Turning Up the Heat II

Exposing the continued failures of the manufacturers' thermostat recycling program

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Executive Summary

Throughout the United States, mercury poses a severe health and environmental threat. Based upon blood testing data, federal scientists estimated that between 200,000 and 460,000 infants are born in the United States each year with mercury levels that are associated with the loss of IQ.

Mercury thermostats are a significant source of preventable mercury pollution. The U.S. Environmental Protection Agency (EPA) has estimated that 2-3 million thermostats come out of service each year. Each thermostat contains about four grams of mercury.

While intact mercury thermostats do not pose a public health risk, when they are handled as wastes or 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. Fish ingestion is the primary exposure route for most Americans.

Over the last two decades, the use of mercury in U.S. thermostat manufacturing has been reduced from 15-21 tons annually to virtually zero. 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 up to several hundred tons of mercury are still in use in U.S. homes and businesses.** Given that mercury thermostats can last 15 to 30 years or more, this vast reservoir of mercury currently on the walls in homes and businesses will continue to be mismanaged in the waste stream 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. Since the program became national in 2002, TRC collected about 5.8 tons of mercury. During this ten year period, EPA conservatively estimated 70-100 tons of mercury in thermostats came out of service. **Over the past decade, TRC has collected at most 8% of what EPA estimated came out of service.**

In some states, the TRC program barely functions, capturing only a tiny fraction of discarded mercury thermostats, and in other states the program ranges from grossly underperforming to mediocre. It's clear that the TRC program is capturing only the tip of the iceberg.

The program results are much better when the program becomes mandatory and financial incentives are included. In 2006, Maine enacted the nation's first comprehensive mercury thermostat collection law and has one of the highest per capita mercury thermostat collection rates 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. Vermont enacted a similar law in 2008; in 2011, Vermont had the highest per capita mercury thermostat collection rate in the country. Together, these two programs are consistently the national leaders.

This is our second evaluation of the TRC program. **After we published the first evaluation in February 2010, TRC stopped releasing its program collection results, and removed the**

historic data from its website. Instead of making fundamental improvements, TRC chose to sacrifice program transparency and hide the lack of progress. In this report, we rely on those program results TRC is mandated to provide by state law, and we estimate program results in other states based upon the recently released TRC 2011-2012 "progress report." These estimations provide an adequate foundation for overall program evaluation and state-by-state comparisons. However, the fact that TRC chooses to withhold the actual collection data, even though they are collected and readily available to TRC, is perhaps the best indication of poor program performance.

Adopting strong mandatory collection 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 to improve their collection rates. 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 has been targeted for reduction because it is a highly potent neurotoxin that is especially harmful to pregnant women, developing fetuses, and infants and children. Mercury can cause permanent damage to the brain, nervous system and kidneys, and is particularly harmful to children and the fetus because their nervous systems are still developing.[1]

Based upon blood sampling data, federal scientists estimated that between 200,000 and 460,000 infants are born in the United States each year with mercury levels that are associated, at later ages, with the loss of IQ.[2]

Methyl mercury bioaccumulates and biomagnifies in the food chain, so for most people, the main source of exposure is fish consumption. When 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. In 2010, 81% of all fish advisories in the United States were due to the presence of mercury, covering most states. **Twenty-five states have statewide mercury advisories for all their fresh water lakes and rivers, and 16 states have statewide advisories for all their coastal waters.[3]**

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, limit consumption of others, and to eat fish and shellfish that are lower in mercury. [4]

Mercury Use in Thermostats

Thermostats use mercury switches to control room temperature through communication with heating,

Thermostats with mercury switches showing glass ampoule containing mercury.

ventilating, and air conditioning (HVAC) equipment. Older thermostats often contain mercury. The photo on the left shows some common mercury thermostats and the glass ampoule 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.

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 about four grams.**[5]

The mercury in a thermostat will pollute the air, land or water if not managed properly at the end of its useful life because **the mercury will be released when the thermostat is broken, crushed, or burned during waste handling, or at a landfill or incinerator.** 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.

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. Therefore, 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 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 thermostats were still manufactured.

EPA estimated that between 15-21 tons of mercury was used to manufacture thermostats in 1997.[6] 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).[7] Most of this mercury was reportedly used by the Big 3, as indicated by the IMERC report they filed collectively.[8]

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%, and by 2010 the Big 3 had discontinued the production of mercury thermostats and overall mercury use dropped to virtually zero.**[9]

This dramatic drop in mercury use 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 followed suit.

The Failing Industry Thermostat Collection Program

Tons of Mercury in Thermostats Awaiting Collection

While virtually no new mercury thermostats will be manufactured in the United States, there are many millions of mercury thermostats still in use from historic sales. 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.[10] 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 because the average mercury thermostat contains about four grams of mercury.

Of course, not all of 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,** with the Agency assuming only three grams of mercury per thermostat.[11] 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.[12]

Similarly, in 2009 TRC (through its consultant) 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 233,000-482,000 mercury thermostats were discarded in 2011 statewide.[13]

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) sometime in 2001.[14]

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.[15]

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. From 2002-2011, TRC collected about 5.8 tons of mercury.[16] **Compared to the conservative EPA estimate of 70-100 tons of mercury in thermostats coming out of service, the TRC program captured 5.8-8%.**

In its 2011/2012 Progress Report, instead of reporting actual data (i.e., pounds of mercury and the number of actual thermostats collected in each state), TRC unveiled the Mercury Recovery Index (MRI), its latest method of spinning the data to create the appearance of program success.[17] The MRI measures progress in a state as a percent increase or decrease of the amount of pounds of mercury collected using 2007 data as a baseline. See Appendix B for TRC's state-specific MRIs.

Since the actual thermostat collection and mercury recovery data for 2007 was once made public by TRC (and included in our first *Turning Up the Heat Report*[18]), we were able to use the MRI to estimate first the pounds of mercury collected annually in 2009-2011, then the number of actual thermostats collected annually in each state, and finally, per capita thermostat collection rates for each state. Exhibit 1 provides the 2009 – 2011 estimates of the number of thermostats collected in each state and pounds of mercury recovered. Exhibit 2 provides the 2009 – 2011 collection estimates on a per capita basis. While we acknowledge that the estimates are likely not the same as the actual TRC collection data, Exhibits 1 and 2 serve as the best estimates available for evaluating and comparing state program performance, given the lack of actual data released by TRC. See Appendix A for more information on how data in Exhibits 1 and 2 were calculated.

As indicated in Exhibit 1, in two states (Mississippi, Wyoming) purportedly part of the program (the TRC program includes all states except Alaska and Hawaii), no information has been provided at all regarding thermostats collected in 2011. Based on previous data for these states, the absence of any TRC "progress data" means very few, if any, thermostats were collected there. In fourteen states where TRC reported thermostat collections in 2011, the number of thermostats collected in each state was less than 1,000. **Taking these 16 states together, in fully 1/3 of the states in the TRC program, TRC is still collecting less than 1,000 thermostats per year, even though TRC has had 10 years to make its national voluntary program successful.**

Looking at the program in another way, in 2011 TRC collected less than 6,000 thermostats per state in five of the ten states with the largest population (Texas, New York, Ohio, Georgia, North Carolina). TRC collected more than 10,000 thermostats per state in only seven states.

In California, TRC collected 19,927 thermostats during 2011.[19] Using TRC's own estimates of the number of mercury thermostats discarded in California, TRC collected only 4.1-8.5% of the available thermostats in that state.

Exhibit 1 - Estimated State Thermostat Collections and Amount of Mercury Collected, 2009 – 2011

	2011		2010		2009	
STATE	STATS	LBS OF MERCURY	STATS	LBS OF MERCURY	STATS	LBS OF MERCURY
ALABAMA	403	4.2	617	6.0	355	3.7
ALASKA						
ARIZONA	2076	16.8	664	5.0	1407	11.4
ARKANSAS	163	1.7			253	2.6
CALIFORNIA	19927*	254.8	13340	185.8	7837*	104.3
COLORADO	1227	11.2	1053	9.0	1042	9.5
CONNECTICUT	1767	14.2	2151	16.2	2783	22.4
DELAWARE	838	9.0	788	8.0	791	8.5
FLORIDA	12295	133.2	13530	137.8	10676	115.7
GEORGIA	1655	19.1	945	10.2	334	3.9
HAWAII						
IDAHO	777	7.1	830	7.2	265	2.4
ILLINOIS	7749**	58.5	5091	38.7	4240	34.3
INDIANA	5494	49.7	6605	56.2	5971	54.0
IOWA	3975*	31.6	2225	18.9	3220*	27.1
KANSAS	2082	18.4	3599	29.9	2080	18.4
KENTUCKY	1701	16.2	2123	18.9	1613	15.3
LOUISIANA	611	4.9	125	0.9	340	2.7
MAINE	6638*	46.4	6537*	44.9	6393*	44.5
MARYLAND	24668	226.5	42000	385.4+	35781	328.5
MASSACHUSETTS	2830	25.4	2322	19.6	1873	16.8
MICHIGAN	16650	131.7	11299	84.0	3615	28.6
MINNESOTA	12507	88.9	14134	94.4	12991	92.3
MISSISSIPPI			55	0.6	38	0.5
MISSOURI	3845	39.0	1995	19.0	1280	13.0
MONTANA	388*	3.5	277	2.0	274	1.3
NEBRASKA	1880	15.7	1446	11.4	2048	17.1
NEVADA	382	4.6	349	4.0	387	4.7
NEW HAMPSHIRE	2146*	16.2	1652	13.4	951*	8.0
NEW JERSEY	4715	42.1	3958	33.3	2829	25.3

	2011		2010		2009	
STATE	**STATS**	**LBS OF MERCURY**	**STATS**	**LBS OF MERCURY**	**STATS**	**LBS OF MERCURY**
NEW MEXICO	80	0.7	84	0.7		
NEW YORK	3422++	31.9	3783++	37.2	3060	28.0
NORTH CAROLINA	5191	64.8	5256	61.7	4701	58.7
NORTH DAKOTA	685	6.7	830	7.6	1656	16.1
OHIO	5720	55.4	9235	84.0	4503	43.6
OKLAHOMA	234	2.2	174	1.5	170	1.6
OREGON	3474	39.5	3266	34.9	2782	31.6
PENNSYLVANIA	14715*	133.2	9500	99.0	7320	72.2
RHODE ISLAND	1238*	10.3	307	2.8	763	7.4
SOUTH CAROLINA	1880	23.9	1374	16.4	382	4.9
SOUTH DAKOTA	191	1.8	307	2.7	314	2.9
TENNESSEE	892	8.2	666	8.9	683	7.5
TEXAS	4902	62.3	2957	35.3	950	12.1
UTAH	293	2.5	103	0.8	809	6.8
VERMONT	3579*	25.4	3349	24.5	1896*	13.6
VIRGINIA	4409	74.4	5640	89.4	3959	66.8
WASHINGTON	2155	31.2	2040	27.8	1595	23.1
WEST VIRGINIA	444	3.9	426	3.5	389	3.4
WISCONSIN	10146	77.8	11056	79.7	8134	62.4
WYOMING						
TOTALS	**203,039**	**1,946.7**	**200,064**	**1,879.1**	**155,733**	**1,479.5**

Key:

Green = Actual performance data as reported by TRC in required state reports.

Grey = No data available on which to even base an estimate.

White = Estimated thermostats collected based upon TRC's Mercury Recovery Index outlined in its 2011/2012 Progress Report. (Source: http://www.thermostat-recycle.org/files/media/20120808125856.pdf).

*Accounts for additional mercury ampoules, or "loose switches," or "bulbs" included in TRC's state annual reports using a 2.05 ampoules (or switches) per thermostat conversion. Source of 2.05 conversion rate: http://www.dtsc.ca.gov/LawsRegsPolicies/Regs/upload/ISOR-Mercury-Thermostats.pdf

**Accounts for additional mercury ampoules, or "loose switches," or "bulbs" included TRC's 2011 Annual Report submitted to the IL Environmental Protection Agency using a 1.75 ampoules (or switches) per thermostat conversion.

+ Source: TRC 2010 Annual Report: http://www.thermostat-recycle.org/files/media/20110510094455.pdf.

++Source: National Electrical Manufacturers Association Legislative Memorandum re Mercury Thermostat Recycling – S.4345-B (Grisanti), Feb. 2012

Another way to evaluate TRC program effectiveness is to review state-by-state program performance data on a per capita basis. Exhibit 2 provides the 2009-11 state collection data, sorted by 2011 per capita rates. Maine and Vermont consistently have among the highest per capita thermostat collection rates in the country, as explained further below.

Exhibit 2 - TRC 2009-11 Per Capita State Collection Data

The table below contains the estimated number of thermostats collected for each of the three years shown and the rate of collection, presented as estimated number of thermostats collected per 10,000 people.

	2011			2010			2009		
State	Rank	Estimated T-stats collected	Rate	Rank	Estimated T-stats collected	Rate	Rank	Estimated T-stats collected	Rate
Vermont	1	3579	57.2	2	3349	53.5	3	1896	30.30
Maine	2	6638	50.0	3	6537	49.2	2	6393	48.13
Maryland	3	24668	42.7	1	42000	72.7	1	35781	61.97
Minnesota	4	12507	23.6	4	14134	26.6	5	12991	24.49
Wisconsin	5	10146	17.8	5	11056	19.4	6	8134	14.30
Michigan	6	16650	16.8	9	11299	11.4	23	3615	3.66
New Hampshire	7	2146	16.3	7	1652	12.5	15	951	7.22
Iowa	8	3975	13.0	16	2225	7.3	8	3220	10.57
Rhode Island	9	1238	11.8	31	307	2.9	14	763	7.25
Pennsylvania	10	14715	11.6	15	9500	7.5	16	7320	5.76
Nebraska	11	1880	10.3	14	1446	7.9	7	2048	11.21
North Dakota	12	685	10.2	8	830	12.3	4	1656	24.62
Delaware	13	838	9.3	11	788	8.8	10	791	8.81
Oregon	14	3474	9.1	12	3266	8.5	13	2782	7.26
Indiana	15	5494	8.5	10	6605	10.2	9	5971	9.21
Kansas	16	2082	7.3	6	3599	12.6	12	2080	7.29
Florida	17	12295	6.5	17	13530	7.2	17	10676	5.68
Missouri	18	3845	6.4	28	1995	3.3	31	1280	2.14
Illinois	19	7749	6.0	24	5091	4.0	24	4240	3.30
Virginia	20	4409	5.5	18	5640	7.0	18	3959	4.95
North Carolina	21	5191	5.4	20	5256	5.5	19	4701	4.93
New Jersey	22	4715	5.4	23	3958	4.5	25	2829	3.22
California	23	19927	5.3	26	13340	3.6	32	7837	2.10
Ohio	24	5720	5.0	13	9235	8.0	20	4503	3.90
Idaho	25	777	5.0	21	830	5.3	35	265	1.69
Connecticut	26	1767	4.9	19	2151	6.0	11	2783	7.79
Massachusetts	27	2830	4.3	27	2322	3.5	27	1873	2.86
South Carolina	28	1880	4.1	30	1374	3.0	40	382	0.83
Montana	29	388	3.9	32	277	2.8	28	274	2.77

	2011			2010			2009		
State	Rank	Estimated T-stats collected	Rate	Rank	Estimated T-stats collected	Rate	Rank	Estimated T-stats collected	Rate
Kentucky	30	1701	3.9	22	2123	4.9	22	1613	3.72
Arizona	31	2076	3.2	40	664	1.0	30	1407	2.20
Washington	32	2155	3.2	29	2040	3.0	29	1595	2.37
Colorado	33	1227	2.4	34	1053	2.1	34	1042	2.07
West Virginia	34	444	2.4	33	426	2.3	33	389	2.10
South Dakota	35	191	2.4	25	307	3.8	21	314	3.86
Texas	36	4902	1.9	38	2957	1.2	44	950	0.38
New York	37	3422	1.8	35	3783	2.0	36	3060	1.58
Georgia	38	1655	1.7	41	945	1.0	45	334	0.35
Nevada	39	382	1.4	36	349	1.3	37	387	1.43
Tennessee	40	892	1.4	39	666	1.1	38	683	1.08
Louisiana	41	611	1.3	45	125	0.3	41	340	0.75
Utah	42	293	1.1	44	103	0.4	26	809	2.93
Alabama	44	403	0.8	37	617	1.3	42	355	0.74
Oklahoma	45	234	0.6	42	174	0.5	43	170	0.45
Arkansas	46	163	0.6		-		39	253	0.87
New Mexico		80	0.4	43	84	0.4		-	
Mississippi		-		46	55	0.2	46	38	0.13
Alaska	NO DATA AVAILABLE								
Hawaii	NO DATA AVAILABLE								
Wyoming	NO DATA AVAILABLE								

TRC as Spin Doctors

TRC obscures its poor performance in two significant ways. First, beginning with the 2009 performance results, TRC ceased to release actual state-by-state thermostat collection results, except in states where it is required to do so by law. Limiting the data availability in this way appears to be an intentional device to remove program accountability.

Second, TRC uses increases in collection numbers from year to year as its measure of success, even where it's clear only a small fraction of mercury thermostats are being recycled. For example, in its 2011 Progress Report, TRC describes the Texas program as a huge success story, because the MRI is up 400% since 2009, largely due to the actions of one wholesale company. However, TRC fails to note that very few mercury thermostats were collected in 2009 and before. Using previously released data from TRC, only 344 mercury thermostats were collected in 2007, the base year for TRC's MRI. In 2008, 1,820 thermostats were collected, again based on data TRC previously released. From these data, using the MRI as a guide, the Texas program results were worse for 2009 than 2008; we estimate about 950 thermostats were collected given the magnitude of the MRI decline. So the increases TRC touts are measured off a Texas program that was collecting fewer than 1,000 thermostats, in a state with a population in excess of 25 million.

Therefore, even after the increases in 2010 and 2011, we estimate the Texas program still collected less than 5,000 thermostats in 2011, as compared to the Maine program which collected over 1,700 more thermostats in the same year with a population 20 times smaller. Given the size of the Texas population, the TRC program is still not collecting the vast majority of mercury thermostats becoming waste in Texas.

Accordingly, many of the states with the highest growth rates under TRC's MRI (i.e., Georgia, Texas) still rank among the lowest in per capita collection rates. For example, **Georgia is ranked first according to the TRC's MRI with a 3522% improvement, but still collected only an estimated 1,655 thermostats in 2011 statewide and ranks near the bottom in per capita collection rates.**

The objective of thermostat collection programs is to ensure the mercury in thermostats is not released into the environment when thermostats reach the end of their useful lives. **Measuring program performance based on its ability to capture a high percentage of the available 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 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 call the collection of less than 10% of available thermostats successful, simply because the total number of thermostats collected grows a little bit each year.

TRC's Budget Confirms Lack of Significant Commitment

TRC's poor program performance reflects the relatively meager resources manufacturers devote to the program. Exhibit 3 shows the TRC annual program costs for 2009-2011, as reported by the California Department of Toxic Substances Control.

Staff and administration represents TRC personnel costs; recycling costs are the expenses associated with transporting, processing and recycling the thermostats; insurance is pollution insurance to cover possible incidents; new collection bins are for replacement of damaged bins and additional requests; and the incentive payments apply to Maine and Vermont. **This leaves an average of less than $100,000 per year for education and outreach to cover the entire country during this three year period. With this meager expenditure of resources, 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.

Exhibit 3 - TRC 3-Yr National Program Cost[20]

	Activities	2009	2010	2011
Direct Costs	TRC – Staff and Administration	$248,066	$231,757	$255,617
	Recycling Costs	$222,755	$300,096	$299,877
	Insurance	$18,706	$17,771	$13,945
	New Collection Containers	$18,130	$18,219	$18,859
	Marketing & Outreach	$96,867	$76,696	$123,221
Other	Travel	$16,105	$28,809	$28,108
	Legal	No-Report Cost	No-Report Cost	$93,272
	Statutory Incentive Payments (not in CA)	$27,496	$40,380	$37,860
Totals		$648,125	$713,728	$870,759

State Action to Promote Thermostat Collection Programs

The Leading State Programs

As Exhibit 2 illustrates, the Maine and Vermont thermostat collection programs are consistently among the top 3 collecting programs in the country.[21] This is why California recently evaluated its program against these two states, to measure what should be achievable in California within a relatively short period of time.[22] These are the most successful programs because they include key elements necessary for successful programs.

Maine: In 2006, Maine enacted the first comprehensive mercury thermostat collection law in the nation.[23] 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.

Vermont: 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.[24]

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). 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."[25]

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.[26] Vermont reported a 45% increase in mercury thermostat collection after the first full two years of the statutory cash incentive program.[27]

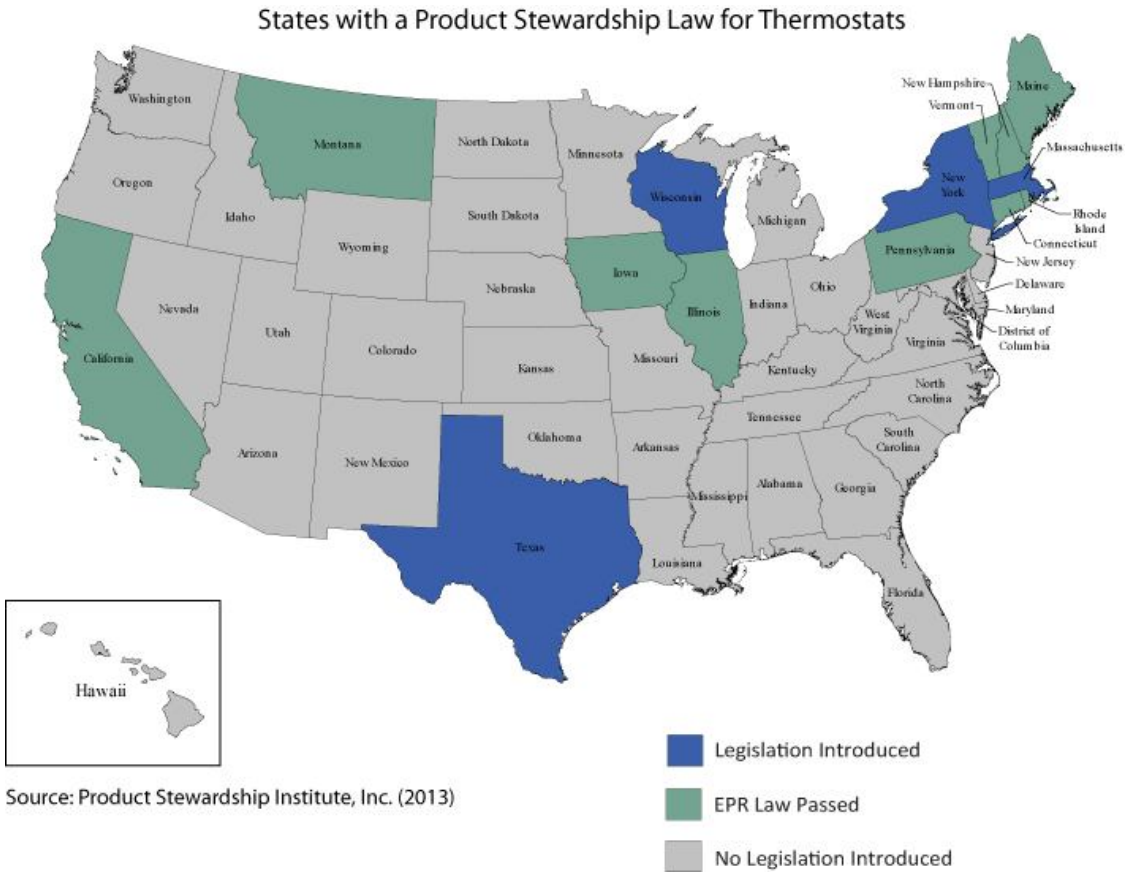
These laws are in line with the results of a report the state of Massachusetts contracted from the Northeast Waste Management Officials Association (NEWMOA) to identify mechanisms that could be used to enhance the recycling of thermostats. The report reviewed thermostat collection and recycling programs 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.[28]

We would add to this NEWMOA list several additional policy recommendations as specified below, most notably the setting of quantified performance goals for this program. Absent performance goals, TRC is able to obfuscate program ineffectiveness through tools such as its MRI. As Exhibit 4 indicates, ten states now have mercury thermostat collection legislation, but only some of those state laws contain quantified performance standards,[29] or mechanisms to establish such standards.[30] California will be the first of several states to establish meaningful quantitative performance standards administratively, during 2013.[31]

In December 2012, the Iowa Department of Natural Resources recommended to its Legislature that the Iowa law be changed to include collection goals expressed as a percentage of the number of thermostats

becoming waste in Iowa annually, and that thermostat manufacturers be required to provide a valid estimate of the number of mercury thermostats becoming waste each year. A financial incentive was also recommended, noting Vermont and Maine collection rates exceeded Iowa's by four times on a per capita basis.[32]

Exhibit 4



Source: Product Stewardship Institute, Inc. (2013)

States with Laws:

- Maine (2006)
- Vermont (2008)
- California (2008)
- Iowa (2008)
- New Hampshire (2008)
- Pennsylvania (2008)
- Montana (2009)
- Illinois (2010)
- Rhode Island (2010)
- Connecticut (2012)

Legislation introduced, not passed (2011 – 2012):

- Massachusetts
- New York
- Texas
- Wisconsin

Policy Recommendations

Every year that the thermostat manufacturers succeed in blocking the adoption of effective thermostat collection programs, large amounts of mercury become available for release during waste handling, or in our incinerators and landfills. There is an urgent need to address this problem, since many of the older thermostats are reaching the end of their useful life, or are being replaced by programmable thermostats as part of energy-efficiency retrofits. It is imperative that states move forward now to adopt strong producer responsibility policies modeled after the most successful thermostat collection programs.

Based on the experiences of those states with the more effective collection programs, 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.[33]

1) States should require manufacturers to finance thermostat take-back programs 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.

2) States should ban the sale of mercury thermostats. While U.S. manufacturers report that they have virtually ended mercury thermostat production, overseas manufacturers may continue to sell mercury thermostats where permitted by law. Fifteen states have already prohibited the sale of mercury thermostats. With viable non-mercury thermostats now dominating the market, all states should ban the sale of mercury thermostats.

3) States should ban the disposal of all mercury thermostats into the solid waste stream. To both encourage active participation in collection programs and prevent mercury pollution in the environment, states should require that all mercury thermostats be recycled. Linkages with energy conservation programs should be established, through state agencies and service providers, so that mercury thermostats are appropriately handled during equipment replacement.

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.

In some states where legislation has been introduced containing these elements, the thermostat industry has introduced alternate legislation to thwart those efforts. These bills are crafted to look like they are creating aggressive thermostat recycling programs, when in reality they set up programs that largely mirror the status quo and include only the elements least burdensome to the manufacturers. These bills are often misinterpreted as "good environmental legislation" by legislators and others who are not familiar with the successes and failures of existing state programs. In 2012, one such bill became law in Connecticut, and was considered by the legislatures in Texas and Massachusetts (where no bill passed).

APPENDIX A – METHODOLOGY FOR CONVERTING TRC'S MRI INTO NUMBER OF THERMOSTATS COLLECTED PER STATE AND PER CAPITA COLLECTION RATES

TRC is required to report collection data to states with producer responsibility laws. Actual data from nine states[34] implementing mandatory collection programs (as of January 2013) is used in Exhibits 1 and 2. For the remaining 38 states[35], we used TRC's Mercury Recovery Index (MRI)[36] to estimate the annual pounds of mercury collected, the number of actual thermostats collected, and the per capita collection for each state as follows:

(1) Pounds of mercury collected for 2008 through 2011 was calculated using TRC's baseline 2007 data on the pounds of mercury collected in each state and the yearly state-specific MRI as a conversion factor. For example, in 2007 Alabama collected 6.86 pounds of mercury. Alabama's 2008 MRI, which is 22, indicates that in 2008, the state collected 22% (by weight) of the weight of mercury collected in 2007. Thus, in 2008, Alabama's collection fell to 1.5 pounds of mercury (i.e., 6.86 lbs x 0.22 = 1.5). Where no 2007 MRI baseline was provided (i.e., Mississippi, Oklahoma, Tennessee), estimates were derived based upon the 2008 MRI and TRC's previously reported data for 2008.

(2) Before the estimated pounds of mercury could be used to calculate the number of thermostats collected in each state for 2009, 2010, and 2011, a "pounds per mercury thermostat" conversion must be calculated. Since the conversion value varies from state to state,[37] a state-specific average was estimated using state thermostat collection data previously reported by TRC.

(3) The state-specific conversion was used to estimate the number of thermostats collected in each state for 2009, 2010, and 2011.

(4) TRC reported data on national thermostat collections for 2009 and 2010 allowed us to check our national collection estimates for 2009 and 2010 against actual data. Our estimates were close to the TRC reported values: 155,730 thermostats for 2009 (TRC actual was 155,733) and 193,014 thermostats for 2010 (TRC actual was 200,064). Therefore, we distributed the remainder (3 thermostats for 2009 and 7,050 thermostats for 2010) proportionally based on the original estimate. For example, a 6.39% increase was applied to the 37 state estimates in 2010[38]. Since TRC does not report a national collection number for 2011, the original collection estimates calculated for 2011 were not altered.

(5) State thermostat collection data was standardized as a rate per 10,000 persons. Population data by state was found in the U.S. Census Bureau, 2010 Census, Summary File 1 at www2.census.gov/census_2010/04-Summary_File_1 . Collection rates for 2009, 2010, and 2011 were based on the 2010 Census count.

APPENDIX B - TRC'S MERCURY RECOVERY INDEX DATA[39]

	Abbreviation	2007	2008	2009	2010	2011	Total Change
ALABAMA	AL	100	22	53.9	88	61.1	-39%
ALASKA	AL	NO DATA					
ARIZONA	AZ	100	117.6	156.8	69.6	231.4	131%
ARKANSAS	AR	100	233.6	290.4	*	187	*
CALIFORNIA	CA	100	125.9	125.2	223.1	306.1	206%
COLORADO	CO	100	102.1	210	199.6	247.4	147%
CONNECTICUT	CT	100	241.4	302.5	219.8	192.1	92%
DELAWARE	DE	100	291.2	343.9	322.1	364.4	264%
FLORIDA	FL	100	98	91	108.4	104.8	5%
GEORGIA	GA	100	902.4	731.8	1943.5	3622.4	3522%
HAWAII	HI	NO DATA					
IDAHO	ID	100	433.1	160	471	469	369%
ILLINOIS	IL	100	105.5	105.9	119.5	180.5	81%
INDIANA	IN	100	86	115.4	120	106.2	6%
IOWA	IA	100	90.9	191.8	135.9	227	127%
KANSAS	KS	100	151.9	285.5	464.5	285.9	186%
KENTUCKY	KY	100	220.9	202.5	250.5	213.6	114%
LOUISIANA	LA	100	48.6	86.9	30	156.3	56%
MAINE	ME	100	104.4	120.4	121.6	124.7	25%
MARYLAND	MD	100	116.6	381.9	448.1	263.3	163%
MASSACHUSETTS	MA	100	159.9	89.6	104.4	135.4	35%
MICHIGAN	MI	100	182.6	97.9	287.6	450.9	351%
MINNESOTA	MN	100	113.8	110.2	112.7	106.1	6%
MISSISSIPPI	MS	*	100	26.5	36.4	*	*
MISSOURI	MO	100	65.3	109.4	160.3	328.7	229%
MONTANA	MT	100	245.1	99.1	148.4	262	162%
NEBRASKA	NE	100	167.2	358.1	237.7	328.8	229%
NEW HAMPSHIRE	NH	100	90.8	165.9	278.2	337.3	237%
NEW JERSEY	NJ	100	107.1	104.4	137.3	174	74%
NEW MEXICO	NM	100	*	*	169.4	172.6	*
NEW YORK	NY	100	150.4	133.4	177.3	152	52%
NEVADA	NV	100	413.3	669	567.3	661.1	561%
NORTH CAROLINA	NC	100	88.9	135.3	142.2	149.4	49%
NORTH DAKOTA	ND	100	526.3	1069.1	503.7	442.4	342%
OHIO	OH	100	141.4	80.3	154.8	102	2%
OKLAHOMA	OK	*	101.8	155.4	150	214.5	*

	Abbreviation	2007	2008	2009	2010	2011	Total Change
OREGON	OR	100	115.7	90.9	100.3	113.5	14%
PENNSYLVANIA	PA	100	112.5	129.4	155.3	207.5	108%
RHODE ISLAND	RI	100	406	1016.2	384.6	1423.1	1323%
SOUTH CAROLINA	SC	100	90.2	82.2	277.7	404.1	304%
SOUTH DAKOTA	SD	100	32.7	58.6	53.8	35.7	-64%
TENNESSEE	TN	*	414.4	355.1	325.5	389.4	*
TEXAS	TX	100	685.8	411.8	1204.2	2124.1	2024%
UTAH	UT	100	*	1893.1	225.9	686.2	*
VERMONT	VT	100	89.4	122.4	220	227.8	128%
VIRGINIA	VA	100	119.5	90.6	121.3	100.9	1%
WASHINGTON	WA	100	92.6	52.4	63	70.8	-29%
WEST VIRGINIA	WV	100	267.1	220.5	227.3	252.2	
WISCONSIN	WI	100	75.2	76	97.1	94.8	-5%
WYOMING	WY	NO DATA					
Total U.S.		**100**	**116.3**	**135.2**	**170.4**	**176.6**	

* Data incomplete

Endnotes

[1] U.S. Environmental Protection Agency, "Mercury Health Effects," http://www.epa.gov/mercury/effects.htm

[2] Mahaffey KR, Clickner RP, Jeffries RA. Adult women's blood mercury concentrations vary regionally in the United States: association with patterns of fish consumption (NHANES 1999-2004). Environ Health Perspect. 2009 Jan;117(1):47-53. Epub 2008 Aug 25. Estimate based on national estimates in Table 1 applied to the 2009 national birth rate reported by CDC at http://www.cdc.gov/nchs/births.htm.

[3] U.S. Environmental Protection Agency (EPA) National Listing of Fish Advisories General Fact Sheet: 2010 National Listing http://water.epa.gov/scitech/swguidance/fishshellfish/fishadvisories/general_factsheet_2010.cfm

[4] 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

[5] Interstate Mercury Education and Reduction Clearinghouse (IMERC) Fact Sheet Mercury Use in Thermostats Last Update: January 2010 http://www.newmoa.org/prevention/mercury/imerc/factsheets/thermostats.pdf

[6] Use and Release of Mercury in the United States, EPA/600/R-02/104, December 2002 (hereafter "EPA Report"), available at http://www.clu-in.org/download/contaminantfocus/mercury/use-and-release-of-mercury-in-usP1001P4H.pdf, Exhibit 3-8.

[7] 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.

[8] http://www.newmoa.org/prevention/mercury/imerc/Notification/totals.cfm?total=417&filing=1162.

[9] 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. For calendar year 2010, six of eight manufacturers (including the Big 3) reported phasing out mercury use in thermostat manufacturing as of January 25, 2013. The remaining two companies had not yet filed their reports with IMERC.

[10] EPA Report at 29.

[11] EPA Report at 30.

[12] 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.

[13] 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 http://www.dtsc.ca.gov/HazardousWaste/upload/TRCThermostat-Report-12_09.pdf.

[14] Review and Assessment of Thermostat Recycling Activities in the Northeast (hereafter "The NEWMOA Report"), Northeast Waste Management Officials' Association (NEWMOA), June 2008, p. 3, available at http://www.newmoa.org/prevention/mercury/publications.cfm.

[15] See generally the TRC website, at http://www.thermostat-recycle.org/pages/safety-first.

[16] Keeping Mercury Out of the Waste Stream – One Thermostat At A Time, TRC 2011/2012 Progress Report (hereafter "TRC Progress Report"), p. 1. http://www.thermostat-recycle.org/files/media/20120808125856.pdf).

[17] TRC Progress Report, p. 2.

[18] Available at http://mercurypolicy.org/wp-content/uploads/2010/02/turning-up-the-heat-3.pdf

[19] Initial Statement of Reasons – Mercury Thermostat Collection and Performance Requirement (hereafter "California Initial Statement of Reasons"), California Department of Toxic Substances Control Reference Number R-2010-3, p. 3, available at http://www.dtsc.ca.gov/LawsRegsPolicies/Regs/upload/ISOR-Mercury-Thermostats.pdf.

[20] http://www.dtsc.ca.gov/LawsRegsPolicies/Regs/upload/Attachment-to-399-Economic-and-Fiscal-Impact-Analysis-2.pdf, p. 5.

[21] The Maryland program was also a national leader from 2009-2011 due to collections associated with an energy conservation program involving thermostat replacements, but as TRC acknowledges, TRC's future results in Maryland are expected to decline as the energy conservation program draws to a close. See TRC Progress Report, p. 4. Still, the Maryland example of making linkages to energy conservation programs is worth noting, as a means of achieving maximum program effectiveness while such programs are ongoing in a particular state.

[22] California Initial Statement of Reasons, p. 11.

[23] For the Maine law, see 38 MRSA §1665-B http://www.mainelegislature.org/legis/statutes/38/title38sec1665-B.html.

[24] 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.

[25] Vermont Pilot Report, p. 6.

[26] For a copy of the Vermont law, see http://www.leg.state.vt.us/docs/legdoc.cfm?URL=/docs/2008/acts/ACT149.HTM.

[27] Annual Report on Mercury Thermostat Collection Program, Vermont Agency of Natural Resources, January 2012, p. 5, available at http://www.leg.state.vt.us/reports/2012ExternalReports/275648.pdf.

[28] See the NEWMOA Report.

[29] Laws in Maine, Vermont, Rhode Island, and Illinois include performance goals that are based on either the number of thermostats collected, the total amount of mercury collected, or a rate (expressed as a percentage) based on both the number of thermostats collected and another variable (e.g., amount sold, amount available for collection, etc.). The Rhode Island and Illinois laws also anticipate state agency development of performance goals after the interim performance standards established by statute expire.

[30] Laws in California, Iowa, Pennsylvania, New Hampshire, and Montana all reference performance goals and give authority to the state agency to set specific targets, but only the California goals have any force and effect.

[31] http://www.dtsc.ca.gov/LawsRegsPolicies/Regs/Mercury_Therm_Recovery_Reg.cfm. Rhode Island and Illinois will be next.

[32] https://www.legis.iowa.gov/APPS/AR/DOCS/Published/80a74ae8-ea4c-41a3-b93e-78a2e5af132b/Mercury%20Thermostat%20Recycling.pdf

[33] Model legislation containing these recommendations developed by the Product Stewardship Institute is available at http://www.productstewardship.us/associations/6596/files/PSI_model_thermostat_legislation_10_24_11.pdf.

[34] Connecticut passed the tenth EPR law for thermostats, but since the program has not yet been implemented, an estimate was calculated.

[35] Alaska and Hawaii are not part of the TRC program. TRC's MRI does not report any data for Wyoming. In addition, TRC does not report complete data for Mississippi, Oklahoma, and Tennessee between 2009 and 2011.

[36] As described earlier in this report, the MRI is an index comparing the pounds of mercury collected in a given year versus the pounds of mercury collected in 2007 (the baseline year). Source: http://www.thermostat-recycle.org/files/media/20120808125856.pdf

[37] A state-specific pounds per mercury thermostat was used to obtain more accurate data. This state-specific conversion is necessary for two main reasons: 1) some states collect more loose switches (or ampoules) than others which are included in the overall amount of mercury collected and therefore increase the pound per mercury thermostat conversion; and 2) different types of thermostats contain different amounts of mercury.

[38] Note: Due to gaps in TRC's MRI for 2009 and 2010, the number of states with thermostat collection estimates varies (39 states estimated in 2009 and 37 states estimated in 2010).

[39] http://www.thermostat-recycle.org/files/media/20120808125856.pdf