CONTAINER RECYCLING INSTITUTE
4361 Keystone Ave. • Culver City, CA 90232
Telephone (310) 559-7451
www.container-recycling.org
www.bottlebill.org

reloop
resources remain resources
www.reloopplatform.org

Natural Resources Council of Maine
www.nrcm.org

clf
conservation law foundation
www.clf.org

March 8, 2021

Swarupa Ganguli
Office of Resource Conservation and Recovery
Environmental Protection Agency
Submitted via email: ORCRMeasurement@epa.gov and ganguli.swarupa@epa.gov

Dear Ms. Ganguli and Team,

We are writing in regard to **Docket ID No. EPA-HQ-OLEM-2020-0443** with comments about the methodology the U.S. EPA uses in calculating national recycling rates, and how this methodology might be improved. Among other things, we will discuss how a combination of overcounting recycling and undercounting generation artificially inflates the recycling rate.

Our Perspective

The Container Recycling Institute (CRI) has been periodically calculating the nation's beverage container recycling rate for more than 20 years. In the last few years, we've been making these calculations annually. CRI obtains data on beverage sales and recycling, and other associated metrics, from more than two dozen sources. Where possible, we cross-check by comparing data from one source to another, such as container manufacturer data, beverage manufacturer sales data and alcohol tax sales data. This work makes us very familiar with the data sources and totals for beverage packaging generation and recycling, including aluminum cans, glass bottles, PET and HDPE beverage containers, aseptic containers, gable-top containers and pouches. We also study the recycling process throughout the entire value chain, as well as gain and loss rates due to contamination and the recycling process itself.

We have been reviewing and using U.S. EPA's MSW "Facts and Figures" data for two decades. We have reviewed the U.S. EPA methodology document. We have reviewed the work of entities that have independently estimated total MSW generation for the United States, including *Biocycle* magazine, Columbia University, and the Moore/Kessler summary of the work of the Environmental Research and Education Foundation (EREF).

The Elephant in the Room

The U.S. EPA's annual Advancing Sustainable Materials Management (ASMM) report produces an annual estimate of MSW waste generation of only 292 million tons (2018 data year), while other, independent estimates have produced numbers that are 93 to 140 million tons higher than U.S. EPA's total generation in the past. These independent estimates go back as many as ten years, and have been reported directly to the U.S. EPA. It is clear that the U.S. EPA's estimate, in total, is significantly undercounting waste. What we don't know is where and how the waste is being undercounted. In which categories, and by how much? Are there some categories that are completely missing from the report?

For example, in the latest report, U.S. EPA used an “enhanced” method to estimate food waste. The old methodology estimated 41 million tons of food waste in 2017, and the new “enhanced” methodology produced an estimate of 63 million tons for 2018. This means that in prior reports, food waste was underestimated by about one third. Furthermore, the entire national MSW waste stream was underestimated by about 22 million tons. This type of enhanced approach is needed for all of the categories of the waste stream.

Getting this right is critically important: as a nation, we cannot craft a national recycling strategy with faulty data at its base. The total waste generated in the United States, and granular data in the various categories of products and packaging, is currently unknown—*but it is not unknowable*. U.S. EPA’s annual project is currently under-resourced, is hampered by the Paperwork Reduction Act, and has serious flaws in its methodology, all of which can and should be corrected.

Furthermore, the ASMM report is frequently used as base data for other reports, such as those that calculate the potential jobs that can be created through recycling, and the current and potential climate benefits that can be achieved from additional recycling. To the extent that waste is underestimated in the ASMM report, then the potential jobs and climate benefits are also underestimated in reports that rely on the ASMM data.

Background to the U.S. EPA’s Advancing Sustainable Materials Report

1. **How it is done now:** the EPA’s recycling rates are derived by dividing the amount of waste generated per year by the amount of waste recycled (and composted) during the same year:

$$\frac{\text{Tons recycled}}{\text{Tons generated}} = \text{Recycling rate}$$

Different methods are used to calculate the numerator and the denominator:

a) **Tons generated (the denominator)** is estimated using a top-down modeling approach. This “materials flow” methodology involves collecting data on the annual manufacturing quantities of product categories containing myriad goods in the United States, and then allocating these quantities by average product lifetime (how long each product lasts before being discarded), thereby producing estimates of the types and amounts of material “generated,” or discarded into the U.S. wastestream, annually. Imports and exports are accounted for.

   Tonnage landfilled is not measured; it is derived by subtracting tons recycled, composted, and sent to WTE from total generation as estimated using the materials flow method.

b) **Tons recycled (the numerator)** is derived by surveying trade associations for the actual tonnages that their member companies (secondary materials processors) purchase annually from materials recovery facilities (MRFs) and other collectors (such as beverage deposit systems). For example, trade associations whose members produce goods for the food and beverage packaging industries include NAPCOR, the Aluminum Association, and the Glass Packaging Institute.

   Empirical data collection methods are also used to estimate actual tonnages composted and sent to waste-to-energy facilities.

2. **Deficiencies in the existing method** occur in both the numerator and the denominator:

a) **Tons generated (the denominator) are being undercounted in at least two ways:** in terms of U.S. manufacturing and in terms of imports.

- **U.S. manufacturing is undercounted:** Several organizations have commented on how the EPA's estimated tons generated are lower than tons generated in real life, as counted by the BioCycle/Columbia University Earth Engineering Center (EEC) mass balance approach. In this "bottom up" method, state-based surveys are conducted to measure actual tonnage volumes recycled, composted, combusted, and landfilled.

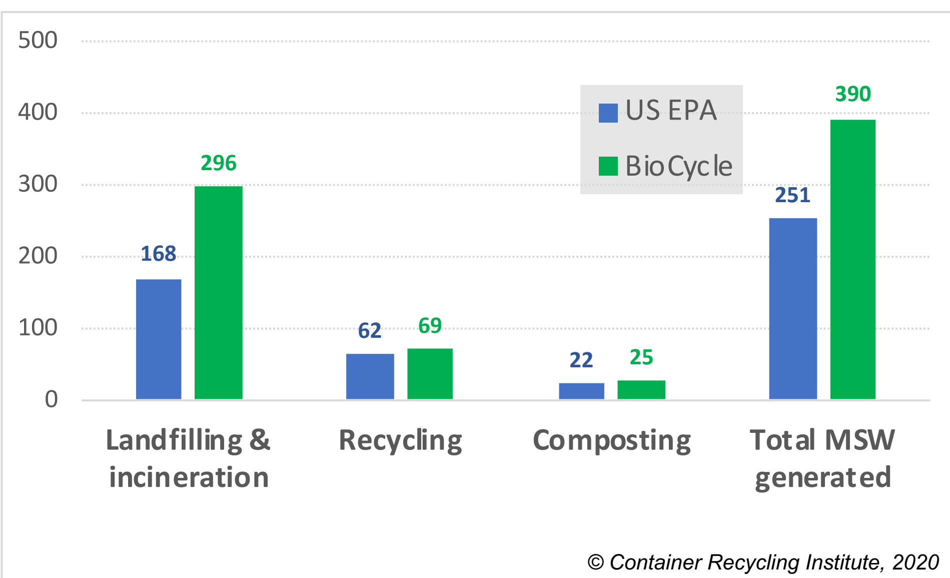
  Eileen Berenyi of Governmental Advisory Associates has explained that the method used by EPA to estimate generation is based on models of production that were developed in the 1970s. She points out that production processes have changed substantially since then, due to materials substitutions, new technologies, and new approaches to materials and residue management. There are also new materials in the waste stream, such as e-waste. These changes mean that the derived number of materials "disposed" is likely to undercount or miss things, including non-product categories such as food and yard waste. She also points out that there is a blurring between certain industrial and non-industrial sources.[1]

  Moore & Associates and Kessler Consulting wrote in 2016:

  "Although our industry has relied on EPA tonnage and recycling rates for a number of years, that analysis is based on a top-down approach that uses complex modeling and divergent data sources. Recent research by others has taken a bottom-up approach, using actual data reported by recovery facilities, waste-to-energy facilities, and landfills. Based on our assessment, the EREF methodology provides a reliable measurement of MSW tonnage and recovery rates. Hence, national MSW disposal and recovery tons are greater than EPA, but recovery rates are lower."[2]

  The data published in the *BioCycle*/Columbia survey of generation and recycling diverge sharply from the EPA's, as Figure 1 shows:

  Figure 1. U.S. EPA vs. BioCycle MSW Estimates, 2008 (millions of tons)[3]



As you can see, the *BioCycle* estimate of total generation is **140 million tons higher than the EPA's** for the 2008 data year. We know something is missing from the EPA analysis, but we don't know what.

To take beverage glass as an example, the **EPA reported that 6.5 million tons** of beverage glass bottles were generated (sold) in 2018.[4] In contrast, **CRI has calculated that 12.8 million tons** of beverage glass were sold in 2018, based on national data from the Beverage Marketing Corporation, state-specific data from trade associations for the beer, wine, and spirits industries, and beverage-specific container weight conversion factors obtained from CalRecycle. This discrepancy of almost 100% casts doubt on the reliability of generation data for other materials in the waste stream.

There is not enough information given in the U.S. EPA methodology report for us to know exactly where potential undercounting is occurring for glass beverage bottles. The undercount may be caused by adherence to the federal Paperwork Reduction Act, which limits to 9 the number of inquiries the EPA may make per waste product being investigated, or perhaps the use of 1970s-era production models.

- **Imports are undercounted**: As we understand it, the current EPA methodology uses Dept. of Commerce data to count only the *products* that are imported, but not the surrounding packaging. In the example of glass beer bottles, the volume of the liquid beer itself is counted by Commerce, and the bottle itself is counted as glass, but the 6- or 12-pack boxboard is not counted, nor the metal cap or cork, nor the label, nor the larger corrugated cardboard boxes, nor the wood pallets, nor the plastic film shrink wrapped around the pallets. As we understand it, this imported packaging is not being counted as a component in the "materials generated" denominator of the recycling rate equation. On the other hand, when primary, secondary and tertiary packaging is manufactured in the U.S. and is purchased by U.S. bottlers (in the beer glass example), it is counted as plastic, metal, cardboard, or wood "generated." The same standard should be applied to imported products.

b) **Tons recycled (the numerator): is being overcounted by including contaminants or similar items.** As we noted above, the EPA currently captures data from the container materials trade associations at the point where the materials leave a materials recovery facility (MRF) and are *inbound to the secondary processing facility* (one that buys material from a MRF or other source and turns it into feedstock for manufacturing). This method erroneously counts as recycled contaminated material that is subsequently removed by the secondary processor and landfilled or incinerated.

While MRF processing removes many contaminants introduced to recyclable loads from single-stream curbside and other programs, more contaminants still are removed during secondary processing: when incoming material from the MRF is processed to be acceptable for use in manufacturing. As I wrote in "A Common Theme" in *Resource Recycling* several years ago, on average, ***22.1% to 27.3% of total incoming materials may be removed during secondary processing.*** [5] Since this residue must be landfilled or incinerated, it is not appropriate to count it as recycled.

Here are several examples of food and beverage container contamination and "similar items" leading to inflation of recycling rates:

- **PET plastic bottles**: PET processors may encounter PET bales containing caps, labels, glue, moisture, food and drink residue, and dirt; foreign objects such as aluminum cans or other metal objects; or look-alike bottles of a different resin type. Caps, labels, adhesives and base cups alone can represent 13% of the weight of PET bottles. In "A Common Theme," I found that ***yield losses can range from 22-32%*** at plastics reclaimers. Because these contaminants are removed by plastics processors before the reclaimed PET can be used in other applications (such as new bottles, fiberfill, or strapping), *they should not be counted in a recycling rate numerator*.

  The EPA would benefit from an examination of how the plastics reclamation industry calculates a "**utilization rate**." A utilization rate counts only the percentage of incoming plastics that is made into clean, saleable RPET flake; it is distinct from a recycling rate that represents collection volumes prior to removal of contaminants. Furthermore, some colored PET is removed and discarded, because it has no market, like green or blue PET. Other items, like polypropylene caps, may be separated and recycled, but should not be reported in the PET recycling rate. In this way, they may be double-counted in both the PET recycling rate and polypropylene recycling rate.

  Our colleagues at Reloop have published a paper discussing the European Union's new goal, under the Single Use Plastics Directive, that calls for member states to achieve a 90% recycling rate for single use plastic bottles by 2029. The paper discusses measurement challenges, and how to close loopholes in both the numerator and denominator. The EPA would benefit from a thorough review of this document.[6]

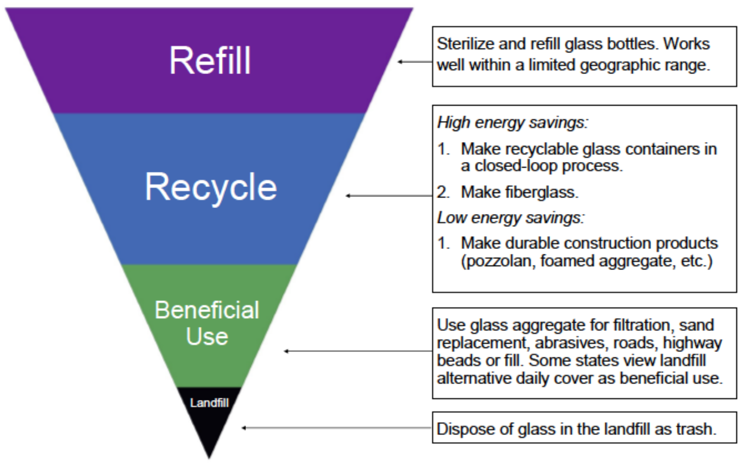
  Please recall that in 2011, the EPA temporarily changed its calculation methodology for PET plastic based on a letter submitted by the Container Recycling Institute.[7] The change removed contaminants from the numerator of the recycling rate, and had the effect of decreasing the reported PET recycling rate from 28% in 2009 to 21% in 2010. Unfortunately, this change was reversed, and a revised report was issued, bringing the 2010 rate back to 29.2%. A review can be found in the CM Consulting blog, "EPA Revises Methodology Again?"[8]

- **Glass bottles:** the processor is a "beneficiator:" a facility that crushes, cleans, and color-sorts MRF glass into uniform cullet (small glass pieces) for use by glass bottle makers, fiberglass manufacturers, and other industries. During beneficiation, caps, labels and glue are removed, as well as dirt, liquid, and solid contaminants.

  In "A Common Theme," I identified **yield losses of 21-40%** at glass processing facilities. *This residual material weight should also not be counted in the numerator of a recycling rate since it is landfilled by the beneficiator*.[9] It is not clear what data U.S. EPA uses to estimate glass "recovery."

  From Feb. 2017 – June 2018, 45 MRFs were surveyed by the Northeast Recycling Council (NERC). The data compiled showed that 54% of reported glass tonnages from northeast MRFs surveyed sent their glass to be cleaned at beneficiators; 5% was used as aggregate, and more than 38% is used at landfills: as alternative daily cover, roadbase, fill, or trash.[10] As Figure 2 shows, NERC has created a hierarchy of uses for glass that prioritizes maximum environmental benefit:

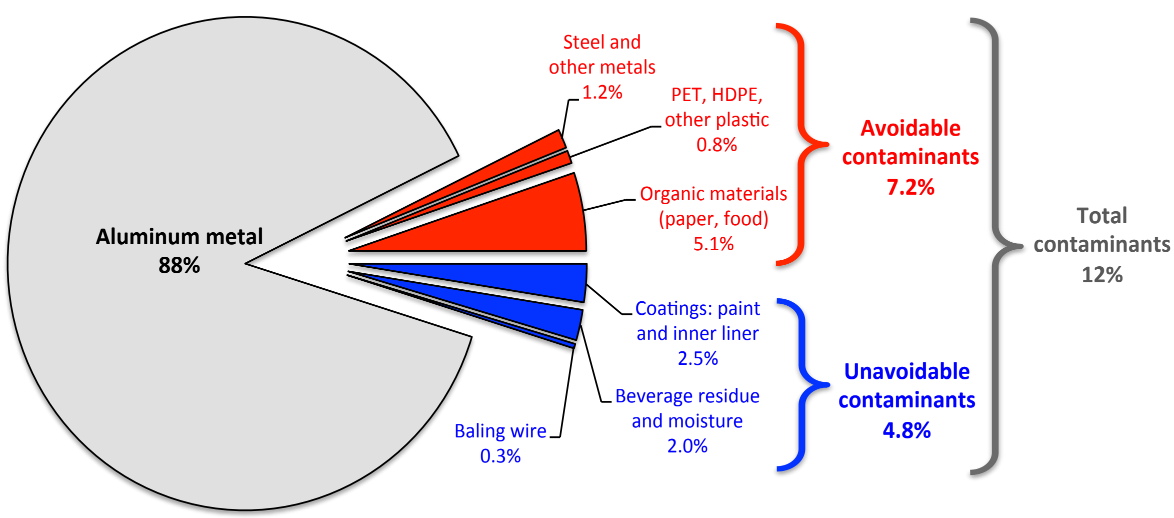
Figure 2. NERC's Glass End-of-Life Management Hierarchy[11]



Furthermore, the mischaracterization of aggregate and landfill uses as glass "recycling" can lead to **overstating the amount of greenhouse gas emissions avoided** in glass production, which incorporates GHG savings from using cullet (broken, cleaned, post-consumer glass) instead of raw materials.[12] When recovered glass is used as aggregate in roadbase or daily landfill cover, virgin materials must be used to manufacture new glass to replace the quantity that has been taken out of the glass cycle of production. Virgin materials use is the primary contributor to greenhouse gas emissions in glass production. Therefore, it is imperative that aggregate so-called "beneficial uses" **not be equated** with actual recycling wherein cullet is used for manufacturing new bottles or fiberglass. These uses should be accounted for, but in a separate category.

- **Aluminum cans**: According to CRI's own research, contaminants comprise 10-12% by weight of UBC (used beverage can) bales purchased by melters.[13] This yield loss is broken down into avoidable and unavoidable contaminants in Figure 3 below.

Figure 3. Avoidable and Unavoidable Contaminants in a UBC Bale



Source: Interviews with aluminum industry representatives; CalRecycle: Bale Rate Study Initial Findings [PowerPoint Slides], Mike Miler, 2015.

This contaminant material should not be counted as recycled. Indeed, it is our understanding that the Aluminum Association correctly counts only the aluminum alloys, and not contamination, in its calculation of the aluminum can recycling rate. The U.S. EPA should correct its data by separating aluminum can data into beverage cans and food cans. Thus, the total of aluminum can recycling would remain the same, while some of those cans would be reported in the "other can" category (which currently shows ZERO recycling), and the remainder would remain in the "beer and soft drink can" category. The name of that category could also be updated to "beverage cans."

- **Paper**: In an earlier CRI report, we found that paper mills buying materials from single-stream MRFs experienced as much as ***an 18% yield loss.***[14] Some of this yield loss results from contaminants such as aluminum cans and plastics that are present in paper bales purchased from MRFs.

c) **Inflated recycling rates:** the combination of overcounting recycling volumes (the numerator) and undercounting production volumes (the denominator) results in **inflated recycling rates**.

As I wrote in "A Common Theme," an article about glass recycling,

"As we seek new policies to increase recycling rates, we need to start reporting what is actually recycled, not just what is collected for recycling. Collection and processing methods have changed dramatically in the last two decades, but reporting mechanisms haven't evolved to capture new recycling rate information correctly. Process losses occur at the MRF when contaminants are removed, and ***even greater levels of contamination*** *are removed when materials arrive at paper mills, plastics reclaimers and other materials processing facilities."*[15]

3. **Excluding landfill and aggregate uses from recycling:** in addition to addressing generation volumes and excluding contaminants from recycling volumes, we recommend that the EPA exclude landfill and aggregate uses from the definition of recycling.

Many MRF operators ship dirty glass and residuals to landfill. In 2018, the Northeast Recycling Council (NERC) surveyed 45 MRFs nationwide, and reported that 38.3% of MRF glass is "used at landfills:" 23.5% as alternative daily cover (ADC) over freshly-dumped trash, 14.7% as trash, and about a tenth of a percent as roadbase or fill [at the landfill]. An additional 5% is used directly by MRFs for aggregate, or ***43% in total for non-recycling uses.***

The same report noted that *only 6 of the 45 MRFs* surveyed had non-glass residuals and fines rates of 10% or less.[16] It stands to reason that the remainder had residual rates that were much higher.

It doesn't matter whether material ends up *in* the landfill or *on* it; it is still landfilled and is **not** displacing virgin materials in any manufacturing process. Public confidence in recycling gets eroded when they learn that the bottles they save for recycling are instead ending up in the landfill. This is not recycling.

In sum, the EPA should distinguish between **collection**, **actual recycling by end users and others kind of uses that don't replace virgin materials in the manufacturing process**.

4. Processes that should be excluded from the definition of "recycling"

We believe that that these modes of waste management **should not qualify** as recycling:

a) **High-heat and/or "chemical recycling" processes** that result in the destruction of recovered material, and mainly create fuel products. These include pyrolysis, gasification, solvolysis, depolymerization, plastic-to-waste fuel, and combustion or waste-to-energy. (We are not opposed to counting anaerobic digestion as composting, as long as it takes place at a low heat, is clean, and captures methane.)

   Contrary to claims made by supporters, these are not "clean" technologies. The air emissions from these facilities are similar to conventional incinerators.[17] They spew a number of cancer-causing compounds, including dioxin, described as the most toxic chemicals known to humankind.[18] Moreover, the ash "byproduct" of these processes may be contaminated with dioxins, PFAS, mercury, and other heavy metals, all of which leaches into our groundwater, rivers, and lakes. And the pollution doesn't end there. The synthetic fuel produced at gasification facilities is later burned to generate energy. Just like with any other oil or gas, this burning creates climate damaging emissions plus heavy metals and other toxics. These technologies also require the extraction of virgin resources and production of new materials because nothing is "recycled," just destroyed.

b) **"Beneficial" aggregate uses** including encapsulated such as in concrete or asphalt; unencapsulated such as in road base or fill; and as daily landfill cover.

c) **Uses involving toxics**: such as co-digestion of food or yard waste with sewage sludge. Sewage sludge is toxic. Laura Orlando, a civil engineer who teaches at the Boston University School of Public Health, has testified repeatedly that by combining our food scraps with sewage sludge we are investing millions to turn food scraps into a source of pollution.[19] Wastewater treatment plants don't just collect wastewater from our toilets and drains. They serve as collection points for polluted runoff from roads, parking lots, hospitals, and industrial and commercial sites that flow into the sewer. These facilities even receive millions of gallons of poisonous liquids leaching from landfills. Wastewater treatment plants "treat" what we flush down our toilets and sinks, so people assume that the chemicals from landfills, household hazardous waste, or industrial facilities are filtered or removed from the remaining solids and liquids, and are then safe to re-enter our rivers, oceans, and soils. But that's not true.

   Over a decade ago, the EPA announced that sewage sludge contains thousands of chemicals, because the technology to fully detoxify the sludge either does not currently exist or is not required. Wastewater treatment plants don't even test for most toxics. So, while some pollutants, including heavy metals like lead and copper, are removed, some **80,000 other synthetic chemicals are not.**

   As Orlando explains, this means that after wastewater is "treated," many of these dangerous pollutants flow right back into our water cycle, while the rest end up in sludge. Sludge is a toxic blend of thousands of chemicals – from flame retardants to pharmaceuticals to steroids, all of which is hazardous to humans and animals.

d) **Pre-consumer recycling:** process-related industrial scrap re-used on site or in companion industry.

e) **Compostable plastics:** these do not add nutrition to the soil, and should not be counted as recycling.

f) **Exports:** generally speaking, we believe exports of material collected in the United States *should* be counted as recycling, with this important caveat: if there is no mechanism to **verify** that the materials are actually being recycled in the importing country, the material should not be counted as recycled.

5. Learning from other countries' measurement guidelines

The European Commission has passed rules requiring EU member states to report in detail on their generation and recycling tonnages, and has developed a comprehensive methodology to calculate recycling rates. We recommend that the EPA study this document for tips on how to close loopholes in the numerator and denominator of the recycling rate calculation.[20]

The Canadian Standards Association (CSA Group) has also issued guidelines for a recycling rate calculation methodology that takes contaminants into account.[21]

We further ask you to refer to the letter the Container Recycling Institute wrote to the EPA in 2011, as many of the points we made then are still valid (attached). In this letter, we have included some examples of how the recycling rate can be improved for certain line items in the ASMM report, and we've addressed the overall undercounting of materials. We do have much more information regarding the beverage container categories, and we would welcome inquiries from the U.S. EPA in order to enhance the data in those categories.

Closing the 90-140 million ton data gap would result in *much more reliable data* for use by countless private businesses and manufacturers, research institutes, civic and environmental organizations, and many local, state, and federal government agencies. ***It is absolutely essential to have the proper data in order to craft a national recycling strategy.*** We are asking the EPA to reconsider the methodology in order to properly characterize the entire waste stream, and to tackle the barriers with additional financial and/or staff resources. We've been told that the Paperwork Reduction Act is also a barrier, and this clearly must be addressed in order to increase the reliability and utility of this important publication.

Please contact me with any questions you may have.

Sincerely,

Susan Collins
President, Container Recycling Institute

Letter also signed by:

Kirstie Pecci	Sarah Nichols	Clarissa Morawski
Director, Zero Waste Project	Sustainable Maine Director	Chief Executive Officer
Conservation Law Foundation	Natural Resources Council of Maine	Reloop Platform
www.clf.org	www.nrcm.org	www.reloopplatform.org

About the Container Recycling Institute: *CRI is a nonprofit organization and a leading authority on the economic and environmental impacts of beverage containers and other consumer-product packaging.*

***** Please see following page for endnotes and citations. ****

ENDNOTES

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[1] "Issues in Measurement of Municipal Solid Waste Measurement," presentation at CRI webinar by Eileen B. Berenyi, Ph.D., Governmental Advisory Associates, Inc. Westport CT, July 11, 2013.
[2] Moore, William P. & Engel, Peter L. "White Paper: Demystifying MSW Recovery Rates." Moore & Associates and Kessler Consulting, Inc., June 2016.
[3] U.S. EPA: Table 29 in "Municipal Solid Waste Generation, Recycling, and Disposal in the United States Tables and Figures for 2010." U.S. Environmental Protection Agency Office of Resource Conservation and Recovery, December 2011. BioCycle: Table in "The State of Garbage in America." by Van Haaren, Themelis, and Goldstein. *BioCycle*, Oct. 2010.
[4] According to the EPA's "Advancing Sustainable Materials Management: 2018 Tables and Figures," (US EPA, Nov. 2020), 4,650 thousand tons of beer and soft drink bottles (including all non-alcoholic, non-carbonated beverages sold in glass), and 1,810 thousand tons of wine & liquor bottles were generated in 2018, for a total of 6.5 million tons. CRI source: "2018 Beverage Market Data Analysis," Container Recycling Institute, 2020.
[5] Collins, Susan. "A Common Theme." *Resource Recycling*, Feb. 2012.
[6] "Getting the numbers right: A discussion paper on calculating & reporting separate collection of plastic beverage bottles." Reloop Platform & Eunomia Research and Consulting Ltd., Feb 2020.
[7] Letter from the Container Recycling Institute to Hope Pillsbury, Office of Resource Conservation and Recovery, Environmental Protection Agency, Sept. 30, 2011 (enclosed).
[8] "EPA revises methodology…again?" CM Consulting blog, Feb. 17, 2012.
[9] The PET plastics industry has explored this issue and publishes a "utilization rate" that is a truer representation of what is actually recycled. See annual NAPCOR reports.
[10] "Northeast MRF Glass Survey." Northeast Recycling Council (NERC), Oct. 2018.
[11] "Glass Recovery Hierarchy." Northeast Recycling Council (NERC), Apr. 2019.
[12] See section 4.3 "Glass Production" in "Draft Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2019." U.S. Environmental Protection Agency, EPA 430-R-21-001.
[13] Aluminum chapter in "The Cost of Contamination," unpublished CRI report (work in progress).
[14] "Understanding economic and environmental impacts of single stream collection systems." Container Recycling Institute, 2009.
[15] Collins, Susan. "A Common Theme." *Resource Recycling*, Feb. 2012.
[16] Remolador, Mary Ann. "Northeast MRF Glass Survey Report." Northeast Recycling Council, Oct. 2018.
[17] "Waste Gasification & Pyrolysis: High Risk, Low Yield Processes for Waste Management: A Technology Risk Analysis." GAIA, March 2017.
[18] "Incineration and Human Health: State of Knowledge of the Impacts of Waste Incinerators on Human Health." Allsopp, M., Costner, P., and Johnston, P. Greenpeace Research Laboratories, University of Exeter, UK, Apr. 2018.
[19] Testimony of Laura Orlando before the Cambridge City Council's Health & Environmental Committee, Oct. 9, 2018.
[20] Commission Implementing Decision (EU) 2019/1004 of 7 June 2019 laying down rules for the calculation, verification and reporting of data on waste in accordance with Directive 2008/98/EC of the European Parliament and of the Council and repealing Commission Implementing Decision C(2012) 2384.
[21] "A Guideline for accountable management of end-of-life materials." CSA SPE-890-15, Aug. 2015.