

August 29, 2017

Ms. Karen Knaebel  
Environmental Analyst  
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Waste Management and Prevention Division  
One National Life Drive  
Montpelier, VT 05620-3704

Subject: Independent Third Party Audit of the Manufacturers' Program for Collection and Disposal of Mercury-containing Lamps

Dear Ms. Knaebel,

### **Background and Scope of Report**

Extended producer responsibility (EPR) policy and regulations transfer the responsibility for financial and/or operational responsibility for end-of-life management of discarded products, in whole or in part, to manufacturers of those products.

Vermont Statutes Title 10, Chapter 164A, Collection And Disposal Of Mercury-containing Lamps – is such a regulation. The program began July 2012 and its objective is to divert mercury-containing lamps for recycling and reduce the disposal of these products in the environment. The program in Vermont was developed and is operated by the National Electrical Manufacturers Association (NEMA) on behalf of its industry members who are the manufacturers of lamps. Mercury-containing lamps targeted in the program include compact fluorescent lamps (CFLs), fluorescent tubes and high-intensity discharge lamps.

§ 7153 of this law requires that once every five years the manufacturers' mercury-containing lamp collection program (Program):

"shall hire an independent third party to audit the plan and plan operation. The auditor shall examine the effectiveness of the program in collecting and disposing of mercury-containing lamps. The auditor shall evaluate the cost-effectiveness of the program and compare it to that of collection programs for mercury-containing lamps in other jurisdictions. The auditor shall make recommendations to the Secretary on ways to increase program efficacy and cost- effectiveness."

NEMA selected RSE USA as the independent third party auditor to conduct this statutorily required audit. RSE USA's audit focused specifically on assessing Program performance with respect to the criteria identified in the statute – efficacy and cost-effectiveness. Findings and recommendations are provided at the end of this report.

For this evaluation RSE USA relied on program cost data and program recycling records of collection quantities provided by NEMA for Vermont and Maine, and program operational results and financial data reported publicly by other producer responsibility organizations for similar EPR programs in other jurisdictions.

The statute does not require nor did RSE USA conduct a financial audit of the Vermont Program or comparison programs used in this evaluation. Our opinions, conclusions, and recommendations found in this report are based on the information that was provided to us, along with site visits RSE USA made to ten lamp collection locations in Vermont, where we interviewed collection location staff whose responsibility includes receiving lamps for recycling from generators.

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**Comparison Jurisdictions**

In addition to Vermont, there are four other U.S. states and four Canadian provinces that have EPR laws on the books for mercury-containing lamps.

Because lamp legislation is recent in Massachusetts and Rhode Island, those state's laws have not yet been applied to manufacturers, and there is no program cost or performance data available for comparison. This only leaves lamp recycling programs in Maine and Washington State that can be considered for comparisons. It should be noted that some large retailers such as Home Depot and Lowe's accept and recycle mercury-containing lamps from the public. They operate their programs separately from EPR programs in Maine, Vermont, and Washington and the quantities of lamps that they collect and recycle is believed to be large but is not known or reported through the industry-sponsored EPR programs.

With respect to Canadian provinces, British Columbia, Manitoba, Quebec, and Prince Edward Island all have EPR programs for mercury-containing lamps. Because Prince Edward Island's program only began operations on April 1, 2015, the program should be considered new and transitional and program cost and performance data not yet stable or suitable for comparison.

Table 1 below summarizes program details of potential comparison jurisdictions in the US and Canada that need to be considered before determining whether "apples-to-apples" comparisons are possible.

**Table 1 – Summary of Mercury-containing Lamp Recycling Programs**

	Vermont	Maine	Washington	British Columbia	Manitoba	Quebec
<b>Population</b>	625,341 <sup>1</sup>	1,331,479	7,288,000	4,751,612	1,318,100	8,326,100
<b>Program Effective Date</b>	7/1/2012	1/1/2011	1/1/2015	7/1/2010	5/1/2012	10/1/2012
<b>Generators Served/Limits</b>	Any "person," including business - any number of CFLs, 10 or fewer non-CFL lamps	Households	Households and businesses - up to 10 lamps/day "sold at retail"	All households and businesses – all lamp types including incandescent, halogen, and LED lamps	All households and businesses	All households and businesses (maximum of 16 lamps per visit)
<b>Producer Responsibility Organization</b>	NEMA	NEMA	Product Care Association (LightRecycle Washington)	Product Care Association (LightRecycle)	Product Care Association (LightRecycle)	Product Care Association (RecycFluo)
<b>Annual report</b>	Yes	Yes	Yes	Yes	Yes	Yes
<b>Disposal ban: Business/ Households</b>	Yes/Yes	Yes/Yes	Yes/No	Some municipalities	Some municipalities	Not Known

Table Notes:

1 Vermont's program operates on a July-June fiscal year basis. The population listed here comes from averaging U.S. Census population estimates for 2015 and 2016. Population estimates for all other jurisdictions are for the 2016 calendar year.

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As a review of the table shows, there are substantial differences in who is served by the programs that will impact the efficacy and cost-effectiveness of programs for comparison to Vermont. All of the Canadian programs include lamps generated by businesses in their programs. The U.S. programs are intended to be for households, although Vermont's program accepts CFLs from businesses as well. NEMA believes that the vast majority of CFLs are purchased and used by households; however, estimates from British Columbia credit non-residential generators with approximately 25 percent of CFL lamp use, and 75 percent of tube fluorescent lamp use. Including non-residential lamps in collection programs can significantly increase quantities of lamps collected through EPR programs, especially for tube fluorescent lamps, and make program data non-comparable to that of Vermont.

Disposal bans for mercury-containing lamps is included in the table above because it is a government policy that can support manufacturer recycling efforts by raising awareness of and prompting recycling of mercury-containing lamps by generators at no cost to manufacturer operated programs.

Of the programs in Table 1, the Maine and Washington State programs are most comparable to that of Vermont. Because the Washington program's data represents its second year of operation, there is a good likelihood that its program efficacy and cost-effectiveness will improve as its program further matures. The Maine program, therefore, is the best comparison for Vermont.

**Program Metrics**

Table 2 summarizes an analysis of program metrics for the U.S. and Canadian programs discussed above.

**Table 2 – Summary of Mercury-containing Lamp Recycling Program  
(Data for Calendar Year 2016 Unless Otherwise Noted)**

	Vermont	Maine	Washington	British Columbia	Manitoba	Quebec
<b>Population</b>	625,341 <sup>1</sup>	1,331,479	7,288,000	4,751,612	1,318,100	8,326,100
<b>Collection Sites</b>	176	653	329	442	69	804
<b>Convenience</b>	3,553 people/site	2,039 people/site	22,152 people/site	10,750 people/site	19,103 people/site	10,356 people/site
<b>Effectiveness – Total lamps and CFL percent</b>	<ul style="list-style-type: none"> <li>• 233,820 total lamps (7/15-6/16)</li> <li>• 82,313 CFLs (35% of total lamps)<sup>2</sup></li> </ul>	<ul style="list-style-type: none"> <li>• 152,035 total lamps</li> <li>• 29,792 CFLs est. (21% of total lamps)</li> </ul>	<ul style="list-style-type: none"> <li>• 1,181,616 total lamps</li> <li>• 309,276 CFLs (26% of total lamps)</li> </ul>	<ul style="list-style-type: none"> <li>• 3,816,287 total mercury-containing lamps</li> <li>• 1,127,552 CFLs (30% of total lamps)</li> </ul>	<ul style="list-style-type: none"> <li>• 110,783 total lamps</li> <li>• 34,430 CFLs (31% of total lamps)</li> </ul>	<ul style="list-style-type: none"> <li>• 3,903,598 total lamps</li> <li>• CFL amount not reported</li> </ul>
<b>Effectiveness – Per capita</b>	<ul style="list-style-type: none"> <li>• 0.37 lamps (7/15-6/16)</li> <li>• 0.13 CFLs</li> </ul>	<ul style="list-style-type: none"> <li>• 0.11 lamps</li> <li>• 0.02 CFLs</li> </ul>	<ul style="list-style-type: none"> <li>• 0.16 lamps</li> <li>• 0.04 CFLs</li> </ul>	<ul style="list-style-type: none"> <li>• 0.80 lamps</li> <li>• 0.24 CFLs</li> </ul>	<ul style="list-style-type: none"> <li>• 0.08 lamps</li> <li>• 0.03 CFLs</li> </ul>	<ul style="list-style-type: none"> <li>• 0.47 lamps</li> <li>• Unknown CFLs</li> </ul>

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	Vermont	Maine	Washington	British Columbia	Manitoba	Quebec
<b>Effectiveness – Reported collection rate</b>	<ul style="list-style-type: none"> <li>◦ 43% of retail sold mercury lamps</li> <li>◦ Based on 13 year average life (9 year avg. CFL life) and historic retail sales data</li> </ul>	<ul style="list-style-type: none"> <li>◦ 11.3% of retail sold mercury lamps</li> <li>◦ Same life and sales basis as Vermont</li> </ul>	<ul style="list-style-type: none"> <li>◦ Not estimated or calculated by the program</li> <li>◦ Would be 16% if NEMA generation approach were used</li> </ul>	<ul style="list-style-type: none"> <li>◦ 42% of fluorescent tubes, 51% of CFLs</li> <li>◦ Assumes an average 8.9 year CFL life</li> <li>◦ Would be 79% if NEMA retail sales/generation approach were used</li> </ul>	<ul style="list-style-type: none"> <li>◦ 180% of fluorescent tubes, 35% of CFLs</li> <li>◦ Based on a Canadian generation model for lamp sales and life</li> <li>◦ Would be 8% if NEMA retail sales/generation approach were used</li> </ul>	<ul style="list-style-type: none"> <li>◦ 40% of fluorescent tubes, 8% of CFLs, 32% of HID</li> <li>◦ Denominator is 2014 lamp sales (causes CFL rate to be under estimated)</li> <li>◦ Would be 46% if NEMA retail sales/generation approach were used</li> </ul>
<b>Cost and Cost-Effectiveness</b>	<ul style="list-style-type: none"> <li>◦ ~\$189,086<sup>3</sup></li> <li>◦ 81 cents/lamp collected</li> </ul>	<ul style="list-style-type: none"> <li>◦ \$179,624</li> <li>◦ 118 cents/lamp collected</li> </ul>	<ul style="list-style-type: none"> <li>◦ \$1,328,747</li> <li>◦ 112 cents/lamp collected</li> </ul>	<ul style="list-style-type: none"> <li>◦ CDN \$4,673,382</li> <li>◦ U.S. 94 cents/lamp collected<sup>4</sup></li> </ul>	<ul style="list-style-type: none"> <li>◦ Program is consolidated with other household waste materials – lamp-only costs are not available</li> </ul>	<ul style="list-style-type: none"> <li>◦ CDN \$3,755,601</li> <li>◦ U.S. 125 cents/lamp collected<sup>4</sup></li> </ul>

Table Notes:

1 Vermont's program operates on a July-June fiscal year basis. The population listed here comes from averaging U.S. Census population estimates for 2015 and 2016. Population estimates for all other jurisdictions are for the 2016 calendar year.

2 This high CFL percentage for Vermont suggests collections are more residentially generated in VT than in other programs where more commercially generated lamps may be collected in programs.

3 Available financial data was for the 2016 calendar year. NEMA additionally provided an estimate an estimate of administration costs for the Program (including Program Manager's time spent, legal fees, accounting support, etc.).

4 Based on a 1.3 Canadian Dollar to 1 U.S. Dollar average long-term exchange rate.

The data in the table clearly shows that the Vermont Program is a high performer in North America, both in terms of efficacy and cost-effectiveness. Differences among programs in terms of collection of lamps from non-residential sources unfortunately cloud the data and limit apples-to-apples comparisons. This is why data were also analyzed only for compact fluorescent lamps as CFLs are primarily a residential product and can provide an improved approach to comparing Vermont's residentially oriented Program to the effectiveness of other programs in recovering lamps from residences in their jurisdictions.

As was discussed previously, the Maine program is the most comparable program to the Vermont Program and the Vermont performance data clearly shows that Vermont performs better on all measures. Quebec and British Columbia in Canada appear to perform better than Vermont's program on an overall lamps collected per capita basis; however, the inclusion of all non-residential lamps in their programs makes their performance not truly comparable to that of Vermont.

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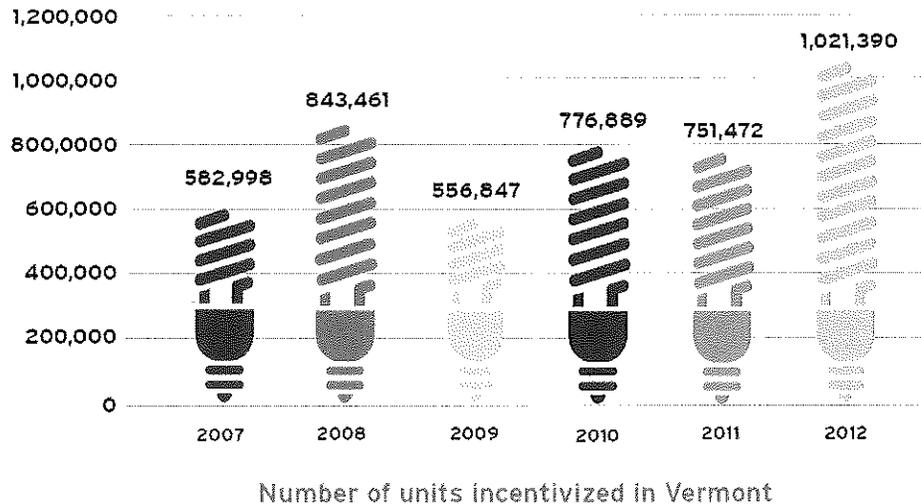
Collection site participants in NEMA's Program in Vermont includes 111 retail locations, 47 transfer station or municipally-operated sites enrolled as municipal participants, and approximately 18 municipal/solid waste district programs that are not in a contract relationship with NEMA, but which receive compensation from NEMA to independently recycle lamps through the contractor of their own choice. Therefore, there are a total of 176 collection sites across the state that are financed and promoted to the public through NEMA's program – this number does not include other private or public sector collection initiatives in addition to NEMA's program, such as those operated by Home Depot or Lowe's. As shown above in Table 2, only Maine offers more sites per capita than Vermont, which is a measure of convenience.

Retail and large municipal sites tend to be more available to the public as they are open during normal business hours during the week and on weekends. Transfer station and small municipal sites often have limited hours and often are only available for a few hours per day on Saturdays. The large number of retail sites in Vermont (including sites operated by non-affiliated stores such as Home Depot and Lowe's) means that drop-off locations for recycling are more convenient and accessible to consumers than programs that rely on municipal household hazardous waste collection sites as the primary mechanism for collection.

It is important to provide some caveats to the data and conclusions drawn from this analysis, as follows:

- Lamp sales and use by type (e.g., incandescent, halogen, and fluorescent) may have historically been different in Canada than in the United States over the past decade – if so, this would limit the comparability of data from Canadian provinces to that of U.S. states, including Vermont. It is clear that the Canadian programs are using significantly different approaches to estimating the "available for collection" denominators of collection rate calculations in comparison to NEMA's approach to the estimates and a simple comparison of collection rates reported in annual reports should not be made between programs.
- A review of recycling quantities reported by one of NEMA's contractors by lamp type and collection location seemed to have a higher proportion for CFLs on the report that ended with a zero than would be expected due to normal statistical variation. There may be an opportunity to improve procedures for precision in reporting for this contractor.
- Efficiency Vermont, Vermont's energy efficiency utility, has implemented energy efficiency programs that intervene in the lamp marketplace such that national lamp sales and use by type, apportioned to states based on their population percentage of the nation (this is the approach used by NEMA to estimate collection rates for fluorescent lamps), may not be an accurate estimator of collection rate because the denominator of the equation may be skewed, and numerator collection quantities as well as lamps sold in prior years reach end of life. In the past, Efficiency Vermont subsidized screw-in CFL lamp sales over less efficient alternatives as Figure 1 shows. More recently, including at the time of this analysis, Efficiency Vermont was subsidizing LED lamp sales over less efficient alternatives. These market interventions will continue to make Vermont data not comparable to that of other jurisdictions for years to come, assuming the subsidies have been effective in shifting sales.

Figure 1 – CFL Screw-in Lamps Subsidized in Vermont



#### Visits to Collection Sites

RSE USA visited ten collection sites for mercury-containing lamps in Vermont. The sites we visited included:

- One Solid Waste Management District site;
- Two local government collection sites;
- Three chain retail sites; and
- Four independent retail sites.

Each individual site visited was randomly selected from NEMA's master list of collection points, after sorting the list into the above four categories. The purpose of the visits was to observe collection and storage practices, visibility of the collection program (e.g., signage), and interview service personnel responsible for receiving lamps from the public for recycling.

Site visit observations and interviews with collection site staff revealed:

- In many cases, small municipal and retail collection sites will allow small commercial generators to recycle more than ten tube fluorescent lamps through the NEMA program. Staff at a majority of these sites had an awareness that there was a limit, but chose to not enforce it for either customer service reasons (retail stores) or for environmental reasons (e.g., "it is better to recycle them through the NEMA program than have the generators dispose of them").
- Collection site staff believed that a substantial majority of lamps collected were from residential generators.
- Collection site staff believed that most Vermonters were aware of recycling opportunities for lamps in Vermont and that many participate in the NEMA collection program. Because Vermont also has similar retail-based collection programs for paint and batteries, and in many cases common retail collection points for all three types of materials, it is likely that the three programs collectively increase awareness, reinforce the development of an environmental ethic, and result in an increased level of recycling behavior.

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- Although the retail collection sites that were visited did not display visible signage to promote the collection program, retail customer service staff believed that most of their customers were aware that they offered a recycling program for fluorescent lamps.

#### FINDINGS AND RECOMMENDATIONS

- Differences among U.S. state and Canadian province EPR programs for mercury-containing lamps in terms of whether large quantity commercial lamps are included in program data, plus market distorting impacts of Efficiency Vermont's past and ongoing subsidies for sale of screw-in types of lamps makes it impossible to compare with confidence the Vermont Program performance data to data from other jurisdictions on an apples-to-apples basis. Creative approaches to examining the data by RSE USA (e.g., by comparing only CFL units recycled per capita) would seem to indicate that the NEMA Vermont Program is a top-performing program both in terms of efficacy and cost-effectiveness.
- Efficiency Vermont is conducting direct outreach to consumers and providing incentives to purchase LED lamps as replacements to replace burned out lamps. Efficiency Vermont should include messaging in its outreach materials that disposing of fluorescent lamps is illegal in Vermont and provide a link to the LampRecycle website so consumers can find out where to recycle them.
- The LampRecycle consumer-facing website for Vermont should be updated. It currently offers two links to find collection sites. The first link, listed as "municipal collection sites" goes to an Agency of Natural Resources, Department of Environmental Conservation website that lists general contact information for local solid waste management districts, alliances, and towns. The second link, listed as a "retailer collection site list" in actuality is an Adobe portable document format document that lists all retail and municipal sites (it was current and dated July 25, 2017). The first link is unnecessary and redundant and may be confusing to program participants.
- The LampRecycle consumer-facing website home page has a link to Earth911<sup>1</sup> to further allow the public to look up lamp recycling locations near their residences. NEMA should work with Earth911 to incorporate a complete list of collection locations into its online database and consumer look-up function. While many of the municipal sites appear to be in Earth911's database, most of NEMA's retail collection sites do not appear to be listed based on an audit looking up the ten collection site locations visited for this assessment. Alternatively, NEMA can add similar mapping and zip code lookup functionality on the LampRecycle website.
- The Program has now been in operation for over six years. NEMA should proactively reach out to each retailer to encourage them to include fresh signage in their stores to increase Program awareness and refresh and remind consumers of the importance of recycling mercury-containing lamps. It is acknowledged that some stores are not willing to include signs in their stores as they can provide the appearance of clutter. Signage can include a combination of window clings, posters, and shelf tags that can be used on the shelves where lamps are sold.

Sincerely,  
RSE USA



Timothy M. Buwalda  
Senior Consultant

cc: Madeleine Bugel, NEMA

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<sup>1</sup> Earth911 is a familiar national website and database that allows individuals to search for recycling opportunities for a large variety of products in their local area after entering their zip code.