Mercury Report and provided some discussion on the emission data in Section 3. Note, upon consultation with the California Air Resources Board Tables 3-1 and 5-2 should be fully referenced as "California Air Resources Board CEIDARS database, year 2000 inventory."

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External Scientific Peer Review Report Comment Summaries and Responses:

Glen Brandenburg (San Diego State University)

PR-A-1: Incorporate mercury impacts to wildlife in the Final Mercury Report as suggested in Dr. Wolfe's peer review report as well as grammatical corrections.

DTSC has determined that changes to the Final Mercury Report to reflect the external scientific peer reviews are outside the scope of this rulemaking and are not required by Health and Safety Code section 57004, subdivision (d).

While revising the Mercury Report (August 2002), based on these findings, would provide additional information to support to the conclusions of the report and the regulations, it would not change the scientific basis of the proposed regulations: mercury is a toxic, persistent and bioaccumulative chemical substance.

PR-A-2: It seems imperative to the overall report to include, as Dr. Flegal suggests, more specific information about the mercury contamination in California.

DTSC has determined that changes to the Final Mercury Report to reflect the external scientific peer reviews are outside the scope of this rulemaking and are not required by Health and Safety Code section 57004, subdivision (d).

While revising the Mercury Report (August 2002), based on these findings, would provide additional information to support to the conclusions of the report and the regulations, it would not change the scientific basis of the proposed regulations: mercury is a toxic, persistent and bioaccumulative chemical substance.

Note that the peer reviewer's overarching finding (discussed in PR-UC-6) substantiates DTSC's regulations.

PR-A-3: Crucial to the credibility of the Mercury Report are Dr. Flegal's comments regarding the lack of underlying scientific studies not cited or referenced.

DTSC has determined that changes to the Final Mercury Report to reflect the external scientific peer reviews are outside the scope of this rulemaking and are not required by Health and Safety Code section 57004, subdivision (d). Full references would not affect the Mercury Report's discussions or conclusions and do not affect the scientific portions of the regulations, thus no regulatory changes are needed to accommodate this comment.

PR-A-4: Correct the "numerous statements that are circumspect or simply incorrect" as outlined by Dr. Flegal to insure the highest quality of the report.

DTSC has determined that changes to the Final Mercury Report to reflect the external scientific peer reviews are outside the scope of this rulemaking and are not required by Health and Safety Code section 57004, subdivision (d). See response to PR-UC-5, PR-UC-12 and PR-UC-17 regarding the peer reviewer's findings.

PR-A-5: Making additions and corrections is crucial to the acceptance and support for the Final Mercury Report.

DTSC has determined that changes to the Final Mercury Report to reflect the external scientific peer reviews are outside the scope of this rulemaking and are not required by Health and Safety Code section 57004, subdivision (d). Revising the Mercury Report to accommodate the peer reviewer's findings would not change the conclusion of the Mercury Report or change the scientific basis of the regulations.

15/3-E-12.1: Commenter noted severe criticisms submitted by Dr. A. Russell Flegal that are sufficiently deficient to abandon this proposal and that "there is a strong appearance that the Department is determined to adopt the proposed regulations regardless of the nature, content, or quality of any comments it may receive." Several examples of criticisms were noted from Dr. Flegal's peer review report, including the "most troubling" statement that "the regulations, it seems, will proceed regardless of a qualitative understanding of the potential impacts or benefits."

DTSC does not agree with the commenter's assertion. The commenter has taken the statements out of context by conveniently not acknowledging other statements and conclusions made by Dr. Flegal about the Mercury Report. No changes to the regulations are necessary to accommodate this comment.

Dr. Flegal's overall finding (discussed in PR-UC-6) substantiates the scientific basis of the regulations and their goal, which is to encourage pollution prevention (source reduction and recycling) in order to further control environmental releases of mercury. The commenter is referred to DTSC's responses to the external scientific peer reviewer's findings for additional discussions.

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Mercury Waste Classification and Management Regulations: R-02-04: 15-Day Public Notice (11/20/02 – 12/5/02) Comment Summaries and Responses:

Commenter 15/2-A: Chuan-Hai Teh (Micro Metallics)

15/2-A-1: *Commenter submitted a letter that duplicates an email received on November 20, 2002, addressing the first 15 Day Notice of Changes.*

See comments and responses for commenter 15-E.

Commenter 15-2-B: Michael F. Ziff, DDS, International Academy of Oral Medicine and Toxicology

15/2-B-1: *DTSC should address the contribution of Dental mercury to environmental pollution and further states that dental amalgam contains 42-50% mercury that is continuously released from the amalgam and is a contributory factor to environmental pollution.*

The analysis of sources of mercury in California's environment reflects the best scientific understanding of the contribution of dental amalgam to the mercury loading in the environment. Moreover, DTSC has addressed this problem to the extent of its authorities by simplifying and streamlining the standards for managing hazardous waste dental amalgam. This simplification and streamlining is accomplished by designating hazardous waste dental amalgam as a universal waste. DTSC does not have authority to regulate dental amalgam while it is being used for its intended purpose and therefore cannot take steps independently to reduce the release from amalgam in teeth.

15/2-B-2: *"Studies … have shown that dentistry contributes 14-75% of the total environmental mercury."*

DTSC acknowledges the information. See the response to comment 15/2-B-1 for further discussion of the steps that DTSC is taking to address this issue and the limitations on DTSC's authority.

15/2-B-3: *Legislation has been introduced at the state and federal level with the intent of phasing out the use of mercury dental fillings.*

DTSC acknowledges this information.

15/2-B-4: *Mercury is highly toxic, is of great concern to the environment, is released from dental amalgam, and is a substantial contributor to environmental mercury pollution; urges the "utmost consideration."*

DTSC concurs with the commenter's assessment of the threats offered by mercury in the environment. See the response to 15/2-B-1, 15/2-B-2 and 15/2-B-3 for discussion of DTSC's actions to control mercury from dental amalgam and the limitations of DTSC's authority to regulate the use of dental amalgam.

Commenter 15/2-C: M. Anthony Collins, Ph.D. (Decision Analysis Impact Consultant)

15/2-C-1: *Opposes to the deletion of references to OSHA and Cal/OSHA requirements. The proposed regulations should be consistent with 40 CFR 262.34 (d)(5) et.Seq.*

DTSC has deleted the references to the OSHA and Cal/OSHA requirements for reasons stated in the Final Statement of Reasons. DTSC does not agree that the reference to Cal/OSHA should be retained.

DTSC has exempted universal wastes from many of the prescriptive standards of the general hazardous waste control regulations and statutes. Exemption is necessary to allow simple and efficient management of these universally generated waste. DTSC determined, as the U.S. EPA determined in adopting the federal Universal Waste Rule, that application of prescriptive standards for such a vast universe of generators would promote illegal disposal rather than protective management.

15/2-C-2: *Ambiguity, and a potential loophole, is introduced into the proposed regulation when the term "persons" is used without incorporating a definition of the term in the text of the document.*

A definition of "person" is included in section 66260.10 and in Health and Safety Code section 25118. It is not necessary to repeat the definition in the special definitions for the Universal Waste Rule, section 66273.9. The commenter and other readers are referred to those definitions of "person".

15/2-C-3: *"What is DTSC's position regarding omitting referenced sections and subsections?"*

DTSC is required by the Government Code to show the full text of all changes to the regulations. However, there is no requirement to show text of regulations that are not affected by the rulemaking. It is necessary to show not only the actual subsection, paragraph, subparagraph, etc. being added, repealed, or modified, but to also show any superior provisions that must be read to understand and assess the impacts of the changes. However, it is not necessary to show all text of each affected section because to do so would often include large unnecessary volumes of text that would detract from commenters' ability to understand and assess the changes being made.

Note that the full text of sections that are not being changed is available in both printed and online copies of the California Code of Regulations. Links to electronic versions can be found on DTSC's website, www.dtsc.ca.gov, under "Laws, Regulations, and Policies" in the menu on the left hand side of the page.

15/2-C-4: *Opposes the extension of the February 9, 2004 deadline to 2006. The extension rewards the "bad management practices" of industry by saving them money to the detriment of children and the elderly.*

As discussed in further detail in the Final Statement of Reasons, the date (the effective date for the M002 listing for appliances containing mercury-containing switches) is being extended because there is no easily available information regarding the presence, number, locations, and removal methods for the mercury switches in the myriad of types, brands, models, and ages of appliances and other products potentially containing mercury switches. Thus, a scrap metal dealer would be unable to determine his/her compliance status and could not be assured of compliance. By moving out the date, DTSC is allowing the industry and other groups to develop this guidance. This date gives the appliance recycling industry time to develop needed guidance, but puts the industry on notice that such guidance must be developed.

15/2-C-5: *Commenter highlights the toxicology, pathways, and health effects of mercury exposure*.

DTSC acknowledges the information. DTSC clearly understands these issues and clearly understands their import. Note that they make up part of the scientific basis for this rulemaking and the standards adopted are intended to at least partially address the problems highlighted in this comment.

Commenter 15/2-D: S. Ward Eccles, DDS

15/2-D-1: *The "best techniques" advocated by "organized dentistry and the California Dental Association" do not occur in every day dental practice; as a result, the bulk of excess new mercury amalgam and old mercury amalgam removed from teeth is vacuumed into suction and discharged into the sewer.*

DTSC is adopting these regulations to make environmentally protective management of waste dental amalgam simpler and more efficient. DTSC believes that simplifying the management standards commensurate with the risks posed by the waste will induce more dentists to properly manage waste amalgam.

Further, educational outreach is planned to all universal waste generators to publicize both the new regulatory standards and the need to properly manage these wastes.

Lastly, enforcement can be used to ensure that these wastes are properly managed. Note that discharge of wastewater containing more than traces of dental amalgam would be identified as hazardous waste due to both the soluble and suspended mercury

and silver content. Discharge of hazardous waste to the sewers without authorization is illegal disposal, chargeable as a felony in California and subject to fines and/or imprisonment.

However, enforcement of the standards is governed by article 8 of chapter 6.5 of division 20 of the California Health and Safety Code; it is not necessary to address enforcement in these regulations.

15/2-D-2: *Advocates the use of amalgam separators, and, find their use simple and economical*.

DTSC agrees that the use of amalgam separators will become necessary to separate amalgam fines from dental wastewaters. In fact, technology capable of finer filtration may be necessary to bring mercury levels in dental wastewaters below hazardous waste thresholds. However, requiring the use of amalgam separators to treat wastewaters is beyond the scope of this regulation, although it can be addressed in future rulemakings.

Commenter 15/2-E: William P. Galaros, DDS (American Academy of Biological Dentistry)

15/2-E-1: T*here are three important issues regarding mercury amalgam: dentistry is divided over the issue, the California Dental Association does not speak for the ordinary dentist, and the public does not support mercury fillings.*

DTSC acknowledges the information. However, the comment is interpreted as requesting that DTSC ban the use of amalgam fillings. This action, as discussed in the response to numerous comments for the 45-Day Public Review and Comment Period and the first 15-Day Notice of Changes, is outside the authority of DTSC to adopt regulations.

15/2-E-2: V*oluntarism will not work. Rules must be imposed to deal with mercury wastes generated in dental offices. Advocates a requirement that every dental office must install an amalgam separator.*

DTSC agrees that voluntarism does not generate as much environmental protection as regulatory requirements as has been stated in response to many similar comments.

However, as discussed in more detail in the response to comment 15/2-D-1 and 15/2-D-2 above, is not addressing treatment of dental wastewaters in this rulemaking.

Commenter 15/2-F: Elisabeth Carlson

15/2-F-1: *Commenter expresses her disappointment that the proposed regulations do not require amalgam separators, do not require dentists to document mercury use and disposal, and do not impose penalties for non-compliance.*

For discussion of the recommendation to require amalgam separators, see the responses to comments 15/2-D-1 and 15/2-D-2. Note that these regulations do require a level of documentation of waste amalgam management. However, DTSC has no authority to require recordkeeping for the use of amalgam as a product. Note that there are significant penalties for non-compliance with the hazardous waste control laws, including the State's Universal Waste Rule, and that these final regulations include enforcement authority restored or adopted by emergency regulation.

15/2-F-2: *Dentists should be required to use amalgam separators*.

For discussion of the recommendation to require amalgam separators, see the responses to comments 15/2-D-1 and 15/2-D-2.

15/2-F-3: *"American dentists are the leading cause of mercury in wastewater."*

DTSC acknowledges this comment. DTSC is adopting these regulations to make environmentally protective management of waste dental amalgam simpler and more efficient. DTSC believes that simplifying the management standards will induce more dentists to properly manage waste amalgam. These regulations are not intended, however, to change the State's regulations for discharge and/or treatment of wastewater. Thus, requiring amalgam separators is beyond the scope of this rulemaking.

Enforcement can be used to ensure that these wastes are properly managed. The discharge of wastewater containing more than traces of dental amalgam would be identified as illegal discharge of a waste that is hazardous due to both the soluble and suspended mercury and silver content. Discharge of hazardous waste to the sewers without authorization is illegal disposal, chargeable as a felony in California and subject to strict fines and/or imprisonment.

15/2-F-4: *Commenter attached a copy of a document prepared by the Stockholm Water Company that discusses measures it has taken to reduce the influx of mercury to wastewater sludge. Document is attached.*

DTSC agrees that the measures discussed in the Stockholm Water Company paper would greatly reduce the amount of mercury both in sewage sludge and in wastewaters discharged by the POTWs. However, as discussed in numerous comments above (for instance, 15/2-D-1, 15/2-D-2, and 15/2-F-3), mandating treatment of wastewaters is beyond the scope of this rule. Note that the designation of dental amalgam wastes as universal waste is intended to promote proper management of amalgam wastes such as

separator sludges. Thus, this rulemaking does represent a step towards removal of amalgam residues from wastewater.

15/2-F-5: *Mercury separators should be required at crematories.*

It is unclear that mercury separators as used in dental offices would be applicable to crematoriums. An air treatment unit to capture gaseous mercury emissions would be needed to remove mercury from the gaseous exhaust. Uncontained gases, such as crematorium exhausts are expressly excluded from classification as wastes in Health and Safety Code section 25124 and as defined in section 25110.11.

The removal of fillings prior to cremation, is beyond the scope of this rule.

15/2-F-6: *"The only proper solution is to end the use of mercury by all dentists" by phasing out amalgam use over the next three years.*

See the response to comment 15/2-E-1.

15/2-F-7: *The pipes in and under buildings occupied by dentists should be regulated.*

The pipes in and under buildings are regulated by several agencies. First, leakage from sewer pipes that could potentially release mercury from amalgam wastes is regulated by the State's water quality agencies. Any released material is regulated as waste requiring cleanup by both DTSC and the State's water quality agencies and many local agencies have cleanup authority. The piping is regulated by the State's water quality agencies and by the local publicly owned treatment works for the chemistry of the waste water discharges. The wastewater discharges are further regulated by DTSC if the discharges exhibit a characteristic of a hazardous waste.

Sewer piping associated with dental offices and clinics is beyond the scope of this rulemaking.

Mercury Waste Classification and Management Regulations:
R-02-04: 15-Day Public Notice (11/20/02 – 12/5/02)
Comment Summaries and Responses:

Index of 15-Day Comments

15-Day Public Notice
(11/26/02 – 12/10/02)
Comment Summaries and Responses

Mercury Waste Classification and Management Regulations: R-02-04 15-day Public Notice (11/26/02 – 12/10/02) Comment Summaries and Responses:

15/3-A **Charles G. Brown**
Coalition to Abolish Mercury Dental Fillings

15/3-A-1 *Please require amalgam separators for all dentists.*

See response to comment DD-3, incorporated herein, for the response to this comment.

15/3-A-2 "Please phase out *mercury fillings in three years."*

DTSC acknowledges the comment. However, the action requested by the commenter is outside both the scope of this rulemaking and the authority granted to DTSC.

15/3-A-3 T*he information contained in a Journal of the California Dental Association (CDA) article titled "Dentistry, Amalgam, and Pollution Prevention" "is sharply at odds with CDA's written and oral testimony."*

While DTSC acknowledges the comment, the comment does not identify objections or suggestions that are germane to this rulemaking.

15/3-A-4 *Commenter summarizes the article identified in 15/3-A-3 and highlights 16 points that make the article "one of the best arguments there could be for abolishing mercury dental fillings."*

DTSC acknowledges the information. However, abolishing mercury dental fillings is outside both the scope of this rulemaking and the authority granted to DTSC.

15/3-B **Mary Ann Newell**

15/3-B-1 S*upports the "mandatory use of amalgam separators for all dental offices" because voluntary use "does not work."*

See responses to comments DD-3 and B-4, incorporated herein, for the response to this comment.

15/3-B-2 *Commenter attached a copy of an April 23, 2001 letter from Denise Laflamme, MS Toxicologist, Department of Health, Washington State to the Program Manager of Washington State's Department of Ecology in which Ms. Laflamme summarizes her findings of a literature survey regarding mercury dental amalgam.*

This letter is evidence of the failures of "voluntary" programs that result in the improper disposal of mercury amalgam wastes.

DTSC acknowledges the information. DTSC agrees that voluntarism does not generate as much environmental protection as regulatory requirements. However, compliance with existing prohibitions on disposal of hazardous waste, such as unauthorized disposal of mercury amalgam wastes is not a voluntary issue. DTSC and the CUPAs have the authority to inspect dentists to enforce the law and regulations related to hazardous waste. See also the responses to comments DD-3, B-4, and E-6, incorporated herein, for additional response to this comment.

15/3-B-3 *Commenter attached a copy of an article published in the Oregonian on January 22, 1999 titled "Dentists, city reach recycling deal." the article is evidence that "some dentists admit a voluntary program will not work."*

DTSC acknowledges the information. See responses to comments 15/3-B-2, DD-3, B-4, and E-6, incorporated herein, for the response to this comment.

15/3-B-4 *Commenter attached a copy of an application for a Washington State Department of Ecology Waste Prevention, Reduction, and Recycling Annual Award from Gen Tech Dentists dated March 13, 2000. Commenter points out the applicant's statement that most dentists dispose of waste mercury amalgam waste in a "careless and irresponsible" manner.*

DTSC acknowledges the information provided by the commenter.

15/3-C **Jared Blumenfeld**
San Francisco County Department of the Environment

15/3-C-1 T*he San Francisco Department of the Environment supports regulation that would mandate the installation of amalgam separators for all dental offices. This requirement is necessary because dental offices contribute half of all mercury entering wastewater, amalgam separators would prevent 95% of dental office waste mercury from entering wastewater, voluntary programs in San Francisco have not worked, a mandatory program in Toronto resulted in a 58% reduction in the amount of mercury entering wastewater, and existing mercury contamination levels in the San Francisco Bay require that all possible pollution prevention practices are put in place for all sectors contributing to the problem.*

See responses to comments DD-3 and B-4, incorporated herein for the response to this comment.

15/3-D **Charles A. White, P.E.**
Director of Regulatory Affairs/West
Waste Management/West
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(Same comment letter received by both fax and email)

15/3-D-1 We *support the deletion of paragraph 4 of subdivision (b) of 66261.3 because "It is virtually impossible for a solid waste service provider to identify every waste that may house a mercury-containing device…"*

DTSC acknowledges the support offered by the commenter.

15/3-D-2 We *support the inclusion of new paragraph 5 of subdivision (b) of section 66261.3(b).*

DTSC acknowledges the support offered by the commenter.

15/3-E **Gene Erbin**
Nielsen, Merksamer, Parrinello, Mueller & Naylor, LLP
(representing Philips Lighting Company)

15/3-E-1 Philips *opposes the Department's proposal and "recommends retention (and modification) of the TTLC test" or, alternatively, "endorses the recommendation made by Mr. Mark Murray…" of Californian's Against Waste.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. While expressing his support of the M003 listing of all mercury-added lamps as hazardous wastes, Mr. Murray proposed at the public hearing on these regulations that the TTLC be retained "for the purposes of product labeling, marketing, procurement ….", not as an alternative to the M003 listing. In Philips' September 30, 2002 written comments on the 45-Day public notice, Philips expressed support for Mr. Murray's proposal. For discussion of this proposal, please see the response to comment T-47 in the responses to the written 45-day comments, and response to comment HM-8 in the response to oral comments made at the public hearing, incorporated herein.

15/3-E-2 Philips *objects to "The Department's decision to circulate its proposed revisions for only 15 days, and not 45 days". "The Initial Statement of Reasons relies on the delayed implementation date and clearly delineates several persuasive reasons for proposing a February 9, 2006 listing date." There revisions "represent a sudden and unwarranted departure from the Department's previously articulated position" and" do not qualify for 15-day review."*

DTSC has reviewed this comment and determined that no regulatory change is necessary. This revision to section 66261.50 could be expected, is warranted, is consistent with DTSC's previously articulated position and qualifies for 15-day review for reasons explained below.

DTSC has shortened the delay between adoption of the regulations and the effective date of the M003 *listing* as presented in the originally proposed regulations. DTSC has not shortened the delay of the exemption from requirements to *manage* M003 waste as universal or hazardous waste for households and Conditionally Exempt Small Quantity Universal Waste Generators (CESQUWGs). Thus, DTSC has not departed from the concept of a delay of the effective date for the listing or management requirements for households and CESQUWGs. DTSC has merely shortened the delay for the effective date of the listing. This change is consistent with, and is only a variation on, DTSC's original approach.

The change in the effective date for the listing from 2006 to 2004 is warranted and not sudden or unexpected. The effective date of 2006 for the M003 listing was included in the original text of section 66261.50 and DTSC made the text available for public comment. A number of comments suggested changing the originally proposed effective date. Suggestions ranged from deleting the delay of the implementation date (shortening the delay) to never having implementation (lengthening the delay). These suggestions show commenters were certainly aware of and could expect there might be change in the effective date. Therefore, proposing a change from 2006 to 2004 for the effective date for the M003 listing complies with the requirement in Government Code section 11346.8, subdivision (c) that a change be "sufficiently related to the original text that the public was adequately placed on notice that the change could result from the originally proposed regulatory action".

Subdivision (c) of Government Code section 11346.8 requires a sufficiently related change to be made available to the public for at least 15 days before adoption. DTSC has complied with the statute by making the change in the effective date of the listing available for at least 15 days.

15/3-E-3 *"It is unreasonable, unfair, and illegal for the Department to abandon its own analysis and preferred explanation without the opportunity for full and informed discussion."*

DTSC has reviewed this comment and determined that no regulatory change is necessary. DTSC's change is consistent with its analysis and explanation for the delayed implementation dates. See response to comment 15/3-E-2 above, incorporated herein. The following discussion provides additional support for the change and responds further to this comment.

In the Initial Statement of Reasons, DTSC explained its rationale for delaying the implementation of the M003 listing until 2006. Reasons for the delay included:

- To allow time to educate the generators of lamps that currently are not classified as hazardous about the change in the lamps' status;
- To allow time for generators to prepare for the proper disposition of all mercury-containing lamps;
- To allow time for the development of the collection infrastructure.

DTSC changed the effective date of the M003 listing in response to comments that a three year delay was too long and was not needed to educate the public that every fluorescent tube was regulated as hazardous waste (the first reason for the delay).

Also, DTSC has determined that a three-year delay in the listing is not needed for the purpose of developing a collection infrastructure for lamps generated by households and CESQUWGs (the second and third reasons listed above for the delay). While currently non-hazardous lamps will become subject to the universal waste management standards in 2004, the regulations allow eligible households and CESQUWGs to continue to dispose of these lamps as non-hazardous waste until 2006, under the existing temporary disposal exemptions. These existing exemptions will allow time for smaller generators to prepare for the proper disposition of all mercury-containing lamps and for the development of the collection infrastructure. (See the discussion of the M003 listing in the Final Statement of Reasons.)

Further, two commenters representing the lamp recycling industry stated in their comments on the original proposal that adequate capacity already exists to recycle all of California's waste fluorescent lamps that can be diverted from municipal landfills. These comments confirm DTSC's pre-existing knowledge about the adequate recycling capacity. (See response to comment T-28 (45- Day Notice), incorporated herein.) Larger generators already have collection systems readily available. Thus, larger generators do not need a lengthy delay for listing or a temporary disposal exemption. See responses to comments C-8, and T-9.1 in the responses to the written 45-day comments, incorporated herein.

For reasons discussed in this response, DTSC has not "abandoned its own analysis," as the commenter asserts. Rather, DTSC has modified the original proposal in response to information and comments submitted during the 45-Day public comment period.

15/3-E-4 T*here is no evidence to support "the earlier listing date," and there is no significant evidence that recycling capacity and infrastructure exist to handle the increased lamp recycling that would result from the earlier listing date. Philips also questions the environmental record and current economic and operational strength of recycling companies.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. Substantial evidence in the record supports the earlier listing date and shows that adequate recycling capacity and infrastructure exist to support the earlier listing date. (See response to comments 15/3 E-2 and E-3 above (listing date) and response to comment T-28 (adequacy of recycling capacity and infrastructure) (45 Day Notice), incorporated herein.) Evidence in the record shows there are recycling companies that are capable and willing to expand their operations to accommodate more lamps. Philips' question about the environmental record of recycling companies is speculative and does not provide enough information to allow DTSC to specifically respond. The info information previously provided by Philips concerned an out-of-state recycler that was not included in DTSC's determination that adequate capacity currently exists to recycle the fluorescent lamps generated in California. However, if Philips has more specific information or concerns in the future, it can file a complaint with DTSC's Statewide Compliance Division.

15/3-E-5 *"There is compelling evidence in the record endorsing source reduction" and the Department has engaged in "over-reliance on recycling." There is no professionally informed testimony rebutting these claims."*

DTSC has reviewed this comment and determined that no regulatory change is needed. These regulations will encourage manufacturers wishing to market lamps that can be disposed of as non-hazardous waste to develop and produce new types of high-efficiency lamps that are entirely free of mercury. The use of the TTLC to classify waste lamps as hazardous or nonhazardous does not provide this incentive. See the responses to comments T-5, T-18, and T-24 in the responses to the written 45-day comments, incorporated herein, for a more detailed discussion.
DTSC does not agree that:

- The M003 listing over-relies on recycling at the expense of source reduction;

- The M003 listing designates all mercury-containing lamps as hazardous waste;

- The Universal Waste Rule encourages lamp recycling, by requiring it in order for lamps to be eligible for universal waste management;
- Until new types of high efficiency mercury-free lamps are developed and available, recycling is preferable to disposal;.
- The tables in the appendix to the responses to the 45-day written comments, incorporated herein, clearly show that raising the lamp recycling rate, even if the lamps are higher in mercury, will reduce releases of mercury more than will reducing the average mercury content of lamps and maintaining the current 20 percent recycling rate.

As noted in the responses to 45-day written comments T-5, T-18, and T-24, incorporated herein, the M003 listing promotes source reduction in a way that the current use of the TTLC does not. The "compelling evidence" to which the commenter refers is, presumably, the analysis by Roux Associates. DTSC does not agree with the assumptions Roux uses in calculating the impact of these regulations on environmental mercury loading in California. Please see the response to 45-day written comment T-36 for discussion, incorporated herein.

DTSC and Cal/EPA staff composed of professional engineers, toxicologists, scientists and economists prepared the Mercury Report, the Initial and Final Statement of Reasons, the regulations, other background documents and responses to comments. Similarly qualified persons prepared DTSC's Universal Waste Rule regulation package. These professionally informed individuals have rebutted the claims Philips asserts in this comment.

15/3-E-6 *DTSC has ignored analytical studies indicating that recycling rates would have to triple to achieve the same reduction in mercury emissions as achieved by the current TTLC.*

DTSC has reviewed this comment and determined that no regulatory change is needed. DTSC has not ignored the analytical studies (Presumably the commentor is referencing the studies submitted by Roux Associates) of the effect of recycling rates on mercury releases. DTSC has reviewed and commented on the analysis in the summaries and responses for the written 45-day comments, incorporated herein.

DTSC acknowledges that the recycling rate must increase significantly if the needed reductions in mercury releases are to be realized. Minnesota has

attained a 70 percent recycling rate[1] by prohibiting the nonhazardous disposal of fluorescent lamps; fluorescent lamps must either be recycled or managed and disposed of as hazardous waste. The M003 listing is a necessary prerequisite for California to reach, or exceed, Minnesota's recycling rate. The M003 listing will classify all waste mercury-added lamps as hazardous wastes, but as universal wastes, they will be exempted from all but a few simple management requirements provided they are recycled. The following factors will allow California to attain (or exceed) a 70 percent recycling rate:

- The M003 listing, which will require recycling of all mercury-added lamps that are managed as universal wastes;
- The February 9, 2004, reduction in the temporary disposal exemption for lamps generated by Conditionally Exempt Small Quantity Universal Waste Generators (CESQUWGs) to no more than 30 lamps per month;
- The February 9, 2006 sunset of the temporary disposal exemptions for lamps generated by households and CESQUWGs; after that date, all lamps will be required to be recycled or managed and disposed as hazardous wastes; Any nonhazardous disposal after this date will be a violation of hazardous waste requirements;
- The implementation of a collection infrastructure for universal wastes generated by households and CESQUWGs, which is currently being developed by the Cal/EPA Universal Waste Infrastructure Workgroup; and
- Education and outreach on the changes in the requirements for managing waste mercury-containing lamps.

The tables in the appendix to the written 45-day comments and responses, incorporated herein, illustrate that under the plausible scenario in which 70 percent of lamps are recycled, less mercury would be released to the state's environment than under the unlikely scenario that all manufacturers would reduce the mercury content of their lamps to the levels used by Philips ALTO lamps, and the current recycling rate would remain unchanged. See the response to comment 15/3-E-5, above, incorporated herein.

15/3-E-7 *At the September 30, 2002 hearing a proposal was made to retain the TTLC "as a means of designating low mercury lamps for the purposes of product labeling, for marketing, and procurement preferences…" In a September 30, 2002 letter, Philips Lighting Company expressed its interest in seriously exploring this option. "Because our request has apparently been denied, Philips now requests, pursuant to Government Code Section 11346.8(e), additional time...before the Department takes final action."*

[1] January 28, 2002 letter from Mr. Paul Walitsky, C.H.M.M., Manager of Environmental Affairs for Philips Lighting Company to Mr. Ed Lowry, Director of the Department of Toxic Substances Control, page 3.

DTSC considered the option to retain the TTLC for labeling and marketing lamps in the context of these regulations and determined that it is beyond its authority and beyond the scope of this rulemaking. See the response to public hearing comment HM-8 for DTSC's response to the proposal. Nonetheless, DTSC is always willing to work with interested parties on proposals to reduce pollution. Therefore, as discussed in response to public hearing comment HM-8, DTSC is willing to work with Mr. Murray, Philips and other interested parties in 2003 on ways that the TTLC can be used to educate the public on the content of hazardous constituents in products that may be disposed. It is important to stress however, that DTSC is not authorized to regulate products.

Philips did not explicitly request additional time to explore the proposal in its September 30, 2002 comment letter. The letter stated "the law requires DTSC to seriously explore this alternative" (see response to public hearing comment HM-8) and that "[it] is incumbent upon the Department to pursue this legitimate alternative." For reasons discussed in the response to hearing comment HM-8, incorporated herein, DTSC has not pursued the alternative further at this time.

Now that the commenter is formally requesting "additional time to respond to [Mr. Murray's] new issue…," DTSC has considered granting this request, pursuant to subdivision (e) of section 11346.8 of the Government Code.[2] However, given that the suggestion is both beyond the scope of this rulemaking and beyond DTSC's authority to adopt, DTSC has determined the commenter's request is not practical and therefore, DTSC must deny the request.

15/3-E-8 *Philips Lighting Company is "at an extreme (and prejudicial) disadvantage at this stage of the regulatory process" because "it has no access to the Department's most recent reasoning." This is "because the Department has obviously discarded its previously announced position". "Is the Department's refusal to adhere to [Government Code] section 11346.8 a product of the [Health and Safety Code] section 25250.6 deadline?"*

First, contrary to its assertion in the comment, Philips has had access to DTSC's most recent thinking. The 45-Day and 15-Day public notices clearly stated that interested parties can contact DTSC personnel with inquiries. Names and

[2] Subdivision (e) of Government Code section 11346.8 states:

> (e) If a comment made at a public hearing raises a new issue concerning a proposed regulation and a member of the public requests additional time to respond to the new issue before the state agency takes final action, it is the intent of the Legislature that rulemaking agencies consider granting the request for additional time if, under the circumstances, granting the request is practical and does not unduly delay action on the regulation.

telephone numbers of specific staff persons were provided in the notices. Philips' representative has contacted various DTSC personnel since the public hearing and has made copies of numerous documents in the file. Thus, Philips' claim that it is at an "extreme and prejudicial disadvantage" due to lack of access is erroneous.

Reasons for the original proposal were explained in the ISOR and supporting documents. The changes in the regulations from the original proposal are fully accounted for and explained in the Final Statement of Reasons, as required by subdivision (a), paragraph (1) of section 11346.9 of the Government Code. As discussed above in responses to comments 15/3 E-2 and E-3, incorporated herein, DTSC complied with Government Code section 11346.8, subdivision (c) and made the changes available for comment for 15 days and DTSC has responded to all comments.

Second, Philips' assertion that DTSC has "discarded" its previous position is also erroneous. (See responses to comments 15/3 E-2 and E-3, incorporated herein.) The original proposal to list all mercury-added lamps waste as hazardous waste has been retained, not discarded. The concept of a delay in the effective date of the listing for M003 waste has been retained, not discarded. The concept of an exemption until 2006 for households and CESQUWGs to manage M003 waste as hazardous (or universal) waste has been retained, not discarded. The only change is that the delay in the effective date for the M003 listing has been reduced from 2006 to 2004.

The effective date for the M003 listing was changed in response to comments received during the 45 day comment period. All effective dates (and delays) were open for comment, and DTSC received a number of suggestions to change or eliminate altogether the effective date for the M003 listing. As discussed above in responses to comments 15/3 E-2 and E-3, this change is "sufficiently related to the original text that the public was adequately placed on notice that the change could result from the originally proposed regulatory action." (Gov. Code § 11346.8, subd. (c).)

Philips' assertion that DTSC has not adhered with section 11346.8 due to Health and Safety Code section 25150.6 (or any other deadline for that matter) is erroneous. The authority for listing M003 wastes rests with Health and Safety Code sections 25140 and 25141, not section 25150.6. Sections 25140 and 25141 do not have expiration dates. Furthermore, DTSC is not adopting universal waste standards for lamps pursuant to section 25150.6. The universal waste management standards for lamps are *already* in the Universal Waste Rule, which was adopted in early 2002. Subdivision (g) of section 25150.6 includes the sunset date and states:

> "This subdivision does not invalidate any regulation adopted pursuant to this section prior to the expiration of the Department's authority." (Emphasis added.)

In conclusion, DTSC has fully complied with Government Code 11346.8, for the change to the effective date of the M003 listing. DTSC has also already complied with the deadline in Health and Safety Code section 25150.6 for designating universal waste standards for mercury-containing lamps.

15/3-E-9 *Philips Lighting Company has previously submitted a demonstration of "the Department's lack of compliance with section 25179.4" This section contains a mandate to "first promote reduction of hazardous waste and, secondly, recycling of hazardous waste." Without convincing evidence, the Department has inverted statutory priorities, and with the revised proposal, has accelerated and magnified "the illegality of the Department's original proposal."*

Listing of waste is authorized and mandated by Health and Safety Code sections 25140 and 25141. Hazardous waste must be identified in order to determine whether the generation is being reduced. Far from inverting its priorities, the listing of mercury-added waste lamps as hazardous wastes, and encouraging recycling over disposal through designation as universal waste is fully consistent with section 25179.4 of the Health and Safety Code. See the responses to 45-day written comments NN-2, T-2, T-5, T-22, T-23, T-24, T-26, T-28 T-47, and T-48 (45-Day Notice), incorporated herein, for discussion.

In addition to demonstrating that the M003 listing is consistent with the priorities of section 25179.4, DTSC provides "convincing evidence" that the listing of mercury-added waste lamps as hazardous waste will produce greater reductions in the release of mercury to California's environment than would continuing to use the TTLC to classify lamps. See the tables in the appendix to the 45-day written comments, incorporated herein. For all of the above stated reasons, DTSC's proposal complies with applicable laws.

15/3-E-10 *Philips Lighting Company has previously submitted large volumes of analytical and documented evidence supporting the retention of the TTLC and demonstrating that reliance on recycling is misplaced. "Green Seal recommends that concerned persons and entities only purchase fluorescent lamps that pass the TTLC test." The commenter attached a copy of Green Seal's "Choose Green Report" and a copy of Green Seal's website (www.greanseal.org/about.htm). Considering the "extraordinary*

evidence" in the record, section 25179.4 "prohibits the Department from proceeding on the basis of insubstantial evidence."

DTSC has elsewhere responded to the documents submitted by the commenter in support of his arguments against the M003 listing (see the responses to the written 45-day comments and also the response to comment 15/3-E-6, above, incorporated herein). The listing of mercury-added lamps as hazardous wastes was proposed in the 45-day public notice, and it has been retained in the revised regulations. Subdivision (c) of Government Code section 11346.8 requires DTSC to respond only to written comments received regarding a change from the original proposal. In the revised regulations circulated in the 15-Day Notice, the scope of the listing has been changed; only lamps with intentionally-added mercury are now covered under the M003 listing. The effective date of the listing has also been changed, from February 9, 2006 to February 9, 2004. Thus, DTSC is required to respond (and has responded) to any comments received on either of these topics. However, because the listing itself was proposed in the 45-day notice and has not changed since then, comments on the listing in general are beyond the scope of this public notice.

DTSC has reviewed the Green Seal documents submitted as comments on the 15-day changes to the originally proposed text, and has determined that no regulatory change is necessary. DTSC does not regulate the marketing of products, and these regulations do not preclude Green Seal from continuing to encourage the use of low-mercury lamps. See the responses to comments T-39 and T-47 in the 45-day written comments and responses, incorporated herein.

15/3-E-11 *"The record, upon which the Department presumably relies, is riddled with inconsistencies and errors."The Department has made no attempt to correct these errors, and, therefore, is proceeding without accurate and consistent answers to even rudimentary questions. These errors are so significant that they could not be corrected in a Final Statement of Reasons.*

DTSC has reviewed this comment and determined that no regulatory change is necessary. DTSC has responded to all of the comments submitted during the public comment periods for this rulemaking, including comments that allege errors and inconsistencies in the record. The commenter asserts that the record is "riddled with inconsistencies and errors." DTSC cannot speculate as to which elements of the record the commenter disputes, other than those cited in his comments. In his comments on this 15-Day Public Notice of Post-Hearing Changes, the commenter objects to the following statements:

- Statements in Fiscal Impact Analysis (page 10) and the Economic Impact Analysis (page 9) for these regulations the low-mercury lamps "are more expensive to manufacture and sell at a premium price of 1.25 to 1.5 times the cost of other lamps."

The commenter submitted this comment during the 45-day public comment on these regulations. DTSC addresses it in the response to comment T-51, incorporated herein. It states, "DTSC has reviewed this comment and determined that no regulatory change is necessary. DTSC's statement in the economic analysis for these regulations to the effect that Philips Alto lamps were more expensive to purchase than competing lamps was based on a spot check of the prices of various brands of lamps at a large home improvement retail store. Lamp prices were not a basis for the M003 listing, and the price of mercury-added lamps was not used in any calculations of the fiscal or economic impact of these regulations. Regardless of the cost of the lamps, DTSC's analysis of the economic impact of these regulations would, remain unchanged."

- The following statement appears in the Initial Statement of Reasons: "… variables other than a lamp's mercury content may affect its impact on the environment. For example, if one type of lamp contains less mercury than another, but also produces less light or has a shorter life, using more of the lower-mercury lamps may not result in a net decrease in the mercury entering the environment." The commenter believes that this statement suggests low-level lamps may have shorter life. The commenter further asserts that this statement conflicts with another statement: that "low-level mercury lamps 'may also have longer rated useful life.'" According to the commenter, the latter statement appears on page 22 of DTSC's "Economic and Fiscal Analysis." The latter statement, which the commenter claims is on page 22 of the "Economic and Fiscal Analysis", does not appear in the Fiscal Impact Analysis (which is only 15 pages long) or the Economic Impact Analysis (which has only 13 pages).

The statement in the ISOR to which the commenter refers is not intended to address any particular brand of lamp, and is not does not compare the longevity of Philips lamps with its competitors. Instead, the statement points out the inadequacy of mercury concentration as a basis for determining whether a particular lamp is hazardous or nonhazardous. A number of variables besides total concentration determine the net amount of mercury that will be released to the environment when a particular type of lamp is used and—at end-of-life—disposed of. The commenter himself acknowledges that increasing the mercury dose in lamps could increase their average longevity.[3]

[3] See footnote 21 on page 8 of Mr. Erbin's September 27, 2002 letter, commenting on these regulations as originally proposed. Mr. Erbin states: "It is very easy to produce a long-lasting lamp - simply add copious quantities of mercury."

One could devise a formula for classifying wastes lamps that would take into account longevity, mercury dose, and light output, but DTSC has determined that regulating "all mercury-containing lamps as hazardous wastes will be more protective of public health and the environment" (see page 16 of the Final Statement of Reasons).

- DTSC lacks accurate information on the cost of lamps, the longevity of lamps, and the mercury content of lamps. (These are the "basic economics or realities of the marketplace," according to the commenter.)

Neither the cost nor the longevity of mercury-added lamps was a basis for the M003 listing. DTSC has (presumably accurate) information submitted by this commenter on the mercury dose of Philips ALTO lamps and of competing brands, as well as data suggesting that ALTO lamps meet or exceed industry standards for life. The commenter has asserted that Philips ALTO lamps cost no more than competing brands. DTSC has reviewed, considered, and responded to all of this information and incorporated it into the rulemaking file. Further, DTSC has used data submitted by this commenter (in the analysis by Roux Associates submitted during the 45-day public comment period) on the mercury content of ALTO lamps and competing brands to calculate the amount of mercury that would be released to the state's environment under various regulatory scenarios. These scenarios include ones in which the TTLC for mercury would continue to be used in classifying lamps, and one in which the TTLC for mercury-added lamps would be lowered to 15 milligrams per kilogram. The calculations show that, in addition to supporting the objectives of these regulations, the M003 listing will reduce mercury releases to California's environment more than would retaining or lowering the TTLC for lamps, even under the optimistic assumptions made in the Roux analysis. See the responses to 45-day written comments T-36 and QQ-5, incorporated herein, for further discussion.

15/3-E-12 *"The record of this proceeding contains other damaging deficiencies which, cumulatively, forbid the Department from proceeding." Philips Lighting Company identified numerous deficiencies in its letter of January 28, 2002, that was submitted on September 27, 2002, (during the 45-day comment period) including miscalculations, outdated data, and inadequate data collection*

DTSC disagrees with the comments and has determined that no regulatory change is necessary. DTSC addressed Philips' January 28, 2002 letter and in the responses to the written 45-day comments, incorporated herein.

15/3-E-12.1 Severe criticisms submitted by Dr. A. Russell Flegal are sufficiently deficient to abandon this proposal and "there is a strong

appearance that the Department is determined *to adopt the proposed regulations regardless of the nature, content, or quality of any comments it may receive." Several examples of criticisms were noted from Dr. Flegal's peer review report, including the "most troubling" statement that "the regulations, it seems, will proceed regardless of a qualitative understanding of the potential impacts or benefits."*

DTSC disagrees. Dr. Flegal did not recommend abandoning the project. Among other supportive things, Dr. Flegal stated in his report: "[r]easoned regulatory action to limit additional mercury contamination in the the state [is] … justified…" DTSC addressed Dr. Flegal's criticisms in its comments on the external scientific peer review, incorporated herein. DTSC determined that none of Dr. Flegal's concerns warranted changing or abandoning the project.

15/3-E-13 *Commenter attached two charts comparing the mortality curve of Philips fluorescent lamps to the industry standard.*

DTSC has reviewed this comment and determined that no regulatory change is needed. These charts contain updates of data submitted during the 45-day public comment period. Pursuant to subdivision (c) of section 11346.8 of the Government Code, DTSC is required to respond only to comments submitted during this 15-Day Public Notice of Post-Hearing Changes that address changes made since the regulations were "originally made available to the public…." The charts do not address any of the post-hearing changes made to the regulations. As discussed in the response to comment 15/3-E-11, the longevity of mercury-added lamps was not used as a basis for these regulations. See also the responses to 45-day written comments T-21, T-43, and NN-12.3, incorporated herein, for further discussion.

15/3-E-14 *Health and Safety Code section 25150.6 erects a substantive barrier to the Department's proposal because it codifies the distinction between hazardous and non-hazardous lamps, removing the ability of the Department to regulate as universal waste lamps that are not hazardous.*

DTSC disagrees. See the response to comment T-25 (45-Day Notice), incorporated herein.

15/3-E-15 *All but one of Philips' comments on the draft Mercury Report were ignored in the Final Mercury Report. The one exception pertained to air emissions from lamp breakage. The draft Report said 450 pounds per year are emitted from lamp breakage; "without explanation, the final Report 'picks' an amount of 370 pounds of*

annual air emissions." This value "is still factors larger than an accurate calculation."

A copy of Philips' January 28, 2002 comments on DTSC's Draft Mercury Report was submitted as a comment on the 45-day public notice. Pursuant to subdivision (c) of section 11346.8 of the Government Code, DTSC is required to respond only to comments submitted during this 15-Day public notice of post-hearing changes that address changes made since the regulations were "originally made available to the public…." This letter does not address any of the post-hearing changes made to the regulations. However, the assertions contained in the letter are responded to in the 45-day written comments and responses.

15/3-E-16 *Green Seal's recommendation of Alto lamps rebuts DTSC's unsupported assertion that confusion exists in the marketplace regarding lamps. "Obviously, just the opposite is true! Persons know which lamps pass the TTLC and which don't. If anything, persons are highly confused by the Department which proposes abolition of a highly useful and progressive standard."*

DTSC has reviewed this comment and determined that no regulatory change is needed. This comment does not address any change in the 15-day notice of post-hearing changes. This commenter submitted similar comments during the 45-day public comment period for this rulemaking. See the response to 45-day written comment T-47 for discussion of the issue raised in this comment.

In the *Choose Green Report* submitted by the commenter, the discussion of "Lamp Mercury Content" does not explain what is meant by "the State of California's requirements, at 3.8 milligrams per 4-ft lamp." The TTLC is not mentioned by name; if the TTLC were mentioned, the statement would imply that California endorses ALTO lamps.[4] These regulations do not preclude Green Seal from recommending Philips ALTO lamps if it chooses to do so, but neither the commenter nor Green Seal should imply that DTSC endorses ALTO lamps.

15/3-F Bernard Windham, President

[4] A copy of a letter from Ronald Pilorin of DTSC's Human and Ecological Risk Division (HERD) to Peter A. Bleasby of Osram Sylvania was submitted by Mr. Erbin with his comments on the 45-day public notice for these regulations. Mr. Pilorin's letter states that the nonhazardous concurrence issued to Philips by DTSC in 1997 does not constitute an endorsement of ALTO lamps, and that any use of the concurrence as an endorsement for ALTO lamps would be inappropriate, beyond the scope of the concurrence, and would not be condoned or approved by DTSC.

**Dams, Inc.
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15/3-F-1 T*he environmental effects of amalgam fillings affect everyone.*

DTSC acknowledges the comment.

15/3-F-2 thru F-15 below. *Commenter provides findings, statements, documentation, and references to support findings related to dental amalgam.*

15/3-F-2 *Human excretion into sewers by those with amalgam dental fillings along with dental office amalgam waste, have been documented to be the largest source of mercury into sewers.*

While DTSC acknowledges the comment, regulation of human waste to sewer plants and Publicly Owned Treatment Works (POTWs) is outside of DTSC's authority and not within the scope of this rulemaking. Discharges to sewers are regulated in California by the local POTW, the local Regional Water Quality Control Board, and the State Water Resources Control Board.

See responses to comments DD-3, B-4, and E-6 for discussion and response to dental office amalgam waste discharges to the sewer.

15/3-F-3 *All sewer plants in the U.S. have high levels of mercury and all sewer sludge has dangerous levels of mercury.*

While DTSC acknowledges the comment, regulation of sewer plants, Publicly Owned Treatment Works (POTWs), is outside of DTSC's authority and not within the scope of this rulemaking. Discharges, including sewage sludge are subject to characterization as a hazardous waste using the existing criteria. They are not affected by this rulemaking. In general, any POTWs are regulated in California by the State Water Resources Control Board and the nine Regional Water Quality Control Boards.

15/3-F-4 D*ental amalgam fillings are a major source of mercury going into waterbodies from dental offices and human wastes.*

While DTSC has no specific information to corroborate or deny this assertion, DTSC does recognize that in urbanized areas dental amalgam may be a major contributor of mercury to wastewater treated by POTWs. However, as discussed in the response to comment HG-2 on the originally proposed regulations,

(incorporated herein), the proposed regulations will provide an incentive for proper disposal and a reduction in sewer disposal of waste amalgam. (See also the response to comment K-1, incorporated herein.)

15/3-F-5 D*entistry is the third largest use of mercury in the U.S., most of which ends up in the environment.*

See response to comment 15/3-F-4, incorporated herein, for the response to this comment.

15/3-F-6 M*ercury pollution is widespread in the U.S. with dangerous amounts of mercury commonly found in both freshwater and saltwater fish.*

DTSC acknowledges this comment.

15/3-F-7 M*ercury is the most toxic substance commonly encountered and is adversely affecting the health of people in the U.S.*

While DTSC does not have information that corroborates or denies the assertion that mercury is the most toxic substance commonly encountered, DTSC does acknowledge and agree that mercury is a highly toxic substance that may adversely affect the health of people in the U.S.

15/3-F-8 I*f sewer sludge is incinerated, most of the mercury goes into emissions.*

While DTSC acknowledges the comment, regulation of nonhazardous sewer sludge incineration and associated emissions is outside of DTSC's authority and not within the scope of this rulemaking.

15/3-F-9 C*rops grown on land using sewer sludge pick up high levels of mercury.*

DTSC acknowledges the comment. However, regulation of the use of nonhazardous sewer sludge as a crop fertilizer or soil additive is outside of DTSC's authority and not within the scope of this rulemaking. Land application of treated municipal sewage sludge is subject to the federal requirements established in Title 40, Code of Federal Regulations, Part 503, and any additional requirements established by the State Water Resources Control Board and local Regional Water Quality Control Board.

15/3-F-10 *Soil bacteria converts methylate mercury to methyl mercury which is released in landfills and land spread sludge areas in methane and landfill gas in high levels.*

While DTSC acknowledges the comment, consideration of the impacts of landfilled or land spread sewer sludge that are not hazardous wastes is outside of DTSC's authority and not within the scope of this rulemaking.

15/3-F-11 *High levels of mercury are being found in rain all over the U.S.*

While DTSC has no specific information to corroborate or deny this assertion, consideration of mercury levels in rain is outside the scope of this rulemaking.

15/3-F-12 *Dental amalgam fillings are the number one source of mercury in most people and levels of mercury exposure from amalgam commonly exceeds government health guidelines, with high levels in human excretion wastes documented.*

While DTSC has no specific information to corroborate or deny this assertion, consideration of non-waste amalgam government health guidelines and nonhazardous human wastes is outside the scope of this rulemaking. However, as discussed in the response to comment HG-2, the proposed regulations will provide an incentive for proper disposal and a reduction in sewer disposal of waste amalgam. (See also the response to comment K-1.)

15/3-F-13 *The level of mercury in all sewer plants in the U.S. exceeds the U.S. EPA proposed mercury limit due to amalgam in sewers from dental offices, homes, and businesses.*

See response to comment 15/3-F-3 for the response to this comment.

15/3-F-14 *Crematoria emissions commonly violate mercury air emission standards and constitute a significant source of mercury emissions due to mercury in amalgam fillings.*

While DTSC has no specific information to corroborate or deny this assertion, regulation of crematoria emissions is outside of DTSC's authority and not within the scope of this rulemaking. Air emission standards are established and enforced by the California Air Resources Board and local air quality management districts.

15/3-F-15 M*ost European countries require amalgam separators in dental offices but U.S. still has no regulations on this source of mercury; and Japanese dental schools, several other countries, and several U.S. states have banned or issued warnings regarding its use.*

While DTSC acknowledges this comment, establishment of regulations governing the use of dental amalgam are outside of DTSC's authority and the scope of this rulemaking. See response to comment DD-3 for discussion regarding use of amalgam separators.

15/3-G **Bernard Windham, President**
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15/3-G-1 *Commenter provides information regarding the DAMS web page and gives 16 internet links and descriptions of DAMS fact sheets documenting high exposures and adverse affects due to mercury from amalgam and other mercury sources.*

DTSC acknowledges the information provided by the commenter.

15/3-H **Bernard Windham, President**
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Note: This email comment is essentially the same comment as 15/3-G but has a different opening (includes a To/From paragraph whereas 15/3-G does not) and was sent about 15 minutes later than 15/3-G. See response to comment 15/3-G, incorporated herein.

15/3-H-1 *Commenter provides information regarding the DAMS web page and gives 16 internet links and descriptions of DAMS fact sheets documenting high exposures and adverse affects due to mercury from amalgam and other mercury sources.*

DTSC acknowledges the information provided by the commenter. No regulatory change is necessary.

15/3-I **Bernard Windham, President
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15/3-I-1 *DTSC may not be fully aware of the extent of the problem of outgasing of mercury from landfills since the proposed rule appears to be allowing more mercury to be landfilled. This would be a big mistake, as mercury levels are already much too high.*

Consideration of mercury outgasing at municipal solid waste landfills is outside both the scope of this rulemaking and DTSC's regulatory authority. In addition, mercury outgasing at hazardous waste landfills is not known to be a problem because these facilities do not accept or co-dispose with hazardous waste the organic putresible wastes that cause landfill gas production.

Furthermore, DTSC disagrees with the assertion that the proposed regulations allow more mercury to be landfilled. The focus of the universal waste management requirements established in the regulations is to ensure that the waste is recycled and never reaches the landfills.

15/3-I-2 I*t appears the proposed rule defines dental amalgam waste and other mercury waste as universal waste and not subject to hazardous waste regulation, as long as it is less than 100 kg for a small generator. This is a huge amount for mercury.*

The commenter is incorrect in stating that dental amalgam and other mercury-containing universal wastes would not be subject to hazardous waste regulation under the proposed regulations if the volume of waste is less that 100 kg for a small generator. Universal wastes are hazardous wastes. However, they are regulated according to management requirements that are tailored to the volumes, properties, and management risks associated with each specific type of universal waste. The Conditionally Exempt Small Quantity Universal Waste Generator (CESQUWG) exemption provides simplified management requirements for the smallest non-household universal waste generators because these generators manage universal wastes in a manner more similar to a household rather than a larger business. The exemption requires that the wastes (except mercury-added novelties without liquid mercury and rubber flooring) not be disposed and that the generator ensures that the waste is transported to another universal waste handler or to a destination facility. The focus of the waste management requirements here is to ensure that the waste is not disposed in the municipal solid waste system where it might inappropriately end up at a municipal landfill. The simplified CESQUWG waste management

requirements serve as an incentive to properly manage and recycle universal wastes by focusing on final disposition of the waste to prevent environmental damage.

While the 100 kg CESQUWG volume limit may appear to be a huge volume of waste to the commenter, it must be noted that this volume limit is not exclusive to mercury or mercury wastes. The 100 kg volume limit takes into account all universal wastes and all federal Resource Conservation and Recovery Act (RCRA) hazardous wastes generated by the CESQUWG in a single month. This means that any universal waste batteries, lamps, or thermostats, as well as mercury-containing universal wastes and RCRA wastes generated by the CESQUWG must be counted toward the 100 kg total. Depending on the wastes generated, the 100 kg total volume of waste may actually only represent a small number of items because wastes like batteries are very heavy compared to their size and the weight of the entire mercury-containing product or device (such as switches or gauges) is counted, not just the weight of the mercury contained in the device.

15/3-I-3 D*ue to mercury's extreme toxicity, the definition of small quantity generator or small quantity handler or shipper needs to be reconsidered and changed.*

While DTSC acknowledges the comment, no specific information or alternative is provided by the commenter to support the requested action. DTSC finds that no regulatory change is necessary. DTSC recognizes that mercury exhibits known toxicity. However, the small quantity generator volume limit is not based exclusively on mercury-containing wastes. As discussed in comment 15/3-1-2, the 100 kg volume limit takes into account all universal wastes and all federal Resource Conservation and Recovery Act (RCRA) hazardous wastes generated by the CESQUWG in a single month.

15/3-I-4 U*.S. EPA, AMSA, and other studies have documented that dental offices have high amounts of mercury and mercury waste that cause dangerous levels of mercury in sewers, sewage sludge, and landfills if the mercury isn't collected by amalgam separators and other means for solid waste and recycled. dental office waste should not be allowed to go into sewers or landfills.*

See response to comment DD-3, incorporated herein, for response regarding discharge into sewers. With respect to dental office waste going to landfills, while DTSC only has authority over management and disposal of hazardous waste, adoption of the proposed regulations will help prevent disposal of dental amalgam at municipal solid waste landfills. Any disposal of dental amalgam that is hazardous waste is a violation of the hazardous waste requirements.

15/3-I-5 T*he proposed rule appears to allow too much mercury at dental offices and in other mercury containing devices to be exempt from more stringent regulations and thus allows dangerous amounts of mercury into landfills and the environment.*

DTSC disagrees with the assertion made by the commenter, and has determined no regulatory change is necessary. The proposed regulations do not allow dangerous amounts of mercury into landfills and the environment. The focus of the universal waste management requirements established in the regulations is to ensure that the waste is recycled and never reaches the landfills. The simplified CESQUWG waste management requirements serve as an incentive to properly manage and recycle universal wastes.

The regulations balance the need for more stringent prescriptive management standards to prevent releases against the need to make proper management simple and less costly. Utilizing full hazardous waste management for the mercury-containing universal wastes may drive generators toward the more harmful action of illegal disposal. DTSC has determined that the performance standards established in the universal waste requirements are the best achievable balance between stringent control of the wastes and the need to remove the wastes from illegal disposal and municipal landfill disposal and into more appropriate waste recycling or hazardous waste disposal facilities.

15/3-I-6 T*he large amounts of mercury exempted from more rigorous regulation and requirements needs to be reconsidered in light of the evidence of harm to the environment, fish and wildlife, and people.*

See response to comment 15/3-I-5, incorporated herein, for the response to this comment.

15/3-J **Rachel Zellner/Mark Murray**
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15/3-J-1 T*hey are generally supportive of the proposed regulations but are concerned that they lack some necessary provisions that would make them more effective in protecting public health and the environment.*

DTSC acknowledges the general support offered by the commenter. However, the comment makes no specific suggestions or objections that DTSC can analyze, respond to, or take action on. Thus, DTSC has determined that no regulatory change is necessary.

15/3-J-2 I*n order to minimize impacts of mercury on public health and the environment, it is essential that incentives and enforcement inherent in the regulatory structure respond to the need for source reduction, safe and effective recycling, and aggressive enforcement of the existing and proposed expanded disposal ban.*

See response to comment HM-2, incorporated herein, for the response to this comment.

15/3-J-3 We *generally support the new approach in proposed section 66261.5 to require virtually all mercury-containing products be managed as hazardous waste when discarded, while creating an incentive for recycling by classifying them as universal waste when they are safely recycled.*

DTSC acknowledges the support offered by the comment.

15/3-J-4 We *strongly support the disposal ban for all fluorescent lamps containing any amount of added mercury.*

DTSC acknowledges the support offered by the comment.

15/3-J-5 We *are concerned that the proposed regulations fall short in addressing the need for source reduction, real recycling, and meaningful enforcement of the disposal ban.*

See response to comment HM-5 for the response to this comment.

15/3-J-6 We are *concerned that the proposed expansion of the existing disposal ban may inadvertently be removing the one existing incentive for manufacturers to source reduce their products.*

See response to comment HM-6 for the response to this comment.

15/3-J-7 We *strongly urge DTSC to retain the existing TTLC test as a means of designating "low mercury lamps" for the purposes of product labeling and marketing, procurement preferences, or other mechanisms that might be used to encourage manufacturers to minimize levels of mercury in lamps and encourage consumers to purchase those lamps.*

See response to comment HM-8, on the originally proposed regulations, incorporated herein, for the response to this comment.

15/3-J-8 We *urge DTSC to convene stakeholders in order to evaluate the existing TTLC "threshold/level" in the context of a source reduction incentive system, and to develop additional source reduction incentives, including but not limited to product labeling and public agency procurement preferences.*

DTSC acknowledges the comment. However, the actions proposed by the comment are beyond the scope of this rulemaking, See response to comments HM-8 and 15/3-E-7, incorporated herein. However, DTSC is willing to meet with interested parties in the near future to discuss these issues.

15/3-J-9 *We are supportive of the ultimate phase out of the householder and small quantity generator exemptions proposed in Section 66273 but strongly object to extending the exemption to 2006. A long lead time may reduce motivation and closing these loopholes by an effective date will provide adequate incentive and lead-time to develop collection infrastructure.*

See the responses to comments HM-10 and HM-11, incorporated herein, for the response to this comment.

15/3-J-10 T*here is nothing in the regulations about providing compliance and recycling information and guidelines to generators. We strongly urge DTSC to develop and implement a public education and enforcement component to ensure that regulatory requirements are adhered to.*

As discussed in comments F-5 and HM-12, incorporated herein, DTSC and the CUPAs have authority and established programs in place to enforce the provisions of the proposed regulations. In addition, DTSC plans to develop educational materials and conduct outreach activities to assist the public and the regulated community in understanding and complying with the proposed regulations. DTSC agrees that aggressive education and enforcement are vital to reaching a high compliance and recycling rate for the newly proposed universal wastes. However, establishment of new public education and enforcement programs are not within the scope of this rulemaking.

15/3-J-11 *DTSC should at least undertake an education and enforcement program targeting the largest generators of mercury added fluorescent lamps (large buildings) and require a compliance certification from building owners/operators, with certification fees to offset costs of the compliance program.*

See the response to comment HM-13, incorporated herein, for the response to this comment.

15/3-J-12 A *front-end financing mechanism will be needed to ensure development of a safe and effective recycling system. While DTSC may not want to test the limits of its authority by proposing an advance disposal fee as part of this rulemaking package, DTSC's leadership on this issue will be needed in the legislature.*

See responses to comments HK-9.3, CC-3, HC-5, H-13, HD-5, and HM-14, incorporated herein, for the response to the issue of front-end financing mechanisms, such as advance disposal fees.

15/3-J-13 We *urge DTSC to consider the changes to the proposed regulations that we have identified in our comments.*

DTSC acknowledges the comment and has given consideration to the changes proposed by the commenter.

15/3-K **Lena Brook, Environmental Health Program Associate**
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15/3-K-1 We *commend DTSC for acknowledging the concerns of many in the environmental community regarding the delay in regulating mercury-containing lamps. The revised February 9, 2004 effective date still provides ample time to comply with the new rules yet will be more effective at reducing environmental mercury releases.*

DTSC acknowledges the support offered by the commenter.

15/3-K-2 We are *concerned about the newly delayed timeline for regulating non-automotive switches because our understanding is that many of the products are already subject to regulations governing their mercury-containing devices. We are unclear on the necessity of postponing implementation until 2006.*

See responses to comments 15-B-3, 15-H-3, and 15/2-C-4, incorporated herein. While many non-automotive products may already be subject to regulations governing their mercury-containing devices, the existing information on the

presence, location, and removal methods of mercury switches in appliances is insufficient to enable recyclers to comply with the requirements. The 2006 implementation date allows the recycling industry and manufacturers adequate time to develop the guidance necessary to ensure compliance with the regulations and also establishes a date certain for removal of mercury switches from non-automotive products and appliances.'

15/3-K-3 *While we appreciate the M001 vehicle light switch clarification, we question the value of only regulating one automotive mercury source, and we are extremely concerned that section 66273.5 specifically exempts mercury-containing lamps found in vehicles.*

As noted in the rulemaking Final Statement of Reasons, the proposed regulations originally included all mercury switches found in vehicles in the M001 listing. However, the listing description was changed in response to comments received from the automobile recycling associations to apply the listing only to those mercury-containing switches that turn on lights when the hood or trunk lid is raised. This change was necessary because, while there is information readily available on the number, location, and accessibility of light switches, there are no clear guides or information available on the presence of other types of mercury switches, some of which are specific to certain parts suppliers or are installed in post-manufacture features, such as car alarms. Because it is difficult or impossible to know the number and location of mercury switches in a vehicle, and thus know whether the switches have been located and removed, the listing was changed to address only the accessible and well documented mercury-containing light switches for which compliance and enforcement of universal waste management requirements is possible. Please note that the M001 listing may be expanded in a future rulemaking as information about the existence and location of other mercury switches in specific vehicle models becomes available.

Similarly, the regulations were also changed to exempt vehicles that contain mercury-added lamps from regulation as universal waste (unless the vehicles exhibit a hazardous waste characteristic) because there is little information available about which lamps in motor vehicles contain intentionally added mercury and how to remove those lamps prior to dismantling. In response to currently available information, DTSC further concluded that few lamps in vehicles at this time actually contain intentionally-added mercury, so the exemption would not be allowing any significant volume of mercury-added lamps to escape proper management. It should be noted, however, that this exemption may be removed or modified in a future rulemaking if comprehensive information is developed showing the types and locations of mercury containing lamps in vehicles and which vehicles contain these lamps.

15/3-K-4 We *believe that dental industry compliance with the proposed regulations will not be achieved if the regulations are not amended; the dental amalgam universal waste designation must be coupled with mandates for the installation of control technologies such as state-of-the-art amalgam separators and dentists should also be required to maintain basic records indicating that pollution prevention equipment was installed and the amount of amalgam in use by each office.*

See responses to comments DD-3 and J-14, incorporated herein, for the response to this comment.

15/3-K-5 We are *concerned that the strength of the waste control provisions in the regulations is not commensurate with the enforcement strategies; a strong enforcement program is needed to compliment the regulations.*

See responses to comments CC-4, DD-4, HC-4, HD-3, J-1, HH-2, FF-4, and BB-4, incorporated herein, for the response to this comment.

15/3-K-6 We *suggest that DTSC create a compliance certification program for mercury-containing wastes similar to the one used by Title V of the Clean Air Act, with criminal penalties and certifications that could be modified as needed for different categories or waste generators.*

See responses to comments HD-4 and J-2, incorporated herein, for response to this comment.

15/3-K-7 *While an advance disposal fee structure may be outside DTSC's regulatory authority, we strongly urge DTSC to proactively work with California legislators to develop an advance disposal fee program for applicable mercury-containing products.*

See responses to comments HK-9.3, CC-3, HC-5, H-13, HD-5, and HM-14, incorporated herein, for the response to the issue of front-end financing mechanisms, such as advance disposal fees.

15/3-L **Sean Robledo Edgar, Director of Regulatory Affairs
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15/3-L-1 We *support inclusion of the listed mercury-containing devices in the universal waste category [section 66268.1(g)] and the handling of mercury-containing devices as "universal waste".*

DTSC acknowledges the support offered by the commenter.

15/3-L-2 *Regarding removal of lamps from waste motor vehicles, section 66273.5(b)(5), we request clarification that a single mercury-added lamp in a waste motor vehicle would automatically result in regulation as a hazardous waste.*

Proposed regulation section 66273.5, subsection (b), paragraphs (4) and (5) actually provide an exemption from the universal waste requirements for vehicles that contain mercury-added lamps and waste vehicles that are crushed, baled, sheared, or shredded from which all mercury-added lamps have not been removed. However, whereas subsection (b), paragraph (4) further provides that vehicles with mercury-added lamps could be eligible for regulation as universal waste if the vehicle itself exhibits a hazardous waste characteristic, subsection (b), paragraph (5) requires waste vehicles containing mercury-added lamps that are *crushed, baled, sheared, or shredded* to be regulated according to full hazardous waste requirements if they exhibit a hazardous waste characteristic.

This means that inclusion of a single mercury-added lamp in a waste (crushed, baled, sheared, or shredded) motor vehicle would not automatically result in regulation of the waste as hazardous waste. The waste vehicle would only be regulated as hazardous waste if it exhibited a hazardous waste characteristic.

Please see the rulemaking Final Statement of Reasons for a more detailed discussion of the requirements and reasons for the requirements.

15/3-M **Greg Jalbert**
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15/3-M-1 T*he proposed regulations do not adequately encourage the elimination of mercury from use in consumer products and fail to ensure that mercury in disposed products is collected and contained in a manner protective of public health.*

See response to comment 15-H-1 for response to this comment. See also responses to comments CC-3, HC-1, HC-3, H-1, J-8, and LL-1 for discussion of the issue of elimination of mercury from consumer products. (All of these references are incorporated herein.)

15/3-M-2 W*e need to stop putting mercury in products in the first place by encouraging manufacturers, through economic incentives and advanced disposal fees, to take mercury out of products and use alternatives.*

See responses to comments CC-2, CC-3, and J-8 for response to stopping use of mercury in products. See response to comments CC-3, HC-5, H-13, and HD-5 for response to use of economic incentives and advanced disposal fees. (All of these references are incorporated herein.)

15/3-M-3 A*n enforcement plan is needed to make sure products containing mercury are properly disposed. Without this oversight, how will we know that mercury waste won't continue to be disposed into municipal landfills and down the drain?*

See responses to comments CC-4, DD-4, HC-4, HD-3, J-1, HH-2, FF-4, and BB-4, incorporated herein, for the response to this comment.

15/3-M-4 W*e need to be able to add new products to the list [of mercury-containing universal wastes or listed mercury-containing products?] and have an established process for considering the addition of other products to the list over time.*

See responses to comments H-12 and J-5, incorporated herein, for the response to this comment.

15/3-M-5 W*e need to have a concrete plan to collect used mercury, "retire" and contain it, taking it out of our environment and preventing future human exposure.*

Sequestration of recycled mercury is outside the scope of this rulemaking. Although discussions on this topic have already begun with the U.S. EPA in Washington, DC, any actions that may be identified to address permanent mercury sequestration will have to be addressed in other, future rulemaking efforts.

See also response to comment GG-2 for an additional discussion of mercury sequestration.

15/3-N **Marjorie Monteleon
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15/3-N-1 Supports inclusion of *a requirement for amalgam separators in all dental offices.*

See response to comment DD-3, incorporated herein, for the response to this comment.

15/3-N-2 Supports *inclusion of a requirement that dental amalgam be regulated with intentionally added mercury as hazardous waste.*

DTSC acknowledges the comment and notes that dental amalgam is already generally subject to regulation as a hazardous waste when discarded because it would exhibit the hazardous waste characteristic of toxicity. Therefore, if the commenter means that a requirement should be added to include dental amalgam as a listed hazardous waste (as with lamps with intentionally added mercury), such a requirement would be unnecessary because dental amalgam is usually considered hazardous waste anyway by virtue of exhibiting a hazardous waste characteristic.

15/3-N-3 Supports *inclusion of a requirement to phase out mercury fillings in 3 years.*

See response to comment 15/3-A-2, incorporated herein, for the response to this comment.

Mercury Waste Classification and Management Regulations: R-02-04 15-day Public Notice (11/26/02 – 12/10/02) Comment Summaries and Responses:

Index of 15-Day Comments

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Final Regulations: Universal Waste Rule
(http://www.dtsc.ca.gov/LawsRegsPolicies/Regs/UWR_regs.cfm**)**

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Final Text: California Universal Waste Rule

Regulatory Background for the Final Rule

- Final Statement of Reasons - December 2001
- Final HSC 25150.6 Analysis and Findings - November 2001
- 15-Day Public Notice & Comment Period: Notice of Public Availability of Post-Hearing Changes - November 2001
- Text of Emergency Regulations - November 2001
- Announcement of Public Hearing and 60-Day Public Notice and Comment Period - December 2000
- Text of Proposed Regulations - September 2000
- Preliminary Analysis and Findings - September 2000
- Initial Statement of Reasons - August 2000

California Environmental Quality Act (CEQA)

- Notice of Completion - January 2001
- CEQA Initial Study - January 2001
- Draft Negative Declaration - January 2001
- CEQA Public Notice - January 2001

Enforcement Authority (DTSC Reference Number: R-02-08)

- Text of Emergency Regulations - September 2002
- Finding of Emergency

Information and Fact Sheets about the Universal Wastes Program

- DTSC Electronic Hazardous Waste page
- DTSC Universal Waste page

Fact Sheets about the Emergency Regulations for Universal Wastes
(Archival only, no longer relevant)

- Fact Sheet: Rules for Generators - March 2000
- Fact Sheet: Repeal of DTSC's 25 Fluorescent Tubes Policy - March 2000
- News Release: Department Adopts Universal Waste Regulations - March 2000