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TO: Gerald Bowes, Ph.D.
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State Water Resources Control Board

FROM: Karl Palmer, Chief 
Toxics in Products Branch
Office of Pollution Prevention and Green Technology
Department of Toxic Substances Control

DATE: August 28, 2012.

SUBJECT: REQUEST FOR EXTERNAL PEER REVIEW PROPOSED ADOPTION
OF SURVEY APPROACH AND METHODOLOGY TO ESTIMATE
MERCURY THERMOSTATS BECOMING WASTE IN CALIFORNIA

The California Department of Toxic Substances Control (DTSC) is developing regulations to implement the Mercury Thermostat Collection Act of 2008 (hereinafter, "Thermostat Collection Act"). As part of this rulemaking, DTSC is required to develop "...a methodology for ... calculat[ing] ... the number of out-of-service mercury-added thermostats becoming waste annually." DTSC proposes to base this methodology on the results of a study conducted for the thermostat manufacturers pursuant to the Thermostat Collection Act. DTSC believes that the study—in which the number of thermostats becoming waste each year was determined using survey data—was well-conducted, that the methodology was appropriate, that the samples were representative and, therefore, that the study provides a reasonable range of estimates of the number of mercury-added thermostats becoming waste each year in California. DTSC is requesting External Peer Review of the study's general approach and methodology.

DTSC requests by transmittal of this memo that the State Water Resources Control Board identify and assign two reviewers to provide external peer review of the report, entitled Mercury Thermostats: Estimating Inventory and Flow from Existing Buildings; Technical Approach Summary (SERA Technical Approach) March 2009, pursuant to California Health and Safety Code section 57004.

Background

The Thermostat Collection Act imposed an extended producer responsibility (EPR) requirement on manufacturers who sold mercury-added thermostats in California prior to January 1, 2006, when their sale was banned. Specifically, the law required these manufacturers to set up and operate a collection and recycling program (or programs) for out-of-service thermostats beginning in 2009. The law requires DTSC to adopt regulations that: 1) establish a methodology for calculating the number of thermostats that become waste annually, and 2) establish collection rate performance requirements, expressed as a percentage of the number becoming waste annually.

The data DTSC intends to use as the basis of the methodology in these regulations was generated as a result of another mandate of the Thermostat Collection Act: a requirement that the manufacturers develop "...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" and present it to DTSC. DTSC proposes to utilize the survey report submitted by the manufacturers to provide initial estimates of the annual removal rate of out-of-service mercury-added thermostats from buildings in California. As additional data become available during implementation of the program, the rate may be adjusted accordingly. The survey approach and methodology is described in the document titled Mercury Thermostats: Estimating Inventory and Flow from Existing Buildings; Technical Approach Summary (SERA Technical Approach) March 2009, (Attachment 1).

DTSC recommends that the State Board select two reviewers with expertise in conducting surveys, analyzing survey data, and/or in statistics. A list of the names and affiliations of individuals who participated in the development of the survey approach and methodology and the draft regulations are included in Attachment 3. The specific questions on which DTSC is requesting the reviewers' feedback are provided in appendices 1 and 2. Several documents are also provided as references:

1. Mercury-Containing Thermostats: Estimating Inventory and Flow from Existing Buildings, Technical Approach Summary (SERA Technical Approach)_Skumatz Economic Research Associates, Inc., 2009, (8 Pages)
2. Draft Regulations: Mercury Thermostat Collection and Performance Requirements; (11 Pages) The Mercury Thermostat Collection Act of 2008 (AB 2347, Ruskin), (8 Pages)
3. Mercury-Containing Thermostats: Estimating Inventory and Flow from Existing Residential & Commercial Buildings, (SERA/TRC Study) Skumatz Economic Research Associates, Inc., December 28, 2009, (35 Pages)
4. Mathematical Model Estimating Thermostats in Commercial Buildings, Final Report, Kings County, Washington Local Hazardous Waste Program, June 2006, (126 Pages)

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We are requesting the results of the peer review before September 30, 2012 to facilitate the submittal of the finalized rulemaking package to the Office of Administrative Law by November 2, 2012.

If you have any questions about this request please do not hesitate to contact me at kpalm@dtsc.ca.gov or (916) 445-2625.

Attachments

CC: Gina Solomon, MD, MPH
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Attachment 1
**Mercury Thermostats: Survey Approach and Methodology for Estimating
Inventory and Flow from Buildings**

Summary

DTSC proposes to adopt a regulation titled, Mercury Thermostat Collection and Performance Requirements to implement the Mercury Thermostat Collection Act of 2008 (AB 2347, Ruskin, hereinafter "Thermostat Collection Act").

The Thermostat Collection Act requires manufacturers to "establish and maintain" a "system for the collection, transportation, recycling, and disposal of out-of-service mercury-added thermostats that is financed, as well as managed or provided, by a manufacturer or collectively with other manufacturers." To help ensure that this system collects the "maximum feasible number of out-of-service mercury-added thermostats," the statute requires DTSC to adopt regulations that establish performance requirements. The regulations have two elements: 1) a methodology for calculating the number of out-of-service thermostats that become waste annually, and 2) performance requirements "that specify collection rates expressed as a percentage of out-of-service mercury-added thermostats becoming waste annually."

To support DTSC's development of these regulations, the statute required the manufacturers to do several things:

1. By April 1, 2009, they were required to submit "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" to DTSC;
2. By December 1, 2009, they were required to complete the survey; and
3. By December 31, 2009, they were required to submit "all survey data" to DTSC.

To comply with these requirements, the manufacturers' representative organization, the Thermostat Recycling Corporation (TRC), contracted with Skumatz Economic Research Associates (SERA) of Superior, Colorado to design and conduct the survey and analyze its data. The methodology for the survey (requirement 1, above) is described in a document titled Mercury-Containing Thermostats: Estimating Inventory and Flow from Existing Buildings, Technical Approach Summary (Enclosure 1). SERA surveyed businesses and households across California, using purchased third-party lists of randomly selected names and addresses. The survey questions were designed to obtain a variety of information, including (but not limited to):

- The number of thermostats in the responding business or household;
- The number of the thermostats that contain mercury;
- The age of the building and date(s) of installation of the thermostat(s);
- Dates thermostats were removed in the past; and
- Demographic/"firm-o-graphic" data on the household or business.

Attachment 1

Mercury Thermostats: Survey Approach and Methodology for Estimating Inventory and Flow from Buildings

The survey provided SERA with data on the ages at which thermostats were removed in the past, whether because they failed or for some other reason. SERA used "... the lifetimes of [mercury-added thermostats] that have already been removed and the age of those still in place to predict how long the remaining equipment will last...."¹ SERA then "... multiplied the inventory or 'count' of thermostat equipment still in place [by] 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."²

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 which found that 17 percent of square thermostats and 70 percent of round thermostats contain mercury;
- A middle estimate, which assumes that all square and round thermostats contain mercury (i.e., 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.

Rationale

DTSC is of the opinion that SERA's study was well-conducted and provided statistically valid data on the number of thermostats becoming waste annually. Therefore, DTSC proposes to adopt the results of the study, as summarized in Table 1.5 of the SERA report, 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 not to apply the 13.5 percent factor to correct for the undercount of thermostats seen in the validation study. However, in adopting the SERA study's low estimate, described above, DTSC is incorporating the percentages of square and round thermostats found to contain mercury in validation study —17 and 70 percent, respectively. While SERA's low estimate likely underestimates the true number of out-of-service mercury-added thermostats becoming waste annually, DTSC has concluded that this approach is conservative and defensible.

¹ SERA, page 19.

² SERA, page 19.

Attachment 2
Mercury-Containing Thermostats: Estimating Inventory and Flow from Existing Residential & Commercial Buildings

Description of Scientific Conclusions to be addressed by Peer Reviewers

The statutory mandate for external scientific peer review (Health and Safety Code Section 57004) states that the reviewer's responsibility is to determine whether the scientific portion of the proposed rule is based upon sound scientific knowledge, methods, and practices.

DTSC requests that you make this determination for each of the following conclusion statements that constitute the scientific portion of the proposed regulatory action. An explanatory statement is provided for each conclusion to focus this review.

- 1) **Sample Methodology:** SERA's approach of surveying a random sample of households and a sample of businesses stratified by number of employees is reasonable and appropriate for obtaining representative data on the numbers, ages, and types of thermostats in California's households and businesses.

SERA obtained a list of approximately 10,000 randomly-selected residences and a stratified random sample (based on number of employees) of approximately 10,000 businesses from a third-party vendor. Each household and business was sent a post card with a web link and a toll-free telephone number for submitting their responses. SERA mailed a second round of postcards and "conducted proactive telephone surveys with the commercial sector to improve the statistical properties and increase the response count...."

- 2) **Survey Response Rate and Bias Reduction Analysis:** a) the number of responses from California households and businesses was sufficient to obtain accurate data with 95 percent confidence; and b) SERA's bias reduction analysis and correction are reasonable and appropriate.
 - a. SERA's survey plan provides a summary of the number of survey responses that would be needed to represent populations of various sizes. Given that California has approximately 723,000 businesses and 13,400,000 residences⁵, a total of 384 responses would be required to achieve +/- 5 percent accuracy with 95 percent confidence and 271 responses would be required to achieve +/- 5 percent accuracy with 90 percent confidence.⁶ SERA received a total of 862 responses (267 surveys from businesses and 595 from households). This response rate is adequate to achieve better than +/- 4 percent accuracy with 95 percent confidence.

⁵ SERA Report, page 15.

⁶ SERA Technical Approach Summary, Table 1, page 5.

Attachment 2
Mercury-Containing Thermostats: Estimating Inventory and Flow from Existing Residential & Commercial Buildings

- b. SERA analyzed the survey responses from businesses and households for bias. When they found that response patterns from certain business or residential sectors differed from that sector's proportion of the total population of households or businesses, SERA applied correction factors. Response patterns from various sectors and the weighting factor for each are shown in tables 4.2 and 4.3 of the SERA report.

3) Developing a Method for Estimating Waste Flows: Using the survey approach to obtain statistically valid data and the methodology for estimating the number of thermostats becoming waste annually is a reasonable approach.

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" (digital thermostats and thermostats installed after California's ban on the sale of mercury-added thermostats took effect were removed from the count).
- Divided the resulting inventory of mercury-added thermostats into age quartiles.
- "Using the [thermostat] lifetime/cumulative distribution curve, ... started at the years of life already expended, and adjusted the annual disposal streams for each cohort to conform with..." the expectation that 100 percent of thermostats will have been replaced after about 70 years.
- "[S]ummed up the cohorts to develop the estimate of the total market that would flow out in a given year."

The results of these calculations are tabulated in Table 1.5 of the SERA Report.

The Big Picture

Reviewers are not limited to addressing only the specific conclusions presented above. Reviewers should note that some proposed action(s) may rely significantly on professional judgment where available scientific data are not as extensive as desired to support the statute requirements for absolute scientific rigor. In these situations, the proposed course of action is favored over no action. At the same time, reviewers also should recognize that DTSC has a legal obligation to consider and respond to all feedback on the scientific portions of the proposed rule. Because of this obligation, reviewers are encouraged to focus feedback on the scientific conclusions that are relevant to the central regulatory elements being proposed. Reviewers should also note that DTSC intends to accept and review additional data in the future as the thermostat collection program is implemented, and may adjust the estimates as appropriate. The report under review is therefore seen as providing the best currently-available estimates for program implementation at this time.

**Attachment 3
List of Project Participants**

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List of Attachments

- Attachment 4.** *Mercury-Containing Thermostats: Estimating Inventory and Flow from Existing Buildings, Technical Approach Summary.* , Skumatz Economic Research Associates, Inc., March 1, 2009.
- Attachment 5.** *Mercury-Containing Thermostats: Estimating Inventory and Flow from Existing Residential & Commercial Buildings.* Skumatz Economic Research Associates, Inc., December 28, 2009.
- Attachment 6.** Watson, Taylor, *Mathematical Model Estimating Thermostats in Commercial Buildings, Final Report.* King County, Washington Local Hazardous Waste Program. June 2006.
- Attachment 7.** *Mercury Thermostat Collection Act of 2008* (AB 2347, Ruskin; stats. 2008, ch. 572).
- Attachment 8.** Draft Regulations: *Mercury Thermostat Collection and Performance Requirements.* Department of Toxic Substances Control, August 7, 2012.