SUPPLIERS PARTNERSHIP FOR THE ENVIRONMENT

Core Waste Metrics for Automotive Operations

Guidance Document

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Contents

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This document sets forth various findings based on information available to working group members at the time of issuance. These findings are not intended to set forth any industry rule, requirement or standard. Each Member should independently determine its own processes and practices, including, without limitation, levels, measurements, vendors, materials, equipment, energy sources, energy use, emissions, and recyclability. It is the responsibility of each individual company to be aware of national and local regulations that may require reporting of waste-related information using specific methods and formats. This document should not be considered to contain legal advice. SP and its member companies make no warranty, expressed or implied, regarding the accuracy or completeness of the information contained in this document, and they will not be liable for any errors or omissions in this information nor for the availability of this information. The authors of this document reserve the right to change it at any time, as they deem appropriate within their sole discretion. SP and its member companies will not be liable for any losses, injuries or damages that may result from the use of the information contained in this document.

Introduction

The Suppliers Partnership for the Environment (SP) provides a forum for global vehicle manufacturers and their large and small suppliers to work together toward a shared vision of an automotive industry with positive environmental impact.

SP's sustainable materials work group is working to move the automotive industry towards a circular materials economy. The work group promotes collaboration amongst automotive manufacturers and suppliers to increase use of sustainable practices, processes, and materials in the production and content of vehicles, and to incentivize sustainable innovation.

A waste metrics subcommittee was formed to identify or develop common definitions, tools, and/or guidance related to waste generation, disposal and recycling to promote consistent and comparable approaches in measuring and reporting industry progress related to waste reduction internally and externally.

Several leading organizations within the automotive industry have announced aspirations toward achieving zero waste from their operations. Currently, there is no universally accepted definition of the term "zero waste". However, at the basis of any evaluation of zero waste is a clear understanding of the total waste generated by an entity and the percentage of that total that has been diverted from certain disposal operations.

The purpose of this guidance document is to outline common automotive industry-supported definitions and approaches for measuring and reporting on waste generated within the boundary of the owned activities of the reporting organization, consistent with those approaches outlined in established standards / frameworks.

It is intended to support companies who are seeking to report their own waste-related data, or request waste-related data from their supply chain, in alignment with established international corporate sustainability reporting best practices.

Introduction: Key Concepts & Definitions

- **Waste:** Any substance or object which the holder discards, intends to discard, or is required to discard. Note: Waste can be defined according to the national legislation at the point of generation. In the context of waste reporting, total waste excludes effluent unless required by national legislation to be reported under total waste.

- **Effluent:** treated or untreated wastewater that is discharged to a municipal treatment plant or surface water body via stationary piping.

- **Hazardous waste:** defined in accordance with applicable jurisdictional legal or regulatory frameworks where the waste was generated. The entity may use the United Nations Environment Programme (UNEP) Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal for the purposes of defining hazardous waste or recycled waste for operations located in jurisdictions that lack applicable legal or regulatory definitions.

- **Recovery:** operation wherein products, components of products, or materials that have become waste are prepared to fulfill a purpose in place of new products, components, or materials that would otherwise have been used for that purpose. Note: In the context of waste reporting, recovery operations do not include energy recovery.

- **Recycling:** Any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes. It includes the reprocessing of organic material but does not include energy recovery and the reprocessing into materials that are to be used as fuels or for backfilling operations.

- **Preparation for Reuse:** checking, cleaning, or repairing operations, by which products or components of products that have become waste are prepared to be put to use for the same purpose for which they were conceived.

- **Disposal:** any operation which is not recovery, even where the operation has as a secondary consequence the recovery of energy.

- **Incineration:** is the controlled burning of waste at high temperature.
    - It is with energy recovery when the energy created in the combustion process is harnessed for re-use, for example for power generation. Energy recovery may also be referred to as waste to energy or energy from waste.
    - It is without energy recovery when the heat generated by combustion is dissipated in the environment. In the context of waste reporting, incineration (with or without energy recovery) is considered a disposal (non-recycling) operation.

- **Landfilling:** final depositing of solid waste at, below, or above ground level at engineered disposal sites. Note: In the context of waste reporting, landfilling refers to depositing of solid waste in sanitary landfills, and excludes uncontrolled waste disposal such as open burning and dumping.

Introduction: Waste Metrics in Sustainability Reporting Frameworks

The purpose of this guidance document is to outline common automotive industry-supported definitions and approaches for measuring and reporting on waste generated within the boundary of the owned activities of the reporting organization, consistent with those approaches outlined in other sustainability reporting standards / frameworks.

A range of sustainability reporting frameworks and initiatives relevant to the automotive industry were reviewed in development of this document, including CDP, European Sustainability Reporting Standards (ESRS), Global Reporting Initiative (GRI), Sustainability Accounting Standards Board (SASB), Manufacture 2030, Zero Waste International Alliance (ZWIA), and others.

The following chart summarizes how the core waste metrics identified in this guidance document may support reporting within several such frameworks.

	GRI 306	ESRS ES-5	SASB TR-AU	SASB TR-AP	M2030 Auto
Total Waste Generated (Mass)	X	X	X	X	
-Hazardous Waste Generated (Mass)	X	X		X	X
-Non-Hazardous Waste Generated (Mass)	X	X			X
-Percentage of Hazardous Waste (Percent)				X	
Total Waste Diverted from Disposal (Mass)	X	X		X	
-Hazardous Waste Diverted from Disposal (Mass)	X	X			
--- Hazardous Waste Diverted from Disposal Due to Preparation for Reuse (Mass)	X	X			
--- Hazardous Waste Diverted from Disposal Due to Recycling (Mass)	X	X			
--- Hazardous Waste Diverted from Disposal Due to Other Recovery Operations (Mass)	X	X			
-Non-Hazardous Waste Diverted from Disposal (Mass)	X	X			
--- Non-Hazardous Waste Diverted from Disposal Due to Preparation for Reuse (Mass)	X	X			
--- Non-Hazardous Waste Diverted from Disposal Due to Recycling (Mass)	X	X			
--- Non-Hazardous Waste Diverted from Disposal Due to Other Recovery Operations (Mass)	X	X			
-Percentage of Recycled Waste (Percent)			X	X	
Total Waste Directed to Disposal (Mass)	X	X			
-Hazardous Waste Directed to Disposal (Mass)	X	X			X
--- Hazardous Waste Directed to Disposal Due to Incineration with energy recovery (Mass)	X	X			
--- Hazardous Waste Directed to Disposal Due to Incineration without energy recovery (Mass)	X	X			
--- Hazardous Waste Directed to Disposal Due to Landfilling (Mass)	X	X			
--- Hazardous Waste Directed to Disposal Due to Other Disposal Operations (Mass)	X	X			
-Non-Hazardous Waste Directed to Disposal (Mass)	X	X			X
--- Non-Hazardous Waste Directed to Disposal Due to Incineration with energy recovery (Mass)	X	X			
--- Non-Hazardous Waste Directed to Disposal Due to Incineration without energy recovery (Mass)	X	X			
--- Non-Hazardous Waste Directed to Disposal Due to Landfilling (Mass)	X	X			
--- Non-Hazardous Waste Directed to Disposal Due to Other Disposal Operations (Mass)	X	X			
-Total Non-Recycled Waste (Mass)		X			
-Percentage of Non-Recycled Waste (Percent)		X			

Note: It is the responsibility of each individual company to be aware of national and local regulations that may require reporting of waste-related information using specific methods and formats. Guidance related to regulatory reporting of waste-related information is outside the scope of this document.

Introduction: Core Waste Metrics for Automotive Operations

Consider tracking and reporting the following core metrics related to the waste generated within the boundary of the owned activities of the reporting organization to provide a foundation to support waste-related considerations within various sustainability reporting frameworks relevant to the automotive industry.

Mass based metrics are recommended to be reported in metric tons, with 1000 kilograms as the measure for a metric ton. To help others understand how data has been compiled, consider specifying whether reported waste data has been modeled or sourced from direct measurements.

1) **Total Waste Generated (Mass)**
    A. Hazardous Waste Generated (Mass)
    B. Non-Hazardous Waste Generated (Mass)
    C. Percentage of Hazardous Waste (Percent)

2) **Total Waste Diverted from Disposal (Mass)**
    A. Percentage of Recovered [Recycled] Waste (Percent)
    B. Hazardous Waste Diverted from Disposal (Mass)
        i. Hazardous Waste Diverted from Disposal Due to Preparation for Reuse (Mass)
        ii. Hazardous Waste Diverted from Disposal Due to Recycling (Mass)
        iii. Hazardous Waste Diverted from Disposal Due to Other Recovery Operations (Mass)
    C. Non-Hazardous Waste Diverted from Disposal (Mass)
        i. Non-Hazardous Waste Diverted from Disposal Due to Preparation for Reuse (Mass)
        ii. Non-Hazardous Waste Diverted from Disposal Due to Recycling (Mass)
        iii. Non-Hazardous Waste Diverted from Disposal Due to Other Recovery Operations (Mass)

3) **Total Waste Directed to Disposal (Mass)**
    A. Percentage of Non-Recovered [Non-Recycled] Waste (Percent)
    B. Hazardous Waste Directed to Disposal (Mass)
        i. Hazardous Waste Directed to Disposal Due to Incineration with energy recovery (Mass)
        ii. Hazardous Waste Directed to Disposal Due to Incineration without energy recovery (Mass)
        iii. Hazardous Waste Directed to Disposal Due to Landfilling (Mass)
        iv. Hazardous Waste Directed to Disposal Due to Other Disposal Operations (Mass)
    C. Non-Hazardous Waste Directed to Disposal (Mass)
        i. Non-Hazardous Waste Directed to Disposal Due to Incineration with energy recovery (Mass)
        ii. Non-Hazardous Waste Directed to Disposal Due to Incineration without energy recovery (Mass)
        iii. Non-Hazardous Waste Directed to Disposal Due to Landfilling (Mass)
        iv. Non-Hazardous Waste Directed to Disposal Due to Other Disposal Operations (Mass)

Note: For the purposes of this guidance, each metric is recommended to be calculated excluding effluent (defined as treated or untreated wastewater that is discharged to a municipal treatment plant or surface water body via stationary piping) unless required by national legislation to be reported under total waste. Wastewater that is collected and trucked off site for treatment/disposal is considered a waste and should be included within waste calculations. Consult GRI 303: Water and Effluents for more information on handling of effluents within corporate sustainability reporting.

Defining & Measuring Waste Generation, Diversion & Disposal

Waste Generation Metrics

This guidance is focused on waste generated within the boundary of the owned activities of the reporting organization. An accounting of the total weight of waste generated, together with the portion of that total directed to recovery and disposal, provides a foundation to address various waste-related target-setting, reporting, and continuous improvement efforts.

1. Total Waste Generated (Mass): Total weight of waste generated in metric tons within the boundary of the owned activities of the reporting organization.

- Waste is any substance or object which the holder discards, or intends to discard, or is required to discard. Waste can be defined according to the national legislation at the point of generation.
- This metric covers waste generated in the organization's own activities. The organization can *separately* report waste generated upstream and downstream in its value chain, if this information is available.
- A breakdown of the total by composition of the waste should be considered. It is recommended to prioritize inclusion of a breakdown by the type of waste, such as hazardous waste or non-hazardous waste, as this information as this information is needed to support additional waste-related questions in various sustainability reporting frameworks. The organization can then consider a further breakdown of the total, such as by waste stream or by materials, as it deems appropriate based on the information available.

1.A. Total Hazardous Waste Generated (Mass): Total weight of hazardous waste generated in metric tons within the boundary of the owned activities of the reporting organization.

- Hazardous Waste is defined in accordance with applicable jurisdictional legal or regulatory frameworks where the waste was generated. The reporting organization may use the United Nations Environment Programme (UNEP) Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal for the purposes of defining hazardous waste or recycled waste for operations located in jurisdictions that lack applicable legal or regulatory definitions.

1.B. Total Non-Hazardous Waste Generated (Mass): Total weight of non-hazardous waste generated in metric tons within the boundary of the owned activities of the reporting organization.

- Total Non-Hazardous Waste = Total Waste – Total Hazardous Waste

1.C. Percentage of Hazardous Waste (Percent): The percentage of hazardous waste, by weight, generated within the boundary of the owned activities of the reporting organization.

- Calculated as the weight of total hazardous waste generated, divided by the total weight of waste generated.
- Automotive Parts Suppliers reporting is accordance with SASB's Sustainable Industry Classification System® (SICS®) TR-AP Standard should also consider tracking and reporting the percentage of hazardous waste by weight from their *manufacturing operations* specifically, if different.

Waste Diversion Metrics

A typical waste management hierarchy prioritizes waste prevention, followed by recovery operations that divert waste from being sent to disposal, such as preparation for reuse, recycling, and other recovery operations, such as repurposing or refurbishment.

Recovery is defined as an operation wherein products, components of products, or materials that have become waste are prepared to fulfill a purpose in place of new products, components, or materials that would otherwise have been used for that purpose. It includes the reprocessing of organic material but does not include energy recovery and the reprocessing into materials that are to be used as fuels or for backfilling operations. Disposal is defined as any operation which is not recovery, even where the operation has as a secondary consequence the recovery of energy.

2. Total Waste Diverted from Disposal (Mass): Total weight of waste diverted from disposal in metric tons.

- A breakdown of this total by composition of the waste should be considered. It is recommended to prioritize inclusion of a breakdown by the type of waste, such as hazardous waste or non-hazardous waste, as this information as this information is needed to support additional waste-related questions in various sustainability reporting frameworks.

2.A. Percentage of Waste Diverted from Disposal [Recovered Waste] (Percent): the percentage of waste generated, by weight, that has been diverted from disposal.

- Calculated as the weight of total waste that has been diverted from disposal divided by the total weight of waste generated within the boundary of the owned activities of the reporting organization. This calculation results in an instantaneous diversion rate. Companies can also use a baseline methodology to calculate diversion performance relative to an established baseline.
- For the purposes of this guidance, percentage of waste diverted from disposal is synonymous with percentage of recovered or recycled waste.
- Automotive Parts Suppliers reporting is accordance with SASB's Sustainable Industry Classification System® (SICS®) TR-AP Standard should also consider tracking and reporting the percentage of recycled waste by weight from their *manufacturing operations* specifically, if different.

Hazardous Waste Diversion Metrics

2.B. Hazardous Waste Diverted from Disposal (Mass): Total weight of hazardous waste diverted from disposal in metric tons.

- A breakdown of this total by the following recovery operations should be considered: Preparation for reuse; Recycling; and, Other recovery operations.

2.B.i. Hazardous Waste Diverted from Disposal Due to Preparation for Reuse (Mass): Total weight of hazardous waste diverted from disposal due to preparation for reuse in metric tons.

- Preparation for Reuse is defined as checking, cleaning, or repairing operations, by which products or components of products that have become waste are prepared to be put to use for the same purpose for which they were conceived.

2.B.ii. Hazardous Waste Diverted from Disposal Due to Recycling (Mass): Total weight of hazardous waste diverted from disposal due to recycling in metric tons.

- Recycling is defined as any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes. It includes the reprocessing of organic material but does not include energy recovery and the reprocessing into materials that are to be used as fuels or for backfilling operations.

2.B.iii. Hazardous Waste Diverted from Disposal Due to Other Recovery Operations (Mass): Total weight of hazardous waste diverted from disposal due to other recovery operations in metric tons.

- Recovery is defined as an operation wherein products, components of products, or materials that have become waste are prepared to fulfill a purpose in place of new products, components, or materials that would otherwise have been used for that purpose.
- Note: In the context of waste reporting, recovery operations do not include energy recovery.

Non-Hazardous Waste Diversion Metrics

2.C. Non-Hazardous Waste Diverted from Disposal (Mass): Total weight of non-hazardous waste diverted from disposal in metric tons.

- A breakdown of this total by the following recovery operations should be considered: Preparation for reuse; Recycling; and, Other recovery operations.

2.C.i. Non-Hazardous Waste Diverted from Disposal Due to Preparation for Reuse (Mass): Total weight of non-hazardous waste diverted from disposal due to preparation for reuse in metric tons.

- Preparation for Reuse is defined as checking, cleaning, or repairing operations, by which products or components of products that have become waste are prepared to be put to use for the same purpose for which they were conceived.

2.C.ii. Non-Hazardous Waste Diverted from Disposal Due to Recycling (Mass): Total weight of non-hazardous waste diverted from disposal due to recycling in metric tons.

- Recycling is defined as any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes. It includes the reprocessing of organic material but does not include energy recovery and the reprocessing into materials that are to be used as fuels or for backfilling operations.

2.C.iii. Non-Hazardous Waste Diverted from Disposal Due to Other Recovery Operations (Mass): Total weight of non-hazardous waste diverted from disposal due to other recovery operations in metric tons.

- Recovery is defined as an operation wherein products, components of products, or materials that have become waste are prepared to fulfill a purpose in place of new products, components, or materials that would otherwise have been used for that purpose.
- Note: In the context of waste reporting, recovery operations do not include energy recovery.

Note: Chemical Processing for Recycling, which is defined as the processing of carbon-based materials such as plastics repolymerization where the majority of input materials are recovered as new polymers not intended for fuels, is considered under Recycling for the purposes of this guidance. See Appendix A for more information on different chemical recycling technologies and their associated outputs.

Note: Organizations reporting in accordance with GRI Standards may wish to consider also reporting a breakdown of the total weight of hazardous waste and non-hazardous waste diverted from disposal via each listed recovery method both onsite and offsite.

- In the context of the GRI Waste Standard, 'onsite' means within the physical boundary or administrative control of the reporting organization, and 'offsite' means outside the physical boundary or administrative control of the reporting organization.
- GRI suggests that reporting on the quantity and type of waste diverted from disposal onsite and offsite shows the extent to which the organization knows how its waste is managed.

Waste Disposal Metrics

Disposal is the end-of-life management of discarded products, materials, and resources in a sink or through a chemical or thermal transformation that makes these products, materials, and resources unavailable for further use. Disposal is generally considered the least preferable option in the waste management hierarchy as it prevents the materials present in the waste from being recirculated in the environment and economy. In the context of waste reporting, incineration (with or without energy recovery) and reprocessing of materials for fuels are considered disposal operations.

3. Total Waste Directed to Disposal [Non-Recovered Waste] (Mass): Total weight of waste directed to disposal in metric tons.

- For the purposes of this guidance, total waste directed to disposal is synonymous with total non-recovered or non-recycled waste.
- A breakdown of this total by composition of the waste should be considered. It is recommended to prioritize inclusion of a breakdown by the type of waste, such as hazardous waste or non-hazardous waste, as this information as this information is needed to support additional waste-related questions in various sustainability reporting frameworks.

3.A. Percentage of Waste Directed to Disposal [Non-Recovered Waste] (Percent): the percentage of total waste, by weight, that has been directed to disposal.

- For the purposes of this guidance, percentage of waste directed to disposal is synonymous with percentage of non-recovered or non-recycled waste.
- Calculated as the weight of total waste that has been directed to disposal divided by the total weight of waste generated within the boundary of the owned activities of the reporting organization.

Hazardous Waste Disposal Metrics

3.B. Hazardous Waste Directed to Disposal (Mass): Total weight of hazardous waste directed to disposal in metric tons.

- Disposal is defined as any operation which is not recovery, even where the operation has as a secondary consequence the recovery of energy.

3.B.i. Hazardous Waste Directed to Disposal Due to Incineration with energy recovery (Mass): Total weight of hazardous waste directed to disposal due to Incineration *with* energy recovery in metric tons.

- Incineration is defined as the controlled burning of waste at high temperature. It is with energy recovery when the energy created in the combustion process is harnessed for re-use, for example for power generation.

3.B.ii. Hazardous Waste Directed to Disposal Due to Incineration without energy recovery (Mass): Total weight of hazardous waste directed to disposal due to Incineration *without* energy recovery in metric tons.

- Incineration is defined as the controlled burning of waste at high temperature. It is without energy recovery when the heat generated by combustion is dissipated in the environment.

3.B.iii. Hazardous Waste Directed to Disposal Due to Landfilling (Mass): Total weight of hazardous waste directed to disposal due to landfilling in metric tons.

- **Landfilling:** final depositing of solid waste at, below, or above ground level at engineered disposal sites. Note: In the context of waste reporting, landfilling refers to depositing of solid waste in sanitary landfills, and excludes uncontrolled waste disposal such as open burning and dumping.

3.B.iv. Hazardous Waste Directed to Disposal Due to Other Disposal Operations (Mass): Total weight of hazardous waste directed to disposal due to other disposal operations in metric tons.

- Disposal is defined as any operation which is not recovery, even where the operation has as a secondary consequence the recovery of energy. This metric covers any disposal operations not included within the scope of incineration and/or landfilling, such as dumping, open burning, or deep well injection.

Non-Hazardous Waste Disposal Metrics

3.C. Non-Hazardous Waste Directed to Disposal (Mass): Total weight of non-hazardous waste directed to disposal in metric tons.

- Disposal is defined as any operation which is not recovery, even where the operation has as a secondary consequence the recovery of energy.

3.C.i. Non-Hazardous Waste Directed to Disposal Due to Incineration with energy recovery (Mass): Total weight of hazardous waste directed to disposal due to Incineration *with* energy recovery in metric tons.

- Incineration is defined as the controlled burning of waste at high temperature. It is with energy recovery when the energy created in the combustion process is harnessed for re-use, for example for power generation.

3.C.ii. Non-Hazardous Waste Directed to Disposal Due to Incineration without energy recovery (Mass): Total weight of non-hazardous waste directed to disposal due to Incineration *without* energy recovery in metric tons.

- Incineration is defined as the controlled burning of waste at high temperature. It is without energy recovery when the heat generated by combustion is dissipated in the environment.

3.C.iii. Non-Hazardous Waste Directed to Disposal Due to Landfilling (Mass): Total weight of non-hazardous waste directed to disposal due to landfilling in metric tons.

- **Landfilling:** final depositing of solid waste at, below, or above ground level at engineered disposal sites. Note: In the context of waste reporting, landfilling refers to depositing of solid waste in sanitary landfills, and excludes uncontrolled waste disposal such as open burning and dumping.

3.C.iv. Non-Hazardous Waste Directed to Disposal Due to Other Disposal Operations (Mass): Total weight of non-hazardous waste directed to disposal due to other disposal operations in metric tons.

- Disposal is defined as any operation which is not recovery, even where the operation has as a secondary consequence the recovery of energy. This metric covers any disposal operations not included within the scope of incineration and/or landfilling, such as dumping, open burning, or deep well injection.

Note: Chemical Processing for Fuel, which is defined as any type of process that converts most of the carbon included in plastics into a syngas and/or other fuel, is considered a disposal operation for the purposes of this guidance. See Appendix A for more information on different chemical recycling technologies and their associated outputs.

Note: Organizations reporting in accordance with GRI Standards may wish to consider also reporting a breakdown of the total weight of hazardous waste and non-hazardous waste directed to disposal via each listed disposal method both onsite and offsite.

- In the context of the GRI Waste Standard, 'onsite' means within the physical boundary or administrative control of the reporting organization, and 'offsite' means outside the physical boundary or administrative control of the reporting organization.
- GRI suggests that reporting on the quantity and type of waste diverted from disposal onsite and offsite shows the extent to which the organization knows how its waste is managed.

Conclusion

At the basis of an evaluation of zero waste progress is a clear understanding of the total waste generated by an entity and the percentage of that total that has been diverted from certain disposal operations. The purpose of this guidance document is to outline common automotive industry-supported definitions and approaches for measuring and reporting on waste generated within the boundary of the owned activities of the reporting organization, consistent with those approaches outlined in established standards / frameworks. It is intended to support companies who are seeking to report their own waste-related data, or request waste-related data from their supply chain, in alignment with established international corporate sustainability reporting best practices.

Acknowledgements

This guidance document was produced through a collaborative process by the Suppliers Partnership for the Environment (SP) Sustainable Materials Work Group Waste Metrics Subcommittee. The documents included input and review from SP members representing automakers, tiered suppliers, and recyclers.

Disclaimer

This document sets forth various findings based on information available to working group members at the time of issuance. These findings are not intended to set forth any industry rule, requirement or standard. Each Member should independently determine its own processes and practices, including, without limitation, levels, measurements, vendors, materials, equipment, energy sources, energy use, emissions, and recyclability. It is the responsibility of each individual company to be aware of national and local regulations that may require reporting of waste-related information using specific methods and formats.

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Frequently Asked Questions

Does a reusable pallet become a "waste" after it is used once?

A reusable pallet is considered a product throughout its first intended lifecycle of regular recirculation and reuse. A reusable pallet only becomes a waste when the holder discards it, i.e. deems the pallet is no longer fit for its original purpose. If a reusable pallet that has been discarded, or is intended to be discarded, at the end of its useful life is directed to an operation to be checked, cleaned, repaired and/or remanufactured and is then deemed fit for use again for its original purpose as a reusable pallet, this pallet would be considered recovered.

If someone pays us $1 for a waste does that mean it is no longer a waste and it is a product? Our company gets paid for some of our scrap from operations. Is scrap a waste (that goes to recycling) or not a waste because we received money?

The determination of whether an item is a waste is not linked to its economic value. Proper waste management may result in a cost or a rebate depending on a variety of factors. Waste is defined as any substance or object which the holder discards, intends to discard, or is required to discard. This may include material discarded by an end consumer (post-consumer) or material diverted from the waste stream during a manufacturing process (pre-consumer), excluding internal reuse of materials that are reclaimed within the same process that generated it. In this case, scrap generated from a manufacturing operation which is not internally reclaimed within the same process that generated it is considered a waste regardless of its value as a recycled commodity.

Is a material re-used/recycled in-house considered as part of Waste Diverted from Disposal? For example, for extrusion process we have a re-grind operation in the building. For off spec production we re-grind and recycle this material back into our feedstock. The alternative is that we send the off-spec material offsite where it is re-ground and then sent back to us to be used in our feedstock. If in-house option – did we recycle? Do we need to consider it as a waste at all?

Internal reuse of materials reclaimed *within the same process* that generated it without any change to composition or form, only changes to size, should not be considered as waste diversion. This material is considered equivalent to virgin material. This is true even if the material resizing is done by a third-party or as a contracted service. **Regrind**[1] and **rework**[2] alone are not considered waste diversion if they are being used to produce the same product or component. They can be considered waste diversion if they are used to produce a different product or component. They can also be considered waste diversion if they go through another process (secondary process) prior to use with the same product or component. A secondary process may include mechanical or advanced recycling processes, alloying, contamination removal, or blending and represents more processing than simply resizing a segregated material (size reduction). Materials processed in this way will have some change in form or composition. See “Guidance on Measuring Recycled Content of Automotive Products” for more information on this topic.

[1] **Regrind:** Recovered material that has been used at least once in a manufacturing process and has gone through a size reduction process to be made into smaller pieces for reuse into the same product from which it was generated.

[2] **Rework:** Materials or products that did not meet specifications upon exiting a process and require one or more tasks to be completed to correct the errors before entering the next processing step or finished goods inventory.

Is wastewater trucked offsite for disposal/solidification included in the definition of effluent and thereby excluded from waste reporting?

The 2020 GRI 306 Waste Standard directs sustainability reporters to exclude effluent (defined as treated or untreated wastewater that is discharged) under waste reporting, unless required by national legislation to be reported under total waste. GRI separately provides guidance on handling of such effluents in GRI 303: Water and Effluents. However, if wastewater is trucked offsite for disposal or solidification, it would typically be included under the definition of a waste rather than effluent. This is because it is being managed as a material that requires disposal, and not a liquid waste which is discharged into the environment or into water treatment facilities. It is the responsibility of each individual company to be aware of relevant national and local regulations and develop their wastewater reporting processes in context of such regulations.

Regarding Incineration with Energy Recovery, all incineration will create heat. How do we define what usable heat is in this instance (i.e. cement kiln fuel replacement). A massive waste incinerator could divert <1% of the heat generated to a guard shack next door for comfort heating – is this heat recovery?

Incineration with energy recovery is defined as when energy created in the combustion process is harnessed for re-use, such as for power generation. Absent a more specific threshold for energy recovery or usable heat, it is at the discretion of each company to determine which disposal technologies they deem to meet the definition of incineration with energy recovery. The example provided of <1% heat recovery would not appear to meet the definition in good faith. As a reference point, according to the US EPA, a typical waste to energy (WTE) plant in the United States generates about 550 kilowatt hours (kWh) of energy per ton of waste. In certain regions, systems exist to accredit waste to energy facilities based on the energy efficiency factor of the incinerator.

Why is incineration with energy recovery reported under "disposal" vs. "recovery"?

This document is intended to provide guidance on measuring and reporting on waste consistent with the approaches outlined in established sustainability reporting standards / frameworks relevant to the automotive industry. Various frameworks, including GRI, SASB, and the EU's Corporate Sustainability Reporting Directive, clearly define incineration as a disposal operation regardless of whether energy is recovered in the process. Companies wishing to publish sustainability data in alignment with such frameworks should take this into consideration when reporting waste diversion and disposal data. Separately, many companies have established waste ambitions / programs, such as achieving zero waste to landfill status, which may consider a broader range of disposition pathways as they deem appropriate. See Appendix B for examples of some of the different zero waste certification standards that may be considered, in addition to reporting of waste diversion and disposal data.

Appendix A: Advanced Recycling

There are several technologies that fall under the category of advanced recycling, also referred to as chemical recycling. These technologies use heat, pressure, and/or chemicals to convert waste plastics into end products that can potentially be further reprocessed into virgin-like quality plastic. They can generally be grouped into the categories of purification, solvolysis and pyrolysis.

The following information is adapted from the report, *Automotive Plastic Packaging: Playbook for Moving Toward a Sustainable Circular Economy*, prepared by Resource Recycling Systems (RRS) under contract to Suppliers Partnership for the Environment (SP).

Purification

Purification (sometimes called dissolution) uses a solvent and a series of physical purification steps to separate a target plastic from additives, colorants, or other contaminants. Different purification technologies use single-polymer feedstock (e.g., polypropylene (PP) or multi-resins (e.g., polyethylene (PE)/polypropylene (PP), or polyamide (nylon)(PA)/polypropylene (PP) films.)). The result is a purified polymer enabling a plastic-to-plastic outcome. While this process can produce a food-grade and other high-quality polymers, there is still some thermal degradation induced, although less than mechanical recycling, suggesting some limitations to circularity remain.

The energy and material inputs are slightly higher than those in mechanical recycling, but the product is closer to virgin-like quality resulting in a similar environmental benefit to mechanical recycling. However, purification technologies are less mature with most in the pilot or early commercialization stage as of 2024.

Solvolysis

Solvolysis involves breaking down the long polymer chains that make up plastic into monomers, through chemical treatments. Monomers are precursors to polymers and can be repolymerized to produce clear virgin-quality plastics. There are several types of solvolysis processes often denoted by the solvent used (e.g., methanolysis, glycolysis, and enzymatic hydrolysis).

Solvolysis requires single resins and is primarily applied to condensation polymers including polyesters (PET), polyamides (PA), polyurethanes (PUs), and polycarbonates (PCs). It is much more challenging for polymers that have a strong carbon-carbon bond, like polyolefins [e.g., polyethylene (HDPE, LDPE) and polypropylene (PP)] or polyvinyl chloride (PVC).

The monomers can be reprocessed into plastics, creating virgin-like quality suitable for food-grade applications. Because additional steps are required to transform the monomers to polymers, additional material and energy inputs are required and additional waste is generated, which can lead to higher environmental impacts. The current state of the various technologies varies from experimental to prototype demonstration level.

Pyrolysis

Pyrolysis involves heating the plastic without oxygen, breaking the polymer chains into simpler molecules (or sometimes monomers). The output consists of a range of hydrocarbons typically comprised of a liquid output (pyrolysis oil, or "pyoil") and a gas that is usually reinvested to heat the reactor, along with inert solids, which are currently typically disposed as a waste product. The pyoil can be processed in much the same way as fossil-based oil (i.e., naphtha), using conventional refining infrastructure and technologies. The materials best suited for pyrolysis include polyethylene (HDPE/LDPE), PP, and PS. Certain plastics, including PET, ABS, Nylon and PVC, do not convert under pyrolysis into value-creating hydrocarbon, and can crystallize or gel, clogging the pyrolysis reaction equipment and creating operational challenges. In addition, inorganic additives, such as carbon black, carbonate, and clay can adversely impact the quality of the pyrolysis oil and create greater amount of inert solids, and are therefore limited as inputs to pyrolysis. Currently, most of the chemical recycling plants in the U.S. using pyrolysis are in the Midwest and Southern U.S.

Pyrolysis can accept mixed streams of PE, PP and PS feedstocks, which are a more practical and likely outcome of a program for diverting plastics at plants along the auto supply chain. However, the presence of incompatible resins in the stream, such as PET trays, requires a step to sort that out of the stream, either at the plant or as a pre-sort at the recycling plant.

Pyrolysis to Feedstock / Plastic to Plastic (P2P)

When the pyrolysis oil is used to manufacture plastics, it is referred to as pyrolysis to feedstock (or plastic to plastic [P2P]) recycling. The process typically replaces a portion of fossil-based oil with pyrolysis oil and then requires additional energy to repolymerize the hydrocarbons back into plastic, noting that the additional process steps will experience the typical yield losses associated with the production of the plastic from a fossil-based oil. The resulting plastic is equivalent to virgin quality, leading to a wider range of end-use applications and higher potential for circularity.

Although pyrolysis technology has been utilized in other industries for quite some time, the use of pyrolysis to convert plastics into their original hydrocarbon building blocks is relatively new and still in its nascent stage with mostly pilot scale or small commercial units. And as such, there is limited data on commercial plastic to feedstock pyrolysis processes. However, the data suggests that both the conversion yield and quality of the pyrolysis oil are highly dependent upon the quality of the feedstock input. This influences life cycle analysis (LCA) results along with assumptions regarding the avoidance of alternative waste treatment for plastic, regional grid mix, and treatment of co-products. As a result, there is a wide range of reported climate impacts for pyrolysis to feedstock.

A meta-study conducted by Sphera reviewed 15 LCAs from 2003 to 2023. It found that the carbon footprint of the pyrolysis of plastic waste from a range of pilot and small commercial units was generally higher than mechanical recycling and lower than incineration or landfill. The benefit is typically seen in regions where incineration of plastic is an end-of-life treatment (landfill is more common in the U.S. with incineration estimated at only about 20%). A more recent 2023 study completed by Argonne National Labs, a division of the US Department of Energy, indicated that an industrial scale pyrolysis facility could have a reduced carbon footprint compared to fossil-based oil and provide a lower GHG impact than making plastics from petroleum sources. So, while pyrolysis processes can accommodate a variety of mixed polyolefin streams, divert hard to recycle plastics from landfill and incineration, and create potentially virgin-quality plastic, the net environmental impact and economic viability both need to be validated as the technology achieves industrial scale in the coming years.

Plastic to Fuel (P2F)

When the output of pyrolysis is used to produce fuel, it is termed plastic to fuel (P2F). In this case the hydrocarbon outputs are used to produce energy or refined into fuels. This can often be achieved through changes in the process parameters and feedstock and is therefore subject to market forces.

Co-processing in cement kilns involves using plastic-content waste as an alternative fuel and raw material in the cement manufacturing process. High temperatures in the kiln convert the plastic into energy that powers the kiln and contributes to the calcination process. While these strategies capture some of the value of waste plastic as a form of energy, it does not keep the resources in use or eliminate the use of virgin plastic and is therefore not considered to be circular. They do provide a treatment alternative to landfill or incineration, however.

Mechanical Recycling

While various chemical recycling technologies are emerging, the dominant technology for recycling plastic presently is mechanical recycling. In this process, reclaimed plastic is reground and extruded to form pellets with no significant change to the plastic's chemical structure. This process generally has low material and energy inputs and provides an environmental benefit relative to virgin pellets. Mechanical recycling works best on pure materials, single polymers with low levels of contamination. In the U.S., established markets exist for polyethylene terephthalate (PET) and high-density polyethylene (HDPE) with newer regional markets for polypropylene (PP) and plastic film (LLDPE, LDPE). Mechanical recycling is not suitable for thermoset polymers (such as polyester and silicone).

The high temperatures and sheer force of the extrusion process causes a degradation in physical properties with each cycle which limits the suitability of mechanically recycled material for certain applications. For this reason, while mechanical recycling may extend the useful life of polymers, it is limited in its ability to infinitely cycle resources.

This has led to the distinction of two classes of mechanical recycling based on end-use applications.

Closed-loop recycling utilizes the recyclate to make the same or similar products thereby replacing the use of virgin plastic. In contrast, **open-loop recycling** repurposes the recyclate into different products, allowing for a broader range of applications but often resulting in a one-time recycled product rather than an infinite cycle. Furthermore, the environmental benefit of open-loop recycling is dependent upon the impact of the substituted material (e.g., wood decking, metal in pipes, etc.). It is generally a lower environmental benefit than close-loop recycling.

Appendix B: Zero Waste Standards & Certifications

Several organizations within the automotive industry have announced aspirations toward achieving zero waste from their operations. There are several different third-party frameworks which may be used to support evaluation of zero waste progress, some of which are summarized below. There is not currently an industry consensus standard regarding this topic.

Note that SP is not endorsing or recommending any particular model or organization listed in this document but only providing information on some of the available options that may be considered.

- **Zero Waste International Alliance (ZWIA):** ZWIA has developed a peer-reviewed definition and principles describing what Zero Waste means and measures to evaluate its success. It defines Zero Waste as "The conservation of all resources by means of responsible production, consumption, reuse, and recovery of products, packaging, and materials without burning and with no discharges to land, water, or air that threaten the environment or human health." There are different levels of potential recognition under ZWIA for businesses that achieve different levels of diversion of discarded materials. All levels require diversion from landfills and incinerators, and that materials are reduced, reused, recycled, composted or recovered for productive use in nature or the economy at biological temperatures and pressures. Learn more at: https://zwia.org/zero-waste-definition/

- **Green Business Certification Inc. (GBCI) TRUE (Total Resource Use and Efficiency):** TRUE is a Zero Waste certification program dedicated to measuring, improving and recognizing zero waste performance. Among TRUE's requirements for certification is that a project has achieved an average of 90 percent or greater overall diversion from landfill, incineration (waste-to-energy) and the environment for solid, non-hazardous wastes for the most recent 12 months. Diverted materials are reduced, reused, recycled, composted and/or recovered for productive use in nature or the economy. TRUE's Certification aligns with the ZWIA definition of Zero Waste. Learn more at: https://true.gbci.org/

- **UL Zero Waste to Landfill Validation:** UL 2799A, the Standard for Environmental Claim Validation Procedure (ECVP) for Zero Waste Classification requires each facility of an organization to prove at least 90% diversion through methods other than waste to energy for that facility to achieve Zero Waste to Landfill (ZWTL) designations (Silver, Gold, Platinum). Facilities that do not achieve greater than 90% diversion may receive a Landfill Waste Diversion claim, according to UL 2799, the Standard for Environmental Claim Validation Procedure (ECVP) for Zero Waste to Landfill. Learn more at: https://www.ul.com/services/ul-2799-landfill-waste-diversion-claim-validations

- **GreenCircle Certification:** At GreenCircle Certified, Zero Waste to Landfill means that a company or manufacturing facility has diverted 100% of its waste from going to landfill. As part of GreenCircle's evaluation process, a review of all waste materials generated by the facility will be conducted to understand total material flows and management of materials; this will include municipal solid, residual, hazardous and universal waste. GreenCircle will also validate a percentage of waste a company or manufacturing facility diverts from landfill. Learn more at: https://www.greencirclecertified.com/operations-certifications

Appendix C: Figures

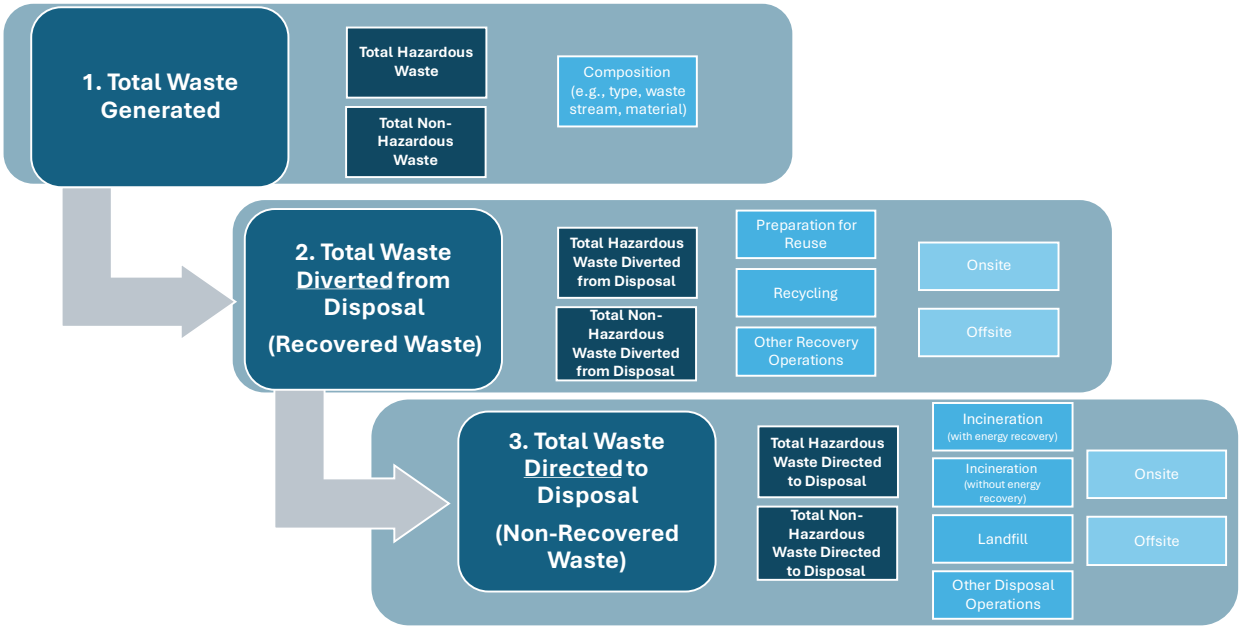

Figure 1: High-Level Example of Waste Metrics Process Flow

	GRI 306	ESRS ES-5	SASB TR-AU	SASB TR-AP	M2030 Auto
Total Waste Generated (Mass)	X	X	X	X	
-Hazardous Waste Generated (Mass)	X	X		X	X
-Non-Hazardous Waste Generated (Mass)	X	X			X
-Percentage of Hazardous Waste (Percent)				X	
Total Waste Diverted from Disposal (Mass)	X	X		X	
-Hazardous Waste Diverted from Disposal (Mass)	X	X			
--- Hazardous Waste Diverted from Disposal Due to Preparation for Reuse (Mass)	X	X			
--- Hazardous Waste Diverted from Disposal Due to Recycling (Mass)	X	X			
--- Hazardous Waste Diverted from Disposal Due to Other Recovery Operations (Mass)	X	X			
-Non-Hazardous Waste Diverted from Disposal (Mass)	X	X			
--- Non-Hazardous Waste Diverted from Disposal Due to Preparation for Reuse (Mass)	X	X			
--- Non-Hazardous Waste Diverted from Disposal Due to Recycling (Mass)	X	X			
--- Non-Hazardous Waste Diverted from Disposal Due to Other Recovery Operations (Mass)	X	X			
-Percentage of Recovered [Recycled] Waste (Percent)			X	X	
Total Waste Directed to Disposal (Mass)	X	X			
-Hazardous Waste Directed to Disposal (Mass)	X	X			X
--- Hazardous Waste Directed to Disposal Due to Incineration with energy recovery (Mass)	X	X			
--- Hazardous Waste Directed to Disposal Due to Incineration without energy recovery (Mass)	X	X			
--- Hazardous Waste Directed to Disposal Due to Landfilling (Mass)	X	X			
--- Hazardous Waste Directed to Disposal Due to Other Disposal Operations (Mass)	X	X			
-Non-Hazardous Waste Directed to Disposal (Mass)	X	X			X
--- Non-Hazardous Waste Directed to Disposal Due to Incineration with energy recovery (Mass)	X	X			
--- Non-Hazardous Waste Directed to Disposal Due to Incineration without energy recovery (Mass)	X	X			
--- Non-Hazardous Waste Directed to Disposal Due to Landfilling (Mass)	X	X			
--- Non-Hazardous Waste Directed to Disposal Due to Other Disposal Operations (Mass)	X	X			
-Percentage of Non-Recovered [Non-Recycled] Waste (Percent)		X			

Figure 2: Summary of Relevant Waste Metrics within External Reporting Frameworks

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