Measuring Recycling, Diversion, and Recovery in Washington

Background and Methodology
1986 to 2016

Washington State Department of Ecology
Solid Waste Management
Olympia, Washington

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Purpose

This document provides background and methodology for Washington Department of Ecology (Ecology) Solid Waste Management recycling, diversion, and recovery metrics from 1986 through 2016. It also clarifies how materials, generator sectors, and processing methods are counted, and provides rationale for counting decisions.

This document has no bearing on regulatory status.

This helps to fulfill strategic recommendations for Ecology’s Solid Waste Management (SWM) program’s data collection and analysis, to provide more communication on measurement methodologies.

Audience

All internal and external stakeholders with an interest in Washington’s recycling and recovery data, including policy makers at the state and local government level, businesses, and non-governmental organizations are among the audience members for this document.

Background

Washington’s First Recycling Survey

Washington’s original recycling survey and municipal solid waste stream analysis was designed and completed by R.W. Beck & Associates (1986 Washington State Recycling Survey, Ecology Publication #87-23). No other state had done anything similar at that time. A limited material list of 15 recycled materials was tracked with the initial survey due to limitations on scope and funding for the study, however, the consultant identified 22 materials from the municipal solid waste (MSW) stream that were significant in terms of recycling.

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3 Calendar year data.
4 MSW recycling, for purposes of determining historic MSW recycling rates (1986-2016), includes mixed solid waste and other materials collected for recycling or disposal from municipal sources (residential and commercial), excludes source separated construction and demolition debris, agricultural waste, mining waste, and most industrial sources. See also the definition in WAC 173-350. (Ecology, 2020)
Table 1: Recyclable Materials Identified in Washington’s 1986 Recycling Survey

<table>
<thead>
<tr>
<th>Refillable beer bottles</th>
<th>Aluminum cans</th>
<th>Batteries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Refillable soft-drink bottles</td>
<td>Aluminum containers</td>
<td>Tires</td>
</tr>
<tr>
<td>Container glass</td>
<td>Tin cans</td>
<td>Oil</td>
</tr>
<tr>
<td>Newsprint</td>
<td>Bi-metal cans</td>
<td>PET bottles</td>
</tr>
<tr>
<td>Corrugated containers</td>
<td>Ferrous metals</td>
<td>HDPE</td>
</tr>
<tr>
<td>Computer paper</td>
<td>Nonferrous metals</td>
<td>LDPE</td>
</tr>
<tr>
<td>Office paper</td>
<td>White goods</td>
<td>Other plastic products</td>
</tr>
<tr>
<td>Mixed waste paper</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Ecology began tracking these 22 materials in the next iteration of the survey, the 1988 Washington State Recycling Survey (Ecology Publication #89-55).

Methodology

Washington’s Early Method for Measuring MSW Recycling

In 1989, the state legislature passed Chapter 70.95 RCW, “The Waste Not Washington Act,” establishing the 50 percent reduction and recycling goal, and Ecology is tasked with continuing to measure waste and recycling. Through the 1990s, Ecology continues to develop its measurement program with input from the Solid Waste Advisory Committee, local governments, non-governmental organizations (NGOs), and a Recycling Assessment Panel with broad-based sector representation.

In recycling surveys from 1989 through 1999, other materials such as yard debris and wood were added as they emerged in the MSW stream and were recovered for recycling and other beneficial uses. These materials were added to the recycling rate. Some recyclable materials were discontinued from measurement due to their decline in the MSW stream, non-viability for recycling, or inclusion in other categories, such as refillable bottles, aluminum containers, and catalytic converters.

The calculation for the MSW recycling rate is:

\[
\frac{\text{MSW collected for recycling}}{\text{MSW collected for recycling + MSW disposed in landfills and incinerators}}
\]

Washington’s Method for Measuring Recycling compared to EPA Guidance

As many states were forming recycling metrics or considering them in the 1990s, the Environmental Protection Agency (EPA) wanted to provide guidance, so they looked to states who had established recycling metrics already for input. As Washington’s MSW recycling metric had been well established by this time, Ecology staff was invited and participated in this effort.

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5 Recycling rate (or MSW recycling rate) refers to the percentage of MSW material that is recycled instead of disposed in landfills or incinerators.
Measuring Recycling: A Guide for State and Local Governments was published in 1997. The following tables are from this guide, with a comparison of Washington’s methodology for determining MSW recycling from the time this guidance was established through 2016.

Table 2: EPA’s Scope of Materials Included in the Standard MSW Recycling Rate compared to Washington’s method

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>WHAT IS MSW</th>
<th>WHAT IS NOT MSW</th>
<th>Washington method for counting MSW Recycling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food Scraps</td>
<td>Uneaten food and food preparation wastes from residences and commercial establishments (restaurants, supermarkets, and produce stands), institutional sources (school cafeterias), and industrial sources (employee lunchrooms).</td>
<td>Food processing waste from agricultural and industrial operations.</td>
<td>Same method.</td>
</tr>
<tr>
<td>Glass Containers</td>
<td>Containers; packaging; and glass found in appliances, furniture, and consumer electronics.</td>
<td>Glass from transportation equipment (automobiles) and construction and demolition (C&amp;D) debris (windows).</td>
<td>Same method.</td>
</tr>
<tr>
<td>Lead-Acid Batteries</td>
<td>Batteries from automobiles, trucks, and motorcycles.</td>
<td>Batteries from aircraft, military vehicles, boats, and heavy-duty trucks and tractors.</td>
<td>Same method.</td>
</tr>
<tr>
<td>Tin/Steel Cans and Other Ferrous Metals</td>
<td>Tin-coated steel cans; strapping; and ferrous metals from appliances (refrigerators), consumer electronics, and furniture.</td>
<td>Ferrous metals from C&amp;D debris and transportation equipment.</td>
<td>Ferrous metals, including transportation equipment and other non-industrial automotive wastes are included in MSW, unless reported as mixed C&amp;D.</td>
</tr>
<tr>
<td>Aluminum Cans and Other Nonferrous Metals</td>
<td>Aluminum cans; nonferrous metals from appliances, furniture, and consumer electronics; and other aluminum items (foil and lids from bimetal cans).</td>
<td>Nonferrous metals from industrial applications and C&amp;D debris (aluminum siding, wiring, and piping).</td>
<td>Nonferrous metals are included in MSW, unless reported as mixed C&amp;D.</td>
</tr>
<tr>
<td>Paper</td>
<td>Old corrugated containers; old magazines; old newspapers; office</td>
<td>Paper manufacturing waste (mill broke) and converting scrap not recovered for recycling.</td>
<td>Same method.</td>
</tr>
<tr>
<td>MATERIAL</td>
<td>WHAT IS MSW</td>
<td>WHAT IS NOT MSW</td>
<td></td>
</tr>
<tr>
<td>----------</td>
<td>-------------</td>
<td>-----------------</td>
<td></td>
</tr>
<tr>
<td>Papers; telephone directories; and other paper products including books, third-class mail, commercial printing, paper towels, and paper plates and cups.</td>
<td>Plastic Containers; packaging; bags and wraps; and plastics found in appliances, furniture, and sporting and recreational equipment.</td>
<td>Plastics from transportation equipment.</td>
<td></td>
</tr>
<tr>
<td>Plastic</td>
<td>Textiles Fiber from apparel, furniture, linens (sheets and towels), carpets and rugs, and footwear.</td>
<td>Textile waste generated during manufacturing processes (mill scrap) and C&amp;D projects.</td>
<td></td>
</tr>
<tr>
<td>Tires Tires from automobiles and trucks.</td>
<td>Tires from motorcycles, buses, and heavy farm and construction equipment.</td>
<td>Tires are counted based on processing method. Reports do not distinguish type.</td>
<td></td>
</tr>
<tr>
<td>Wood Pallets; crates; barrels; and wood found in furniture and consumer electronics.</td>
<td>Wood from C&amp;D debris (lumber and tree stumps) and industrial process waste (shavings and sawdust).</td>
<td>Reports generally do not distinguish origin. Recycled wood, and shavings and sawdust with MSW origins such as yard debris, are counted as MSW; wood with mixed C&amp;D debris is excluded.</td>
<td></td>
</tr>
<tr>
<td>Yard Trimmings Grass, leaves, brush and branches, and tree stumps.</td>
<td>Yard trimmings from C&amp;D debris.</td>
<td>In MSW unless reported as landclearing debris.</td>
<td></td>
</tr>
<tr>
<td>Other Household hazardous waste (HHW), oil filters, fluorescent tubes, mattresses, and consumer electronics.</td>
<td>Abatement debris, agricultural waste, combustion ash, C&amp;D debris, industrial process waste, medical waste, mining waste, municipal sewage and industrial sludges, natural disaster debris, used motor oil, oil and gas waste, and preconsumer waste.</td>
<td>Used motor oil that is recycled is counted as MSW; reuse, such as mattresses and electronics are excluded; MSW includes fats &amp; oils.</td>
<td></td>
</tr>
</tbody>
</table>
Notes (Table A)
1. Composite materials are categorized according to their main constituent; however, they can be designated as a separate category under Other MSW if they cannot be otherwise categorized.
2. These wastes are not considered MSW due to one or more of the following reasons: (1) they are not defined as MSW in EPA’s Characterization of Municipal Solid Waste in the United States, (2) they have not been historically handled and disposed of as MSW, (3) they are regulated as hazardous waste, and/or (4) they were generated by a preconsumer source. These non-MSW wastes are referred to as Other Solid Waste in this guide and on the survey forms and worksheets.
3. Carpets are categorized as Textiles when discarded in MSW and are included in the rate calculation. When carpets are discarded in C&D debris, they are not considered MSW and are excluded from the rate calculation.
4. Tires from motorcycles are not defined as MSW because they historically have not been characterized as MSW in EPA’s Characterization of Municipal Solid Waste in the United States.
5. Tree stumps are categorized as Yard Trimmings when discarded in MSW and are included in the rate calculation. When tree stumps are discarded in C&D debris, they are not considered MSW and are excluded from the rate calculation.
6. HHW includes paints, stains, varnishes, solvents, pesticides, and other materials or products containing volatile chemicals that catch fire, react, explode under certain circumstances, or that are corrosive or toxic. Specific examples include oil-based paint, antifreeze, household cleansers, and bug sprays. Used motor oil is excluded.
7. Fluorescent tubes are categorized as Other MSW when found in MSW and are included in the rate calculation. When fluorescent tubes are discarded in C&D debris, they are not considered MSW and are excluded from the rate calculation.
8. Natural disasters include earthquakes, floods, hurricanes, and tornados. Heavy storms are not considered natural disasters.

Washington Notes as Relates to Table 2
a. Reports to Ecology may not distinguish origin or specific destination.

Table 3: EPA’s Scope of Activities included in the Standard MSW Recycling Rate compared to Washington’s method

<table>
<thead>
<tr>
<th>EPA’s SCOPE OF ACTIVITIES INCLUDED IN THE STANDARD MSW RECYCLING RATE</th>
<th>Washington method for counting MSW Recycling</th>
</tr>
</thead>
<tbody>
<tr>
<td>RECYCLABLE MATERIAL</td>
<td>WHAT COUNTS AS RECYCLING</td>
</tr>
<tr>
<td>Food Scraps</td>
<td>Composting of food scraps from grocery stores, restaurants, cafeterias, lunchrooms, and private residences, and the use of food scraps to feed farm animals.</td>
</tr>
<tr>
<td>Glass</td>
<td>Recycling of container and packaging glass (beverage and food containers), and recycling of glass found in furniture, appliances, and consumer electronics into new glass products such as containers, packaging,</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>---------------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>Construction</td>
<td>construction materials (aggregate), or fiberglass (insulation).</td>
</tr>
<tr>
<td>Lead-Acid Batteries</td>
<td>Recycling of lead-acid batteries found in cars, trucks, or motorcycles into new plastic and lead products.</td>
</tr>
<tr>
<td>Metals</td>
<td>Recycling of aluminum and tin/steel cans, and recycling of metals found in appliances and packaging into new metal products.</td>
</tr>
<tr>
<td>Paper</td>
<td>Recycling of paper products (old newspapers and office papers) into new paper products (tissue, paperboard, hydromulch, animal bedding, or insulation materials).</td>
</tr>
<tr>
<td>Plastic</td>
<td>Recycling of plastic products (containers, bags, and wraps), and recycling of plastic from furniture and consumer electronics into new plastic products (fiber fill and plastic lumber).</td>
</tr>
<tr>
<td>Textiles</td>
<td>Recycling of textiles into wiper rags, and recycling of apparel and carpet fiber² into new products such as linen paper or carpet padding.</td>
</tr>
<tr>
<td>Tires</td>
<td>Recycling of automobile and truck tires into new products containing rubber (trash cans, storage containers, and</td>
</tr>
</tbody>
</table>

¹ This list includes items that may not always be accounted for in MSW recycling programs.


<table>
<thead>
<tr>
<th>EPA’s SCOPE OF ACTIVITIES INCLUDED IN THE STANDARD MSW RECYCLING RATE</th>
<th>Washington method for counting MSW Recycling</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RECYCLABLE MATERIAL</strong></td>
<td><strong>WHAT COUNTS AS RECYCLING</strong></td>
</tr>
<tr>
<td>Rubberized asphalt, and use of whole tires for playground and reef construction.</td>
<td>Combustion of tire chips for energy recovery.</td>
</tr>
<tr>
<td>Wood</td>
<td>Recycling of wood products (pallets and crates) into mulch, compost, or similar uses.</td>
</tr>
<tr>
<td>Yard Trimmings</td>
<td>Offsite recycling of grass, leaves, brush or branches³, and tree stumps⁴ into compost, mulch, or similar uses; and landspreading of leaves⁵.</td>
</tr>
<tr>
<td>Other</td>
<td>Household hazardous waste (HHW)⁶, oil filters, fluorescent tubes⁷, mattresses, circuit boards, and consumer electronics⁸.</td>
</tr>
</tbody>
</table>

**Notes (Table 3)**
1. These activities are not considered recycling due to one or more of the following reasons: (1) they are not defined as recycling in EPA’s Characterization of Municipal Solid Waste in the United States, (2) they involve the recycling of materials that are not part of MSW, (3) they involve reuse or source reduction, and/or (4) they involve the recycling of preconsumer waste.
2. Carpeting is categorized as Textiles when discarded in MSW and is included in the rate calculation. When carpets are discarded in C&D debris, they are excluded from the rate calculation.
3. Includes woody material such as branches, brush, and whole trees such as Christmas trees.
4. Tree stumps are categorized as Yard Trimmings when discarded in MSW and are included in the rate calculation. When tree stumps are discarded in C&D debris, they are excluded from the rate calculation.
5. Landspreading of leaves counts as recycling if the manner of the application allows timely biodegradation of the organic plant material. Landspreading of leaves does not count as recycling if the manner of the application precludes the timely biodegradation of the organic plant material.
6. HHW includes paints, stains, varnishes, solvents, pesticides, antifreeze products, and other materials or products containing volatile chemicals that catch fire, react, explode under certain circumstances, or that are corrosive or toxic. Specific examples include oil-based paint, antifreeze, household cleansers, and bug sprays. Used motor oil is excluded.

7. Fluorescent tubes are categorized as Other MSW when discarded in MSW and are included in the rate calculation. When fluorescent tubes are discarded in C&D debris, they are excluded from the rate calculation.

8. Composite materials are categorized according to their main constituent; however, they can be designated as a separate category under Other if they cannot be otherwise categorized.

Ecology continued to use this calculation for the MSW recycling rate through 2016:

\[
\frac{\text{MSW collected for recycling}}{\text{MSW collected for recycling} + \text{MSW disposed in landfills and incinerators}}
\]

**Measuring Landfill Diversion**

In the late 1990s, Ecology noticed the need for tracking activities and materials separately from MSW recycling that were either not part of MSW or were diverting materials from landfills using other methods besides recycling, and thus had not been included in the numerator nor denominator of the Washington MSW recycling rate. In 1999, the “diversion rate”\(^7\) was created as an alternative metric that would account for these beneficial uses of other recoverable wastes. The other recoverable wastes added in 1999 to both the numerator and denominator to create the new diversion rate calculation are:

- Construction and demolition (C&D) debris
- Industrial materials
- Organic materials from large scale commercial operations, such as agricultural wastes and food processing wastes
- Materials burned for energy recovery
- Reused materials

The diversion rate was available along with the recycling rate for 1999 to 2015 datasets.

The calculation for the diversion rate is:

---

\(^6\) Diversion is defined as waste diverted from landfills, which includes materials reused and burned for energy in addition to those that are recycled. Includes materials collected for recycling; diverted materials were tracked in addition to materials collected for recycling starting in 1999. ([Ecology, 2020](https://www.ecology.wa.gov/)

\(^7\) Diversion rate is the percentage of materials that are diverted from disposal in landfills and incinerators for recycling, reuse and other beneficial uses. ([Ecology, 2020](https://www.ecology.wa.gov/))
(MSW collected for recycling + diverted materials)

-----------------------------------------------------------------------------------

(MSW collected for recycling + diverted materials + MSW disposed in landfills and incinerators + other recoverable wastes disposed)

**Diversion to Recovery**

Diversion from landfill as the point of success should not be the goal. We want to focus on positive outcomes and putting a material to a useful purpose. For this reason, starting with 2016 data, Ecology began to shift emphasis and terminology used for solid waste metrics from “diversion” to “recovery”. This shift was due to an increasing focus on sustainable materials management, which places greater importance on the environmental benefits of recovering wastes, such as greenhouse gas and other environmental emissions savings, and lesser importance on the amount of material diverted from landfills.

For the 2016 data, this shift was focused on terminology, and simply the words “diversion” and “recovery” were switched.

The recovery rate was available along with the recycling rate for the 2016 dataset.

The calculation for the recovery rate is:

\[
\left( \frac{\text{MSW collected for recycling} + \text{recovered materials}}{\text{MSW collected for recycling} + \text{recovered materials} + \text{MSW disposed in landfills and incinerators} + \text{other recoverable wastes disposed}} \right)
\]

This terminology shift sparked a change in methodology as well. For 2017 and going forward, another paper is available that explains the methodology for counting solid waste materials, including recovery and waste generation.

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8 Recovery is defined as material that is diverted from the solid waste stream for the intended purpose of recycling, composting, burning source-separated materials for energy, anaerobic digestion, land application, and other beneficial uses. Similar to [Diversion](https://Ecology, 2020) (however focuses on the resource aspect instead of offsetting landfill).

9 Recovery rate is the percentage of materials collected for recycling, composting, and burning source-separated materials for energy. Similar to the previously calculated diversion rate.