REGIONAL GUIDEBOOK

Standards for Responsible Plastic Waste Trade, Sorted Plastics and Recycled Plastics



SEA-MaP
SOUTHEAST ASIA REGIONAL PROGRAM ON COMBATING MARINE PLASTICS

An ASEAN project supported by the World Bank

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Research for this Guidebook was completed before 26 October 2025, when **Timor-Leste** formally joined the **Association of Southeast Asian Nations (ASEAN)**. Consequently, this Guidebook does not include Timor-Leste–specific member state information. However, the background information, risk management approaches, technical context and practical guidance remain relevant to all ASEAN Member States, including Timor-Leste.

RATIONALE FOR THE GUIDEBOOK

The **Regional Action Plan for Combating Marine Debris** is a four-year (2021-2025) ASEAN initiative which aims to provide a comprehensive framework to address marine plastic pollution in Southeast Asia. It consists of four overarching components within which fourteen regional actions sit.

The **Southeast Asia Regional Program on Combating Marine Plastics (SEA-MaP)** was established in 2022 with the aim of supporting implementation of the Regional Action Plan. With funding from the World Bank and support from the United Nations Office for Project Services (UNOPS), it works to reduce plastic consumption, increase recycling and minimize leakage of plastics into the environment.

This **Regional Guidebook on Standards for Responsible Plastic Waste Trade, Sorted Plastics and Recycled Plastics (the Guidebook)**, falls under component one of the SEA-MaP program. It is also listed as a specific action in the ASEAN Regional Action Plan as part of the Policy Support and Planning framework component.

The overall purpose of the Guidebook is to provide ASEAN Member States with a reference document to assist them in better controlling the import, export and management of plastic waste. The intended audience includes government officials, policy makers and customs officials, plastics recyclers and waste managers, and non-governmental organizations.

The Guidebook is intended to provide a comprehensive reference for responsible plastic waste management in the ASEAN region. It includes, for example, information and guidance on:

- Plastic waste collection, sorting, recycling and trading along the value chain
- Technical quality standards, labelling and traceability
- Import and export requirements, and
- International and national legal frameworks

The Guidebook provides critical principles for responsible waste trade, technical and capacity requirements relevant to plastic waste quality standards, and suggestions for harmonization across the ASEAN region.

THE ROLE OF ASEAN

The Association of Southeast Asian Nations (ASEAN) is a regional intergovernmental organisation founded in 1967, in Bangkok, Thailand. Its primary purpose is to promote economic growth, cultural exchange, peace and stability among its member countries in Southeast Asia. There are currently 11 ASEAN Member States (AMS), with a collective population of over 700 million people. It is home to some of the world's fastest-growing economies and is considered the world's fifth-largest economy.

The ASEAN Strategic Plan on Environment (ASPEN) is the region's overarching framework guiding environmental cooperation among ASEAN Member States. It translates high-level political commitments into structured programmes, targets and priority actions.

ASPEN sets out strategic priorities across key thematic areas, including climate change, biodiversity, coastal and marine environment, chemicals and waste, environmental education, and sustainable cities. It operates under the ASEAN Socio-Cultural Community Blueprint and provides direction to technical working groups and ministerial bodies.

In relation to plastics, **ASEAN has moved from general marine debris commitments towards strengthening responsible plastic waste recycling systems.** Political direction is set through instruments such as the **Bangkok Declaration on Combating Marine Debris** and operationalised via the **Regional Action Plan for Combating Marine Debris in the ASEAN Member States (2021–2025)**. While these frameworks address pollution broadly, they emphasise upstream design, improved collection, environmentally sound recycling and circular economy approaches as essential responses.

ASEAN's role is primarily one of coordination and alignment rather than enforcement. It facilitates harmonisation of definitions, technical standards and monitoring methodologies, helping AMS reduce regulatory fragmentation and strengthen markets for secondary materials. Through technical groups such as the **ASEAN Working Group on Coastal and Marine Environment**, Member States can discuss how they have designed and implemented different waste management systems.

Capacity development is another key function. ASEAN convenes regional workshops, develops guidance materials and supports knowledge platforms that enable AMS to adapt proven recycling models to national circumstances. It can also assist in developing comparable data systems to track plastic flows and recycling performance across the region.

Furthermore, the **Framework for Circular Economy for the ASEAN Economic Community** sets out a regional roadmap to promote resource efficiency, sustainable production, and waste reduction across ASEAN. It prioritises standards harmonisation, innovation, sustainable finance, and trade in circular goods and services to support resilient economic growth.

ASEAN is therefore a key player in promoting responsible plastic waste recycling across its Member States.

GUIDEBOOK SCOPE

This Guidebook provides good practice technical and regulatory guidance on plastic waste collection, sorting, recycling and trading in ASEAN Member States (AMS).

It focuses on the collection, sorting and recycling of plastic waste, transboundary movements (i.e. imports, exports and transit movements) of plastic waste originating from outside and within the ASEAN region, and recycled plastics (recyclates), to be used in the manufacturing of new products.

To make the Guidebook user-friendly, it is structured around the **plastic waste value chain**, with information and guidance aligned to each stage of the chain.

The diversity of plastic products placed on the market (POM), and the different ways in which they are managed across the AMS region, necessarily meant that certain assumptions needed to be made:

Firstly, most of the guidance relates to **post-consumer plastic packaging waste**. This is because these fractions make up most of the waste plastic in the region. Items such as waste electrical and electronic equipment (WEEE), healthcare products and textiles all contain significant amounts of plastic; however, other components need to be prioritised before the plastics fractions are sent for recycling or disposal.

For example, removal of printed circuit boards and computer silicon chips from WEEE are prioritised due to their much higher value and material scarcity; similarly, pathogens, pharmaceuticals and bodily liquids necessitate prioritisation when present in healthcare wastes.

Secondly, the operation of both the formal and informal waste sectors have been assumed to work in parallel alongside each other. In most southeast nations, informal waste pickers play a pivotal role in the collection of plastic waste; from homes and businesses in wealthy neighbourhoods to dumpsites which form the main waste disposal method across the region. In some cities and in Singapore, the informal waste sector does operate, but in a more integrated and regulated manner compared to the baseline. Furthermore, most nations are starting to modernise their waste infrastructure, moving from polluting dumpsites to sanitary **engineered landfill sites.**

As this Guidebook considers both the formal and informal sectors, readers should be able to find information relevant to their specific local situation. Moreover, as the final disposal of waste not intended for recycling falls outside of the scope of this document, it remains relevant to a wide range of socio-economic areas having different disposal infrastructure in place.

Finally, information and reference to standards in this Guidebook relate to **mechanical recycling** techniques, as this is the dominant method globally and it is well established across Southeast Asia. However, in recent years, **chemical recycling** is beginning to emerge as an alternative, in particular for multi polymer products and those that are inherently contaminated; whilst compostable and biodegradable plastics are also finding use in food packaging applications and as alternatives to single-use plastic food service items. The intent has not been to ignore these innovative approaches, but to provide targeted guidance and information that is of relevance to today's plastics collectors, traders and recyclers.

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GUIDEBOOK STRUCTURE & NAVIGATION

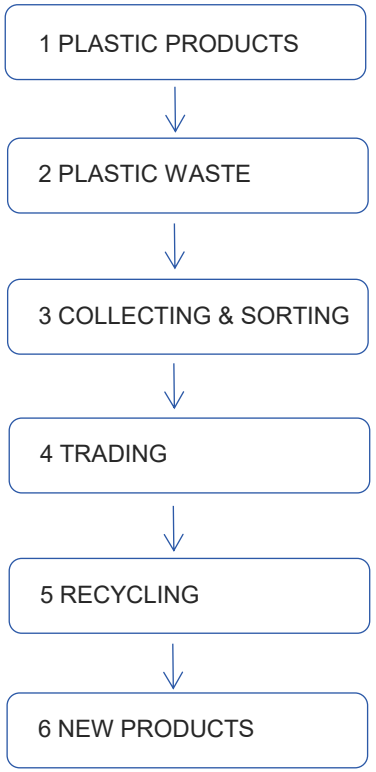
This Guidebook presents a comprehensive collection of information, guiding principles, practical recommendations, and country-specific insights on the sustainable management and recycling of plastic waste.

Given the breadth of its scope, not all sections will be relevant to every reader. Instead, users are encouraged to navigate directly to the topics most relevant to their role or area of interest.

To support this, the Guidebook is presented in a 'SlideDoc' format, designed to be both logical and user-friendly. Hyperlinks are included throughout to enable easy navigation between sections.

The structure is based on the plastic waste value chain, which serves as the document's central organising framework. Country-specific and more general content is provided towards the end of the Guide and is cross-referenced where relevant. This approach aims to help readers quickly locate the information most pertinent to their specific context or information needs.

PLASTIC WASTE VALUE CHAIN



This button takes the reader back to the main **GUIDEBOOK CONTENTS**

GUIDEBOOK DESIGN

The Guidebook has been laid out using colour-coding as shown below. This should assist the reader to navigate the information in the Guidebook and to cross-refer to different sections.

TECHNICAL CONTEXT	**WHITE PAGES** CONTAIN INFORMATION SETTING OUT THE TECHNICAL CONTEXT
GUIDANCE & SUPPLEMENTARY INFORMATION	**BLUE PAGES** CONTAIN GUIDANCE AND SUPPLEMENTARY INFORMATION
ABBREVIATIONS & DEFINITIONS	**YELLOW PAGES** CONTAIN ABBREVIATIONS AND DEFINITIONS
GOOD PRACTICE CASE STUDIES	**GREEN PAGES** CONTAIN GOOD PRACTISE CASE STUDIES
AMS SPECIFIC INFORMATION	**RED PAGES** CONTAIN ASEAN MEMBER STATE SPECIFIC INFORMATION

STRUCTURE OF CHAPTERS 3, 4 AND 5

The chapters covering the three Critical Control Points are organised as follows:

TECHNICAL & POLICY CONTEXT

This sets out essential technical information and the policy context necessary to understand how to manage quality.

MANAGING QUALITY

This describes how practitioners can measure, monitor and control the quality of plastic waste necessary for quality recycling. It assumes that the stage in the plastic waste value chain is a Critical Control Point.

GUIDANCE

Practical guidance, including checklists and links to published documents are included in this sub-section. These sections are useful for practitioners.
These pages are blue.

3. PLASTIC WASTE COLLECTION & SORTING (CCP1)

- 3.1 Technical Context: Collecting Plastics Waste
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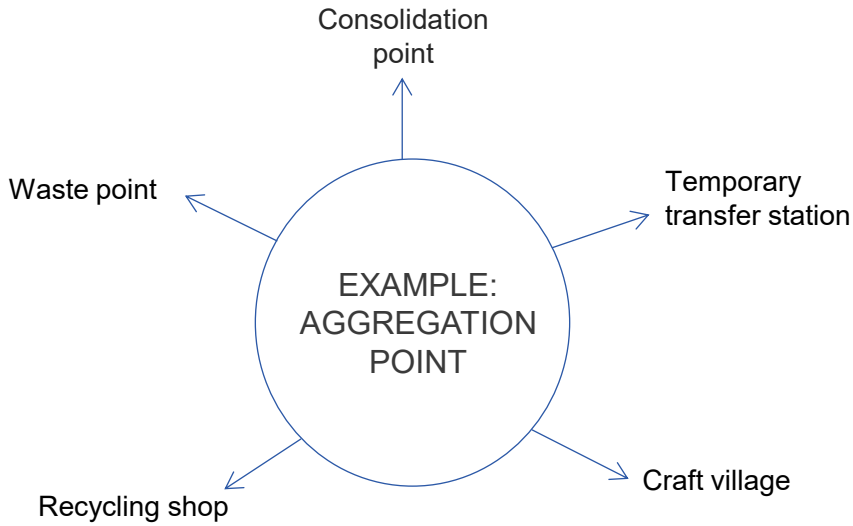
5. PLASTIC WASTE RECYCLING (CCP3)

- 5.1 Technical Context: Recycling Methods & ESM
- 5.2 Technical Context: Recycled Plastics Quality Standards
- 5.3 Managing Quality: CCP3
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A NOTE ON TERMINOLOGY

Across the eleven ASEAN Member States, different terms may be used to describe similar practices, infrastructure and materials. Some of these differences result because terms are defined in legislation, whilst others reflect national and local linguistic preferences. Translation into English is an additional contributing factor.

Authors of this Guidebook have endeavoured to describe processes and practices consistently, using, as far as possible, terminology that is both logical and defined internationally (such as in the Basel Convention). All relevant terms have been defined in the definitions section in Appendix A.



EXECUTIVE SUMMARY



EXECUTIVE SUMMARY

This Guidebook presents a comprehensive collection of background information, guiding principles, practical recommendations and country-specific insights on the sustainable management and recycling of plastic waste in ASEAN Member States (AMS), including collection, sorting, recycling and trading.

It is intended to be of use to **policymakers** and **regulators**, **customs officials**, **private businesses**, **not-for-profit non-governmental organisations** and other practitioners seeking to improve the management and recycling plastic waste and reduce its environmental impact. The Guidebook is relevant to both the **formal** and **informal sectors** and includes guidance for both where appropriate.

The information in the Guidebook has been structured around the **plastic waste value chain**, which serves as the document's central organising framework.

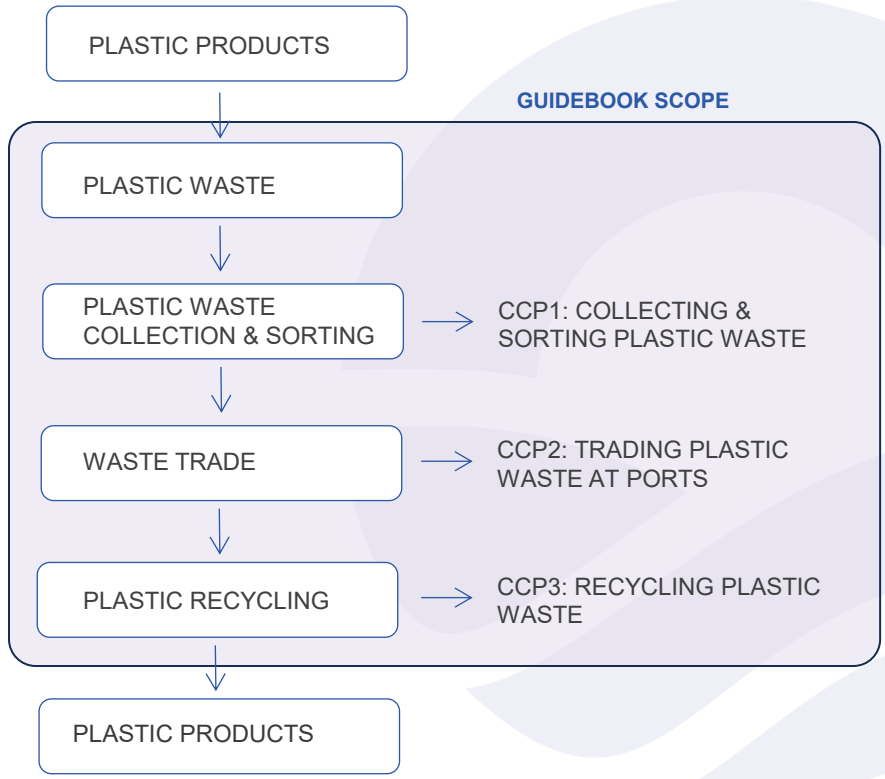
CONCEPTUAL APPROACH

The quality of plastic waste intended for recycling depends on its purity; that is the extent and level of contaminating items and substances, such as different polymer types, food and drink, and potentially hazardous chemicals.

There are three steps along the plastic waste value chain where **control measures** can be introduced to reduce or limit the presence of contaminants (hazards).

These Critical Control Points (CCPs) are described in detail in this Guidebook. The principle has been adopted from the Hazard Analysis Critical Control Point (HACCP) framework that is widely employed in food manufacture and some waste management processes.

PLASTIC WASTE VALUE CHAIN



EXECUTIVE SUMMARY

1 INTRODUCTION

This chapter provides context for the Guidebook.

It includes background information on the plastics value chain, hazard analysis critical control point, critical control points, responsible plastic waste management, and the principles of preventing and managing contamination.

2 ABOUT PLASTICS

This chapter provides background information about the different plastic polymers and products, plastic waste generation, composition and trends.

It highlights how much plastic waste is generated within ASEAN Member States (22.9 million tonnes annually) and how much is imported (1.5 M tonnes in 2024; equivalent to 7% of that generated within AMS annually).

3 PLASTIC WASTE COLLECTION & SORTING

This chapter provides background information about the different plastic polymers and products, plastic waste generation, composition and trends.

It highlights how much plastic waste is generated within ASEAN Member States (22.9 million tonnes annually) and how much is imported (1.5 M tonnes in 2024; equivalent to 7% of that generated within AMS annually).

4 PLASTIC WASTE TRADE

This chapter addresses Critical Control Point 2 (CCP2) in the cross-border movement of plastic waste and recyclables.

It includes sections on waste classification requirements, import acceptance procedures at ports, transportation by road, how to manage quality and guidance documents/checklists.

5 PLASTIC WASTE RECYCLING

This chapter describes how plastic waste is recycled, some of the controls that need to be established for food contact materials, and the role quality standards play (CCP3).

It describes measures to minimise leakage of plastics into the environment and makes refence to standards, specifications and grading criteria.

APPENDICES

Appendix A: This defines the key terms and abbreviations used in the Guidebook.

Appendix B: This sets out case studies highlighting good practice across all ASEAN Member States.

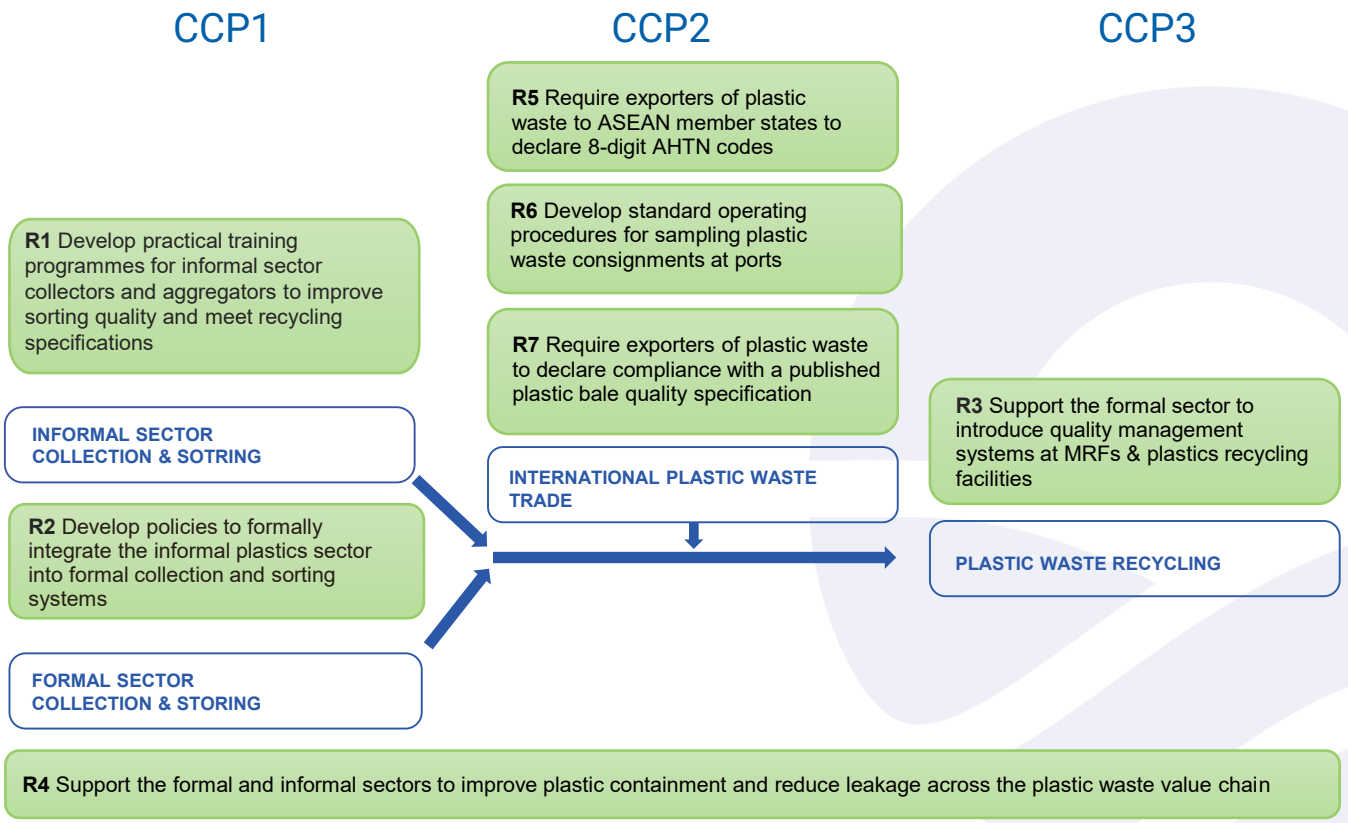
Appendix C: This provides more detailed information about the state of play across the ASEAN region.

SUMMARY OF RECOMMENDATIONS

This section sets out seven recommendations aimed at improving the quality of collected, sorted, traded and recycled plastic waste across ASEAN Member States.

The recommendations have been based on the stocktaking exercise of extant legislation, guidelines and standards, and following consultation exercises with governmental and non-governmental stakeholders.

The recommendations are summarised in this figure and are detailed on subsequent pages.



RECOMMENDATIONS



INTRODUCTION TO THE RECOMMENDATIONS

The recommendations presented in this Guidebook were developed through a structured, consultative process involving regional experts, government representatives and industry stakeholders across the plastics value chain.

These recommendations are intended to be relevant across all eleven ASEAN Member States. However, ASEAN countries operate within diverse socio-economic, regulator, and infrastructure contexts. As a result, the ease, pace, and extent of implementation will vary. Some recommendations may be relatively straightforward to adopt, particularly where existing systems are already in place, whilst others may require longer-term development, capacity building, or investment.

The recommendations also recognise the important roles of both the formal and informal sectors. Some recommendations are primarily directed at formal sector actors, such as registered businesses and regulated facilities. Others are aimed at the informal sector, which plays a significant role in plastics collection and sorting in many ASEAN Member States. Several recommendations apply to both sectors and encourage collaboration between them to strengthen overall system performance.

Certain recommendations refer to technical terms and concepts that are explained in detail later in this Guidebook. To support accessibility and ease of use, key terms are reproduced in this section to assist readers in understanding the recommendations.

Targets associated with the recommendations are designed to be SMART (Specific, Measurable, Achievable, Relevant, and Time-bound). This allows Member States to tailor implementation according to national circumstances, priorities and available resources.

Whilst individual Member States can implement the recommendations independently, the ASEAN Secretariat can play an important co-ordinating role. This may include facilitating information exchange, promoting regional consistency, and supporting the development of shared resources, such as templates, posters, and guidance materials that can be adapted into national languages.

Some recommendations may be implemented relatively quickly, at low cost, and within a short timeframe (e.g. under two years). These ‘low-hanging fruit’ are identified to help ASEAN Member States prioritise early actions, while recognising that implementation timelines and priorities will ultimately depend on national circumstances.

KEY TERMS AND ICONS USED IN THE RECOMMENDATIONS

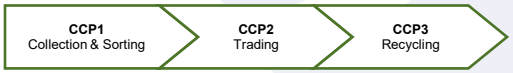
Formal sector actors
Collective term for municipal (or licensed collectors) and fully permitted/licensed aggregators and recyclers.

Informal sector actors
People who earn an income from managing waste but are not formally employed to do so.

VALUE CHAIN STAGE

The Guidebook refers to the plastics value chain, involving collection/aggregation/sorting, trading and recycling. These three stages represent Critical Control Points (CCPs); steps in the value chain where control measures can be implemented to manage quality.

The value chain is shown in the arrow diagram below, with each stage relevant to a specific recommendation shaded in green.



TARGET FACILITATORS

Target facilitators are suggested in the recommendations for clarity only and are not intended to be prescriptive. Decisions on whether and how to implement each recommendation should remain with ASEAN Member States, reflecting national priorities, governance structures and capacities.

SUMMARY OF RECOMMENDATIONS

RECOMMENDATION	TIMESCALE	TARGET SECTOR(S)	PLASTIC WASTE VALUE CHAIN POSITION
R1 Develop practical training programmes for informal sector collectors and aggregators to improve sorting quality and meet recycling specifications	Short	Informal	CCP1 Collection & Sorting; CCP2 Trading; CCP3 Recycling
R2 Develop policies to formally integrate the informal plastics sector into formal collection and sorting systems	Medium	Informal	CCP1 Collection & Sorting; CCP2 Trading; CCP3 Recycling
R3 Support the formal sector to introduce quality management systems at MRFs & plastics recycling facilities	Medium	Formal	CCP1 Collection & Sorting; CCP2 Trading; CCP3 Recycling
R4 Support the formal and informal sectors to improve plastic containment and reduce leakage across the plastic waste value chain	Medium	Formal; Informal	CCP1 Collection & Sorting; CCP2 Trading; CCP3 Recycling
R5 Require exporters of plastic waste to ASEAN member states to declare 8-digit AHTN codes	Medium	Formal	CCP1 Collection & Sorting; CCP2 Trading; CCP3 Recycling
R6 Develop standard operating procedures for sampling plastic waste consignments at ports	Medium	Formal	CCP1 Collection & Sorting; CCP2 Trading; CCP3 Recycling
R7 Require exporters of plastic waste to declare compliance with a published plastic bale quality specification	Medium	Formal	CCP1 Collection & Sorting; CCP2 Trading; CCP3 Recycling

Note to table: Short (≤2 years) Medium (2–5 years) Long (>5 years) Formal sector Informal sector

RECOMMENDATION 1:

DEVELOP PRACTICAL TRAINING PROGRAMMES FOR INFORMAL SECTOR COLLECTORS AND AGGREGATORS TO IMPROVE SORTING QUALITY AND MEET RECYCLING SPECIFICATIONS

RATIONALE

The informal sector plays an important role in ASEAN Member States, collecting plastic waste for recycling. However, the quality of plastics delivered to informal aggregators can be variable, as sorting practices and output quality differ. This reduces the quality of recycled plastics, lowers the price paid to collectors and increases rejected materials.



RECOMMENDATION 1

NGOs, the formal waste sector involved in sorting and operating materials recovery facilities (MRFs) and local government (in consultation with concerned government agencies/offices) should consider developing practical training courses for informal waste pickers/collectors and aggregators to help them identify and sort quality plastic items for recycling, including input and output specifications.

EXAMPLE ACTIVITIES MAY INCLUDE

- Face-to-face training of collectors and aggregators demonstrating the different plastic types and acceptable levels of contamination e.g. attached labels or caps
- Provision of posters/information boards showing acceptable (positive list) and unacceptable (negative/undesirable) plastics.
- Developing input and output quality specifications at aggregation points.
- Developing robust grading criteria linked to prices paid to collectors.

TRAINING COMPONENTS



VALUE CHAIN STAGE(S)



TARGET FACILITATORS

- NGOs
- Formal sector sorting/MRF operators
- Local government

TARGET STAKEHOLDERS

Informal sector waste pickers/ collectors of plastics
Informal & formal waste aggregators/ MRFs

INTENDED OUTCOME(S)

Reduced contamination & increased quality of plastic waste delivered to aggregation points

Increased value & pay for collectors

Reduced rejection rates at aggregation & recycling stages

TIMESCALE

Short (≤2 years), medium (2–5 years), long (>5 years)

Short

RECOMMENDATION 2:
DEVELOP POLICIES TO FORMALLY INTEGRATE THE INFORMAL PLASTICS SECTOR INTO FORMAL COLLECTION AND SORTING SYSTEMS

RATIONALE

Integrating the informal sector within formal systems in ASEAN Member States can improve material quality, traceability, and environmentally sound management (ESM). Informal workers play a critical role in plastics collection and sorting, yet often operate without adequate infrastructure, health and safety protections, or stable market access. Formal integration can strengthen worker income and protection, reduce environmental risks, improve data collection, and enhance the quality of plastics entering recycling systems.



RECOMMENDATION 2

ASEAN Member States should consider developing policy frameworks that formally recognise and integrate informal sector actors into formal plastics collection and sorting systems. Policies should gradually create enabling conditions for improved working conditions (including occupational safety and health), income stability, quality management, and environmentally sound management practices, including infrastructure development, training, and access to finance. This should always be carried out through inclusive consultation to ensure that it reflects the wishes of affected workers.

EXAMPLE ACTIVITIES MAY INCLUDE



Adopting policies that recognise informal workers, map their activities, and provide legal status.



Channelling funding, public–private partnerships or microfinance schemes to upgrade practices, purchase equipment and improve logistics.



Supporting community-level or co-operative aggregation facilities to implement safe storage areas and basic pollution controls.



Including informal-sector organisations in governance, standards development and municipal waste planning.

VALUE CHAIN STAGE(S)



TARGET FACILITATORS

- NGOs
- Formal sector sorting/MRF operators
- Local government

TARGET STAKEHOLDERS

Informal sector waste pickers/ collectors of plastics
Informal & formal waste aggregators/ MRFs

INTENDED OUTCOME(S)

Reduced contamination & increased quality of plastic waste delivered to aggregation points

Increased value & pay for collectors

Reduced rejection rates at aggregation & recycling stages

TIMESCALE

Short (≤2 years), medium (2–5 years), long (>5 years)

Medium

RECOMMENDATION 3:
SUPPORT THE FORMAL SECTOR TO INTRODUCE QUALITY MANAGEMENT SYSTEMS AT MRFs & PLASTICS RECYCLING FACILITIES

RATIONALE

Quality management systems (QMS) improve operational consistency, material quality and traceability in plastics recycling. Supporting formal recycling facilities to implement structured management systems helps reduce contamination, improve environmental and safety performance, and enable access to higher-value markets, including food-contact applications.



RECOMMENDATION 3

Local and national governments should support material recovery facilities and plastics recycling facilities to implement quality management systems aligned with recognised standards such as ISO 9001, including documented procedures, traceability and Good Manufacturing Practices.

For medium- and large-scale facilities, governments should consider requiring implementation and independent third-party certification or develop requirements for compliance in line with the ISO standard.

Adoption of complementary systems, including ISO 14001 and ISO 45001, should also be encouraged.

EXAMPLE ACTIVITIES MAY INCLUDE

- Promoting the adoption of Good Manufacturing Practices, traceability systems and documented procedures to ensure consistent material quality.
- Providing targeted training and technical support to help facilities implement quality management systems aligned with recognised standards.
- Supporting facilities to work towards certification (e.g. ISO 9001, ISO 14001, ISO 45001) and other relevant quality standards.
- Offering grants, tax incentives or blended finance mechanisms to support implementation, audits and certification costs.

VALUE CHAIN STAGE(S)

CCP1 Collection & Sorting → CCP2 Trading → CCP3 Recycling

TARGET FACILITATORS

- Local & national governments (providing financial incentives or technical assistance)
- Expert consultancies (1-on-1 support)
- Quality Assurance Service Providers

TARGET STAKEHOLDERS

Formal waste sector MRF operators
Formal sector plastics recyclers

INTENDED OUTCOME(S)

- Introduction of quality management systems and traceability of plastics
- Implementation of environmentally sound management practices
- Improved health & safety and welfare of workers
- Reduced environmental emissions
- Manufacture of recycled plastic suitable for food-contact applications

TIMESCALE

Short (≤2 years), medium (2–5 years), long (>5 years)

Medium

RECOMMENDATION 4:
SUPPORT THE FORMAL AND INFORMAL SECTORS TO IMPROVE PLASTIC CONTAINMENT AND REDUCE LEAKAGE ACROSS THE PLASTIC WASTE VALUE CHAIN

RATIONALE

Plastic leakage can occur at every stage of the value chain, particularly during collection, transport, trading, and recycling. Poor containment, inadequate infrastructure, and weak operational practices increase the risk of plastics entering the environment. Mechanical recycling facilities can also generate microplastics if controls are not in place.

Strengthening containment practices, infrastructure, and operational management can significantly reduce plastic leakage and improve environmental and occupational safety performance.

RECOMMENDATION 4

Local and national governments should consider supporting the formal and informal sectors to improve plastic containment and reduce leakage across the plastic waste value chain. Support should prioritise improved infrastructure, operational controls, and training, particularly at collection, transport, trading, and recycling stages.

EXAMPLE ACTIVITIES MAY INCLUDE



Supporting improved storage, handling, and transport practices at trading and aggregation facilities through training, demonstration projects.



Support for improved storage and transport equipment (such as sheeting of trucks).



Providing technical and financial support to upgrade recycling facility infrastructure to reduce plastic and microplastic leakage.



Promoting knowledge sharing, capacity building, and collaboration across the plastic waste value chain.

VALUE CHAIN STAGE(S)



TARGET FACILITATORS

- National governments, including Environment and Transport Ministries
- Local governments
- Environment authorities

TARGET STAKEHOLDERS

Formal sector
Informal sector
Logistics operators

INTENDED OUTCOME(S)

Reduced leakage of plastics into the environment

Implementation of environmentally sound management practices

Improved health & safety for workers

TIMESCALE

Short (≤2 years), medium (2–5 years), long (>5 years)

Long

RECOMMENDATION 5:
REQUIRE EXPORTERS OF PLASTIC WASTE TO ASEAN MEMBER STATES TO DECLARE 8-DIGIT AHTN CODES

RATIONALE

The ASEAN Harmonised Tariff Nomenclature (AHTN) expands the 6-digit HS code to 8 digits, allowing more precise identification of plastic waste shipments.

Using 8-digit AHTN codes improves transparency, supports traceability, and enables better monitoring of plastic waste trade.

For example, HS 3915 identifies plastic waste but does not distinguish polymer type. An 8-digit AHTN code allows differentiation (e.g. HDPE vs LDPE), improving oversight and data quality.

Example format

AHTN 8-digit + Country + Port + Date + Sequence

39151010-TH-BKK-20251218-001

RECOMMENDATION

Require exporters of plastic waste to ASEAN Member States to consistently declare 8-digit AHTN codes.

EXAMPLE ACTIVITIES MAY INCLUDE



Providing guidance on the consistent use of 8-digit AHTN codes



Supporting customs authorities to prioritise consignments with 8-digit AHTN codes



Developing digital tools or reference lists for 8-digit AHTN codes



Raising awareness among exporters and traders

VALUE CHAIN STAGE(S)



TARGET FACILITATORS

- ASEAN Secretariat
- Ministries of Trade and Commerce
- Customs and environment authorities

TARGET STAKEHOLDERS



Exporters

Importers

Customs agencies

INTENDED OUTCOME(S)



Improved tracking of plastic waste shipments



Better alignment with recycling facility requirements



Improved trade data and analysis

TIMESCALE



Short (≤2 years), medium (2–5 years), long (>5 years)



Short

RECOMMENDATION 6 :
DEVELOP STANDARD OPERATING PROCEDURES FOR SAMPLING PLASTIC WASTE CONSIGNMENTS AT PORTS

RATIONALE

Inconsistent sampling practices at ports can result in unsuitable plastic waste consignments being accepted or rejected. Standardised procedures help ensure representative sampling, improve decision-making, and strengthen traceability and reporting.



RECOMMENDATION 6

Develop standard operating procedures for sampling plastic waste consignments at ports.

EXAMPLE ACTIVITIES MAY INCLUDE



Defining sampling locations at ports, warehouses, and customs checkpoints



Establishing consistent sampling methods and minimum sample sizes



Providing guidance on appropriate sampling equipment and safety procedures



Recording sampling results using standardised forms and traceability systems

VALUE CHAIN STAGE(S)



TARGET FACILITATORS

- ASEAN Secretariat
- AMS Ministries of Trade & Commerce, Customs and Environment

TARGET STAKEHOLDERS

- Importers & Exporters
- Port authorities
- Customs entities
- Environment agencies

INTENDED OUTCOME(S)

- Improved identification of unsuitable consignments
- Better alignment with approved recycling facilities
- Improved data quality and reporting
- Strengthened traceability

TIMESCALE

Short (≤2 years), medium (2–5 years), long (>5 years)

Short

RECOMMENDATION 7 : REQUIRE EXPORTERS OF PLASTIC WASTE TO DECLARE COMPLIANCE WITH A PUBLISHED PLASTIC BALE QUALITY SPECIFICATION

RATIONALE

Clear bale quality specifications improve transparency and enable customs authorities, importers, and recyclers to assess plastic waste consignments before shipment. Requiring exporters to declare compliance supports technical screening, reduces unsuitable shipments, and improves alignment with receiving market requirements.

Published specifications (e.g. ISRI or nationally developed standards) provide a consistent reference for material identity, contamination limits, prohibited materials, and traceability requirements



RECOMMENDATION 7

Require exporters of plastic waste to declare compliance with a published plastic bale quality specification as part of pre-notification documentation.

EXAMPLE ACTIVITIES MAY INCLUDE

- Incorporating bale quality specification declarations into export pre-notification and shipping documentation
- Recognising published bale specifications (e.g. ISRI or national standards) for use in export controls
- Providing guidance to exporters on acceptable bale quality specifications and documentation requirements
- Facilitating awareness and training for customs officials and port authorities on interpreting bale specifications

VALUE CHAIN STAGE(S)



TARGET FACILITATORS

- ASEAN Secretariat
- AMS ministries responsible for trade and environment
- Customs departments

TARGET STAKEHOLDERS

Importers & Exporters
Port authorities
Customs entities
Environment agencies

INTENDED OUTCOME(S)

- Improved identification of unsuitable consignments
- Better alignment with receiving market requirements
- Reduced shipment of substandard plastic waste
- Increased transparency and traceability

TIMESCALE

Short (≤2 years), medium (2–5 years), long (>5 years)

Short

1 INTRODUCTION: CONTENTS

This chapter provides context for the Guidebook through background information, principles of responsible plastic waste management, and principles of preventing and managing contamination.

1.1 Context & Rationale

1.2 Principles of Responsible Plastic Waste Management

1.3 Principles of Preventing & Managing Contamination



1.1 CONTEXT & RATIONALE

This section provides background context and introduces the conceptual framework used to structure the Guidebook.

THE LIFE CYCLE OF PLASTIC

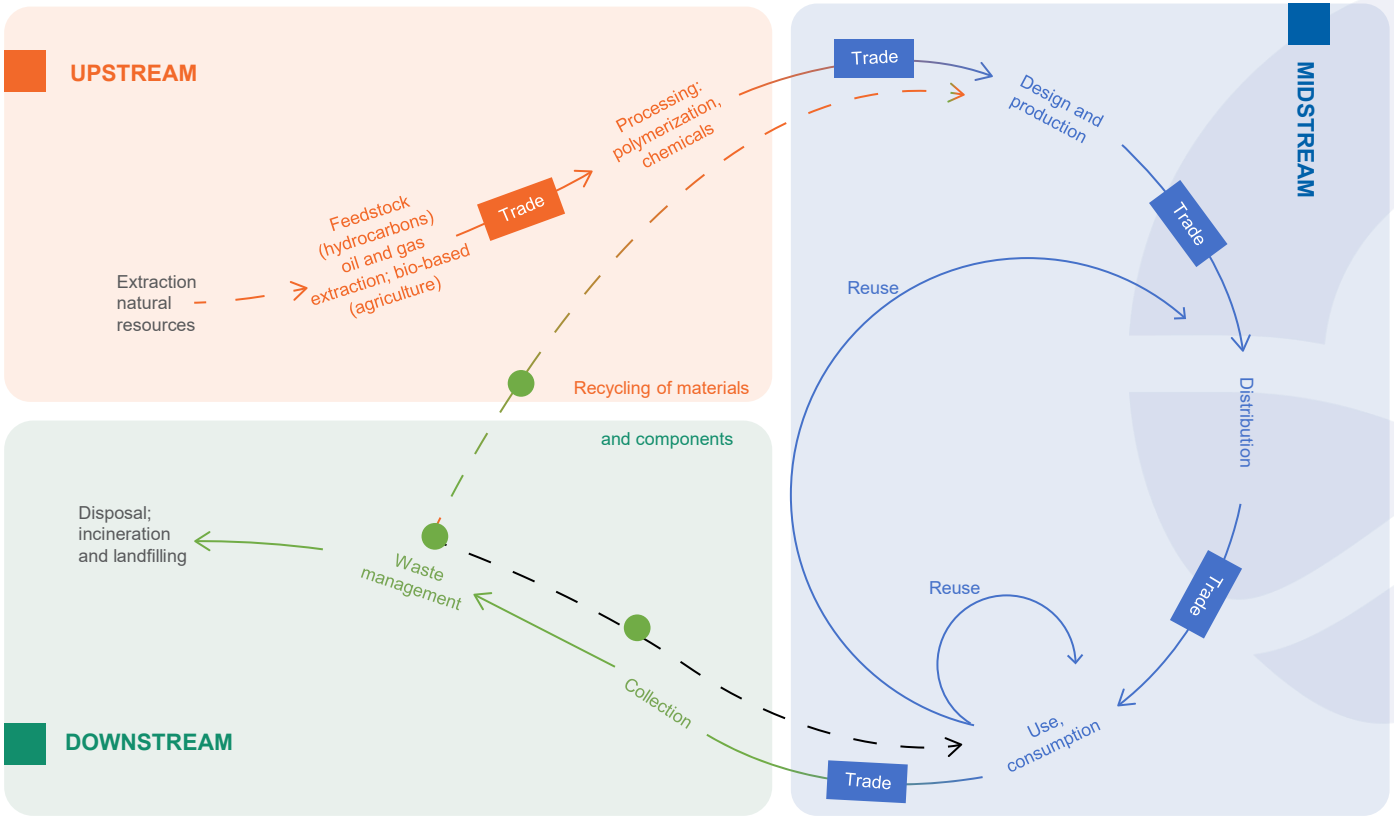
Plastic products have a complex life cycle which can be divided into three separate phases as shown below.

UPSTREAM

This involves polymerisation of precursor monomers into long chain plastic polymers.

DOWNSTREAM

This is where plastic products reach the end of their life and become waste.

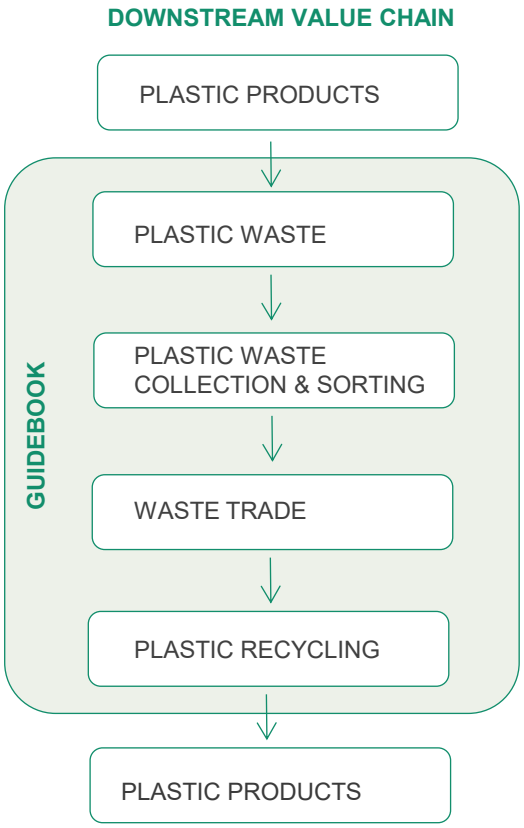


MIDSTREAM

This involves the design, manufacture, distribution and use of plastic products.

THE DOWNSTREAM PLASTICS VALUE CHAIN

Throughout this Guidebook the downstream phase of the plastics value chain is analysed in detail. This forms the 'backbone' of the Guidebook, with chapters covering each stage.



KEY CONCEPT

This part of the value chain is similar to a manufacturing process:

- Materials → Processing → Products
- There are therefor a number of key stages along this part of the value chain where quality controls are important
- Standards, specifications & regulatory compliance are important at all stages
- The overall aim of the process is to manufacture goods to a defined specification—this includes both **quality and functionality**
- With regard to plastic waste recycling, this includes:
    - **Polymer purity, and**
    - **Contamination levels**.
- Contaminants and unwanted polymers can be thought of as hazards.
    - They have potential to harm the recycling process, including workers, and
    - Impair the quality of the recycled plastic.

HACCP

This Guidebook has drawn on the principles enshrined in the Hazard Analysis Critical Control Point (HACCP) approach.

HACCP is an approach to risk management that both government bodies and many private sector stakeholders are familiar with.

It is widely used in the food and waste management sectors to control hazards.

INTRODUCTION TO HACCP

HACCP is a system used to identify, evaluate and control hazards that are significant for safety and/or quality.

HACCP follows a structured approach involving seven principles. It was developed as part of a Hazard Analysis Critical Control Point (HACCP) system in the 1960s when the United States National Aeronautics and Space Administration (NASA) was planning its moon landings. It was born out of the need for "zero defect" food for astronauts to eat when on mission. Since then, it has been widely applied in food manufacturing and waste treatment processes, such as composting and anaerobic digestion.

A Critical Control Point (CCP) is a step in a process where control measures can be applied to prevent, eliminate or reduce a hazard to an acceptable level.

HACCP SEVEN PRINCIPLES

1. Conduct a Hazard Analysis
2. Determine Critical Control Points
3. Establish Critical Limits
4. Establish a Monitoring System
5. Establish Corrective Actions
6. Establish Verification Procedures
7. Establish Documentation and Records

DEFINITIONS

HAZARD ANALYSIS CRITICAL CONTROL POINT (HACCP)
A system used to identify, evaluate and control hazards that are significant for safety and/or quality.

CRITICAL CONTROL POINT (CCP)
A step in a process where control measures can be applied to prevent, eliminate, or reduce a hazard to an acceptable level.

HAZARD
A contaminant that has potential to harm human health, the environment or the quality of a product.

RISK
The chance or likelihood that a hazard will cause harm to human health and/or the environment or impair the quality of a product.

HACCP SEVEN PRINCIPLES

All HACCP systems follow **seven fundamental principles**, irrespective of whether it is the food industry manufacturing biscuits or the waste sector recycling plastics. These are summarised below.

1. CONDUCT A HAZARD ANALYSIS

The hazards are contaminants present in the plastic waste. They include, for example:

- **Physical contaminants**
  e.g. metals, glass, stones
- **Chemical contaminants**
  e.g. phthalates, PFAS, heavy metals, other plastic polymers
- **Biological contaminants**
  e.g. microbial pathogens, food waste

Depending upon the plastic waste stream and the quality specifications set by recyclers, the presence of non-target plastic polymers would also be viewed as a contaminant.

2. DETERMINE CRITICAL CONTROL POINTS

A **Critical Control Point** (CCP) is a step in a process where control measures can be applied to prevent, eliminate, or reduce a hazard to an acceptable level.

A Critical Control Point functions as a binary decision-making criterion because control at that point is necessary and effective to manage the hazard.

3. ESTABLISH CRITICAL LIMITS

At each CCP, specific, measurable critical limits must be set. These limits are the maximum levels of contamination deemed acceptable to ensure that plastic waste is sufficiently safe to be moved along the value chain.

4. ESTABLISH MONITORING PROCEDURES

Continuous or scheduled monitoring is essential to verify that the CCP stays within the critical limits. Monitoring can include visual inspections or laboratory testing. The monitoring frequency and methods should be sufficient to detect deviations.

5. ESTABLISH CORRECTIVE ACTIONS

If monitoring shows that a critical limit is not met, immediate corrective actions must be taken to address the deviation. This may involve additional visual inspections or more laboratory testing.

Corrective actions also include investigating the root cause to prevent recurrence and verifying that the actions taken are effective. This means investigating what quality control checks are taken further up the value chain. Monitoring of corrective actions should also be carried out.

6. ESTABLISH VERIFICATION PROCEDURES

Verification ensures that the HACCP system and CCP management are functioning correctly. This includes reviewing monitoring records, conducting audits, testing products, and validating that critical limits and control measures are appropriate and effective.

7. ESTABLISH DOCUMENTATION & RECORD-KEEPING PROCEDURES

All CCP management activities—hazard analysis, critical limits, monitoring results, corrective actions, and verification—must be thoroughly documented. Ideally, records should be dated and signed by responsible personnel to provide traceability and accountability; however, this may prove challenging in practice, especially when carried out by the informal sector.

CRITICAL CONTROL POINTS ALONG THE VALUE CHAIN

There are **three steps along the plastic waste** value chain where control measures can be introduced to reduce or limit the presence of contaminants (hazards). **These Critical Control Points (CCPs)** are described in detail in this Guidebook. Consideration is given to both the **informa**l and formal sectors, including relevant guidance where appropriate.

PLASTIC WASTE VALUE CHAIN



For each CCP the Guidebook provides guidance on how to:

- Identify maximum limit levels for selected contaminants.
- Implement monitoring procedures.
- Define corrective actions
- Review monitoring records, conduct audits, test products etc.
- Document and keep records

It makes reference, as appropriate, to:

- Regulations
- Standards
- Inspections
- Record keeping
- Good practices

1.2 PRINCIPLES OF ENVIRONMENTALLY SOUND MANAGEMENT OF PLASTIC WASTE

This section provides context for the Guidebook by describing some of the key principles of responsible plastic waste management.

UNDERLYING PRINCIPLE: THE TRANSITION FROM A LINEAR TO A CIRCULAR ECONOMY

A transition from a linear to a circular economy is essential for the environmentally sound management of plastic waste because it reduces reliance on virgin fossil resources and prevents plastics from becoming persistent pollution at their end of life.

By keeping plastics in use through design for reuse, repair and high-quality recycling, a circular economy reduces leakage to the environment and lowers greenhouse gas emissions across the life cycle.

Environmentally sound management of plastic waste is essential because plastics can persist for centuries, harming ecosystems and human health through microplastics, toxic additives and the spread of pollutants.

LINEAR ECONOMY

The linear economy is the prevailing economic model, developed over the last two centuries since the industrial revolution. It is based on a 'take–make–dispose' flow of materials, in which resources are extracted, transformed into products, used and then discarded as waste, often to landfill or incineration.

Value is lost at the end of use, and environmental impacts accumulate through ongoing resource extraction, waste generation and energy use.

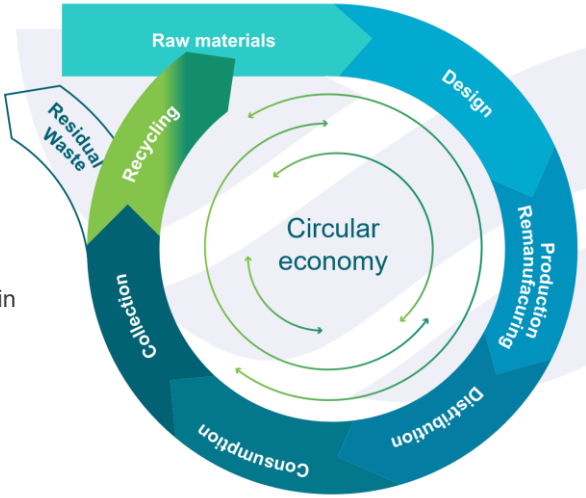


CIRCULAR ECONOMY

The circular economy, however, is designed to keep materials and products in use for as long as possible through reuse, repair, remanufacturing and recycling, while minimising waste and virgin resource inputs.

At its heart, the circular economy is based on three main principles:

- **Eliminate waste and pollution** by designing it out from the start
- **Circulate products and materials** at their highest value, keeping them in use for as long as possible through reuse, repair, remanufacturing and recycling
- **Regenerate nature** by returning valuable nutrients to the soil and transitioning to renewable energy sources.



Diagrams: International Solid Waste Association (2015)
Circular Economy: Trends & Emerging Ideas www.iswa.org
Adapted from: *Towards a circular economy: A zero waste programme for Europe*

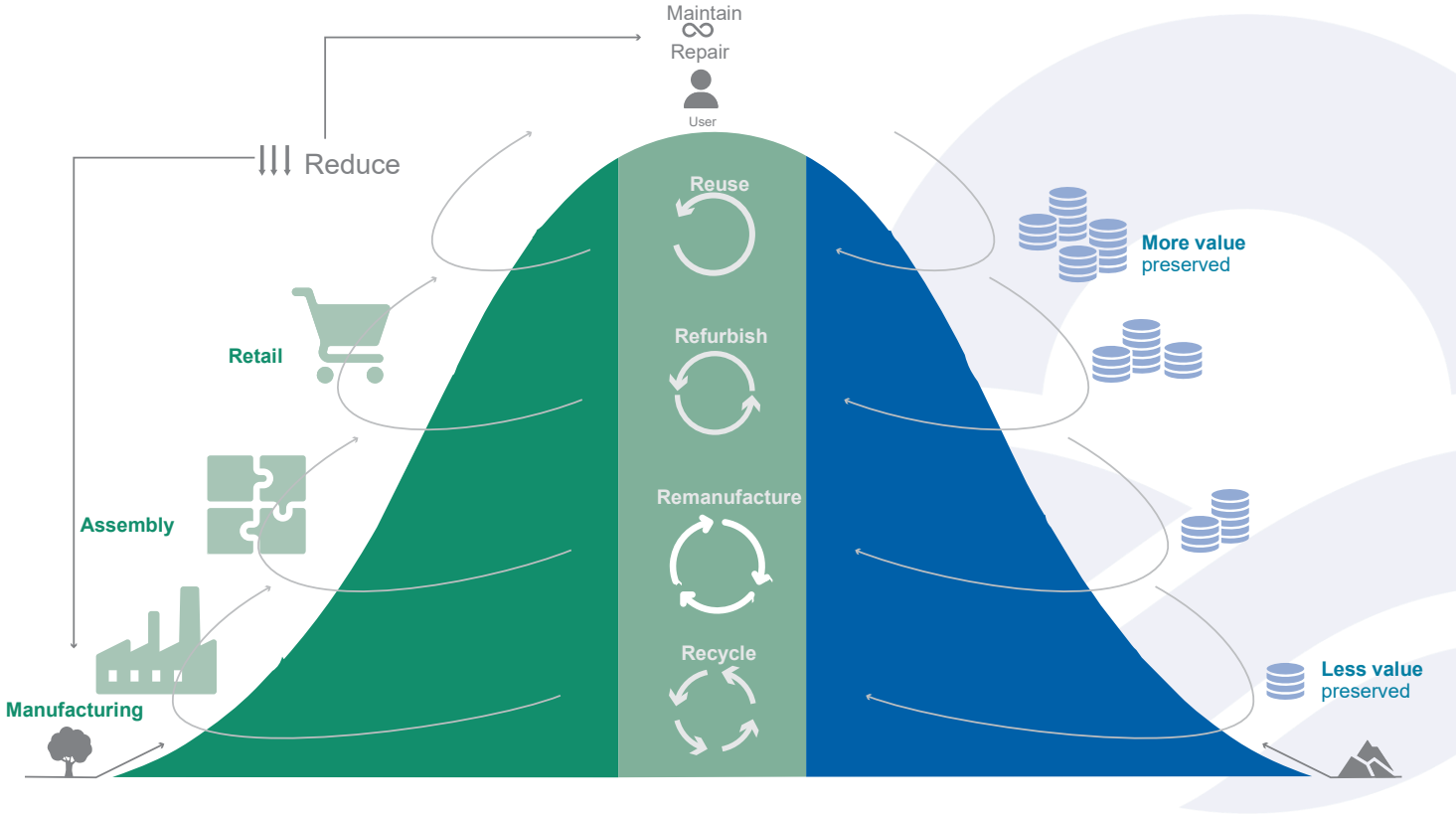
THE CIRCULAR ECONOMY

The circular economy (CE) has been formally defined as an **"economic system that uses a systemic approach to maintain a circular flow of resources, by recovering, retaining or adding to their value, while contributing to sustainable development"** (ISO 59004:2024).

It is a system that aims to eliminate waste and pollution, keep products and materials in use, and regenerate natural systems. The circular economy is an alternative to the current linear economy that is based on a "take, make, consume and dispose" model.

The **Framework for Circular Economy for the ASEAN Economic Community** sets out a regional roadmap to promote resource efficiency, sustainable production and waste reduction across ASEAN. It seeks to maximise the value of products throughout their lifecycles and prevent wastage as much as possible, while in the process enabling AMS to meet their respective carbon emission targets under the Paris Agreement for climate change.

INTERPRETATION OF THE CIRCULAR ECONOMY (AS ADAPTED BY METABOLIC, NL)



Source: https://www.metabolic.nl/news/recycling-downcycling-and-the-need-for-a-circular-economy/

PRINCIPLES OF ENVIRONMENTALLY SOUND MANAGEMENT OF PLASTIC WASTE

Environmentally sound management (ESM) of plastic waste refers to the processes and strategies aimed at minimising harm to the environment and human health through prevention, collection, containment, sorting, recycling and proper disposal of plastic materials.

This approach is increasingly guided by the principles of the circular economy and extended producer responsibility (EPR), which require producers to manage the full lifecycle of their products, including post-consumer waste management.

Key elements of responsible plastic waste management include:

- **Legislative Instruments**: Governments enact laws and policies such as bans on certain single-use plastics, deposit return schemes, and mandatory recycled content requirements.
- **Waste Prevention**: Reducing plastic waste generation at the source by designing products with less plastic, avoiding single-use plastics, and minimizing over-packaging.
- **Recycling and the Circular Economy**: Implementing effective recycling systems to convert plastic waste into reusable raw materials, thus reducing reliance on fossil fuels and lowering greenhouse gas emissions.
- **Extended Producer Responsibility (EPR)**: A policy a policy approach that makes producers responsible for the entire lifecycle of their products, especially for take-back, recycling, and final disposal.
- **Public Awareness and Education**: Informing and educating the public about the environmental impacts of plastic waste, the importance of waste segregation, and the benefits of reducing plastic consumption and littering.
- **International Cooperation**: Agreements like the Basel Convention regulate the transboundary movement and environmentally sound management of plastic waste.



LEGISLATIVE INSTRUMENTS

- Bans on single-use plastics
- Deposit return schemes
- Mandatory recycled content

WASTE PREVENTION

- Design with less plastic
- Avoid single-use
- Reduce over-packaging

RECYCLING & CE

- Effective collection & sorting
- Recycling
- Re-use as feedstock

EPR

- Producer accountability
- Take-back schemes
- Eco-design incentives

PUBLIC AWARENESS

- Impact of plastic waste
- Segregation & recycling
- Reduce littering

INTERNATIONAL COOPERATION

- Basel Convention
- Harmonised standards
- Transboundary controls

ENVIRONMENTAL & SOCIAL STANDARDS

The World Bank's Environmental and Social Framework (ESF) comprises ten Environmental and Social Standards (ESS) that set out requirements for managing environmental and social risks and impacts in projects it finances. When applied by UNOPS, including under the SEA-MaP project, these standards provide a structured, risk-based approach to ensure projects are environmentally sound, socially inclusive, and ethically implemented. These principles also extend to the Environmentally Sound Management (ESM) of plastic waste, including worker health, safety and welfare in both the formal and informal sectors.



ESS1 underpins the overall approach, requiring identification, assessment, and mitigation of environmental and social risks through appropriate management instruments.



ESS2 promotes fair labour practices, occupational health and safety, and protection of workers involved in project delivery.



ESS3 addresses resource efficiency and pollution prevention, including waste management and avoidance of environmental contamination.



ESS4 focuses on community health, safety, and security, ensuring that project activities do not expose communities to undue risk.



ESS5 on land acquisition and involuntary resettlement is applied as a precaution, designed to avoid land take or livelihood displacement wherever possible.



ESS6 supports the protection of biodiversity and sustainable management of natural resources, relevant to marine and coastal contexts addressed by SEA-MaP.



ESS7 and **ESS8** ensure respect for Indigenous Peoples and cultural heritage, even where risks are low, through screening and stakeholder awareness.



ESS9 requires financial intermediaries to assess, manage, and monitor the environmental and social risks and impacts of the projects they finance



ESS10 on stakeholder engagement and information disclosure is central to SEA-MaP, requiring transparent communication, inclusive consultation, and accessible grievance mechanisms.

Overall, UNOPS integrates the World Bank ESS into project planning, implementation, monitoring, and reporting to ensure SEA-MaP delivers technical assistance and policy support in a manner consistent with international best practice for environmental and social sustainability.

LEGISLATIVE INSTRUMENTS

Legislative instruments broadly refer to **formal legal documents and mechanisms** through which **laws, regulations, treaties, and agreements are enacted, implemented, and harmonized within the region**. These include Acts, subsidiary legislation, treaties, agreements, codes, decrees, and regulations adopted by national parliaments or regional bodies like ASEAN.

KEY ASPECTS OF LEGISLATIVE INSTRUMENTS IN AMS

- **National Legislation**: Each Southeast Asian country has its own legislative process and instruments. For example, in Singapore, legislation is passed by a unicameral Parliament through a process involving three readings and presidential assent before becoming an Act, published in the Government Gazette. Similarly, the Philippines has a bicameral Congress that enacts statutes, including Acts, Presidential Decrees, and Codes, which form the backbone of its legal system. Thailand's legislation comes into force upon publication in its Government Gazette, which includes civil codes, Acts, Royal Decrees, and Emergency Decrees.

- **Types of Instruments**: Legislative instruments include primary laws (Acts, statutes), subsidiary legislation (regulations, rules), executive orders, decrees, and codes (civil, penal, procedural). For instance, Brunei Darussalam uses a combination of common law principles and Sharia law codified in penal codes and procedural codes.

- **ASEAN Legal Instruments**: At the regional level, ASEAN Member States enter into various legal instruments such as treaties, agreements, framework agreements, and arrangements that create rights and obligations under international law. These instruments reflect a gradual legalization process in ASEAN cooperation, balancing sovereignty concerns with the need for legal commitments. ASEAN legal instruments cover areas like nuclear weapon-free zones and the establishment of the ASEAN Secretariat.

MAIN TYPES OF INSTRUMENTS RELEVANT TO PLASTIC WASTE

- **Environmental Protection & Management** – Establish a legal framework to protect the environment and prevent harm to humans and ecosystems. Sometimes make reference to the prevention of marine pollution.

- **Waste Management** – Define waste and set out rules regarding the collection, storage, transfer, treatment, recycling and disposal of waste. Often also set rules for waste minimisation and plastics, including circular economy principles.

- **Plastic Waste** – Some Member States have specific instruments for plastics, such as banning single-use plastic items or setting out rules for plastic waste management and/or recycling.

- **Extended Producer Responsibility** – Set out rules and requirements for EPR schemes and the different products they should include.

- **Hazardous waste** – Set out detailed rules regarding the control and disposal of hazardous waste. May align with the Basel Convention.

- **Export & import of waste (including hazardous waste)** – Set rules for transnational movements and often align with the Basel Convention. Make reference to international Harmonised System (HS) codes.

- **Circular Economy** - Require products and materials to be designed, used and managed so that they are kept in use longer whilst minimising waste and environmental harm.

INTERNATIONAL INSTRUMENTS: THE BASEL CONVENTION

BACKGROUND

The Basel Convention is an international treaty adopted in 1989 and entered into force in 1992, aimed at protecting human health and the environment from the adverse effects of hazardous and other wastes, especially those transported across national borders.

It establishes a regulatory framework to control and reduce the generation and transboundary movement of hazardous wastes and mandates their environmentally sound management, preferably as close as possible to the waste source.

HOW THE BASEL CONVENTION WORKS

It requires a Prior Informed Consent (PIC) procedure for transboundary movement of wastes, meaning the exporting country must notify and obtain written consent from the importing and transit countries before shipment.

The Convention prohibits exports of hazardous wastes to countries that have banned such imports or are not parties to the treaty.

It obliges parties to minimize waste generation and ensure environmentally sound management and disposal.

Illegal traffic of hazardous wastes is prohibited and subject to penalties.

PLASTIC WASTE

In May 2019, the Basel Convention was amended to include plastic wastes as regulated materials under its scope, following global concerns about plastic pollution and waste dumping.

This amendment **means that international shipments of plastic waste are now subject to the PIC procedure**, requiring prior consent and proper documentation to ensure **environmentally sound management**.

The inclusion of plastics aims to curb illegal plastic waste exports, improve transparency, and encourage better domestic management and recycling of plastic waste.

Countries not party to the Convention (e.g., the United States) face restrictions and potential liability for plastic waste shipments, as such exports are considered illegal trafficking under the Convention's rules.

ASEAN MEMBER STATES

All 10 ASEAN Member States are parties to the Basel Convention.

Countries integrate Basel rules into domestic laws and enforcement mechanisms.

ASEAN Member States collaborate through the **Asian Network for Prevention of Illegal Transboundary Movement of Wastes**.

www.basel.int/Implementation/Plasticwaste/Overview/tabid/8347/Default.aspx

https://www.basel.int/Default.aspx?tabid=2936

ENFORCEMENT OF ENVIRONMENTAL LAWS

Environmental laws in ASEAN Member States are enforced through a combination of national legal frameworks, regional co-operation mechanisms, and emerging rights-based approaches. Whilst each AMS has enacted environmental laws regulating issues such as pollution, waste management and natural resource use, enforcement effectiveness varies widely across the region.

Enforcement of environmental and waste management laws is important because it ensures that the intended benefits of these laws—protecting the environment, public health and promoting sustainable development—are realised.

CHALLENGES INCLUDE

- Limited public enforcement data; low administrative capacity; weak monitoring.
- Weak institutions and scarce resources; informal sector involvement.
- Overlapping mandates; political influence; weak producer sanctions.
- Limited enforcement capacity and infrastructure; poor compliance systems.
- Weak implementation; enforcement uncertainty; illegal dumping persists.
- Political instability; limited resources and technical expertise.
- Uneven local enforcement; coordination problems; informal sector challenges.
- Generally high compliance, but problems with e-waste and new waste streams.
- Compliance gaps; weak EIA follow-up; poor reporting and illegal trafficking.

THE ROLE OF STANDARDS

National and international standards are **officially established criteria that define the quality, safety and compatibility requirements for products, services and systems** within a country. By aligning technical specifications, they help to lower trade barriers and enable products to comply with common requirements, facilitating access to a range of markets without regulatory conflicts. Moreover, they contribute to environmental sustainability by standardising monitoring and reporting practices—an essential step towards setting national targets and supporting the successful implementation of international treaties.

Standards are distinct from governmental legislative instruments. They are voluntary and not legally binding like governmental regulations; however, they frequently find incorporation in legislative texts to provide technical nuances and are often used by organisations to substantiate legal compliance and to guide procurement, design, production and evaluation processes.

DIFFERENT TYPES OF STANDARDS

There are different types of standards, depending upon their purpose. They can be categorised into different groups as follows:

- **Test methods:** these set out how to measure or test performance so that results are comparable and repeatable.
- **Specifications:** These set out the required characteristics and performance criteria that a product, material, or process must meet to be considered compliant and fit for its intended purpose.
- **Vocabulary:** This comprises a compilation of terms and definitions devised to harmonize the linguistic usage within a specific field or discipline.
- **Guidance / codes of practice / application standards**: These provide recommended approaches for design, installation, use, or conformity assessment.
- **Classification standards:** These define classes/grades (e.g., performance classes) based on test results.
- **Management system / process standards:** These set out requirements for organisational systems, such as quality management or environmental management systems.

EXTENDED PRODUCER RESPONSIBILITY

Extended Producer Responsibility (EPR) is an environmental policy framework that makes producers accountable for the entire lifecycle of their products, including post-consumer waste. This responsibility may be financial, operational, or both, and aims to promote sustainable product design and reduce environmental harm from waste.

EPR PRINCIPLES INCLUDE

- **Producer Responsibility:** Producers must take responsibility for managing the waste generated by their products. This includes improving product design for sustainability and recyclability, as well as overseeing take-back schemes, recycling, and final disposal.
- **Financial and Operational Shifts:** EPR transfers waste management costs from the public sector to producers, who may either fund or directly manage the collection, sorting and recycling of their products.
- **Targeted Product Categories:** In the European Union, EPR schemes commonly apply to packaging, electrical and electronic equipment, and batteries—sectors with high waste volumes or environmental risks.
- **Compliance Requirements**: Producers must meet legal obligations such as design standards, labelling, reporting and recycling targets, often involving formal registration and performance monitoring.
- **Support for the Circular Economy:** By encouraging reuse, recycling, and better design, EPR helps shift from a linear to a circular economy model, reducing waste and environmental impacts.

EPR systems vary in structure. They may be mandatory or voluntary, and responsibilities may be individual (producer-specific) or collective (shared across producers). Cost allocation is often based on the quantity and recyclability of materials.

THE ROLE OF STANDARDS IN EPR

Standards provide a common framework for design, collection, sorting and recycling, ensuring materials are recyclable, safely processed and traceable, while enabling producers, recyclers and regulators to measure performance consistently and support compliance with environmental targets. They also define quality criteria for recyclates, helping ensure that recycled materials meet consistent performance and safety standards.

Global Action Partnership for EPR: https://gap-epr.prevent-waste.net/ Prevent Waste Alliance, EPR Toolbox: https://prevent-waste.net/epr-toolbox/

EPR for Plastic Packaging in Selected ASEAN Member States: https://doi.org/10.1596/44097

1.3 PRINCIPLES OF PREVENTING & MANAGING CONTAMINATION

This section provides background information and context by describing some of the key principles of preventing and managing the contamination of plastic waste streams.

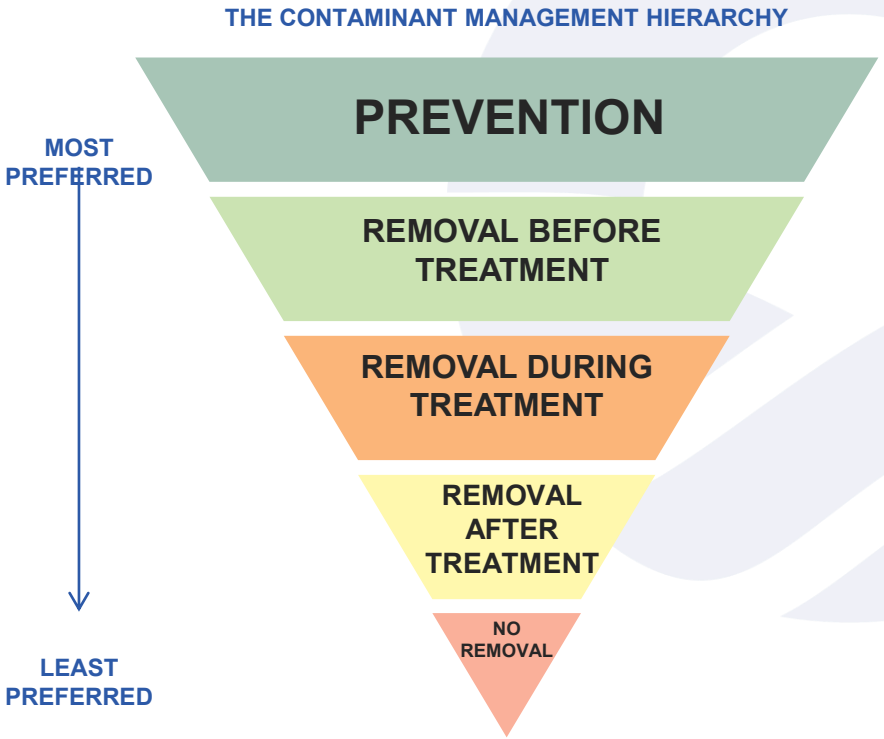
MANAGING QUALITY

Quality refers to how well the recycled plastic material retains or recovers its distinct characteristics throughout the recycling process, enabling it to be re-used effectively in new products.

QUALITY INDICATORS

- **Material Cleanliness:** This means the extent to which plastic waste is free from contaminants such as physical, chemical and biological contaminants.
- **Material Composition:** This means the extent to which plastic waste has been sorted into different types (e.g., PET, HDPE) to ensure uniformity in the recycling process. Contaminants and mixing of different plastic types degrade the quality of recycled plastic and limit its usability.
- **Preservation of Material Properties:** This relates to the extent to which the polymer's distinct properties are preserved or recovered through the recycling chain. This preservation maximizes the potential for the recycled plastic to be re-used in applications with demanding requirements, thus avoiding downcycling (where recycled material is used for lower-value products) and enabling multiple recycling loops.
- **Degradation Through Recycling:** Each recycling cycle tends to degrade the quality of plastic due to thermal and mechanical stress and contamination. Therefore, most plastics are recycled only once or twice before their quality diminishes to a point where they are no longer suitable for recycling and end up requiring disposal or energy recovery.

As materials separation techniques are never 100% effective, preventing contamination in the first place is always a more effective and economic way of obtaining clean plastics for recycling, compared with mixed waste sources.



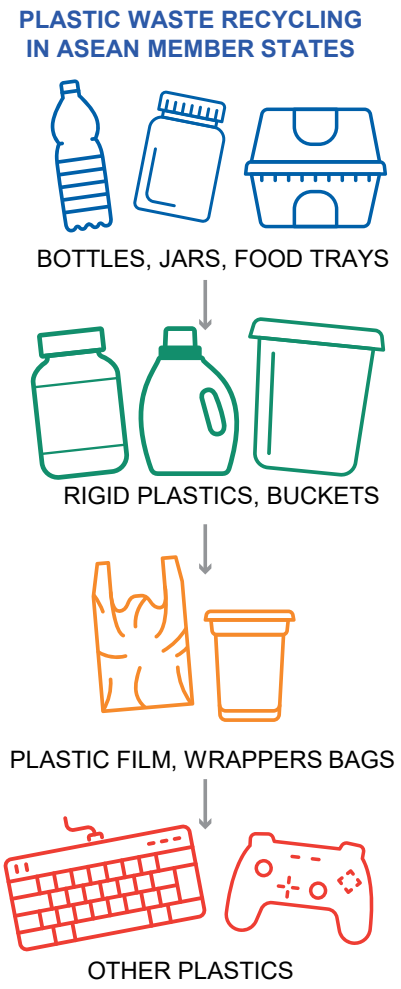
The contaminant management hierarchy. Reproduced from Gilbert and Ricci-Jürgensen (2023), with permission from the International Solid Waste Association (ISWA)
Gilbert, J. and Ricci-Jürgensen, M. (2023), A Practitioner's Guide to Preventing & Managing Contamination in Organic Waste Recycling. International Solid Waste Association, Rotterdam.

PREVENTING CONTAMINATION: SEPARATE PLASTIC WASTE COLLECTION

Separate collection (also called source separation) refers to the process of collecting different types of solid waste separately according to their material type or nature, usually at the point of generation, such as households or businesses. This means that waste streams like plastics are kept apart in different containers or compartments during collection, transportation and storage to facilitate specific treatment or recycling processes.

When waste materials are mixed together, food waste, broken glass, wet/dirty paper, nappies (diapers) and sanitary products can all adhere to the outside of waste plastics or become lodged inside them. The separate collection of plastic waste is therefore preferable over mixed waste collections (where plastics are removed subsequently) as it offers the following advantages:

- Lower levels of contamination
- Cleaning and sorting steps are reduced; hence they are cheaper to operate
- The risk of harm to workers' health is reduced
- The risk of 'downcycling' is reduced: i.e. it is more likely that plastic products can be recycled into similar products
- Recycling processes are cheaper and more efficient
- The risk of damage to equipment is reduced
- The risk of fires at aggregation points, sorting and recycling centres are reduced as there is a lower risk of contamination with lithium-ion batteries
- There is potential for recycling plastics into food contact materials (FCM)
- There is less waste (as rejected materials) requiring disposal.




COMPRESSED PET BOTTLES


ASSORTED PLASTIC SCRAP


FISHING NETS & ROPES

CONTAMINANTS IN PLASTIC WASTE

A contaminant is a hazard that has potential to harm human health, the environment, recycling equipment or the quality of the recycled plastic.

Contaminants may enter plastic waste through a number of different pathways, including:

- **Product design**, in which different plastic polymers or materials are used to create multi-material products. These can include of additives, degradation products, and legacy contaminants (e.g., from previous use or processing).
- **Product use**, in which plastics are mixed with, or contain, hazardous substances or items. This is particularly important in the case of plastic packaging where a wide range of hazardous products may be contained inside plastic bottles or sachets.
- **Product end-of-life management**, where waste plastics may be poorly segregated from other wastes, mixed with other types of waste or poorly cleaned.

Examples of hazards in plastic waste include:

PHYSICAL CONTAMINANTS

- Fragments of metal such as:
  - Hypodermic needles
  - Bottle tops
  - Printed circuit boards
  - Drinks cans
- Stones, rocks or sand
- Items made out of different plastic polymers
- Fragments of glass
- Wood and other plant or animal items

CHEMICAL CONTAMINANTS

- Phthalates
- Per- and Polyfluoroalkyl Substances (PFAS)
- Bisphenols
- Polycyclic Aromatic Hydrocarbons (PAHs)
- Heavy Metals
- Pesticide residues
- Different polymer types
- Radioactive substances

BIOLOGICAL CONTAMINANTS

- Micro-organisms, such as bacteria, viruses and fungi. These may be:
  - Pathogenic and/or
  - Allergenic
- Biofilms, formed on plastic surfaces due to the growth of different micro-organisms
- Food waste and other plant or animal items

POTENTIAL HARM CAUSED BY CONTAMINANTS IN PLASTIC WASTE

	HUMAN HEALTH OR SAFETY	ENVIRONMENT & ECOSYSTEMS	RECYCLING EQUIPMENT	QUALITY OF RECYCLED PLASTICS
PHYSICAL HAZARDS	• Scratches or cuts (injury) to the skin of workers • Can transfer infective or toxic substances to workers	• Unlikely	• Can jam or clog screens or nozzles • Can damage machinery by causing dents or cracks • Reduces efficiency and can result in inconsistent processing	• Reduces plastic quality, therefore limits potential manufacture of new products (results in 'downcycling') • Prevents use of plastic in food contact materials
CHEMICAL HAZARDS	• Wide range of potential harm by toxic compounds, including acute and chronic toxic effects (e.g. endocrine disruption, developmental neurotoxicity, reproductive disorders and carcinogenicity) • Potential for bioaccumulation along food chains		• Unlikely, unless present in high concentrations	
BIOLOGICAL HAZARDS	• Potential for respiratory problems of workers due to formation of bioaerosols • Potential for infection by pathogens	• Unlikely unless plastics are contaminated with highly infectious animal or plant pathogens	• Unlikely	• Unlikely

RECORD KEEPING & TRACEABILITY

Keeping records of the source, sorting, cleaning and recycling of waste plastics is an important aspect of a quality management system and is fundamental to the HACCP process and the concept of critical control points. This raises particular challenges in AMS due to the involvement of the informal sector, especially where plastics are collected from mixed waste sources at dumpsites. Overall, as plastics move along the value chain, the number of people involved decreases at each stage, whilst the potential for record keeping, hence auditing, increases.

FOOD CONTACT MATERIALS

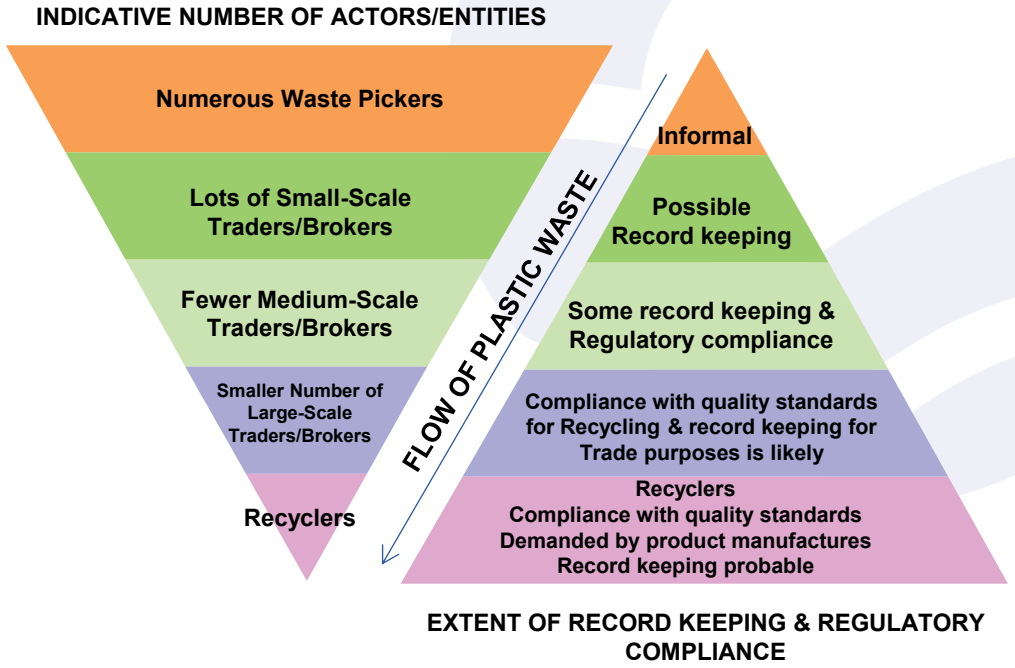
Detailed record keeping is essential for ensuring recycled plastics meet safety standards in Food Contact Materials (FCMs) for several critical reasons:

Firstly, it provides traceability throughout the entire recycling process, from the source of post-consumer plastic waste to the final recycled product. This allows for the identification of the origin and composition of raw materials, which is vital for preventing contamination and ensuring that only suitable plastics enter the food contact supply chain.

Secondly, robust record keeping supports contamination control and risk management. Regulations require rigorous assessment of non-intentionally added substances, impurities, and potential contaminants. Detailed records of testing, decontamination processes, and critical control points ensure that any deviations from safety limits are identified and addressed through corrective actions. For example, a robust recording system for monitoring CCPs is clearly linked to individual production batches.

Thirdly, record keeping is fundamental for regulatory compliance and verification. Authorities, such as those in the EU, require evidence that recycled plastics comply with specific safety standards, including migration limits and good manufacturing practices. Documents such as a Declaration of Compliance are issued for all batches of recycled plastic to confirm identity, recycled origin, and provide instructions for use. Records must be maintained for a minimum of five years, supporting audits and demonstrating adherence to established procedures.

Finally, it fosters accountability and quality assurance. Documented procedures for raw material flow, organizational structure, responsibilities, and quality management systems ensure consistency and reliability in the recycling process. This ensures that recycled plastics used in FCMs are safe and do not endanger human health or alter food composition or sensory properties of the food.



2 ABOUT PLASTIC: CONTENTS

This chapter provides background information about different plastic polymers and products, and plastic waste generation, composition and trends.

2.1 Plastic Products

2.2 Plastic Waste



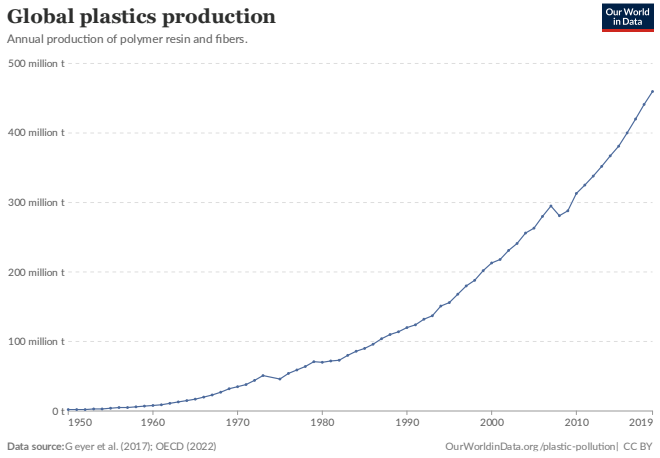
2.1 PLASTIC PRODUCTS

This section provides background information on the different types of plastic polymers and the products they create.

ABOUT PLASTIC

Plastics have transformed modern life since their invention in the 19th century. They are synthetic polymers primarily derived from fossil fuels such as petroleum, natural gas and coal. They are large molecules made up of many repeating smaller units called monomers, chemically bonded together in long chains. These synthetic polymers are processed through polymerization, where monomers such as ethylene or propylene chemically join to form long chains. The resulting plastic polymers have unique properties like moldability and durability, making them suitable for a wide range of applications.

Structurally, plastic polymers typically consist of carbon atom chains forming the backbone, with various side groups attached that influence their characteristics. The arrangement of these chains can be linear, branched, or cross-linked, affecting the plastic's strength, flexibility, and thermal behaviour. Plastics are broadly classified into thermoplastics, which can be melted and reshaped multiple times, and thermosets, which form irreversible chemical bonds and cannot be remelted.

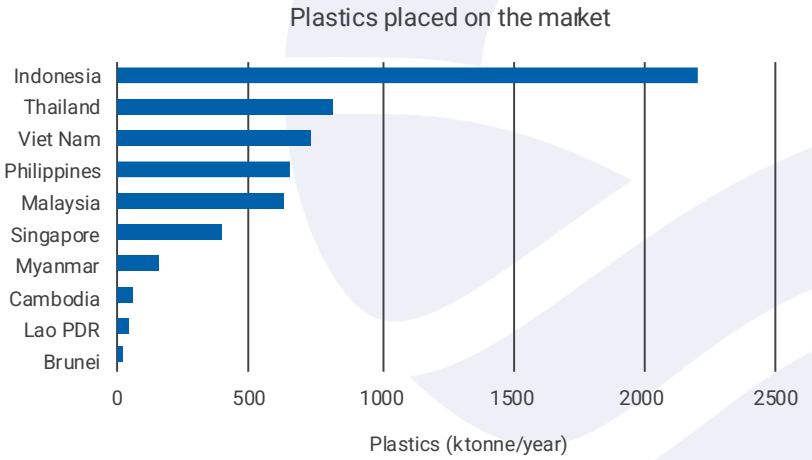


https://ourworldindata.org/grapher/global-plastics-production

HOW MUCH

Global plastic production has grown exponentially, from just 2 million metric tonnes in 1950 to over 400 million metric tons in 2022, with **413.8 million metric tonnes of resin produced in 2023**. Asia, especially China, is the largest producer, accounting for about one-third of global output.

Across ASEAN Member States (AMS), information about the quantity of plastic placed on the market is limited; however, a 2024 study by SEA-MaP indicated that it was in the region of **5.7 million tonnes a year**.



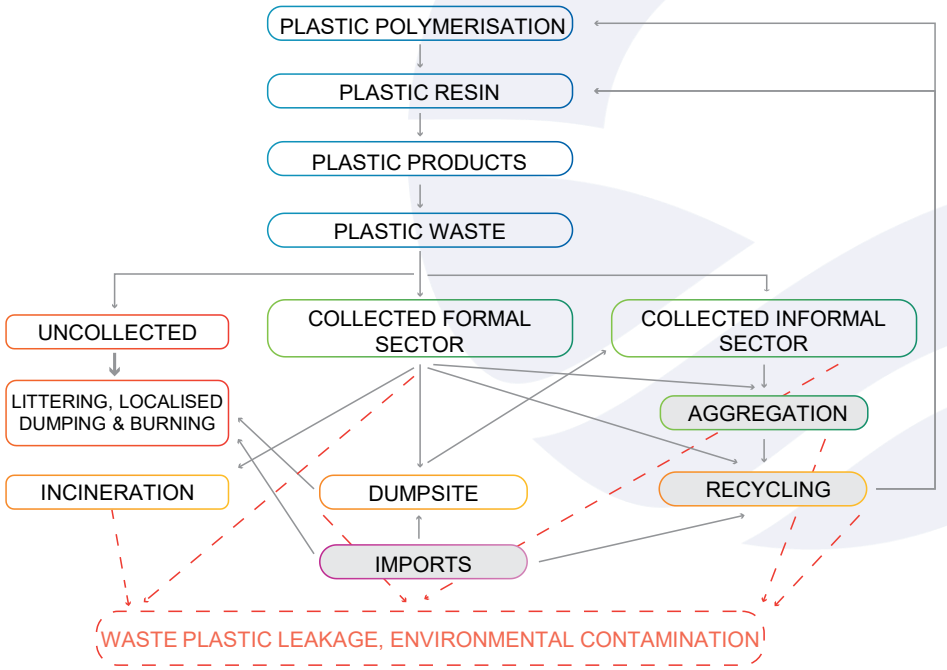
PLASTIC (NOUN)
Material which contains as an essential ingredient a high polymer and which, at some stage in its processing into finished products, can be shaped by flow.
ISO 472:2013(en) Plastics — Vocabulary

THE PLASTICS VALUE CHAIN

The plastics value chain refers to the full sequence of processes and stakeholders involved in the life cycle of plastics, from raw material extraction through manufacturing, product use, and end-of-life management such as recycling or disposal. This chain is complex and involves multiple sectors, including petrochemicals, manufacturing, packaging, waste management, and recycling industries.

VALUE CHAIN STAGE	KEY ACTIVITIES		REGIONAL HIGHLIGHTS
UPSTREAM	Raw Material Production	Petrochemical extraction, monomer supply	Singapore, Thailand, Malaysia as major producers
	Polymerization	Conversion to PE, PP, PVC, etc.	Thailand, Malaysia, Indonesia expanding capacity
	Manufacturing	Product conversion, packaging, goods	Viet Nam, Indonesia, Thailand strong in exports
MIDSTREAM	Distribution & Use	Retail, consumer, industrial use	High demand in packaging, construction, consumer goods
DOWNSTREAM	End-of-Life Management	Collection, recycling, disposal	Low recycling rates, pollution challenges

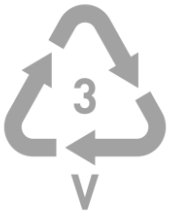
Southeast Asian countries have significant capabilities in both the upstream (product manufacture) and midstream (product distribution and use) sections. However, downstream (waste collection, aggregation, sorting and recycling) remains a challenge across all ASEAN Member States, due, in part, to poor collection, containment infrastructure and reliance on dumpsites for disposal. Significant leakage into the environment occurs. In all AMS, the formal and informal recycling sectors play an important role in plastics collection and recycling.



PLASTIC POLYMERS

POLYMER	MONOMER(S)	APPROX. % OF GLOBAL PRODUCTION	COMMON USES	RECYCLING SYMBOL
Polyethylene (PE)	Ethylene (C2H4)	~36%	Packaging films, plastic bags, bottles, pipes	1 (PET), 2 (HDPE), 4 (LDPE) (varies by type)
- High-Density Polyethylene (HDPE)			Milk jugs, detergent bottles, piping	2
- Low-Density Polyethylene (LDPE)			Plastic bags, food wrap, squeeze bottles	4
Polypropylene (PP)	Propylene (C3H6)	~21%	Food containers, automotive parts, textiles	5
Polyvinyl Chloride (PVC)	Vinyl chloride (C2H3Cl)	~10%	Pipes, window frames, flooring, cable insulation, medical tubing	3
Polystyrene (PS)	Styrene (C8H8)	~7%	Disposable cutlery, CD cases, insulation foam	6
Polyethylene Terephthalate (PET)	Terephthalic acid + ethylene glycol	~7%	Beverage bottles, food packaging, textile fibres	1
Nylon (Polyamide)	Nylon 6: ε-caprolactam (single monomer) Nylon 6,6: hexamethylenediamine + adipic acid (two monomers)	~3-4%	Textiles, automotive parts, industrial components, toothbrush bristles	Not commonly recycled (varies)
Acrylonitrile Butadiene Styrene (ABS)	Acrylonitrile + butadiene + styrene	~3-4%	Automotive parts, toys, electronic housings	Not commonly recycled
Polymethyl Methacrylate (PMMA) (Acrylic)	Methyl methacrylate	<1%	Signage, lenses, menu holders	Not commonly recycled

POLYMER SYMBOLS (RESIN IDENTIFICATION CODES)

SYMBOL							
POLYMER	Polyethylene terephthalate	High-density polyethylene	Polyvinyl chloride	Low-density polyethylene	Polypropylene	Polystyrene	Other polymers
TYPICAL PRODUCTS	Polyester fibres, Drinks bottles	Milk bottles, Bottle caps	Pipes, Shower curtains	Plastic bags	Food containers	Plastic utensils, Clamshell food boxes	Headlight lenses, Spectacle lenses

Resin Identification Codes are specified in the international standard:
ASTM D7611/D7611M-20 Standard Practice for Coding Plastic Manufactured Articles for Resin Identification

POLYMER ADDITIVES

During manufacture, substances are often mixed with plastic resins to enhance and customise the properties of specific plastic products.

These 'additives' confer specific properties, so that the products are fit for their intended purpose. Additives are used for the following reasons:

- To improve processing efficiency
- To increase durability and product lifespan
- To enhance mechanical properties
- To customise aesthetic and surface features
- To reduce costs
- To increase safety, and
- To adapt plastics for specific environments

ADDITIVE	WHAT IT DOES	HARM IT MAY CAUSE
Plasticiser	Increases flexibility, softness	Hormone disruption (e.g. phthalates), reproductive issues, possible cancer
Stabiliser (e.g. antioxidants)	Protects against heat, oxidation, UV	Persistent organics, possible toxicity, bioaccumulation
Flame Retardants	Reduces flammability	Endocrine disruption, cancer, persistent pollution
Colourant/Pigment	Provides colour	Heavy metals (cadmium, lead), toxicity to humans/ecosystems
Fillers/Extenders	Reduces cost, modifies strength	Mineral dust inhalation risk, may be contaminated with harmful substances
UV Stabilizer	Prevents sunlight degradation	Some can bioaccumulate, uncertain toxicity
Anti-static agent	Reduces static charge	Can release toxic fumes if burned, uncertain health effects
Clarifying agent	Increases transparency	Poorly studied; possible ingestion, ecosystem impact
Odour-neutralizer	Reduces product smell	Unknown; may mask harmful chemicals
Desiccant	Absorbs moisture during production	Minimal direct harm; possible dust issues

TYPES OF PLASTIC PRODUCTS

Product Type	Beverage & Food Containers	Bags & Films	Household & Personal Care Bottles	Durable Goods & Toys	Foam Packaging & Insulation	Other Flexible Packaging
Common Examples	Drink bottles, fruit punnets, food trays, condiment bottles, peanut butter jars, microwaveable containers	Shopping bags, bread bags, dry cleaning bags, cling film, shrink wrap, produce bags	Milk jugs, detergent bottles, shampoo bottles, bleach bottles	Outdoor furniture, piping, crates, bins, toys, buckets, automotive parts	Egg cartons, meat trays, disposable cups, protective packaging inserts, insulation boards	Snack bags, pet food bags, coffee pouches, squeezable tubes
Main Polymer(s) Used	PET, HDPE, PP, (some PS foam)	LDPE, (some HDPE)	HDPE, (some PET)	HDPE, PP, PVC, ABS	PS (Expanded Polystyrene - EPS)	Multi-layer films (PE, PP, PET, foil)
Key Properties of the Plastic	Lightweight, transparent, strong (PET); rigid, chemical/moisture resistant (HDPE); heat-resistant, tough (PP)	Flexible, stretchable, transparent, good barrier properties	Rigid, chemical resistant, moisture resistant, opaque or translucent	Strong, impact-resistant, weather-resistant, rigid (HDPE, PP, ABS); chemical resistant (PVC)	Lightweight, excellent insulation, shock absorption	Barrier properties, flexible, often opaque
Collection, Sorting & Recycling Considerations	**Contamination**: Food residues, labels, caps (different polymer), non-food grade materials. **Sorting**: Requires meticulous sorting by resin type (e.g., clear PET from coloured PET, HDPE from PP); often sorted by colour. **Recycling**: Generally well-established for PET and HDPE.	**Contamination**: Food residues, dirt, moisture, mixed materials (e.g., paper labels). **Sorting**: Difficult to sort due to flexibility and entanglement; often collected separately in store drop-offs. **Recycling**: Requires specialized film recycling facilities; can cause machinery jams.	**Contamination**: Residues of cleaning products/chemicals; labels, caps (often different polymer). **Sorting**: Relatively easy to sort by resin type and colour. **Recycling**: Well-established infrastructure for HDPE.	**Contamination**: Often contain mixed plastics, fillers, colourants, metals. **Sorting**: Challenging due to complexity of materials; requires advanced sorting technologies. **Recycling**: Often downcycled; PVC poses significant challenges due to additives.	**Contamination**: Food residues, moisture, dirt, tape. **Sorting**: Very bulky, low density, high air content makes transportation and processing inefficient; easily breaks into small pieces. **Recycling**: Limited; requires specialized densification equipment.	**Contamination**: Food residues, mixed materials (plastics, aluminium foil). **Sorting**: Extremely challenging due to multiple layers of different materials that are difficult to separate. **Recycling**: Very limited infrastructure; often not recycled and ends up in landfill or incineration.

MULTI-POLYMER PRODUCTS

Plastic items and packaging are often manufactured out of multiple different polymer types in order to create products with specific functional properties. These multi-polymer or multilayer plastic products are widely used in packaging applications and household consumer goods; however, this creates challenges for recyclers at their end-of-life.

PACKAGING

Multiple polymers are commonly combined in packaging applications, especially those containing food, drink or medicines.

Some of the reasons for this include:

Enhanced Barrier Properties: Providing resistance to oxygen, moisture, UV light and chemicals.

Mechanical Strength and Durability: Improving impact resistance, puncture resistance and structural integrity.

Sealing and Flexibility: Enabling rapid and effective sealing of packaging during manufacture.

Typical multi-plastic packaging applications include multilayer packaging films and pouches; plastic bottles and containers; laminated cartons; and high-barrier flexible pouches.

ELECTRICAL PRODUCTS

These often use plastic components made out of multiple polymers to meet specific functional and safety requirements. These plastics provide durability, electrical insulation, heat resistance, impact resistance and moldability.

Examples include appliance housings (e.g., washing machines, microwaves and coffee makers); electrical cable insulation; internal components (e.g. connectors, filters and fittings); transparent parts (e.g. oven door windows and blender jars) and components exposed to heat in ovens and kettles.

COMMON POLYMERS USED IN MULTI-POLYMER PRODUCTS

Polyethylene (PE): LDPE is flexible and used in films and bags; HDPE adds rigidity and strength; LLDPE is used in stretch wraps and pouches.

Polypropylene (PP): Due to its chemical resistance, flexibility and heat resistance, used in caps, containers, and food packaging.

Polyethylene Terephthalate (PET): Used for its clarity, strength and barrier properties, especially in beverage bottles and trays.

Polyvinyl Chloride (PVC): Can be rigid or flexible; used in blister packs, shrink wraps, medical tubing, electrical cable insulation and hoses in appliances.

Ethylene Vinyl Alcohol (EVOH): Used as an oxygen barrier in multilayer films to preserve food.

Polyamide (PA): Adds puncture resistance and mechanical strength to films.

Acrylonitrile Butadiene Styrene (ABS): Used as it is tough, impact-resistant and provides good electrical resistance.

Polycarbonate (PC): Strong, transparent, impact-resistant, UV resistant and can withstand a wide temperature range.

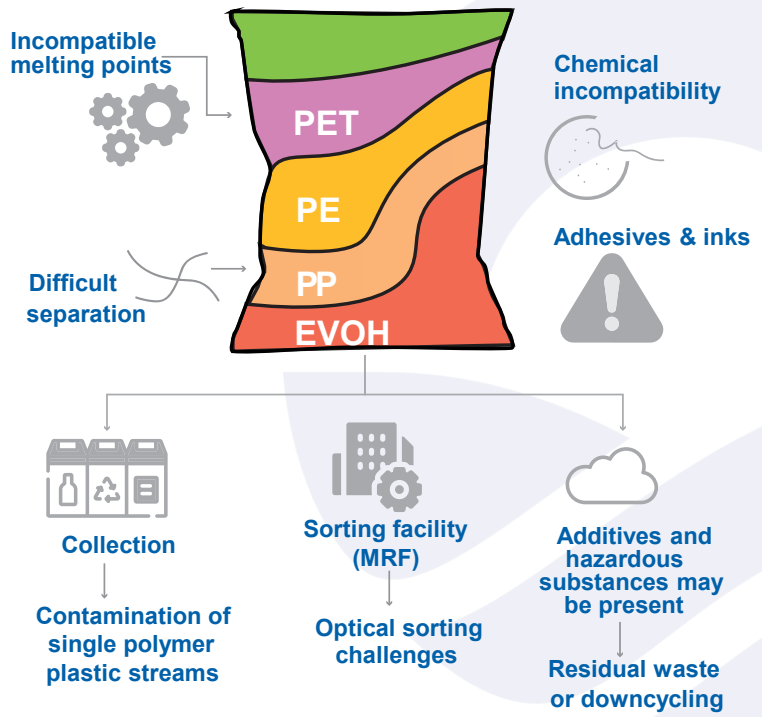
Polyamide (PA, Nylon): Used in components exposed to friction or heat.

Polybutylene Terephthalate (PBT): Used in electrical connectors and automotive housings.

MULTI-POLYMER PRODUCTS: RECYCLING CHALLENGES

Products and packaging made from multiple plastic polymers present recycling challenges due to their complex structure and material composition. The very features that make multi-polymer plastics effective for household electrical items and packaging (e.g. combining strength, barrier properties and flexibility) also make them hard to recycle with existing methods. These challenges include:

- **Complexity of Classification and Sorting:** Multi-polymer products often involve several layers or components made from different polymers (e.g., PE, PET, PA, EVOH) and sometimes non-polymer materials like aluminium foil or paper. Sorting these accurately by polymer type is difficult in conventional recycling systems, which usually require single-polymer streams for efficient mechanical recycling.
- **Layer Separation Difficulty:** The layers in multilayer plastics are tightly bonded to leverage each polymer's functional benefits (such as barrier protection, strength and sealability). This strong bonding makes separating the layers technically challenging and cost-prohibitive with current recycling technologies.
- **Contamination and Quality Issues:** Contamination between polymers or with residues from the product can degrade the quality of recycled materials. Recycled plastics from mixed polymers often have reduced properties such as clarity, impact resistance and mechanical strength, limiting their re-use options.
- **Presence of Additives and Hazardous Substances:** Multi-material products may contain flame retardants, stabilizers, plasticizers, or other additives that complicate recycling and may pose health risks if not properly managed.
- **Limited Recycling Technologies:** Traditional mechanical recycling struggles with mixed or multilayer plastics. Alternative methods, such as chemical recycling, may address some of these issues as they break down the plastic polymers into their chemical building blocks, enabling recovery from mixed polymer wastes.



2.2 PLASTIC WASTE

This section provides background information about defining plastic waste, its generation, composition and trends.

DEFINING WASTE: BASEL CONVENTION & OECD

A precise definition of waste is important as it provides a clear legal and operational basis for regulating waste management activities. This ensures that entities understand what materials must be controlled, how they should be handled and what standards they must meet to protect public health and the environment.

SCOPE

There is currently no single, unified definition of waste collectively defined by ASEAN. Instead, individual ASEAN Member States have established their own national legal frameworks and classifications for various waste streams within their respective regulations and guidelines. These are detailed in the AMS section of this Guidebook.

As the Basel Convention* regulates the transboundary trade of waste plastic into and between AMS, this definition has been used as the default for the purposes of the Guidebook.

* The Basel Convention is an international treaty that regulates and controls the transboundary movements of hazardous and plastic wastes.

BASEL CONVENTION

Article 2 defines waste as follows:

"Substances or objects which are disposed of or are intended to be disposed of or are required to be disposed of by the provisions of national law."

Disposal includes two categories of operations:

- **R (recovery) operations**: which include recycling, reclamation, direct re-use or alternative uses, and
- **D (final disposal) operations**: including engineered landfill and thermal treatment.

OECD

The Organisation for Economic Co-operation and Development (OECD) defines waste in OECD/LEGAL/0266, as:

"Substances or objects, other than radioactive materials covered by other international agreements, which:

i) are disposed of or are being recovered; or

ii) are intended to be disposed of or recovered; or

iii) are required, by the provisions of national law, to be disposed of or recovered."

Both the Basel Convention and OECD define waste in relation to the material's intended destination, whether this be final disposal or recovery. Discarded plastics are defined as waste and therefore need to be handled, transported, treated, recycled and disposed of in accordance with relevant national and international legislative instruments.

The definition of waste in each ASEAN member state is summarised in the AMS section of this Guidebook

DEFINING WASTE: ISO STANDARDS

There are a number of definitions in different ISO standards depending on context, with the most relevant shown below.

ISO:14040:2006 Environmental management – Lifecycle assessment – Principles and framework

"substances or objects which the holder intends or is required to dispose of"

ISO 24161:2022 Waste collection and transportation management — Vocabulary

"refuse substances or objects which are discarded, are intended to be discarded or are required to be discarded in accordance with national laws"

The definition of PLASTIC is explained in the section on PLASTIC PRODUCTS



TYPES OF PLASTIC WASTE

PRODUCT TYPES

In the ASEAN region, plastic waste is primarily **characterised by short-lived products, representing applications with lifespans of fewer than five years.**

Packaging is the largest contributor, accounting for an estimated **44% of total municipal solid waste** and typically having an average lifetime of months. It is also projected to remain the **largest source of plastic use,** accounting for 32% in both 2022 and 2050 projections. (Source: OECD)

Although the **composition of plastic waste** varies in each ASEAN member state, overall, **plastic bags** and **drinks bottles** represent the largest share of plastic waste by mass in the region. This highlights the dominance of **single-use plastic packaging** in the region.

The management and recycling of nationally and regionally generated plastic waste should therefore focus on **PET** and **polyethylene film.**

CHALLENGES

Recycling plastic bags and food packaging wrappers present a number of significant challenges. Their low density means they occupy a large volume, making collection systems costly, whilst their inherent flexibility can lead to their entanglement in machinery during sorting and processing. Contamination, in particular with food waste, can be difficult to remove; whilst multi-polymer products can cause sorting and polymer separation difficulties.

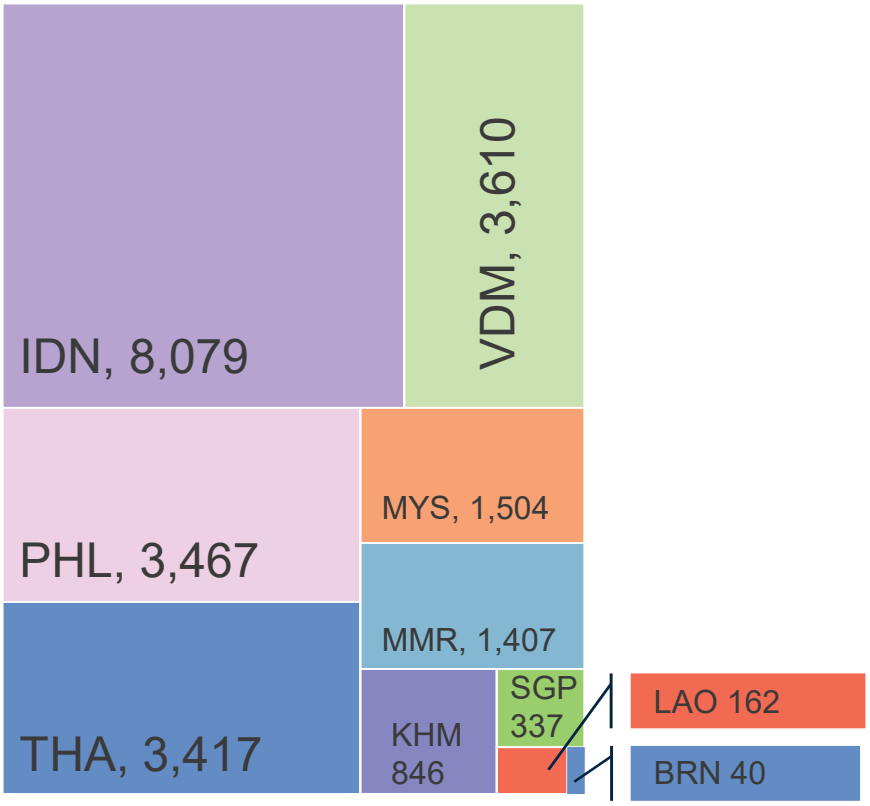
In general, whilst recycling PET drinks bottles is less problematic than films, there remain challenges associated with the use of different polymers for labels and caps, and residual liquids being left inside the containers.

Type of Plastic Waste	Approximate % by Mass
Plastic Bags	20-30%
Plastic Bottles (PET)	15-25%
Food Packaging Wrappers	10-20%
Plastic Containers	10-15%
Plastic Straws and Stirrers	5-10%
Bottle Caps and Lids	5-10%
Polystyrene Foam Packaging	5-10%
Plastic Cutlery	3-7%
Other Single-Use Plastics	2-5%

Sources: Based on a number of documents, including:
OECD (2025) Regional Plastics Outlook for Southeast & East Asia
SEA MaP Regional Action Plan

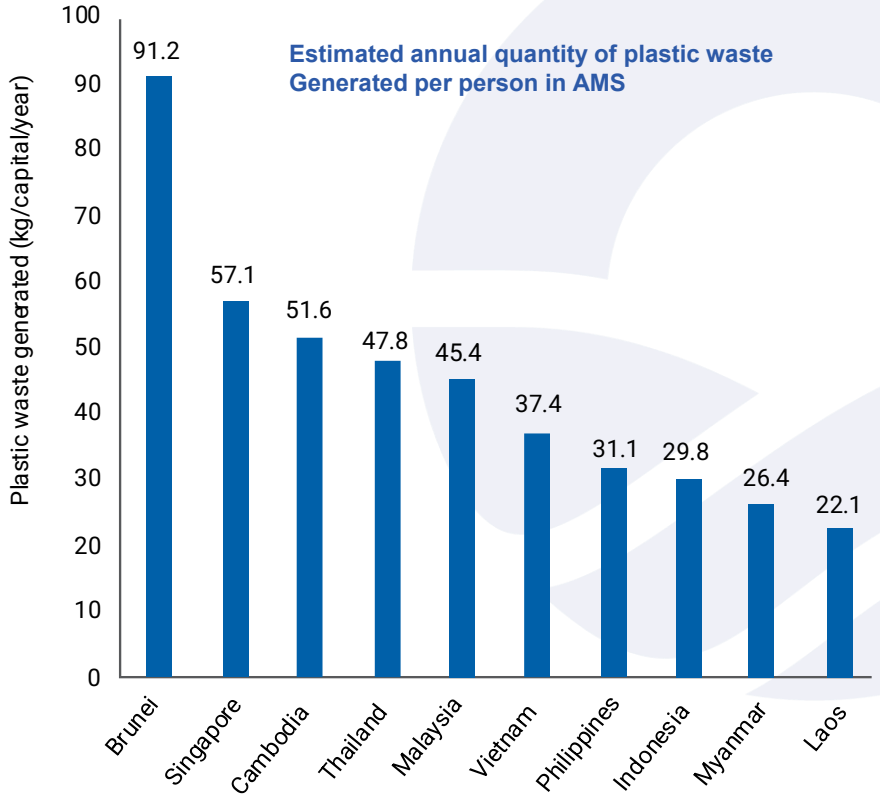
AMOUNT OF PLASTIC WASTE GENERATED

An estimated **23.8 million tonnes of plastic waste was generated** in ASEAN Member States in 2024, with Indonesia generating the most.
THIS IS 14 TIMES MORE THAN WAS IMPORTED INTO AMS IN 2024.



Values shown in thousand metric tonne per annum
Baseline data, 2020. Data extracted from Cottom et al (2024)

The total amount of **plastic waste generated in each country** broadly depends on both **the total population and the overall level of income**, which, in turn, affects product availability and consumer choices.

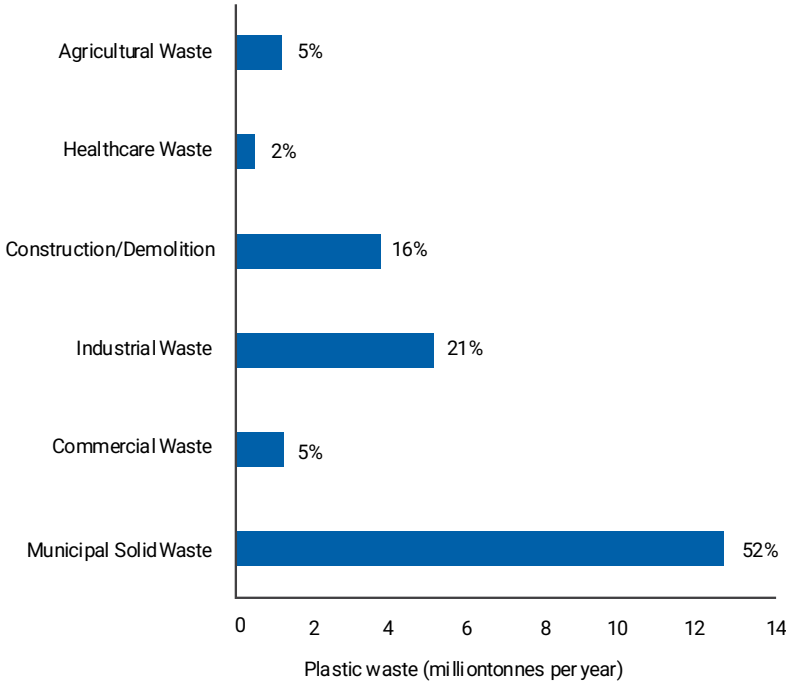


Data extracted from Cottom et al (2024)

SOURCES OF PLASTIC WASTE GENERATED IN ASEAN

An estimated **23 million tonnes** of plastic waste is generated annually across ASEAN Member States.

Of this over half comes **from municipal sources (52%),** followed by **industrial (21%),** then **construction/demolition (16%).**



Sources: OECD & analysis of multiple sources by consultants

WASTE CATEGORY	DEFINITION
Municipal Solid Waste	Waste generated by households, public institutions and commercial establishments. Usually excludes industrial, agricultural and hazardous wastes.
Commercial Waste	Waste produced by businesses such as shops, restaurants, offices, hotels, and markets. A subset is often managed with MSW but can also be counted separately.
Industrial Waste	Waste produced from manufacturing activities and industrial processes.
Construction/ Demolition	Waste derived from construction, renovation, or demolition of buildings and infrastructure. Includes concrete, bricks, metals, wood, glass, plastics, and soil.
Agricultural Waste	Residues produced from various agricultural operations.
Healthcare Waste	All types of waste generated from healthcare facilities including hospitals, clinics, and laboratories.

Definitions consolidated from available ASEAN, international, and sector-specific reports, reflecting common interpretation in Southeast Asia.
In practice, overlaps exist between commercial, municipal, and industrial waste streams depending on local regulations and waste management practices.

INTERNATIONAL PLASTIC WASTE TRADE FLOW (IMPORTS & EXPORTS)

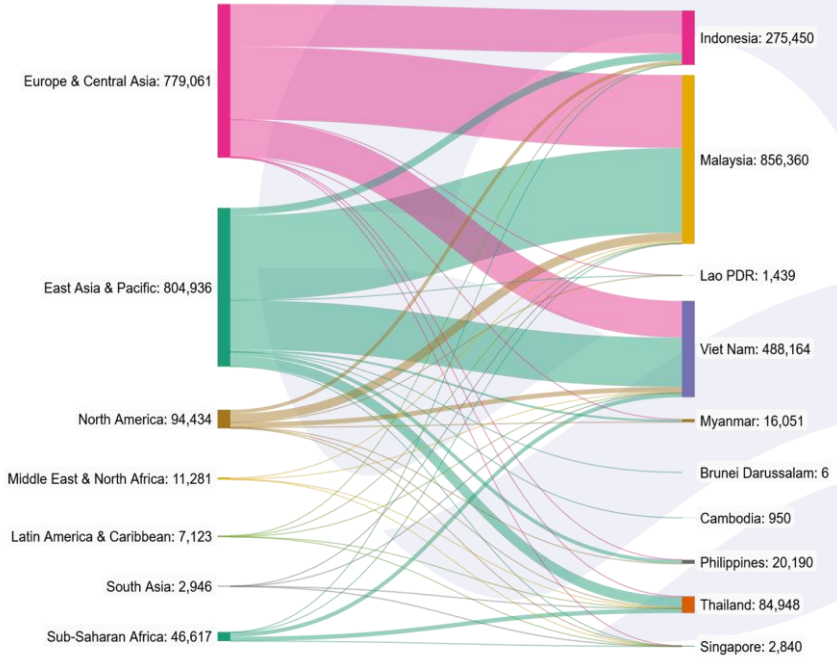
In addition to plastic waste generated nationally, the **ASEAN region is also a major importer and exporter hub** for plastic waste.

Plastic waste trade has undergone significant shifts in the last decade, particularly after global policy changes such as China's Green Fence and National Sword policies, as well as implementation of the Basel Amendment in 2021.

Much of this plastic waste was **poorly sorted, highly contaminated** and often **misclassified.**

- Trade data for 2024 suggested that an estimated **1.54 million tonnes** of plastic waste* were **imported into ASEAN** Member States in **2024**.
- This represented an **increase of 7%** on **2023 data** (1.44 million metric tonnes).
- It is equivalent to 7% **of that generated within AMS annually.**
- **Europe – Central Asia** exported just over half of all plastic waste (50%)
- **East Asia – Pacific** exported 40%
- Malaysia imported the greatest quantity, followed by **Viet Nam.**

AMS	PERCENTAGE
Malaysia	46.2%
Viet Nam	29.2%
Indonesia	17.2%
Thailand	4.9%
Philippines	1.2%
Myanmar	1.0%
Lao PDR	0.1%
Singapore	0.1%
Cambodia	0.1%
Brunei Darussalam	<0.1%
TOTAL	**100.0%**

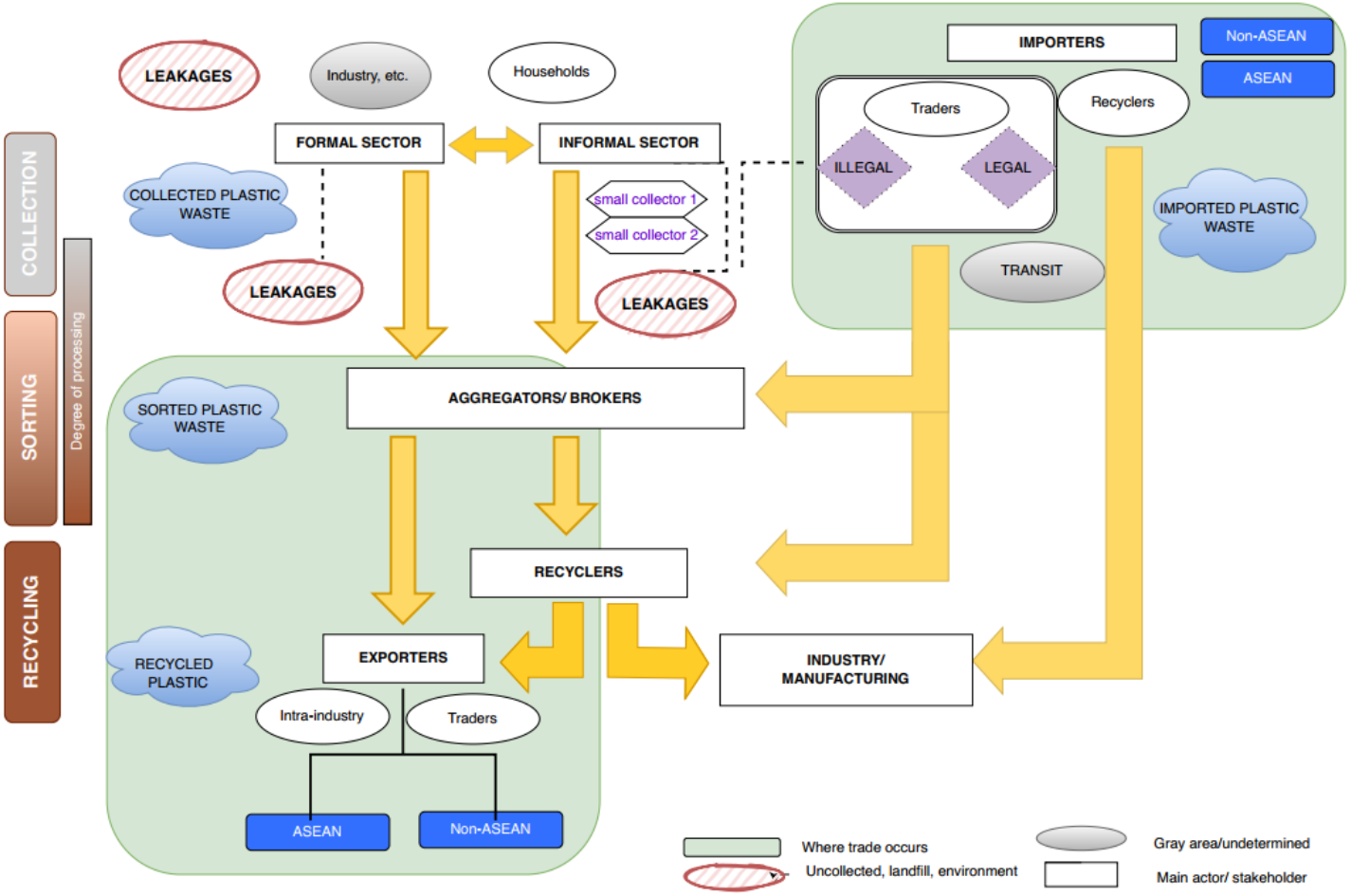


* Classed as **HS Code 3915** (waste, parings and scrap, of plastic)

Comtrade database (2024 data); values shown in metric tonnes

VALUE CHAIN COMPLEXITY

The plastics value chain in AMS is shaped by a complex interplay of local production, heavy reliance on informal waste management, and the legacy of imported plastic waste. These factors, combined with infrastructure and regulatory gaps, result in **high rates of plastic leakage into the environment.**



PLASTIC LEAKAGE: SOURCES



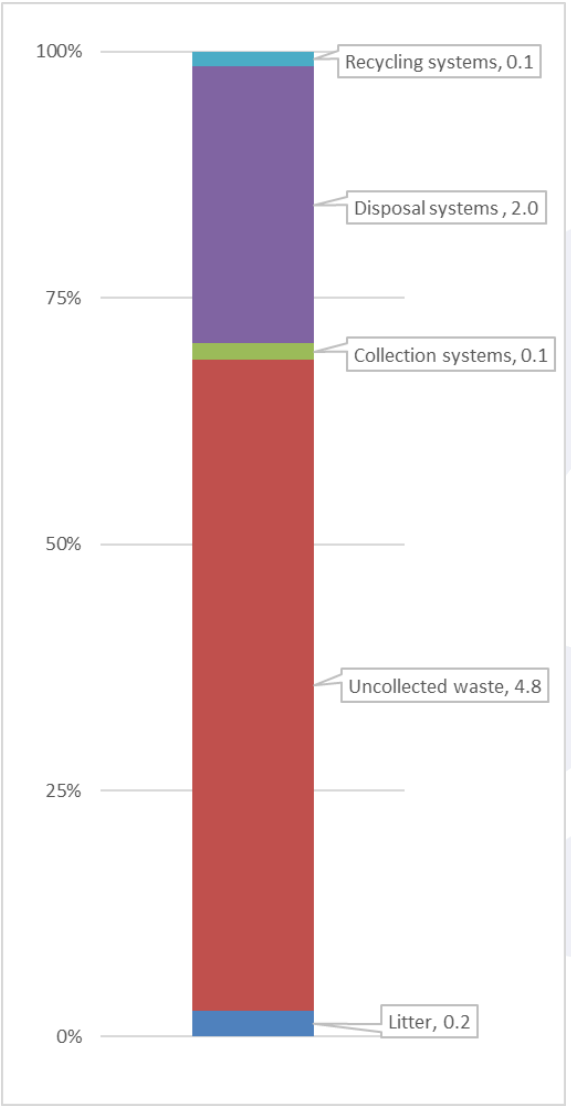
Globally, an estimated **52.1 million metric tonnes** of plastic waste leak into the environment, every year. This is equivalent to about 13% of the 414 million metric tonnes of plastic resin manufactured annually.

The **five main sources of leakage** come from:

- Uncollected waste (66%)
- Littering (3%)
- Collection system (2%)
- Uncontrolled disposal (28%)
- Rejects from sorting and reprocessing (recycling system) (1%)

Overall, **ASEAN Member States leaked** an estimated **7.3 million tonnes of plastic waste in 2020**.
This is equivalent to 31% of plastic waste generation.

Source: Cottom et al., 2024



Sources of plastic waste leaked into the environment (million metric tonnes in 2020)

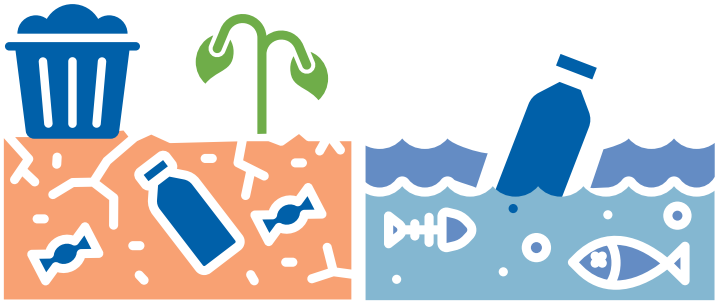
7.3 million metric tonnes of plastic waste was emitted into the environment in 2020 (modelled)

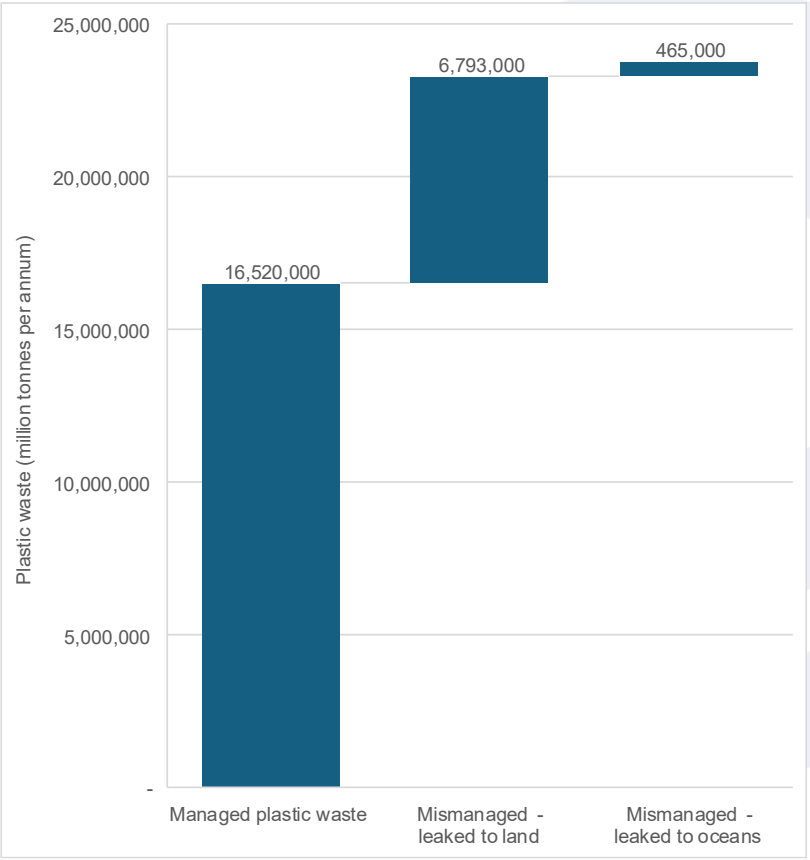
ESTIMATED POTENTIAL PLASTIC LEAKAGE: RECEPTORS

On average across ASEAN Member States, the majority (over 90%) of mismanaged plastic waste is thought to end up on land, **with less than 10% entering the oceans**. This means that **terrestrial (land-based) ecosystems are most affected by mismanaged plastic waste**.

Data modelling carried out by Meijer et al., 2021, and based on estimates of mismanaged plastic waste generation from a sub-set of countries, country surface area, coast length and annual rainfall suggested that Brunei Darussalam, followed by Malaysia and the Philippines, have the greatest potential for leakage into oceans. (Lao PDR and Myanmar were not included in their model).

Overall, the authors estimated that **potential leakage to oceans** was **6.4% of mismanaged plastic waste**.



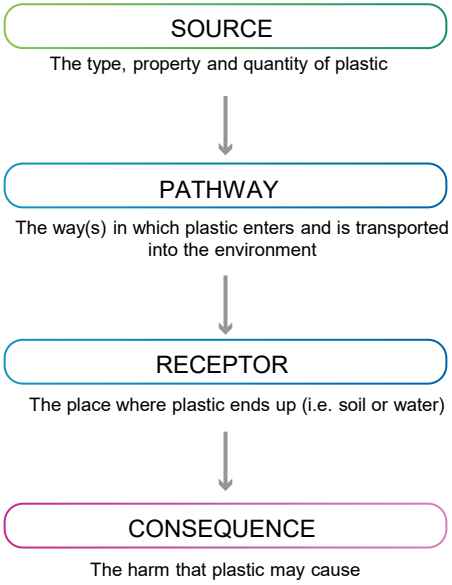


Note: Estimated plastic waste leakage based on data by Cottom et al. (7.3 M tonnes/annum) and percentages estimated by Meijer et al., 2021.

PLASTIC LEAKAGE: ECOSYSTEM HARM

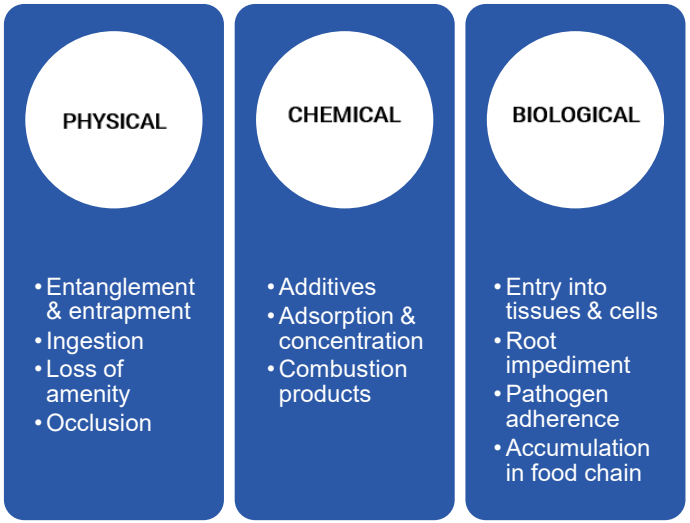
Understanding how plastics can harm human health and ecosystems is complex; therefore, conceptual models are often used to break down complex environmental risk scenarios into clear components. **The source-pathway-receptor-consequence model** is used primarily as a conceptual framework to understand, analyse and manage environmental hazards, including pollution and flooding.

THE SPRC MODEL



ECOSYSTEM HARM

As the majority (>90%) of mismanaged **plastics are thought to be retained on land, soil and terrestrial ecosystems are the main receptors.**
Plastics can cause harm in a number of different ways, as follows:



MICROPLASTICS

Microplastics are tiny plastic **particles less than 5 mm in size** that persist in both terrestrial and aquatic environments, contaminating soil, freshwater and marine ecosystems. In these environments, **microplastics can enter food chains** and potentially become concentrated further up the food chain.

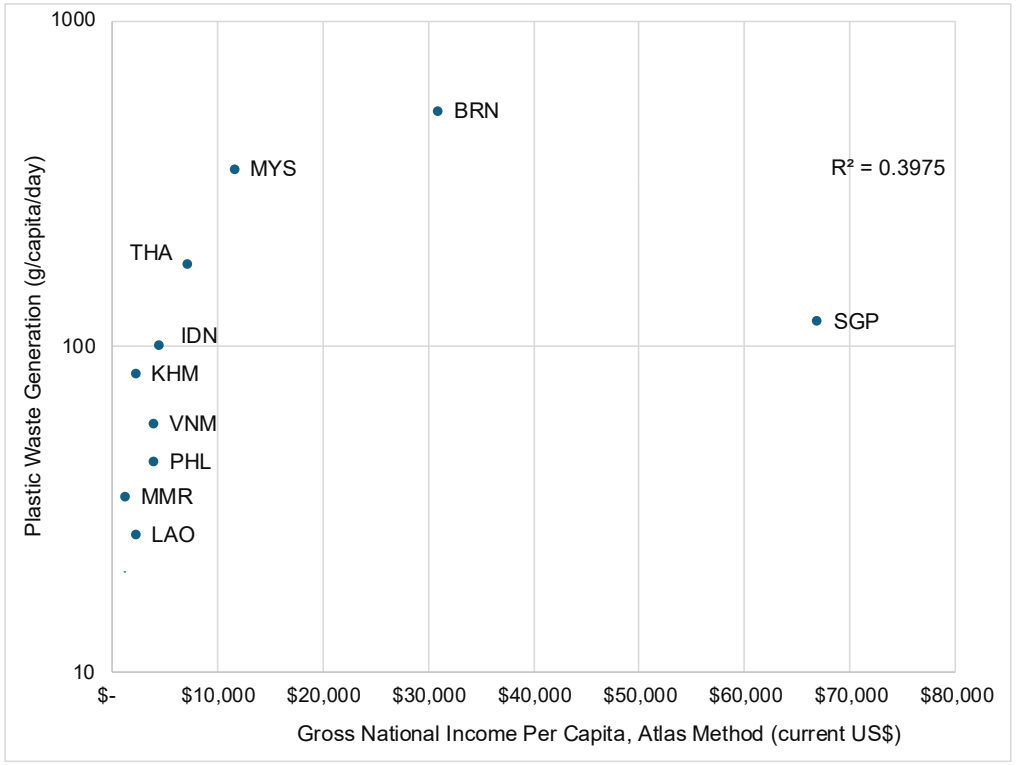
Furthermore, microplastics have **potential to carry toxic chemicals and pathogens** that can cause oxidative stress, inflammation, nucleic acid damage, metabolic and immune system disorders in a wide range of living organisms across land and water ecosystems.

Source: Food and Agriculture Organization of the United Nations, 2021

INCREASE IN PLASTIC USE AND WASTE GENERATION

The **amount of plastic waste generated in each country** is determined by a number of factors, including **population**, the level of **urbanisation** and the level of **economic prosperity**. These, in turn, affect the number and types of plastic products marketed to consumers which end up as waste. As the population grows, overall demand for plastic products also increases.

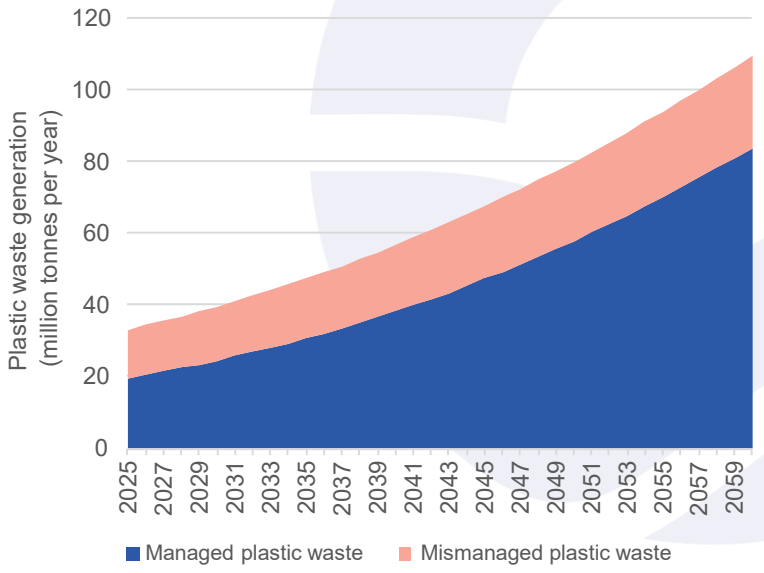
PER CAPITA WASTE GENERATION INCREASES AS ECONOMIC WEALTH INCREASES (2022 DATA)



Sources: Plastic waste data: What a Waste 3.0 (World Bank); Estimated plastic for Lao PDR (16%) taken from: World Bank. 2022. Get CLEAN and Green—Solid and Plastic Waste Management in Lao PDR GNI data for 2022, World Development Indicators, World Bank

OECD MODELLING OF PLASTICS WASTE IN NON-OECD ASIAN COUNTRIES (BASELINE SCENARIO TO 2060)

These data suggest that total plastics waste will double by 2045.



Source: OECD Plastic Waste Estimates

3 PLASTIC WASTE COLLECTION, AGGREGATION AND SORTING

CCP1: CONTENTS

This chapter provides background information about the different ways that plastic wastes can be collected and sorted in ASEAN Member States.

It describes the control measures that can be implemented at informal sector aggregation points and formal sector materials recovery facilities (Critical Control Point 1).

3.1 Technical Context: Collecting Plastic Waste

3.2 Technical Context: Sorting Plastic Waste

3.3 Controlling Quality at Sorting Facilities: CCP1

3.4 Guidance: Collecting & Sorting Plastic Waste



3.1 TECHNICAL CONTEXT: COLLECTING PLASTIC WASTE

This section describes some of the different ways that plastic waste can be collected and its effect on quality.

COLLECTION PRINCIPLES

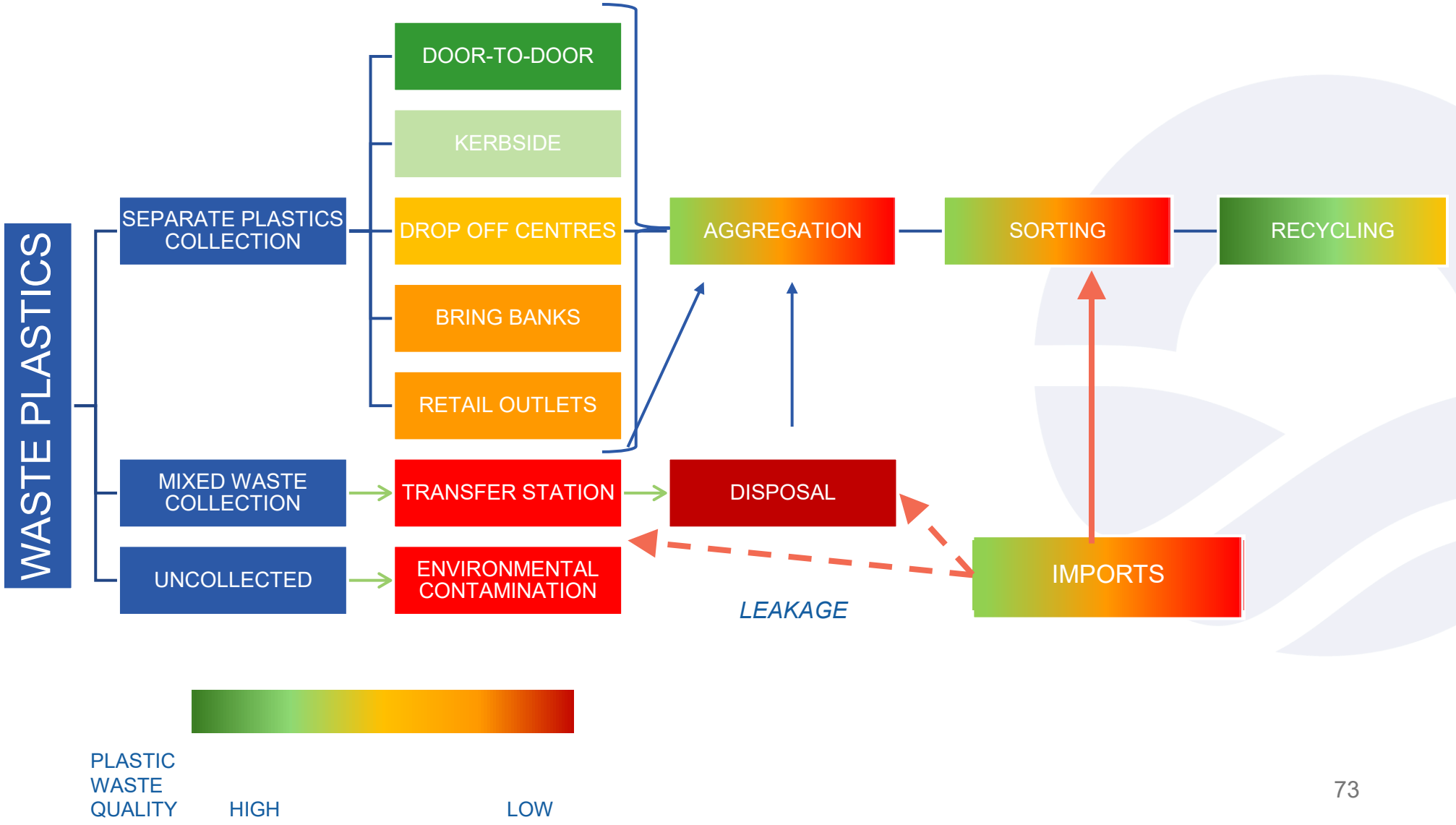
Collection is the first step in the journey plastic waste takes from end user to recycler. Whilst there are many different collection systems in place globally, some are better suited to the ASEAN socio-economic conditions than others.

The overall aims of an effective plastics collection service include:

- Maximising the quantity and quality of plastics collected for recycling
- Preventing leakage into the environment
- Preventing disposal
- Supporting a circular economy and the plastics value chain
- Achieving compliance with regulations.



FLOWS OF PLASTIC WASTE FOR RECYCLING



PLASTIC WASTE COLLECTION OPTIONS

In principle, there are three main approaches for collecting plastic waste for recycling, although there are many different variations depending on local circumstances.









ASPECT	SINGLE-STREAM (e.g., PET BOTTLES)	CO-MINGLED (MULTIPLE PLASTICS SEPARATED FROM GENERAL WASTE)	CO-MINGLED DRY RECYCLABLES (SEPARATED FROM NON-RECYCLABLE RESIDUAL WASTE)	MIXED WASTE (PLASTICS MIXED WITH ALL OTHER WASTES)
Description	Collection focuses on a specific type of plastic, usually high-value like PET bottles	Several plastic types collected together but separated from non-plastics	Several types of dry recyclables collected together (e.g. plastics, paper, card, glass, metals) but separated from organics and residual waste	Plastics mixed with all other wastes (organic, paper, metals), including non-recyclable waste
What Happens to the Plastics	Plastics are collected separately at source; require minimal sorting after collection	Sorting is done at Material Recovery Facilities (MRFs) or recycling centres		Plastics separated manually or mechanically after collection, usually low efficiency
Impact on Recycling Quality and Efficiency	High-quality recyclate due to less contamination; higher market value	Moderate quality; contamination from other plastics and materials possible; sorting adds cost		Low recyclate quality due to high contamination
ASEAN Context Notes	Singapore and some cities promote single-stream for better recycling outcomes and efficiency	Common in emerging ASEAN cities; relies on MRFs and technology, but sorting challenges remain		Predominant in many ASEAN countries due to lack of segregation infrastructure and public education

COLLECTION CONTAINERS

A wide range of containers - including bins, bags and baskets – are used within and across ASEAN Member States. These may be used for mixed residual waste and/or separated recyclables.

The type of container used depends upon the **economic status** and **level of urbanisation** of the area. These factors, in turn, affect infrastructure (such as roads), public participation and local government capacity (including provision of waste collection vehicles).

URBAN AREAS (LARGE CITIES)	MIDDLE- AND LOW-INCOME URBAN OR PERI-URBAN AREAS	RURAL AREAS AND SMALLER TOWNS
• Communal bins or skips: In many cities waste is put into large metal or plastic communal bins placed at collection points rather than individual household bins. • **Plastic bags**: Households often use single-use plastic bags (sometimes black bags, but often just repurposed shopping bags) left outside the home or at designated points for collection. • **Colour-coded bins** (in better-organised areas): Some cities (Singapore, Kuala Lumpur, Bangkok pilot schemes) provide different bins for recyclables, organics, and residual waste.	• **Mixed bag and container use**: Residents typically place waste in any available container (buckets, sacks, cardboard boxes) or directly in plastic bags. • **Street-side piles**: In less serviced neighbourhoods, waste is simply piled at collection points, sometimes in baskets or crates. • **Informal recycling bags**: Recyclables (plastic bottles, cans, cardboard) may be separated into clear bags or sold directly to waste-pickers.	• **Sacks or woven polypropylene bags** (e.g. rice sacks): Commonly used for household waste storage. • **Open baskets**: In some villages, particularly in Indonesia, Cambodia, and the Philippines, bamboo baskets or buckets are still used to hold waste until collection. • **Minimal bin provision**: Often no official bins are provided, and waste is carried directly to a collection vehicle, or openly dumped/burned.

Plastic bags and sacks are the most common “container” at the household level. **Communal bins** or **collection points** dominate in urban areas.
Formal wheeled bins are rare, except in Singapore or high-end neighbourhoods.

COLLECTION POINTS

Waste, including recyclable plastics, are often collected at a range of different locations, depending upon local circumstances. This directly affects the **quality** and **quantity** of **recyclable waste collected.**

COLLECTION OPTION	DESCRIPTION	KEY FEATURES IN ASEAN CONTEXT	ADVANTAGES	CHALLENGES IN ASEAN
Door-to-Door Collection	Waste collectors pick up segregated recyclables or mixed waste directly from households	Used in some urban areas and pilot programs; informal collectors often involved	Convenient, increases separation at source	Limited coverage, costly, relies on infrastructure and awareness
Kerbside Collection	Residents place waste/recyclables outside their homes on collection day	Emerging in more developed cities like Singapore, parts of Malaysia and Thailand	Facilitates sorting, better coverage	Requires better public compliance and collection logistics
Recycling Points / Bring Banks	Designated public bins or containers where households bring recyclables	Widely used in urban areas; common in Singapore, Malaysia, Philippines	Easy access, encourages voluntary drop-off	Limited accessibility for rural areas, requires regular servicing
Drop-off Centres / Recycling Centres	Larger facilities where recyclables are sorted, sometimes processed on-site	Present in urban centres in ASEAN countries; supported by local governments	Centralised sorting, higher quality recycling	Transport needed, less convenient for households
Supermarkets/Retail Outlets	Collection bins for plastic packaging and recyclables within stores	Increasingly adopted in Singapore, Malaysia, Viet Nam, as part of extended producer responsibility (EPR)	Convenient for shoppers, links to producer responsibility	Limited to urban, retail areas; only collects certain plastics

FORMAL & INFORMAL PLASTIC WASTE COLLECTIONS

In ASEAN Member States, the **formal sector** in plastics collection refers to **licensed, regulated organisations** (e.g., municipal services, contracted waste companies, registered recyclers) that collect, transport, and process plastics under defined rules, permits, and reporting requirements. The **informal sector** refers to **unregistered or semi-organised** actors (e.g., waste pickers, itinerant buyers, small aggregators/junk shops) who recover plastics through direct collection and trading, typically outside formal regulatory oversight. In practice, plastics collection systems in many ASEAN countries are **hybrid**, with informal collectors supplying a large share of recyclable plastics into formal recycling value chains.

DEFINITIONS USED IN THIS GUIDEBOOK

- **Formal recyclers:** Typically, large recycling sites with large-scale equipment that hold suitable business and waste permits and licenses for their operations.
- **Formal sector:** Collective term for municipal (or licensed collectors) and fully permitted/licensed aggregators and recyclers.
- **Informal sector:** People who earn an income from managing waste but are not formally employed to do so. Roles include collection (including picking), sorting, and other pre-processing and recycling.
- **Informal recycler:** Typically, small recycling facilities that operate without full licenses and permits.

Municipalities* are typically responsible for organising **separate plastic waste collections in much of Europe, North America, Japan, South Korea, Australia and New Zealand.**
Depending on the country, collection may be carried out directly or be sub-contracted to private sector companies.
In other regions, such as **parts of Asia, Latin America, and Africa**, municipal involvement varies and is often complemented by **informal sector** efforts.
The effectiveness and coverage of separate plastic waste collection depend greatly on local governance, resources and regulatory frameworks.

* Municipalities are also referred to as local authorities or local government administrations, depending on the country or region.

THE ROLE OF INTERMEDIARIES

After plastic waste is collected, a range of intermediaries link the informal and formal parts of the recycling value chain, ensuring materials reach processors in usable form. Together, these actors form the commercial backbone of post-collection plastic waste management in much of Southeast Asia, linking informal recovery with formal recycling.

- **Middlemen** act as go-betweens, purchasing mixed or sorted plastics from waste pickers or small collectors and reselling to larger buyers. They typically operate at local level, offering cash payments and ensuring a steady flow of material from informal sources into the commercial system.
- **Traders** manage the buying and selling of plastic scrap, sometimes handling the material but often co-ordinating logistics and transactions between other actors. They play a key role in price setting and in connecting local supply with national or export markets.
- **Aggregators** focus on physically consolidating plastics from multiple small suppliers. They sort, clean and bale materials to meet the specifications required by recyclers or exporters. By improving quality and volume consistency, aggregators provide a vital bridge between dispersed collection networks and formal recycling facilities.
- **Brokers** arrange sales between suppliers, traders and recycling plants without directly handling the materials. Their role centres on market intelligence, contract negotiation and risk management, helping ensure continuous movement of materials despite market fluctuations.
- **Dealers** are local business operators who buy recyclables for resale, often maintaining small yards or warehouses. They may perform limited sorting or baling but primarily focus on trading for profit within local or regional markets. Dealers provide a stable buying point for waste pickers and small collectors, helping maintain livelihood opportunities in the informal sector.

The complexity of local supply chains and the role of these intermediaries depend largely on national and local circumstances; this includes, for example, whether plastic waste has been sourced locally or imported from abroad, as well as supply and demand characteristics.

For simplicity, this Guidebook uses the term ‘middlemen’ to describe a range of intermediaries.

3.2 TECHNICAL CONTEXT: SORTING PLASTIC WASTE

This section provides contextual information on the different ways that plastic waste can be sorted at informal aggregation point and formal sector material recycling facilities.

AGGREGATION

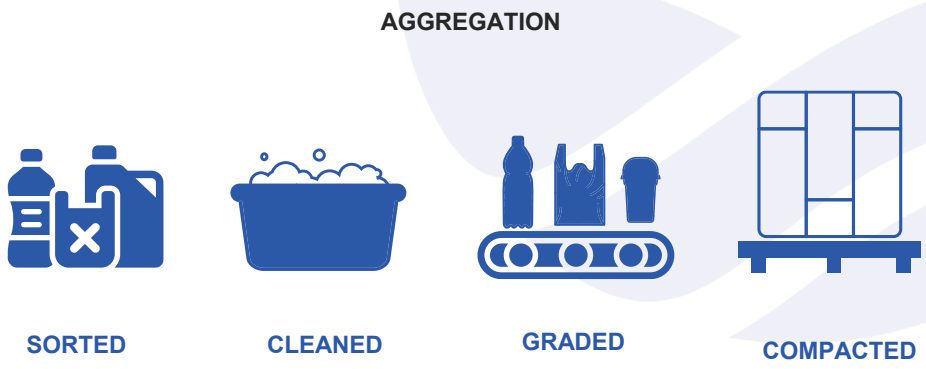
Aggregation involves the **consolidation, sorting** and **preparation of plastics** into marketable quantities and qualities that meet buyer requirements. Both informal and formal systems carry out aggregation, though they differ markedly in organisation, scale and technology.

In the **informal sector**, aggregation is typically performed by small operators, community collection points, or family-run yards. They are often also called '**Junk Shops'.**
Waste collectors sell their plastics to these intermediaries, who **sort, clean** and **grade** the materials **by polymer type** and **colour**.

Aggregators then bale and store the plastics until they have sufficient quantities to sell on to larger traders or recyclers. This system is flexible, responding rapidly to market prices. Although operations are usually manual and small-scale, informal aggregation significantly improves material quality and volume consistency, forming the backbone of regional recycling flows.

In the **formal sector**, aggregation takes place at **transfer stations or material recovery facilities (MRFs)** managed by municipalities or private contractors. Here, plastics from kerbside or mixed-waste collections are sorted mechanically or manually, often using conveyor systems, air classifiers, or optical sorters. The focus is on achieving cleaner, more **standardised outputs** suitable for recycling.

In practice, the two systems frequently overlap. Informal workers often recover plastics from formal collection trucks or disposal sites, feeding materials back into informal aggregation networks. Conversely, formal MRFs may purchase sorted plastics from informal aggregators to boost throughput.



INFORMAL SECTOR AGGREGATION GOOD PRACTICE

There are several measures that should also be considered good practice at an aggregation point, especially one operated by the informal sector.

COMMUNICATIONS

Communicate clearly with waste collectors:

- Establish a **positive list** of plastic products accepted
- Establish a **negative list** of prohibited contaminants
- Create a **poster/leaflet** showing this using **graphics/photos**

Establish a level of contamination above which the plastic will not be accepted for recycling

- This means setting out clear **acceptance & rejection criteria**

Communicate with **buyers** and understand their **purchasing specifications**

OPERATIONS

Keep all areas as **clean and tidy** as possible

Ensure that all areas **are safe for workers**

- Provide **personal protective equipment**, as appropriate

Create a **secure space to store all contaminants/rejected materials** before they are disposed of

- Take care with hazardous materials such as lithium-ion batteries, chemicals and infectious waste

Store all plastic waste **out of the sun and rain**

Weigh all incoming plastic waste to assess whether it has been 'weighed down' with non-target materials

Make and retain records of all incoming and outgoing materials, including photos

Dispose of any **rejected materials** and **discharges** in compliance with local/national laws

EQUIPMENT

Keep all equipment **clean**

Ensure that machinery is **serviced regularly**

Instruct all workers how to operate machinery in a **safe manner**

- **Do not remove or tamper with safety guards**

Do not compress or bale plastics **on the floor**

Ensure that plastics are **compressed to the specification** required by the purchaser

FORMAL SECTOR AGGREGATION AT MRFs

A **Materials Recovery Facility (MRF)** is a plant where mixed dry recyclable wastes are sorted into different fractions for recycling. The MRF is usually contained in a large building to shelter it from the rain and sun, to control odours, to prevent littering of the environment and to keep pests out. Depending on the type of recyclable waste received, the intended recycling markets and level of sophistication (capital infrastructure), it contains equipment designed to separate fractions based on their **size, density, colour** and **magnetic properties**. Many MRFs also rely on human sorting, usually at the input stage, to remove unwanted contaminants. MRFs may include some, or all, of the following types of equipment:

MECHANICAL SCREENS

Trommels: These are rotating cylindrical drums with holes that separate materials by size as they pass through.

Disc Screens: These have a series of rotating discs that sort materials based on their size and shape; they are commonly used for separating paper or cardboard from containers.

AIR SEPARATION EQUIPMENT

Air Classifiers: These blow lighter materials (such as paper or plastic film) away from heavier items using airflow.

Aspiration Systems: These remove dust and very light materials by suction. They are often used to keep the MRF clean and improve air quality for workers.

MAGNETIC & EDDY CURRENT SEPARATORS

Magnetic Separators: These extract ferrous metals (steel and iron containers) using powerful magnets.

Eddy Current Separators: These use magnets to induce currents in non-ferrous metals (such as aluminium), causing them to be ejected from other wastes.

OPTICAL SORTERS

Near-Infrared (NIR) Sorters: These use sensors and air jets to identify and separate plastics by resin type and colour, as well as to distinguish other materials like paper.

Colour Sorters: These use sensors to identify and separate materials based on colour; they are often used to separate coloured and colourless PET bottles.

OTHER SPECIALIZED EQUIPMENT

Bag Splitters: These use a rotating drum or counter-rotating shafts fitted with hooks or teeth to tear the plastic bags (refuse sacks) and release their contents for separation.

Ballistic Separators: These distinguish between 2-dimensional (flat) and 3-dimensional materials by shaking them along an inclined surface.

Glass Cleanup Systems: These use vibrating screens and air separators to process broken glass and remove contaminants.

Density Separators: These use water or other media to split materials by density, especially for glass and plastics separation.

X-Ray Sorters: These identify different materials based on their atomic density.

Laser Sorters: These are used to sort metals due to the different ways metal atoms respond to specific wavelengths of high-intensity light.

In recent years, **robotic** separators powered by **artificial intelligence (AI)** have been developed. These use cameras and sensors to scan and identify specific materials, including those containing **"digital watermarks".** Machine-learning algorithms classify items in real time; then robotic arms are used to place the targeted materials into dedicated bins. These systems are capable of continuous operation, can identify many different types of products and are much faster and more effective than manual sorting. This increased efficiency is reflected in their cost.

EQUIPMENT USED AT HIGH-TECH MRFs

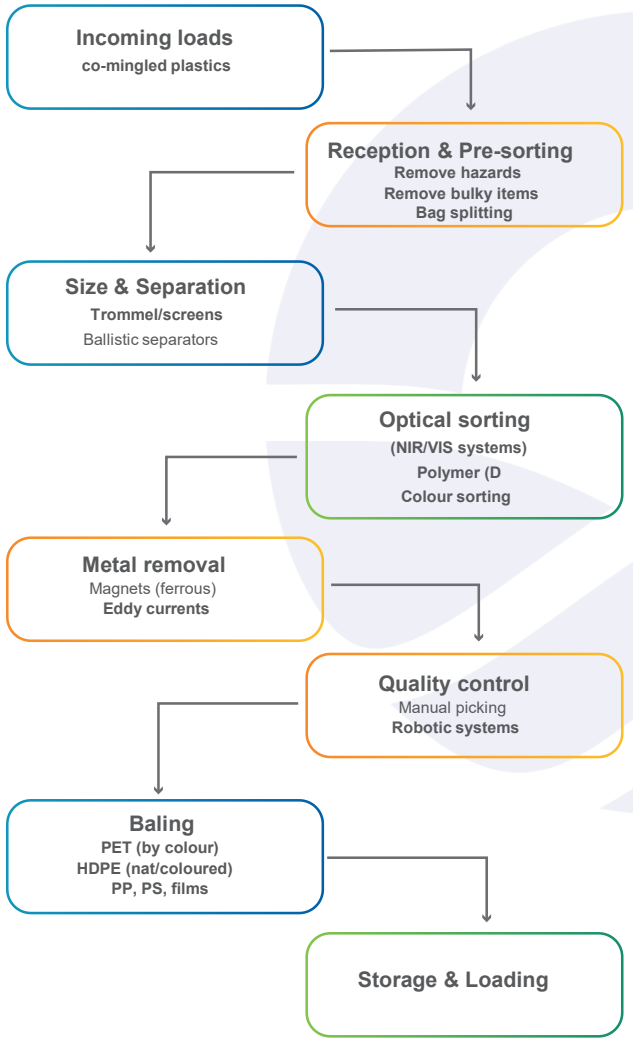
METHOD	PRINCIPLE	WHAT IT SEPARATES	TYPICAL USE
Manual sorting	Human visual inspection	Remove contaminants, bulky items, hazards; QC on specific polymers	Front-end preparation and final quality control
Bag splitter	Low-speed mechanical device used to rip open refuse sacks	Opens plastic bags containing recyclable waste	Front-end preparation before screening
Size-based separation (trommel, disc screen, star screen)	Items fall through or pass over based on size; 2D vs 3D behaviour	Fines, films, small fragments, 3D containers	Early-stage preparation for optical sorting
Ballistic separation	Distinguishes flat vs rolling items using paddles	Films and fibre vs bottles and rigid containers	Separating films before NIR sorting
Air/aspiration systems	Airflow lifts light materials	Films, labels, lightweight plastics	Removing films that hinder downstream equipment
Density separation (sink–float, usually post-shredding)	Different polymers float or sink in water	Polyolefins vs PET/PVC	Reprocessing stages (flake separation)
Magnetic separation	Magnetic fields attract ferrous metals	Steel closures, rings	Removing metals from bottle streams
Eddy current separation	Induced currents repel aluminium	Aluminium caps, cans, small metal components	Protects downstream equipment and improves bale quality
Optical sorting – NIR	Polymer-specific spectral signatures	PET, HDPE (natural/coloured), PP, PS, PVC, etc.	Main separation step for rigid plastics
Optical sorting – VIS/colour cameras	Visible-light colour recognition	Natural, clear, blue, opaque, mixed-coloured plastics	Colour-sorting PET and HDPE
Optical flake sorting	NIR/VIS applied to small fragments post-shredding	Polymer type and colour of flakes	PET and HDPE recycling plants
Electrostatic sorting	Differences in surface charge	Some mixed-polymer flakes	Specialist plants; niche applications
Robotic sorting (AI-guided)	Vision systems + robotic pickers	Targeted items, contaminants, hard-to-sort shapes	QC lines and flexible recovery of high-value plastics
Hyperspectral imaging	High-resolution spectral detection	Complex, dark, or near-black plastics	Facilities targeting difficult materials

FORMAL SECTOR AGGREGATION AT MRFs

The effectiveness of sorting plastic waste at Materials Recovery Facilities into different plastic fractions for recycling is dependent on a number of variables, such as:

- The **type of collection system** (see: Plastic Waste Collection Options),
- The **type and efficiency of the sorting equipment** (see: Equipment Used at MRFs),
- The **input quality specification** included in contracts with suppliers
- The **buyer's specification** set by intermediaries or recyclers (see: Bale Specifications)
- The **quality assurance system** in place at the MRF, and
- The **technical competence of employees** working at the MRF.

PROCESS FLOW DIAGRAM
SORTING OF CO-MINGLED PLASTIC WASTE

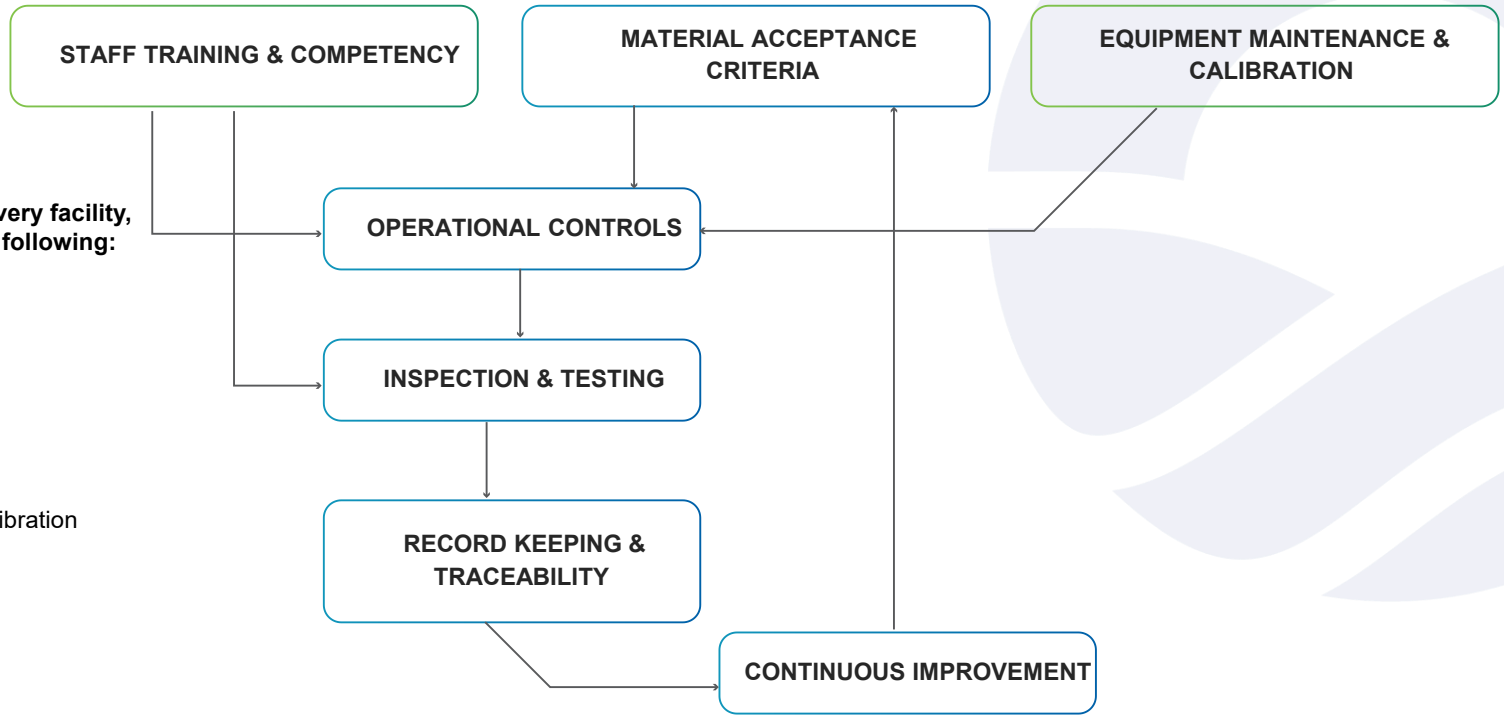


QUALITY MANAGEMENT SYSTEMS

A **quality management system (QMS)** can be defined as a **formal framework of policies, processes and procedures** that an organization uses to **consistently deliver products and services that meet customer and regulatory requirements.** A QMS and Hazard Analysis and Critical Control Points **(HACCP)** are complementary frameworks, addressing different aspects of risk and control. In essence, **a QMS provides an overarching management framework, whilst HACCP is a specialised tool that can sit within a QMS** framework to control risks associated with specific hazards.

In the context of a materials recovery facility, a QMS would need to include the following:

- Material acceptance criteria
- Operational controls
- Staff training and competency
- Inspection and testing
- Equipment maintenance and calibration
- Record keeping and traceability
- Continuous improvement



QUALITY MANAGEMENT SYSTEMS

At a Materials Recovery Facility, a Quality Management System should address the following operational aspects:

MATERIAL ACCEPTANCE CRITERIA

Establishing clear rules regarding:

- The **source** of plastic waste (i.e. where the waste has come from and the type of collection system in place to transport it to the MRF, e.g. polypropylene foodservice trays from cafeterias),
- The **types of plastic products** (including the product and polymer type, e.g. PET drinks bottles),
- **Excluded contaminants**, and
- **Levels of acceptable residual contamination.**

OPERATIONAL CONTROLS

Ensuring that there are **documented (written) procedures relating to each stage of the sorting process**. These should include, as appropriate, pre-sorting, mechanical separation, optical sorting, manual picking and baling. These aim to reduce variation, keep contamination levels within target limits and ensure that all equipment is operated safely.

EQUIPMENT MAINTENANCE AND CALIBRATION

All equipment, including materials handling vehicles, should be serviced regularly, in accordance with manufacturers' recommendations. In addition, daily checks should be carried on all equipment out for health and safety purposes (e.g. checking that safety guards are undamaged and have not been bypassed, and that fallen materials are not allowed to accumulate).

INSPECTION AND TESTING

This should include periodic checking at pre-defined intervals of input materials and sorted fractions. It should include visual inspections, record keeping, sampling, and measuring contamination rates, moisture levels and bale density.

STAFF TRAINING AND COMPETENCY

This is to ensure that all operatives understand input specifications, sorting requirements, polymer identification, and common contaminants including how these should be stored, transported and disposed of in an **environmentally sound manner**. Importantly, it should also include the use of personal protective equipment and safe systems of work.

RECORD KEEPING AND TRACEABILITY

A record of all activities carried out on site should be made. This should include, but is not limited to, input materials received, non-conformances, operative training, equipment maintenance, customer feedback and corrective actions taken.

CONTINUOUS IMPROVEMENT

Periodic reviews of monitoring data and MRF performance should be carried out to identify recurring issues, implement corrective measures, refine processes and monitor corrective actions.

MANAGEMENT STANDARDS ISO 9001 & 45001

Companies operating in the formal sector may wish to obtain independent third-party certification to one of more **international management standards**. A description of **certification, certification bodies and accreditation** is detailed here.

ISO 9001:2015

QUALITY MANAGEMENT SYSTEMS — REQUIREMENTS

This is the core global standard for quality management systems. It sets out a structured approach for organisations to ensure consistent service or product quality, continual improvement, and strong customer focus. It is built around **seven Quality Management Principles:**

1. **Customer focus:** Meeting customer needs and aiming to exceed expectations. In the waste sector, this includes meeting contractual specifications for sorted materials, service performance and compliance requirements.
2. **Leadership:** Clear direction and alignment of people with the organisation's purpose, ensuring that quality objectives are embedded throughout operations.
3. **Engagement of people:** Ensuring that everyone is competent, empowered, and involved in delivering quality outcomes. This includes operators, supervisors, maintenance teams, and support staff.
4. **Process approach:** Managing activities as interconnected processes that function as a coherent system. This helps maintain consistent output quality, particularly important in variable waste streams.
5. **Improvement:** Ongoing enhancement of performance, systems and outputs. This applies both to routine incremental improvements and more substantial innovation.
6. **Evidence-based decision making:** Using data, monitoring, testing and analysis to guide decisions. For a waste operation, this may include performance metrics, contamination data, maintenance logs and audit results.
7. **Relationship management:** Building effective relationships with stakeholders such as suppliers, regulators, customers and service partners to enhance performance and create shared value.

ISO 9000:2015

QUALITY MANAGEMENT SYSTEMS FUNDAMENTALS AND VOCABULARY

This sets out a framework for quality management and defines key terms associated with it.

ISO 45001:2018

OCCUPATIONAL HEALTH AND SAFETY

A management system for identifying and controlling risks to worker health and safety. It is particularly relevant in the waste sector due to hazards such as machinery, manual handling and contaminants.

ENVIRONMENTAL MANAGEMENT STANDARD ISO 14001

ISO 14001:2026 **(Environmental management systems — Requirements with guidance for use)** is an international standard that sets out the requirements for an environmental management system. Its core purpose is to help organisations identify, manage, monitor, and improve their environmental performance; providing a framework for them to develop a systematic approach to managing environmental responsibilities.

Key elements include:

- Establishing an environmental policy that reflects the organisation's commitments, including compliance obligations and continual improvement.
- Identifying environmental aspects and impacts associated with operations, products, and services, and determining which are significant.
- Setting measurable environmental objectives and planning actions to achieve them.
- Implementing operational controls, competence and training, communication processes, and emergency preparedness.
- Monitoring and measuring performance, conducting internal audits, and undertaking management reviews.
- Driving continual improvement in environmental performance through corrective actions and periodic reassessment of the EMS.

ISO 14001 is an important management standard as it **directly supports the delivery of environmentally sound management (ESM)** in sorting and recycling facilities for plastic waste. Although it does not prescribe technical process standards, it ensures that the organisation operates in a controlled, compliant, and continuously improving manner.

- **Alignment with ESM principles**: ESM requires facilities to minimise environmental harm, manage risks, and demonstrate responsible practices. ISO 14001 provides a formalised EMS through which these obligations can be implemented, evidenced and maintained.
- **Legal and regulatory compliance:** Plastic-waste recycling is subject to environmental permits, pollution-control requirements, occupational safety provisions, and transboundary-movement rules. ISO 14001 requires systematic identification of applicable legal requirements and procedures to ensure compliance.
- **Control of environmental aspects:** Sorting and recycling operations generate emissions, wastewater, noise, odour, and residual wastes. ISO 14001 requires identification of environmental aspects, assessment of associated impacts, and implementation of controls—key to meeting ESM expectations for pollution prevention.
- **Operational consistency and traceability:** ESM relies on controlled, documented, and reproducible processes. ISO 14001 establishes requirements for operational controls, competence, documentation, and record-keeping that strengthen facility integrity and traceability.
- **Continuous improvement:** ESM is not static; facilities must improve over time, particularly in efficiency, pollution reduction, and material-quality management. ISO 14001 embeds continuous improvement through measurement, audits, corrective actions, and management review.

Please note: Don't confuse Environmental Management Systems (EMS) with Environmentally Sound Management (ESM)

ENVIRONMENTALLY SOUND MANAGEMENT OF WASTE (1)

The Environmentally Sound Management (ESM) of waste is a concept set out in the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal. Its central aim is to ensure that **"all practicable steps [be taken] to ensure that hazardous wastes or other wastes are managed in a manner which will protect human health and the environment against the adverse effects which may result from such wastes". This includes plastic waste and its recycling**.

ESM is a broad concept encompassing the **entire waste management system.**

Its guiding principles include:

- The waste management hierarchy,
- The "polluter pays" principle,
- The precautionary approach,
- The proximity principle,
- The least transboundary movement principle, and
- The non-transfer of responsibility for ESM.

Waste management facilities that handle wastes must meet all **basic requirements** to ensure ESM and commit to **continual improvement** in their operations.

1. APPROPRIATE DESIGN AND LOCATION

- The design and location of the plant must be appropriate, taking into account potential risks to the environment, especially in environmentally sensitive areas.
- An environmental and social impact assessment should be conducted and approved by the appropriate authorities before the facility is constructed.

2. MEASURES TO SAFEGUARD OCCUPATIONAL SAFETY & HEALTH (OSH)

- Measures that meet the requirements of national OSH legislation.
- Appropriate actions based on a **risk assessment** to address significant actual and/or potential risks to the **health and safety of the public and workers**.
- Contingency arrangements in the event of plant breakdown or accidental spillages.
- An **adequate training programme** for personnel to ensure employees have the necessary awareness, competency and training for managing occupational risks and wastes effectively.

ENVIRONMENTALLY SOUND MANAGEMENT OF WASTE (2)

3. MEASURES TO PROTECT THE ENVIRONMENT

Measures to control **pollution**, taking into account **emission limit values to air, water, and soil**. This includes leakage of plastics.

Appropriate actions based on **risk assessment to address** significant actual and/or potential risks to the environment.

Contingency arrangements in the event of plant breakdown or accidental spillages.

Waste acceptance and handling criteria, including measures for due diligence and proper collection, sorting, pre-treatment, treatment, storage, and downstream management of wastes and residuals.

4. ORGANISATIONAL AND MANAGEMENT SYSTEMS

- The facility must have **all the necessary permits** according to the applicable legislation.
- An **applicable environmental management system (EMS)** should be in place, if feasible and appropriate. An EMS should describe, assess, and periodically review the design, construction, operation, monitoring, management, and maintenance of the facility.
- The EMS should demonstrate **compliance with applicable legislation and regulations**.
- The system should include provisions for **transparency** and confirm ESM implementation, possibly through third-party audits and inspections, while protecting confidential business information.

5. MONITORING AND REPORTING

- An **adequate and transparent monitoring, recording, reporting, and evaluation programme** is required.
- This programme should cover relevant legal requirements, key process parameters, compliance with applicable safety requirements, effluents and emissions, and records of incoming, stored, and outgoing wastes.

6. EMERGENCY RESPONSE AND CLOSURE

- An **adequate emergency plan and response mechanism** must be in place.
- An adequate **plan for closure and aftercare** is needed, including the identification and remediation of contaminated sites.

In order to operate a materials recovery facility (MRF) in accordance with ESM principles, a **quality management system (QMS)** is essential.

BALED PLASTIC QUALITY SPECIFICATIONS

Once compressed and baled, it is much harder to assess whether sorted plastics meet buyer's specifications, simply because the majority of the target plastics are hidden within the bale, with only a small proportion visible on the surface. However, published methods have been developed to allow for assessments for quality control purposes as part of a quality management system.

QUALITY STANDARD RECYCLED PLASTICS (ESA, UK)

This standard covers:

- Mixed plastic bottles, pots, tubs and trays (HDPE, PET, PP, PS), and
- LDPE films

It is aimed at entities sorting and baling plastics primarily to export for recycling. It therefore provides guidance regarding compliance with the Basel Convention's requirement for the plastics to be "almost free of contamination"

The standard requires operators to implement a certified quality management system.

It specifies that a **visual check** be carried out on **five sides of a bale**, and provides criteria to classify the bale as either:

- **Green**: acceptable to export,
- **Amber**: requires further inspection and sampling, and
- **Red**: the bale should not be exported.



The assessment criteria are detailed here.

A copy of the standard can be downloaded here.

ISRI SPECIFICATIONS (ReMa and APR, USA)

These specifications were initially developed by **the Institute of Scrap Recycling Industries (ISRI)** and are updated by the **Recycled Materials Association (ReMA)** and the **Association of Plastics Recyclers (APR)** in the USA. They provide commercial guidelines for baled recycled plastic scrap in order to facilitate commodity trading and provide industry-wide quality standards.

The specifications include criteria for:

- Bale Density
- Bale Tying Material
- Bale Integrity
- Allowable Contamination
- Prohibited Material



There are 13 specifications covering different plastic polymers.

An example is shown here.

Copies of the standards can be accessed here.

OUTPUT SORTED MATERIAL SAMPLING FREQUENCIES

Inspection of baled plastics should form part of the facility's quality management system. Although quality specifications do not state the frequency of inspection, the expectation is that every bale should receive a basic visual inspection before it leaves the site.

REASONS WHY EVERY BALE SHOULD BE INSPECTED

- Bale quality can vary significantly even within the same shift.
- Contamination is easier and cheaper to address before dispatch.
- Buyers would expect consistent grading and traceability.
- Visual inspection is quick and low-cost compared to downstream quality failures.

This check should be a **brief external examination**, looking for obvious contaminants, excessive moisture, loose wires, non-conforming material or poor compaction.

All inspections should be logged and recorded for auditing purposes.

The ESA Standard summarised here provides a quality standard based on a visual assessment of baled plastics.

FURTHER INSPECTION INSIDE BALES

In addition to visual inspections, a more in-depth assessment should be carried out periodically involving breaking open bales.

This should be carried out as a minimum:

- **One bale per batch**, or **one per hour**, or **per shift** depending on throughput at the MRF.
- Whenever a bale fails a visual check quality criteria (e.g. is ranked as 'amber' in the ESA standard).
- Whenever feedstock quality changes.
- Following maintenance, staff rotation, or process disturbances.
- Whenever contamination levels in inputs rise. This provides a direct link with quality controls at the input stage.

LINK WITH HACCP PASS/FAIL CRITERIA

Collectively, visual inspections and an analysis of the contents of bales should provide MRF operators with the information they need to either:

- **Pass the batch for sale and distribution** to reprocessors or for export, or
- **Fail the batch and do not dispatch**. In the event that this occurs, this should trigger a number of actions as part of the facility's QMS, including:
  - A review of input materials and quality,
  - Assessment of suppliers' adherence to input specifications,
  - Effectiveness of the sorting equipment,
  - Working practices of operatives.

The batch should then be either re-processed or sent for ESM disposal.

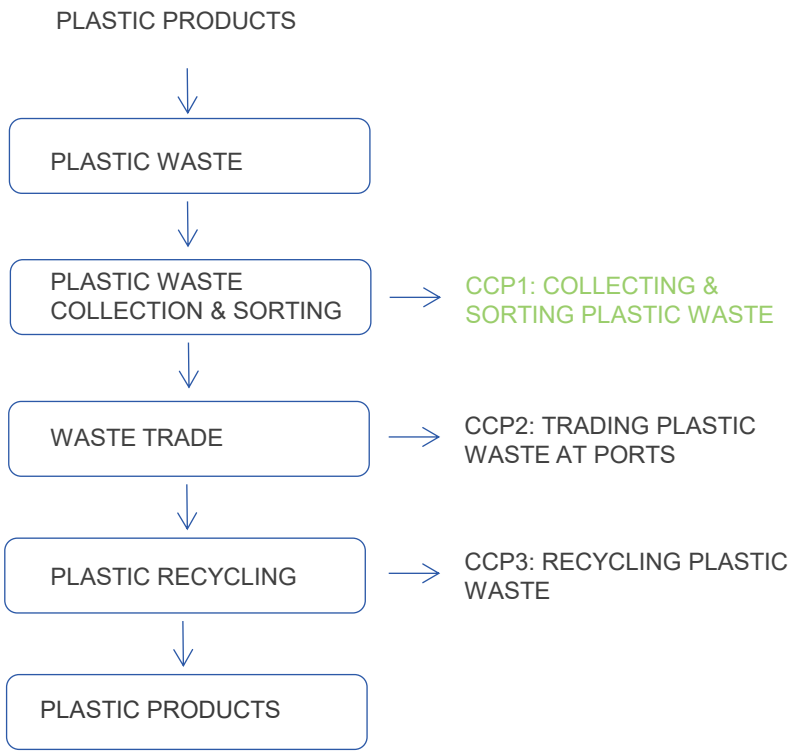
3.3 CONTROLLING QUALITY AT SORTING FACILITIES: CCP1

This section summarises how a Hazard Analysis Critical Control Point methodology can be applied to the sorting stage to determine whether batches of plastic waste should be accepted or rejected.

CRITICAL CONTROL POINT 1: PLASTIC WASTE COLLECTION & SORTING

The way in which plastic waste is collected then sorted has a significant impact on its quality and potential for recycling. In principle, the collection and sorting of plastic waste should form two distinct critical control points (CCPs), with each assigned its own contamination limits, monitoring procedures and corrective actions. In practice, however, it is difficult to separate the two practices, especially when the informal sector is involved; for example, a waste picker collecting PET from street bins simultaneously sorts and collects.

GUIDEBOOK



In this Guidebook collection and sorting have therefore been assigned a single CCP.

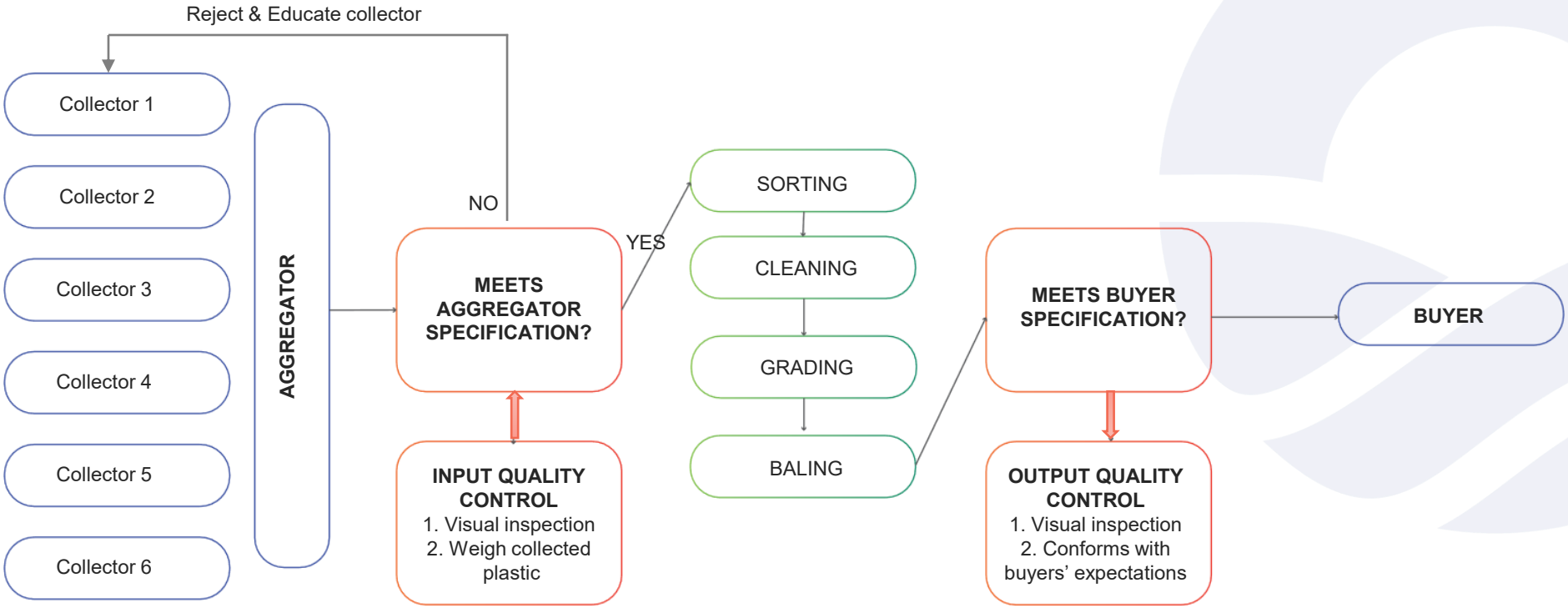
Guidance and information have been provided for both the collection and sorting stages, with contaminant limit levels and monitoring suggestions made at the sorting stage in the form of input and output specifications.
There are two distinct points during the sorting stage where the quality of plastic waste can be controlled:

1.The input stage – the point at which plastic waste has been delivered to the facility and an assessment is made whether the load is accepted for sorting, or it is rejected for disposal, and

2.The output stage – the point at which sorted plastics (just before, or just after baling) are assessed whether they meet bale quality specifications and are therefore suitable for sale to recyclers, or they don't meet bale specifications and either need to be re-sorted or sent for disposal.
These principles **apply** to both **informal and formal sector** enterprises.

CCP1:
CONTROLS AT INFORMAL SECTOR AGGREGATION POINTS

CRITICAL CONTROL POINT 1: Informal sector aggregators should continuously monitor quality at the INPUT and OUTPUT stages.



CCP1: INFORMAL AGGREGATION POINT INPUT SPECIFICATION

There are TWO stages where aggregators should monitor the quality of the plastics they handle:

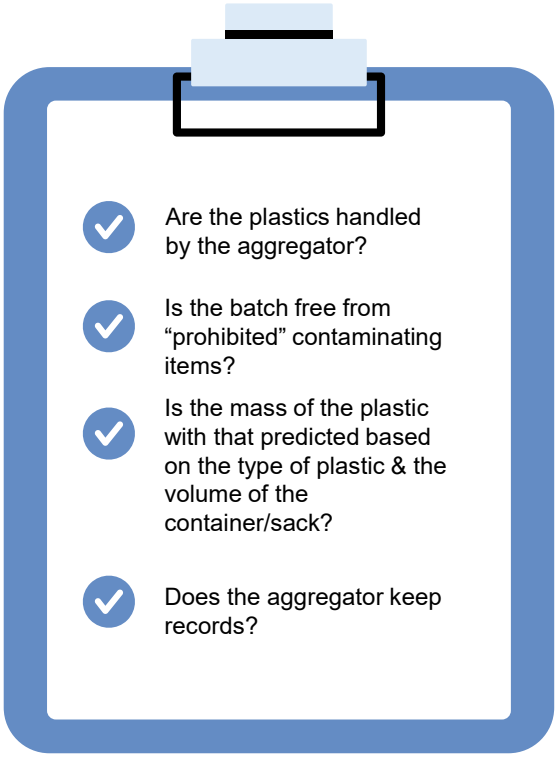
1. **INPUT STAGE: This relates to the quality of the plastics they buy from informal collectors, and**
2. **OUTPUT STAGE : This relates to the quality of the plastics sold on to either intermediaries or plastics recyclers.**

INPUT SPECIFICATION

- This will depend on:
- The **type(s) of plastic handled** by the aggregator, and
- The **facilities available** at the aggregation point to sort, clean and grade the different types of plastic.

VISUAL INSPECTION

- A visual inspection should be carried out on every delivery to determine:
- That the **correct type(s) of plastic** products (polymers) have been collected, and
- That there are **no prohibited contaminants** present.
- That the level of **other contaminating** items falls within **acceptable levels**.



Guidance on weighing plastics

PROHIBITED CONTAMINANTS

- Aggregators should have a list of contaminating items whose presence would lead to ‘rejection’ of the load. These should include:
- Batteries
- Nappies (diapers) and sanitary products
- Infectious healthcare waste
- Metals
- Bricks, stones and soil

WEIGHING THE PLASTICS

- As aggregators will pay collectors based on the mass (weight) of the plastic, this incentivises collectors to ‘weigh down’ the batch with water, bricks, stones etc.
- By estimating the volume of the collected plastics and knowing its density, the expected mass can be calculated.
- Batches weighing more than 20% more than the estimated mass should be checked carefully for contaminants.

CCP1: INFORMAL AGGREGATION POINT OUTPUT SPECIFICATION

Quality requirements for plastics purchased directly from informal aggregators vary according to the type of buyer—whether a trader or broker, a local recycler, or an exporter.

TRADERS/BROKERS (MIDDLEMEN)

Traders/brokers will generally tend to set their own standards, with these being dependent on supply and demand criteria, the extent to which further sorting will be carried out, and end-point recycler specifications.

Specific quality criteria in Thailand have been described here.

In the absence of formalised standards, aggregators should consider the following:

- **Single-polymer streams:** Material should be separated by polymer type, as mixed polymer loads attract lower prices or may be rejected further downstream.
- **Colour grading (especially for PET):** Clear / natural PET bales are worth more than mixed-colour or coloured PET. Buyers often specify “clear” vs “mixed” bales. Some specifications may allow bottles with caps and labels on, whilst others will stipulate that they be removed.
- **Contamination limits (by mass):** Most specifications will set low levels for certain types of contaminants (e.g. paper/cardboard, glues and other plastic polymers) and will have a zero tolerance for others (e.g. batteries).
- **Cleanliness / liquids:** Containers should be empty and largely free of residues and liquids. Guidance on weighing incoming plastics has been described here.
- **Bale formation & labelling.** Bales are expected to meet buyer limits for bale weight and density, have secure non-rusting ties, be free of excess moisture and labelled with polymer, grade and origin. Over-compression can also be problematic for some buyers.

LOCAL RECYCLERS

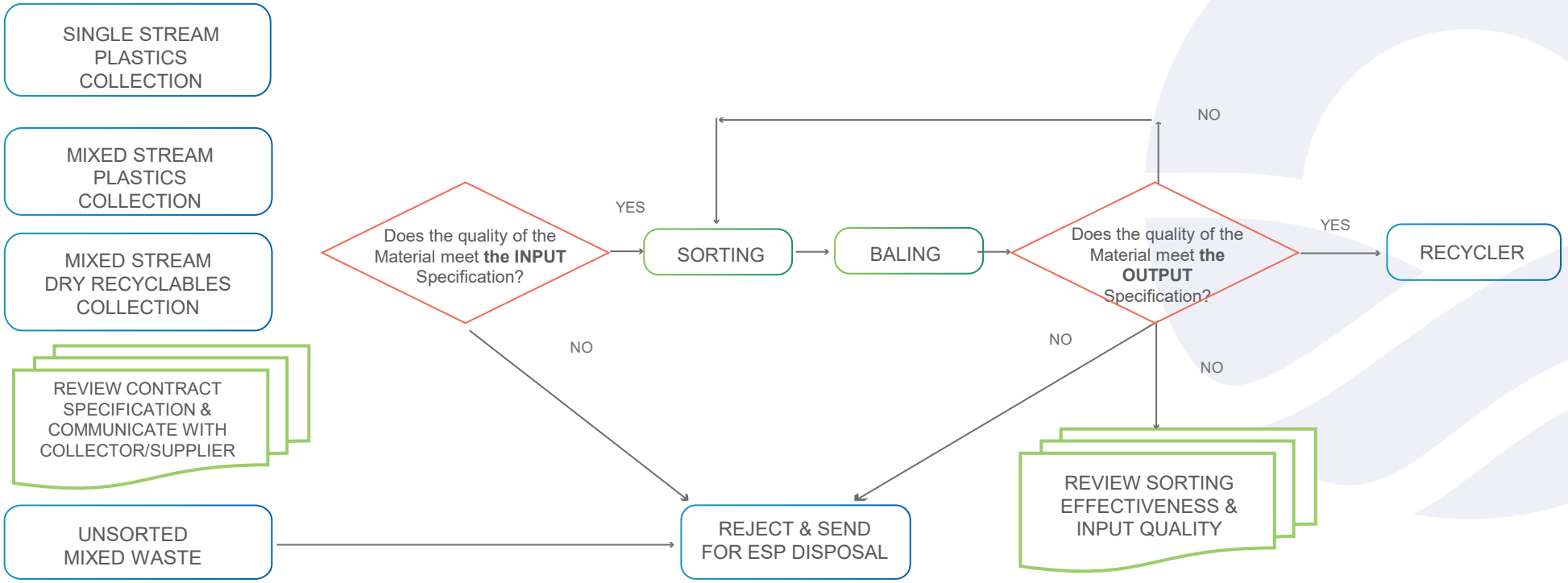
Quality criteria set by local recyclers is often context specific, and depends on the size of the recycling entity, the polymers to be recycled and the intended end products. Formal sector quality standards are described in detail here.

EXPORTERS

Plastic waste exported for recycling falls under the **Basel Convention**, where strict criteria apply.
This is described in detail here.

CCP1: CONTROLS AT FORMAL SECTOR MRFs

In the same way that an aggregation point in the informal sector should have two different specifications (input and output), **materials recovery facilities** (MRFs) should also have an input and output specification in place. These, however, need to form part of an overall **quality management system** so that **all operations associated with the acceptance, sorting, baling and sale of plastics for recycling** are **controlled and monitored continuously**.



CCP1: EXAMINING INPUT QUALITY AT A MRF

Operators of materials recovery facilities should routinely monitor the quality of the incoming materials. This helps the facility run safely, efficiently and in line with regulatory and contractual obligations.

WHY INPUT CHECKS ARE NEEDED

To monitor the quality of materials collected for sorting in order to:

- Ensure that 'target' materials are received
- Ensure that non-target materials fall within the maximum levels specified by the MRF
- Ensure that prohibited materials are not delivered to the site

To support consistent sorting of materials

To maintain product quality and meet contractual (output) specifications

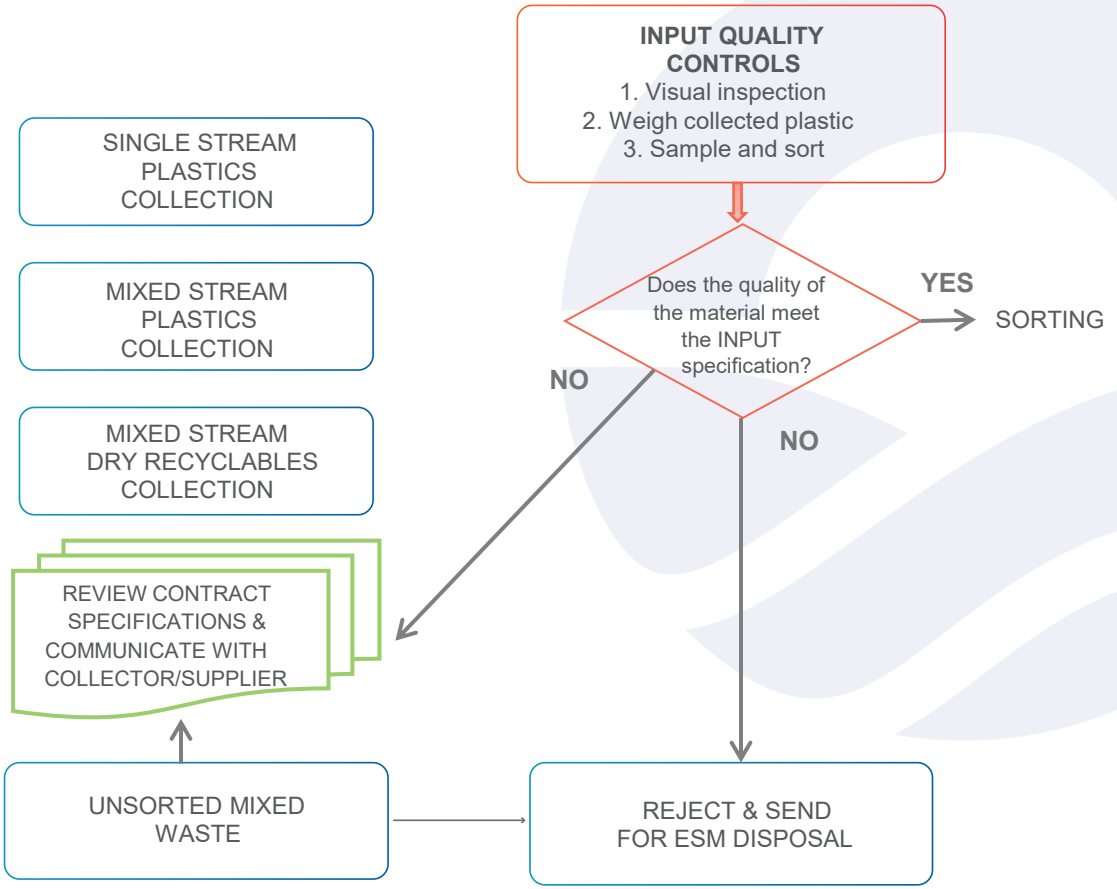
To protect workers' health and safety

To protect equipment and maintain operations

To manage costs and improve yields

To monitor contractual obligations by suppliers and improve upstream collection systems

To meet regulatory and ESM obligations



CCP1: MRF INPUT QUALITY CONTROLS

There are three different ways in which the quality of materials at a MRF should be routinely checked as part of the facilities' quality management strategy: **visual inspection**; **weighing the material** to check it falls within the expected range; **and analysing the composition of a representative sample**.

VISUAL INSPECTION

Operatives should visually inspect all incoming loads at the MRF BEFORE it is processed.

This means that it should be inspected once the material has been deposited on the tipping floor.

Key decision-making criteria should include the following :

- **Does the material look like it comes from the specified source?**
  For example, if it is supposed to originate from households, but contains a lot of commercial waste, this would suggest a deviation from a contractual specification.
- **Is the level of contamination low and in line with input specifications?**
  Over time operatives should be able to identify loads that are unduly contaminated.
  Visual posters/signs could help.
- **Are prohibited items present?**
  This may include non-target plastics such as agricultural mulch films, waste electronic and electrical equipment (WEEE), used nappies (diapers) or sanitary products, or plastics from end-of-life vehicles.
  The presence of prohibited items should lead to rejection of the load followed by its disposal in an environmentally sound manner.
  Where rejected loads or items need to be stored, this should be in a dedicated area that is contained to prevent non-target items becoming mixed with target materials.

WEIGHING THE LOAD

All incoming materials should be weighed, preferably on a **calibrated weighbridge.**

Loads that fall outside of the anticipated range should be inspected further, as this may indicate the presence of non-target materials.

SEE: SELECTED BULK DENSITIES

Taking photographs of each incoming load, and linking this to the delivery vehicle, helps to identify good and poor practices.
It facilitates discussions with contracted suppliers in the event of non-target wastes being delivered.
Saving the photos in a structured manner on a server alongside delivery information forms part of an overarching quality management system.

CCP1: INPUT CONTROL MEASURES AT A MRF HACCP PASS/FAIL CRITERIA

By following the previous guidance and implementing routine checks of all input materials (visual inspections, weighing materials and periodic sampling), MRF operators should have sufficient information to be able to either accept the load for processing, or reject it for ESM disposal.

	CCP1: INPUT MATERIAL RECEIVED AT MRF BEFORE SORTING & BALING
Description of plastics	Types of plastic, sources, methods used to collect the material.
Hazards	Permitted contaminants: e.g. metal drinks cans, paper/cardboard Prohibited contaminants: e.g. soiled nappies (diapers), batteries, WEEE
Critical limits	Permitted contaminants: 15% Prohibited contaminants: zero%
Who is responsible	Facility manager
How it is measured	Mass of contaminating items in a representative sample, using scales
How it is monitored	60 kg samples taken every 75 tonnes plus visual checks
Measures to reduce contamination	If above critical limit: • Review upstream source of plastics & collection methods; contracts with suppliers & return policies. • Reject load to ESM disposal.
Record keeping	All samples and measurements, including photos, logged on a standard form, then stored in site office.
Verification/auditing	Operations director to review records monthly and to sample random batches. Review feedback from customers regarding quality.

This will depend on whether single stream plastics, or co-mingled recyclables collections

This will depend on MRF infrastructure and types of materials sorted

This forms part of a QMS, aimed at improving operational effectiveness

CCP1: EXAMINING OUTPUT QUALITY AT A MRF

Once plastics and other recyclable materials have been sorted into different materials categories, MRF operators should implement further **quality control checks to ensure that materials meet buyer specifications**. This is particularly important when considering recycling into high quality products, such as PET drinks bottles, where food contact material specifications will be mandated.

LOOSE MATERIALS BEFORE BALING

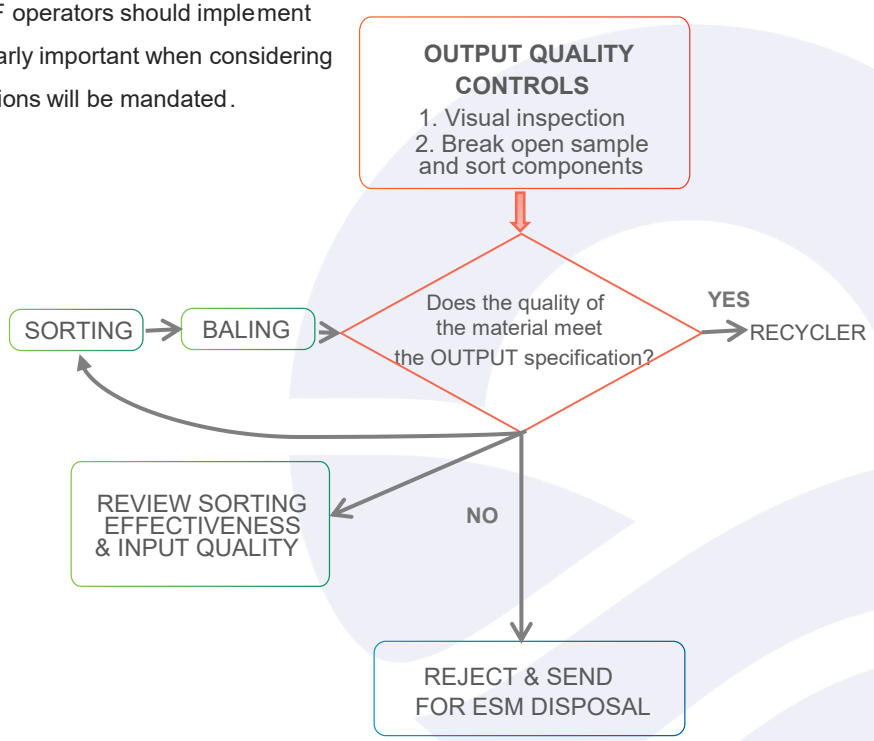
Checks similar to those outlined for incoming materials can be carried out:

- **Visual inspection**, including the logging of photographs; or
- **Analysing the composition** of a representative sample.

COMPRESSED, BALED PLASTICS

Quality can be assessed in one of two ways:

- **A visual inspection** carried out in a standardised way, or
- **Breaking open random bales**, then assessing quality using the same techniques outlined for loose materials.



Materials that fail to meet the desired quality criteria (i.e. output specification/buyer specification) should be **returned to the start of the sorting stage for re-processing**. Highly contaminated material should be rejected and sent for ESM disposal.

Such events should trigger a thorough **review of input quality**, and **an assessment of the effectiveness and efficiency of the sorting equipment**. The RecyClass Sorting Evaluation Protocol provides useful guidance.

Operational practices, including **operator competences**, should be reviewed and training opportunities identified.

CCP1: OUTPUT CONTROL MEASURES AT A MRF FOR SORTED BALED POLYPROPYLENE SMALL RIGID PLASTICS

STAGE	CCP1: OUTPUT MATERIAL SORTED AND BALED AT A MRF
Description of plastics	PP Small Rigid Plastics: Any polypropylene (PP) containers, packaging or products, generated through a positive sort from kerbside, drop-off or other public or private recycling collection programme. Bottles, cups and other containers and packaging and other non-container/packaging or products are accepted.
Hazards	**Allowable Contaminants at Low Levels (< 2% by mass)**: HDPE or LDPE rigid plastic, PET, PS, any other non-PP rigid plastic, including other (no. 7) and compostable plastic, e.g. PLA and PHA. **Prohibited Contaminants**: PVC in any form, containers that held hazardous materials (e.g. pesticides), plastic bags or film, non-PP plastic foam, metal, wood, glass, batteries, electronics scrap, bio-medical waste/items, rocks, stones, mud, oils, grease.
Critical limit	Total level of allowable contamination <2% mass/mass
Who is responsible	Fully trained personnel/ inspectors under the supervision of the Facility Manager
How it is measured	Visual inspections using documented industry standard. Mass of contaminating items in a representative sample of baled plastics, using scales.
How it is monitored	Visual inspection of every bale. Random bales broken open and the composition analysed; at least one for every batch of plastics.
Measures to reduce contamination	If above critical limit, review: upstream source of plastics & collection methods; efficiency of sorting machinery; training of sorting operatives etc. Contracts with suppliers & return policies.
Record keeping	All samples and measurements logged on a standard form, then stored in site office
Verification/auditing	Operations director to review records monthly and to sample random batches. Review feedback from customers regarding quality. Reporting to government periodically, if required.

3.4 GUIDANCE: COLLECTING & SORTING PLASTIC WASTE

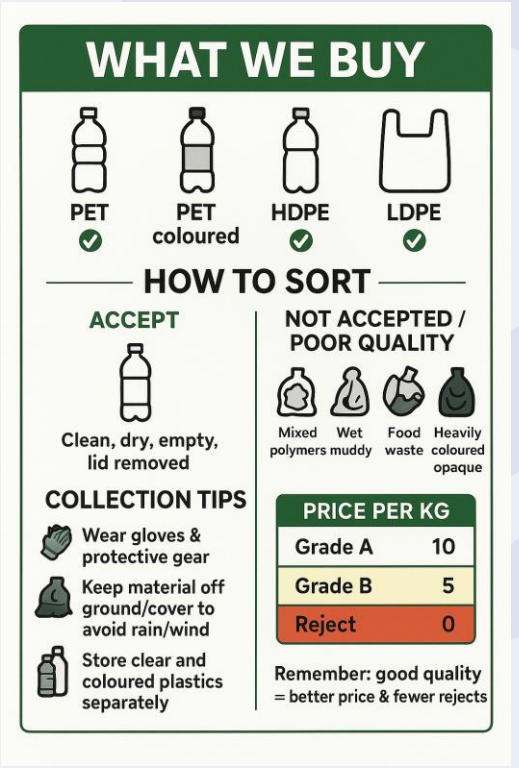
This section contains guidance, checklists and links to supporting documents.

MANAGING THE QUALITY OF COLLECTED PLASTICS IN THE INFORMAL SECTOR

The quality of plastic waste collected by the informal sector depends on how it is gathered, sorted, cleaned, and stored. Informal collectors usually focus on high-value, easily recognised plastics such as PET bottles and HDPE containers, which they sell to intermediaries or small recyclers.

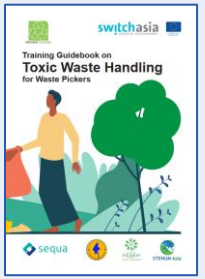
- **Structured support**—training, basic tools, and access to clean sorting areas—can greatly improve the quality and value of collected plastics. Various guides now exist to train informal collectors. Linking informal workers to formal schemes or material recovery facilities allows municipalities to benefit from their reach and efficiency while improving segregation at source. In return, informal workers gain more stable markets, fairer prices, and safer conditions. Introducing standardised grading systems and transparent pricing for different plastic types further encourages cleaner materials.
- **Community initiatives** are also vital. Awareness campaigns and source-separation programmes reduce contamination and lighten the workload for waste pickers. Encouraging households and small businesses to separate plastics using clear bags or colour-coded bins produces cleaner streams for collection.
- Finally, **digital tools and co-operatives** are improving coordination and traceability. Mobile apps can link collectors with buyers and recyclers, support fair transactions, and monitor the flow and quality of recovered plastics.

Example of a leaflet or poster that can be adapted to local situations









BALE STANDARD INSPECTION CRITERIA LDPE: UK

This standard is based on a visual examination of baled plastics intended for export. It categorises plastic bales into one of three categories, as shown below. The bale of plastic should be inspected on five sides. It can be downloaded here.

STANDARD FOR BALED LDPE FILMS

GREEN

Suitable for export

- If surface of bale covered by 10x10 grid contamination present only in 3 “squares” or fewer
- Occasional dirt e.g. from baler
- Paper labels used for information e.g. on pallet wrap



AMBER

Requires further inspection and sampling

- Dirt covering plastic
- If surface of bale covered by 10x10 grid contamination present more than 3 “squares”
- Visual appearance of some different polymer to load description
- Mild organic odour
- Flies arising from bale
- Labels beyond normal product/pallet information
- If un-split bag(s) present – check to ensure it is empty and does not contain contaminants.
- Construction waste film

RED

Banned from exporting

- Any nappies (diapers)
- Any soiled healthcare items
- Solid food waste
- Liquid (including yoghurt/ketchup) in containers other than residues left when container emptied
- Mineral oil contaminated plastic
- Dirt that can be removed by hand
- Strong organic odour
- Petrol or diesel odour
- Chemical odour
- Liquid leaking from containers or free flowing from bale.
- On visual inspection of whole bale, more than occasional (e.g. five items of each):
  • Cans• Carboard• Paper• Wood

BALE STANDARD INSPECTION CRITERIA HDPE, PET, PP, PS: UK

This standard is based on a visual examination of baled plastics intended for export. It categorises plastic bales into one of three categories, as shown below. The bale of plastic should be inspected on five sides. It can be downloaded here.

STANDARD FOR BALED MIXED PLASTIC BOTTLES, POTS, TUBS & TRAYS (HDPE, PET, PP, PS)

GREEN

Suitable for export

- Up to five items of each non-hazardous non-plastic visible
- Occasional dirt e.g. from baler
- Paper labels used for information e.g. on pallet wrap
- Non-plastic lids on beverage bottles
- Mixed polymers (PE PP and PET) from MRF
- Single polymers from MRF



AMBER

Requires further inspection and sampling

- Plastic covered in excess dirt
- Up to ten items of each non-hazardous non-plastic visible
- Visual appearance of some different polymer to load description
- Mild organic odour
- Flies appear when container door opened
- Labels beyond normal product/pallet information
- Mixed polymers from MRF
- Construction waste film

RED

Banned from exporting

- Any nappies
- Any soiled healthcare items
- Solid food waste
- Liquid (including yoghurt/ketchup) in containers other than residues left when container emptied
- Mineral oil contaminated plastic
- Dirt that can be removed by hand
- Strong organic odour
- Petrol or diesel odour
- Chemicals odour
- Liquid leaking from containers or free flowing from bale
- On visual inspection of whole bale, more than occasional (e.g. five items of each):

  • Cans• Carboard• Paper• Wood

BALED PLASTICS: ISRI QUALITY SPECS

Bale Density

Bales shall be compressed to a minimum density of 10 pounds per cubic foot (160 kg/m^3)

Bale Tying Material

Bale wires, ties, or straps shall be made of non-rusting or corroding material.

Bale Integrity

Bale integrity must be maintained through loading, shipping, handling, and storage.

Allowable Contamination

Refer to each specification for allowable contamination levels. Unspecified materials must not exceed 2% of total bale weight.

Prohibited Material

Certain materials are understood to be specified as “prohibited.” Such materials will render the bale “non-specification” and may cause some customers to reject the entire shipment. These may include plastic materials which have a deleterious effect on each other when reprocessed, and materials such as agricultural chemicals, hazardous materials, flammable liquids and/or their containers, and medical waste.

POLYMER-SPECIFIC STANDARDS

- Flexible PVC
- HDPE Colour Bottles & Select Containers
- HDPE Injection Bulky Rigid Plastics
- HDPE Natural Bottles
- Mixed Bulky Rigid Plastic
- Mixed Small Rigid Plastic
- PET Bottles (No PET Thermoforms)
- PET Bottles With Thermoforms
- PET Thermoforms
- PP Small Rigid Plastic
- Rigid PVC - Pipe
- Rigid PVC - Siding
- Rigid PVC - Window Profiles



https://www.isrispecs.org/orpheus_resource_categories/plastic/

SAMPLING INCOMING MATERIAL AT A MRF

WHY INPUT CHECKS ARE NEEDED

To monitor the quality of materials collected for sorting in order to:

- Ensure that 'target' materials are received
- Ensure that non-target materials fall within the maximum levels specified by the MRF
- Ensure that prohibited materials are not delivered to the site, and

- To support consistent sorting of materials
- To maintain product quality and meet contractual (output) specifications
- To protect workers' health and safety
- To protect equipment and maintain operations
- To manage costs and improve yields
- To monitor contractual obligations by suppliers and improve upstream collection systems
- To meet regulatory and ESM obligations

SUGGESTED EQUIPMENT

These will need to include the following as a minimum:

- Weighing scales up to 50 kg
- Receptacles/bins to contain the different waste fractions
- Labels or signs to put on the bins identifying the different fractions
- Equipment to keep the area clean e.g. brooms and shovels
- Appropriate personal protective equipment, in particular puncture proof gloves
- Standardised sample sheets to record data
- Wherever possible, weighing scales should be calibrated using weights of known mass (e.g. 1 kg and 5 kg).

IDENTIFY A SUITABLE SAMPLING AREA

This should be:

- Under cover to shelter workers and samples from rain and sunlight
- Away from moving vehicles—this is very important to protect workers and prevent accidents
- Of sufficient size to allow for effective sorting of materials
- On a clean surface that can be cleaned afterwards

THE NEXT STEP IS TO DEVELOP A SAMPLING STRATEGY

SAMPLING PRINCIPLES

Sampling is the **planned and systematic process** of **selecting a portion of plastic waste or recyclate batch** for the purpose of **testing and analysis**. Given that plastics waste streams are often **highly heterogeneous**—containing materials from various sources, products, contaminants and polymers—sampling must be **statistically robust** and designed to minimize bias or error. It is important for the following reasons:

Obtaining Representative Data:

Proper sampling ensures the sample reflects the composition and properties of the whole batch, providing reliable information about the plastic recyclate's quality and suitability for further processing or specific applications.

Ensuring Quality Control:

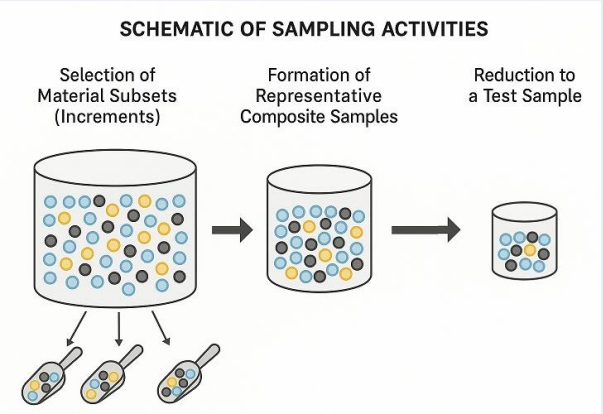
Good sampling allows detection of issues such as cross-contamination, heterogeneity, or the presence of unwanted materials (like PVC in PET batches), which is essential to meet quality standards and performance requirements.

Supporting Process Optimisation:

By understanding the quality and variability of input materials through representative samples, recycling processes and technologies can be improved, ultimately leading to better and more consistent recycled plastic products.

Enabling Evidence-based Decisions:

Sampling makes it possible to make informed decisions about accepting, blending, or rejecting material batches, based on scientifically obtained, manageable sample sizes.



Limiting Analytical Resources:

Instead of testing entire large lots, sampling allows for manageable laboratory analysis, making quality assessment efficient and practicable.

Regulatory Compliance and Comparability:

Standardised sampling ensures that results are comparable across batches, plants and laboratories, supporting regulatory and market requirements.

Standard **PD CEN/TS 16010:2020 Plastics — Recycled plastics — Sampling procedures for testing plastics waste and recyclates** specifies a sampling system tailored for the testing of plastic waste and recyclates, taking into consideration their particular characteristics.

DEVELOPING A SAMPLING STRATEGY

A sampling strategy should form part of a MRF's quality assurance system. It should be a routine activity, carried out to assess the quality of input materials from suppliers old and new. By taking **a risk-based approach**, MRF operators can increase sampling frequencies whenever problems have arisen, or new contracts signed.

SAMPLING ACTIVITIES

Sampling typically involves the following activities:

Selection of Material Subsets (Increments):
Small quantities taken from different parts of a bulk material (e.g. plastic flakes, granules, bales) to capture possible variations in composition or quality.

Formation of Representative Composite Samples:
Combining multiple increments to create a gross sample that accurately represents the characteristics of the entire lot or batch.

Reduction to a Test Sample:
Further processing of the gross sample to prepare a lab-scale test sample while preserving its representativity.

STANDARD

At a MRF, incoming materials vary in terms of size, shape and level of contamination, which will be distributed unevenly throughout the load.

A single grab or small sample is unlikely to represent the whole load accurately. Furthermore, contaminants may be clustered in some parts and be absent in others. Several increments or a structured sampling method are therefore needed to obtain a representative sample.

Standard **PD CEN/TS 16010:2020 Plastics — Recycled plastics — Sampling procedures for testing plastics waste and recyclates** sets out the statistical basis for sampling materials that are mixed and not uniform in composition (i.e. they are heterogeneous).

PRACTICAL GUIDANCE

MRFs operating in parts of the United Kingdom are required to routinely monitor the input composition of materials prior to sorting.

- Government guidance requires operators to:
- Take one **sample for every 75 tonnes** of material received at the MRF.
- The average mass of the sample should be at least 60 kg.
- A risk-based approach is advised, depending on the suppliers and types of materials received.
- Data that need to be recorded include:
- Date, mass of material received, and the name and address of the supplier.
- Categories of materials, including:
- target material
- non-target material
- non-recyclable material

Sub-categories will depend on the types of plastic waste received at the MRF and intended output specifications.

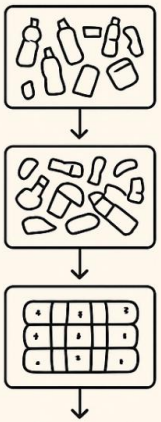
HOW TO ESTIMATE THE MASS OF COLLECTED PLASTICS

Understanding the physical characteristics of collected plastics helps assess their quality. By comparing the mass of material received at an aggregation point, operators can detect whether it has been artificially increased by the addition of contaminants intended to inflate the sale price.

- The **bulk density** of collected material is its mass per unit volume, including the spaces (voids) between individual particles or items.
- In the context of waste or recyclables, it measures **how much material (by mass) fits into a given space**, usually expressed in **kilograms per cubic metre (kg/m³)**.
- It reflects both the **intrinsic density** of the material and **how loosely or tightly it is packed**. For example:
- Loose, uncompressed plastic bottles have a low bulk density because of the air between them.
- When compacted or baled, their bulk density increases as the voids are reduced.
- **By looking up the bulk density of the material and calculating the volume of the container or bale, an estimation of its mass should be possible.**
- Plastics that are heavier than expected should therefore be checked carefully to ensure that the package does not contain unwanted contaminants, such as bottles filled with water or bricks/soil.

Volume of plastics (m^3) X **Bulk density (kg/m^3)** = **Expected mass of material (kg)**

SIMPLIFIED DIAGRAM: EFFECT OF INCREASING DENSITY



LOOSE PLASTIC
(30–50 kg/m^3)

LIGHTLY COMPACTED
(80–150 kg/m^3)

BALED
(200–350 kg/m^3)

SELECTED BULK DENSITIES OF COLLECTED PLASTICS

The table below provides indicative bulk densities for selected types of plastic. As the characteristics of plastic products vary according to product, collection, and container type, aggregators are advised to establish their own bulk density ranges for the materials they commonly handle.

PLASTIC TYPE	LOOSE (kg/m³)	LIGHTLY COMPACTED (kg/m³)	BALED (kg/m³)	NOTES
PET bottles	30–50	100–150	250–350 (up to 400)	Commonly exported in dense bales; clear PET tends to be densest.
HDPE bottles (e.g. detergent, milk)	25–40	80–120	180–300	Larger, more rigid shapes make bales less dense than PET.
PP containers (e.g. tubs, caps)	25–40	70–100	150–250	Typically mixed with HDPE in light rigid plastics fraction.
LDPE film (e.g. bags, wraps)	20–30	50–80	180–250	Difficult to bale tightly; density depends on cleanliness and dryness.
Mixed rigid plastics	25–45	80–120	200–300	Widely variable depending on composition.
Expanded polystyrene (EPS)	5–10	20–30	80–150	Extremely low density; often densified by heat rather than baling.

HOW TO ESTIMATE VOLUME

Estimating the volume of collected plastics can be challenging, especially when delivered to aggregation points loose or in large sacks. An approximation can be made based on the shape of the sack or container. All that is needed is a long tape measure and something to note down the dimensions.

Decide **which simple shape** best approximates the filled container or sack, then measure its dimensions:

Cylinder (good if a sack stands fairly straight with an even diameter):

$$v = \pi \times r^2 \times h$$

Rectangle (good if the plastic has been compressed into bales):

$$v = l \times w \times h$$

Elliptical spheroid (useful if a sack bulges in the middle like an elongated ball):

$$v = 2/3 \times \pi \times h \times r^2$$

KEY:

v = volume, h = height, r = radius,
l = length, w = width, π = 3.14,
c = circumference

The **radius** of the **elliptical spheroid** should be measured halfway down the **longest axis** (as shown in the diagram).



Some bags can be assumed to be cylinders



Baled plastics can be assumed to be rectangular



Some sacks can be assumed to be elliptical spheroids, especially when they bulge in the middle

It may be easier to measure the **circumference (c)** around the widest part and **calculate the radius** using the following equation:

$$r = c / (2\pi)$$

If the measurements have been made in **centimetres (cm)**, then the volume will be calculated in centimetres cubed (cm^3). To **convert this to cubic metres (m^3)**, either divide the number by 1,000,000 (one million = 10^6)

or

multiply by 0.000001 (one millionth = 10^{-6})

Flexible sacks and mixed recyclables will likely contain voids and irregular bulging; therefore, plan for an uncertainty of ±10–25% depending on how loosely or tightly the contents sit.

GOOD PRACTICE: GUIDANCE IN THAILAND FOR SORTING PLASTIC WASTE FOR RECYCLING BY THE INFORMAL SECTOR

The 'Characteristics of Plastic Waste Suitable for Recycling', (B.E. 2565, 2022), by the Pollution Control Department, Kingdom of Thailand, sets out methods for sorting plastic waste with suitable characteristics for recycling. It is aimed at the informal sector, with instructions for individual householders, waste collectors and aggregators and is summarised below.

HOUSEHOLDERS

- Sort plastic waste and do not throw it away with food waste and hazardous waste to prevent contamination.
- If there is contamination, wash and clean it, and remove adhesive tape, paper or stickers.
- Sort plastic waste for:
    - Sale to junk (second-hand) shops, or
    - Collection at drop-off points, or
    - Collection by waste collection trucks of local administrative organizations.

INFORMAL SECTOR WASTE COLLECTORS

- Observe symbols to separate different types of plastic waste so they are not mixed together.
- Separate plastic waste into groups according to the colour of the plastic waste.
- Sort plastic waste by type and collect them for sale to aggregators.



AGGREGATORS

Observe symbols to separate different types of plastic waste so they are not mixed together.

Separate plastic waste into groups according to the colour of the plastic waste.

Store plastics in a place that is protected from the sun and rain to prevent deterioration and to ensure that the moisture levels do not exceed those set by the recycling plant.

Crushing and compressing of plastics must not be done on the ground.

Ensure that all baling or compressing equipment is kept clean.

CHARACTERISTICS OF PLASTIC WASTE SUITABLE FOR RECYCLING

The 'Characteristics of Plastic Waste Suitable for Recycling', (B.E. 2565, 2022), by the Pollution Control Department, Kingdom of Thailand, aims to promote the government's circular economy policy by maximizing the utilisation of domestic plastic waste through recycling.

TYPES OF PLASTIC

- The document categorizes plastics into seven types, each identified by specific symbols and numbers to facilitate sorting and recycling:
- **Polyethylene Terephthalate (PET or PETE)**: Commonly used for water and beverage bottles.
- **High-Density Polyethylene (HDPE)**: Used for products like shampoo bottles and milk jugs.
- **Polyvinyl Chloride (PVC)**: Found in items such as pipes and vinyl flooring.
- **Low-Density Polyethylene (LDPE)**: Used for plastic bags and film wraps.
- **Polypropylene (PP)**: Found in products like yogurt containers and straws.
- **Polystyrene (PS)**: Used for disposable foam cups and plates.
- **Other Plastics** (labelled as "Other" or with a number 7): Includes various plastics like polycarbonate and ABS, used in items such as electronics casings.

BASIC CHARACTERISTICS OF PLASTIC SCRAPS SUITABLE FOR RECYCLING

- The plastics must be **clean**, **not contaminated** with food scraps, chemicals or hazardous substances.
- They must **not be exposed to sunlight** for a long periods of time or left in the open-air, as this will reduce the properties of the plastic waste (i.e. stretching, pressing, or pulling).
- The plastic waste must **not be sourced from landfills**.

The Pollution Control Department's guidance document specifically **excludes** plastics collected at landfill (dump) sites.

This is particularly important when recycled plastics will be used in applications that will come into contact with food or drink (i.e. will be used as Food Contact Material).

SPECIFIC CHARACTERISTICS OF PLASTIC WASTE SUITABLE FOR RECYCLING

The 'Characteristics of Plastic Waste Suitable for Recycling', (B.E. 2565, 2022), by the Pollution Control Department, Kingdom of Thailand, sets out specific characteristics suitable for recycling plastic waste separated by type.

CHARACTERISTIC/TYPE	PETE/PET	HDPE	LDPE	PP	PS	PVC	Others
1. Example products	Bottle e.g. drinking water, cooking oil, soft drinks	Containers e.g. Shampoo, Liquid dishwashing, Laundry detergent, baby milk bottle	Film wrap, bag	Noodle cup, yoghurt cup, straw, heat-resistant bag	Foam container, food container, utensil, spoon and fork	Pipe, hose, electric wire, card, document file	Phone case, electronic device case and parts, vehicle parts
2. Grade or colour	-	3 grades (clear/light brown/other colour)		3 grades (clear/black/other colour)	-	-	-
3. Mixing of plastic polymers	Shall separate cooking oil bottle from other types of bottle	Clear or white colour are most needed for recycling		Clear colour is most needed for recycling	Must be kept separate and not mixed with other types of plastic polymers		
4. Cleanliness	Must be clean, not contaminated with food scraps, hazardous materials or chemicals						
5. Levels of contamination in the bale	Zero	Not more than 10% contamination		Zero	Zero	Zero	Zero
6. Moisture levels	Not more than 5%						
7. Freshness	Shall not be exposed to the sun for >30 days	✓	✓	✓	✓	✓	✓
8. Source of plastics	Must not come from a landfill/dumpsite						
9. Crushing and compacting equipment	Must be clean and compacting must not be done on the ground						

MRF GOOD PRACTICE GUIDANCE DOCUMENTS

A number of documents, available free of charge on the internet, describe good practices at materials recovery facilities.

Materials Recovery Facilities Effective Operation, Design and Management in Theory & in Practice

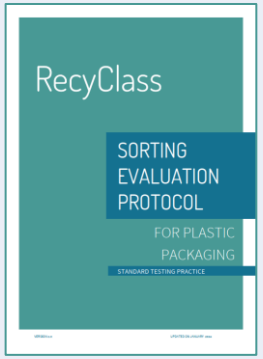
This document, published by **Closed Loop Partners**, provides guidance on:
Metrics and performance optimisation
Equipment maintenance and spare parts management
Facility management and staff organisation
Industry relations

It can be downloaded here.



Sorting Evaluation Protocol for Plastic Packaging

This document, published by **RecyClass**, describes a protocol to evaluate the sorting behaviour of plastic packaging at a MRF.
It can be downloaded here.



Safe Design and Operation of Materials Recovery Facilities

This document is one in a series of formal guidance documents published by the **Waste Industry Safety & Health Forum (WISH)** in the UK.

It includes guidance on:

- Traffic management
- Machinery safety
- Falls and access
- Wastes, appropriate equipment and change management
- Ergonomics
- Working environment
- Fire and waste/recyclates storage

It can be downloaded here.



GUIDANCE DOCUMENTS ON ESM

The website of the **Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal** contains a number of documents on the environmentally sound management of plastic wastes.

https://www.basel.int/Implementation/CountryLedInitiative/EnvironmentallySoundManagement/Overview/tabid/3615/Default.aspx

Technical guidelines on the environmentally sound management of plastic wastes UNEP/CHW.16/6/Add.3/Rev.1

This is a formal document setting out scientific and technical matters:

- General considerations
- Legislative and regulatory framework
- Waste prevention and minimization
- Identification and inventories
- Sampling, analysis and monitoring
- Handling, separation, collection, packaging, compaction, transportation and storage
- Environmentally sound disposal
- Health and safety
- Emergency response
- Awareness and participation

It can be accessed here.

Guidance on how to address the environmentally sound management of wastes in the informal sector UNEP/CHW.14/INF/8

This document provides background information on the informal waste sector. It describes:

- Opportunities to incorporate ESM practices in the informal sector
- Considerations for integrating the informal sector

It can be accessed here.

Environmentally sound management toolkit

The toolkit comprises a number of documents covering different aspects of ESM. The most relevant include the following:

- Practical Manuals on promoting the ESM of wastes
- Practical manual for stakeholders to ensure that notifications of transboundary movements meet environmentally sound management requirements
- Practical manuals on EPR and financing
- Checklist for self-assessment of national ESM capacity
- Compilation of ESM criteria and core performance elements
- Compilation of training materials
- ESM Framework
- Fact sheets on specific waste streams
- Guidance on prevention and minimization

The documents can be accessed here.

CHECKLIST TO PREVENT PLASTICS LEAKING INTO THE ENVIRONMENT DURING SORTING & TRANSPORTATION

This phase involves managing plastic waste during reception, sorting, storage, and transportation. It is important to ensure that plastics do not inadvertently 'leak' into the environment where they become pollutants with potential to harm ecosystems, block drains and create an environmental blight.

TRANSPORTATION AND LOGISTICS

- Ensure that collected post-consumer plastics are **securely bagged** and transported to prevent losses}
- Transport lightweight plastic scraps and packaging in **woven polypropylene (PP) sacks without perforations**
- Use appropriate tarpaulins in cover nets (such as polyvinyl chloride (PVC) transport tarpaulins) to secure plastic materials during transport to recycling facilities
- When loading and unloading, personnel should employ careful handling to minimise spillage or scattering, especially from small plastic wastes like pellets or flakes
- Transport vehicles used for pellets must be **secure and leak-proof**

MATERIAL RECEPTION, STORAGE & SORTING

- **Designated Work Areas**: Recycling activities, including dismantling and pre-sorting, should be conducted in plain, **vegetation-free areas** away from residential zones, public facilities, and water bodies
- **Containment Infrastructure**: Floors in storage and processing areas should ideally be paved (or covered with tarpaulins if unpaved) to **prevent plastic fragments from escaping into the soil or nearby waterways**. The facilities should include **walls** and a **roof** to prevent releases of hazardous contaminants
- **Storage Practices**: Protect plastic waste and pellets stored outdoors from wind, rain, and floods by using covers, such as **tarpaulins**, and store them in enclosed spaces away from drains, floodplains, and watercourses. Store bagged materials (flakes or pellets**) on pallets** (wooden or plastic) to elevate them above the ground and prevent contamination
- **Handling Rejected Materials:** Implement measures to **contain, collect, and properly dispose of rejected, low-value polymers and other impurities**. Rejected fractions resulting from sorting (which can reach 10–25% of materials) must be handled and disposed of correctly to minimize environmental impact, rather than being illegally dumped or open-burned.

4 PLASTIC WASTE TRADE: CONTENTS

This chapter addresses the critical control point (CCP2) in the cross-border movement of plastic waste and recyclables.

It includes sections on waste classification requirements, import acceptance procedures at ports, transportation by road, how to manage quality and guidance documents/checklists.

4.1 Technical Context: Waste Classification & Documentation Requirements

4.2 Technical Context: Import Acceptance Procedures at Ports

4.3 Technical Context: Waste Transportation by Road

4.4 Managing Quality: CCP2

4.5 Guidance: Border Checklists

4.6 Guidance: Inspections & Testing



WHAT IS MEANT BY TRADE IN PLASTIC WASTE

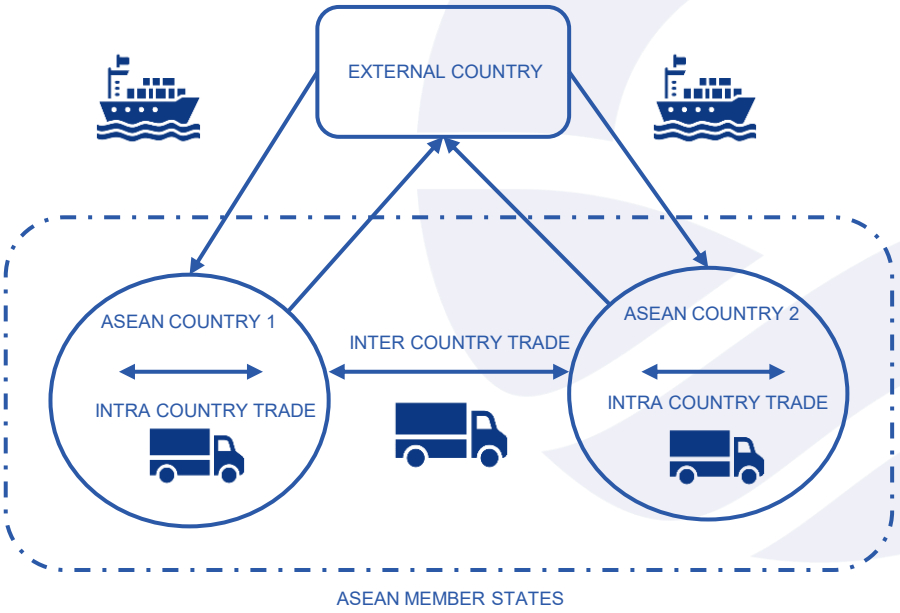
The term 'trade' can have a number of different definitions depending on the context. With regards to plastic waste, it refers to the buying, selling and movement of recycled plastic materials between different actors in the value chain. It can happen at local, national or international levels, and it covers a wide range of material types and qualities.

The quality standards described in the previous chapter on plastic waste sorting and aggregation provide a basis for transparent trade at the **local** and **national** levels. This should, in theory, provide greater transparency in pricing between collectors, aggregators, MRF operators and recyclers.

Trade at the **international** level, however, becomes complicated, due to the use of different plastic waste classification systems set out in **customs codes** (for the purposes of monitoring trade) and the **Basel Convention** (for the purposes of protecting the environment and human health).

This chapter principally focusses on these classification systems and provides **guideline of a common framework for regulating the movement, inspection, and compliance requirements for plastic waste traded** within and beyond ASEAN. It aims to reduce environmental and health risks, support responsible recycling practices, and align Member States with the Basel Convention, regional commitments, and emerging global standards.

The scope of inspection covers pre-consumer and post-consumer plastic scrap, sorted and unsorted waste, recycled feedstock, and contamination parameters relevant to cross-border movement.



Depending on the source, quality and degree of pre-treatment, plastic waste traded internationally may take the form of baled materials, such as bottles or films, or shredded plastic flakes.

4.1 TECHNICAL CONTEXT: WASTE CLASSIFICATION & DOCUMENTATION REQUIREMENTS

This section describes how plastic waste should be classified prior to export, including prior informed consent to destination countries.

CLASSIFICATION OF PLASTIC WASTE IMPORTS & EXPORTS

All plastic waste that is transported internationally needs to be assigned appropriate codes. There are two different coding systems: one for **trade monitoring purposes (HS codes)** and **one to classify plastic waste based** on to its **potential to harm human health and the environment (Basel Convention codes)**.

HS CODES

These are internationally agreed **tariff codes** used to **classify goods in trade**. When exporting plastic waste, these codes **determine how the material is described on customs documents**, what controls apply, and **whether the shipment is treated as hazardous** or non-hazardous under environmental agreements.

Plastic waste should be categorised under HS code **3915 Waste, parings and scrap, of plastics**. However, waste plastic may also enter countries under any of the following codes:

- 4004 Waste, parings and scrap of rubber
- 401220 Used pneumatic tyres of rubber
- 4707 Waste and scrap of paper or paperboard
- 5505 Waste of man-made fibres
- 6309 Worn clothing and clothing accessories etc.
- 8549 Electrical and electronic waste and scrap
- 382510 Residual products from the chemical or allied industries, including municipal waste

BASEL CONVENTION CODES

Basel codes classify plastic waste according **to how strictly its movement must be controlled** when it crosses borders.

- **B3011** covers clean, well-sorted plastics suitable for direct recycling and is subject to lighter controls where permitted.
- **Y48** applies to mixed or contaminated plastics, which require prior notification, consent, and full tracking under the Basel Convention.
- **A3210** is used when plastics contain hazardous substances, triggering the highest level of control and, in many countries, import bans.

BOTH CODES ARE REQUIRED

Every export shipment will have one HS code for customs.

Every Basel-controlled shipment must have the appropriate Basel code on the notification and movement documents.

The HS code does not determine the Basel code; the Basel code depends on the following:

- polymer type,
- degree of sorting,
- level of contamination, and
- presence of hazardous constituents.

The HS and Basel Convention classification codes are explained in detail on the following pages.

HS CODES

HS six-digit codes follow a fixed, hierarchical structure used worldwide for classifying traded goods. The system is maintained by the World Customs Organization and forms the basis of most national tariff schedules.

STRUCTURE OF AN HS 6-DIGIT CODE

FIRST TWO DIGITS – Chapter (NN)

- These identify the broad sector or material category.
- There are 99 chapters in total.
- Example: 39 = Plastics and articles thereof.

NEXT TWO DIGITS – Heading (NN)

- These narrow the category to a particular class of goods.
- Within Chapter 39, many headings exist (e.g., tubes, plates, waste).
- Example: 3915 = Waste, parings and scrap of plastics.

FINAL TWO DIGITS – Subheading (NN)

- These define the goods more specifically, usually by polymer type, form, or use.
- Example:
  - 3915.10 = Waste of polymers of ethylene
  - 3915.20 = Waste of polymers of styrene
  - 3915.30 = Waste of PVC
  - 3915.90 = Other plastics waste

AHTN 8-DIGIT CODE

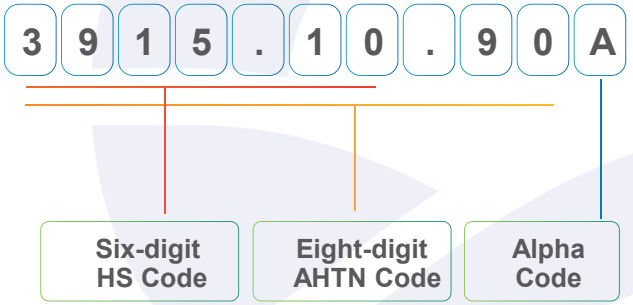
The **ASEAN Harmonised Tariff Nomenclature (AHTN)** expands the international HS 6-digit code into an 8-digit code.

These additional two digits add further detail for tariff, statistical purposes and trade controls.

"00" means ASEAN has not subdivided the HS subheading further, so the HS 6-digit description stands without additional distinctions.

ALPHA-NUMERIC CODE

Individual AMS (e.g. Philippines) may assign an additional alpha-numeric code to denote national tariff lines beyond the standard 8-digit AHTN code.



Digits	Meaning	Description
1–2	Chapter	Broad category (e.g., plastics)
3–4	Heading	Product group (e.g., plastic waste)
5–6	HS Subheading	International detail (e.g., ethylene polymer waste)
7–8	AHTN Subheading	ASEAN-specific split (e.g., "00" = no further division)
Alpha-numeric	Country-specific	Additional code used by individual AMS

BASEL CONVENTION CODES

Basel codes classify plastic waste according to how strictly its movement must be controlled when it crosses borders. There are three codes based on the based on their hazardous properties and the control measures that will need to be implemented for ESM recycling.

Both Y48 and A3210 require Prior Informed Consent (PIC).

Code	Scope	Hazard/Quality	Border control implications	Typical Examples
A3210	Applies when plastics contain hazardous additives, are co-contaminated with hazardous waste, or exhibit hazardous characteristics.	Hazardous	Always requires PIC and is often subject to import bans.	Contains Annex I constituents at hazardous levels (e.g., plastics with toxic additives or persistent pollutants) • PVC waste with high heavy-metal stabilisers • Plastics contaminated with oils, solvents, or infectious residues • Plastics from electrical/electronic waste with brominated flame retardants
Y48	Applies to mixed, difficult-to-recycle, or contaminated plastic waste, even if non-hazardous. Default for most post-consumer plastics. Any load that does not meet B3011 conditions automatically becomes Y48.	Non-hazardous but requires special consideration	Requires Prior Informed Consent (PIC): notification, written consent, tracking, and movement documents. Some countries prohibit Y48 imports entirely.	Mixed or contaminated plastics, multi-materials, most plastics not meeting B3011 or A3210 • Mixed LDPE/PP/PS film bundles- PET bottle bales with food residues or liquids • Coloured HDPE bales with >2% contamination • MRF mixed plastics (3D + film) • Multilayer/laminate packaging
B3011	Applies to clean, well-sorted, almost contamination-free plastic waste streams destined for recycling. Must be a single polymer or a very limited number of compatible polymers. Not allowed if mixed, dirty, or containing problematic residues.	Non-hazardous, almost free from contamination	May move under “green list” procedures if allowed by the importing state. Some countries still require notification and consent.	Single polymer or clearly defined mixture suitable for direct, sound recycling • PET bottle flakes or bales with <2% non-plastic content • HDPE natural bottle bales with minimal contamination- PP crate regrind • Clean PE film from post-industrial sources

BASEL CODES, SOURCES & TYPES OF PLASTIC WASTE

SOURCE	PLASTIC POLYMER TYPES	B3011 Non-Hazardous & Easily Recyclable (Annex IX)	A3210 Restricted/Hazardous Plastic Waste (Annex VIII)	Y48 Other Mixed/Unsorted Waste (Annex II)
Packaging	PE, PP, PET, PS, PVC	**Clean, single-polymer waste** (e.g., sorted PET bottles, PE films)	**Mixed, contaminated** packaging waste (e.g., multilayer packaging, food-contaminated plastics)	PVC-based packaging with **toxic additives** (e.g., phthalates, lead stabilisers)
Automotive	PP, PU, ABS, PC, PA	**Clean, sorted** thermoplastics from vehicle dismantling (e.g., PP, ABS)	Mixed automotive plastic waste (e.g., bumpers with coatings, multilayer composites)	Plastics containing **flame retardants** (e.g., brominated ABS), lead-containing plastics
Construction	PE, PP, PS, PVC	**Sorted, clean** plastic waste from construction (e.g., PE pipes, PP geotextiles)	Mixed construction plastics (e.g., PS foam with adhesives, coated PVC materials)	PVC waste with toxic stabilisers, PS foams containing hazardous flame retardants
Electronics & Electrical	PC, ABS, PA, PVC	Clean, **single-polymer** e-waste plastics (e.g., PC laptop casings)	**Mixed plastic** waste from e-waste dismantling (e.g., mixed ABS/PC casings)	Plastics containing brominated flame retardants (e.g., FR-ABS in electronic housings)

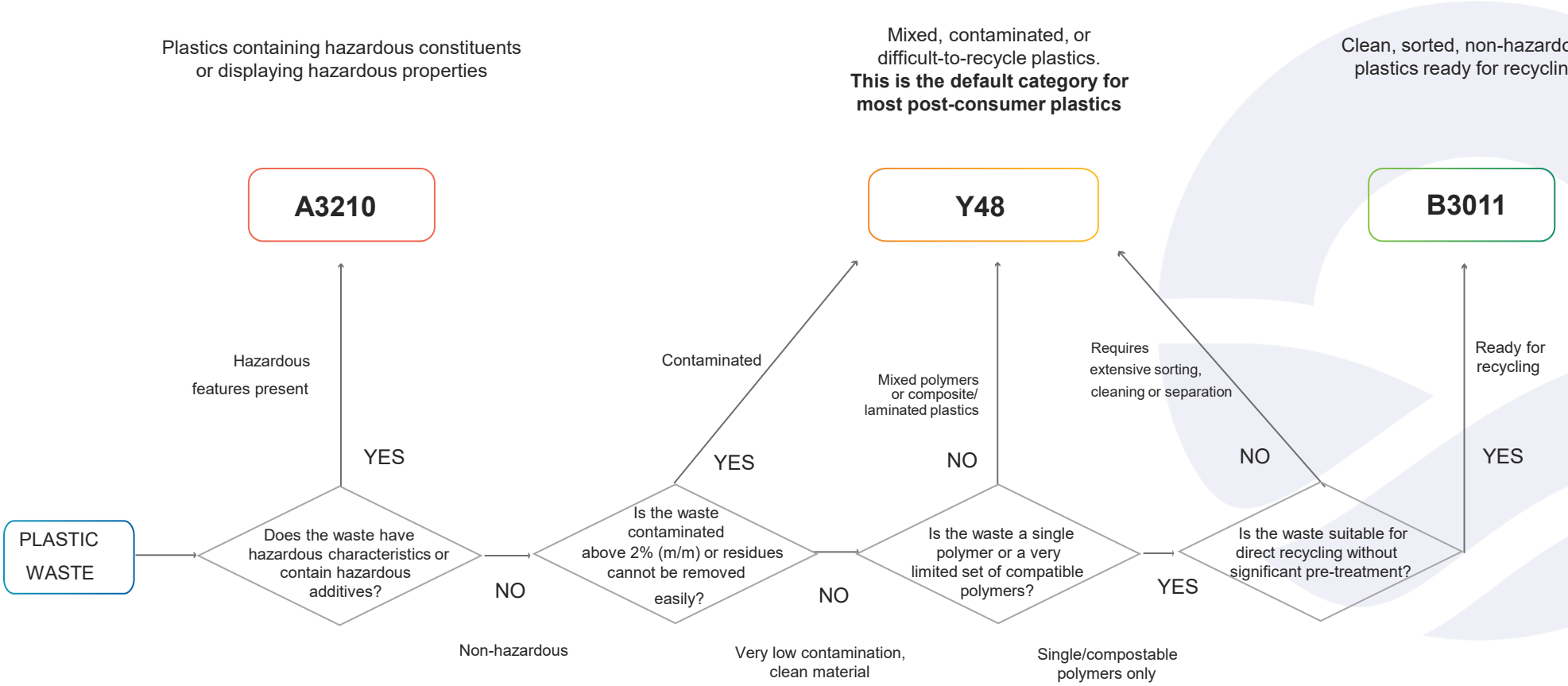
BASEL CODES, SOURCES & TYPES OF PLASTIC WASTE

SOURCE	PLASTIC POLYMER TYPES	B3011 Non-Hazardous & Easily Recyclable (Annex IX)	A3210 Restricted/Hazardous Plastic Waste (Annex VIII)	Y48 Other Mixed/Unsorted Waste (Annex II)
Medical & Healthcare	PP, PVC, PC, PS	Clean, sorted non-contaminated medical plastic waste (e.g., unused packaging materials)	Mixed hospital plastic waste (e.g., intravenous bags, mixed polymer tubing)	Infectious medical plastic waste (e.g., used syringes, blood bags)
Textiles & Apparel	PET, PA, PU	Clean, sorted PET fibre waste (e.g., recycled polyester textiles)	Mixed textile waste with non-recyclable polymers (e.g., blended fabrics)	Coated textiles with hazardous chemicals (e.g., PFAS-treated waterproof fabrics)
Agriculture	PE, PP, PVC	Sorted, clean PE/PP films and pipes	Contaminated agricultural plastics (e.g., soil-covered mulch films, pesticide containers)	Plastic waste contaminated with agrochemicals (e.g., pesticide-laden plastic drums)

TRENDS IN ASEAN TRADE UNDER BASEL RULES

- **Increased Restrictions**: ASEAN countries like **Malaysia (ban), Thailand (ban), and Viet Nam (PIC)** have tightened imports of mixed plastic waste, following Basel **Y48** rules.
- **Rise in Recycling Capacity**: Countries such as **Indonesia and the Philippines** are expanding sorting and recycling facilities for **B3011**-compliant plastics.
- **Illegal Trade Risks**: Some ASEAN nations still face **illegal waste imports**, where **Y48 and A3210** waste is **mis-declared** as recyclable **B3011** waste.

DECISION TREE FOR ASSIGNING BASEL CODES TO EXPORTED PLASTIC WASTE



DECISION TREE FOR ASSIGNING BASEL CODES TO EXPORTED PLASTIC WASTE

The **Correspondents' Guidelines No. 12 – Classification of Plastic Waste** are an official interpretative document under the European Union's **Waste Shipment Regulation**. Their purpose is to help authorities, exporters, and importers correctly classify plastic waste for transboundary movements, particularly to determine whether a shipment falls under **green-listed waste (B3011)** especially for exports from the EU to non-OECD countries (which includes all ASEAN Member States).

A 2% CONTAMINATION LIMIT

The Basel Convention requires green-listed plastics classified as **B3011** to be "**almost free from contamination**".

The Guidelines introduce a 2% (mass/mass) contamination limit to judge whether a plastic-waste consignment is clean enough to qualify as B3011 (i.e. suitable for direct recycling without needing further sorting or washing).It is not a strict legal limit written directly into the Basel Convention. Instead, it is a widely applied operational threshold drawn from the technical interpretation agreed by competent authorities.

WHAT THE 2% REFERS TO

It represents the maximum total mass of non-plastic material that may be present in a load still considered "almost free from contamination".

It covers:

- dirt,
- food residues,
- organic matter
- metal caps, paper, labels, adhesives, tapes
- incompatible plastics (e.g. PVC in a PET stream)
- Liquids
- other foreign materials.

In a 1-tonne bale of PET bottles, up to about 20 kg of combined contaminants is typically the upper boundary for considering it B3011

WHY 2% IS USED

1. PRACTICALITY

- A zero-contamination requirement is impossible in real supply chains.
- Two per cent is viewed as the **highest level at which the waste can still go straight into a recycling process without harming product quality** or requiring further pre-treatment.

2. ALIGNMENT WITH RECYCLING PERFORMANCE

Most established recyclers can handle up to ~2% non-plastic impurities without damaging equipment, producing unacceptable melt contamination & increasing reject rates above normal levels

It therefore aligns regulatory definition with industrial reality.

3. CONSISTENCY FOR INSPECTION

Port and border officers need a workable standard.

The 2% yardstick allows them to decide whether:

- the load is genuinely a **clean, single-polymer stream** → *B3011*, or
- the load still needs sorting or washing → *Y48*, or
- the load is contaminated with hazardous constituents → *A3210*.

4. PREVENTING CIRCUMVENTION

Without a defined level of permissible contamination, exporters could claim that mixed or dirty waste is "recyclable", undermining the purpose of the Basel plastic controls.

The 2% threshold helps close that loophole.

PRIOR INFORMED CONSENT

This is a procedure under the Basel Convention that ensures the exporting country obtains formal approval from the importing country before shipping certain types of waste. It is a legal mechanism to prevent unwanted or hazardous waste movements and to ensure environmentally sound management.

It is mandatory for **most post-consumer plastic wastes (Y48)** and **all hazardous plastic wastes (A3210)**.

It **may not be required for clean, well-sorted, non-hazardous plastics (B3011)** if the importing country allows trade in **these 'green-listed' wastes, however, some countries still require notification.**

1. NOTIFICATION

The exporter or the competent authority of the exporting country submits a **notification form** to the importing country.

The form includes details of the shipment: type of waste (Basel code), quantity, composition, origin, destination, and intended disposal or recycling method.

Transport and any transit countries must be indicated.

2. CONSENT

The importing country reviews the notification to decide whether to accept, refuse, or request modifications.

Consent must be **explicit and documented in writing**.

Conditions may be attached, e.g., transport routes, handling requirements, or environmental standards at the recycling facility.

3. ACKNOWLEDGEMENT & RECORD-KEEPING

The exporting country receives the written consent (or refusal) and retains it for regulatory compliance.

Both countries keep records of the shipment for reporting to the Basel Convention Secretariat.

4. SHIPMENT & TRACKING

Only once consent is granted can the shipment proceed.

Movement documents must accompany the waste throughout transit.

Some countries require **tracking** to confirm the waste arrives at the intended facility and is managed safely.

PRIOR INFORMED CONSENT (PIC) PROCEDURE FOR PLASTIC WASTE



COMPARISON OF HS & BASEL CODES

Every export shipment will have one HS code for customs.

Every Basel-controlled shipment must have the appropriate Basel code on the notification and movement documents.

The HS code DOES NOT determine the Basel code; the Basel code depends on the polymer type, degree of sorting, level of contamination, and presence of hazardous constituents.

The table below shows how plastics with different HS codes can have different Basel classification codes.

HS Code	Description	Typical Basel Code(s)	Notes
3915.10	Waste, parings and scrap of polymers of ethylene (e.g., PE films, PE packaging)	**B3011** (if clean, sorted, almost free of contamination) / **Y48** (if mixed or contaminated) / **A3210** (if hazardous)	Basel classification depends on quality and contamination.
3915.20	Waste, parings and scrap of polymers of styrene (e.g., PS, EPS)	**B3011 / Y48 / A3210**	Same rules as above. EPS is often Y48 as it tends to contain residues.
3915.30	Waste, parings and scrap of polymers of vinyl chloride (PVC)	**Y48** (typical) / **A3210** (if hazardous additives present)	PVC rarely meets the B3011 “clean” criteria.
3915.90	Waste, parings and scrap of other plastics (PP, PET, multilayer, mixes, etc.)	**B3011** (clean single-polymer streams) / **Y48** (most mixed plastics) / **A3210** (hazardous)	This is the most frequently used code for mixed plastics.

Note to table: plastic polymer abbreviations are detailed here.

MISCLASSIFICATION OF PLASTIC WASTE

Misclassification of plastic waste is common in both export and import paperwork, often to evade controls under the Basel Convention or domestic regulations.

TYPICAL PATTERNS SEEN BY INSPECTORS

- Dirty film or mixed plastics labelled as **"PP regrind"** (HS 3902)
- PET bottle bales with labels, caps and impurities declared as **"PET flakes"** under HS 3907
- Loads with **electronic or medical residues** declared as B3011
- Mixed post-consumer plastic declared as **"manufacturing offcuts"**
- Composite packaging (e.g., multilayer) declared as **recyclable mono-material**





Mixed plastic waste (coloured plastic films, some printed, bottle caps) with approx. 13-15% contaminants such as paper, some metal, wood and composites – Y48 (EU48)



Mixed plastic waste from PP, PS with a 16-20% contaminant content including PVC - Y48 (EU48)



UV-damaged film waste – Y48 (R3 recycling is impossible)

HS CODES COMMONLY USED TO MISCLASSIFY PLASTIC WASTE

HS CODES FOR "NEW" AND "VIRGIN" PLASTICS

These are sometimes used instead of waste codes to disguise waste as a non-controlled product:

These codes are *not* for waste, but are often used to declare as if it were unused polymer.

HS 3901–390X (polymers in primary forms)
Examples:

3901 – Polyethylene in primary form
3902 – Polypropylene in primary form
3904 – PVC in primary form

HS CODES FOR "SCRAP" THAT DO NOT CORRESPOND TO PLASTICS

Used to hide waste inside a broader scrap category:
HS 3915 is the *correct* code for plastic waste, parings and scrap.

Misclassification includes use of:

7204 – Ferrous metal scrap
7602 – Aluminium scrap
4707 – Wastepaper
6309 – Used clothing

Mixed loads containing plastic waste may be declared entirely under these codes.

HS CODES FOR PLASTIC ARTICLES

Used to present waste as finished goods:

HS 3920 – Plastic sheets, films
HS 3923 – Packaging articles (boxes, crates, bottles)
HS 3926 – Other plastic articles

These are sometimes applied to mixed or contaminated plastic waste to avoid scrutiny.

BASEL CODES COMMONLY MISUSED OR MIS-DECLARED

DECLARING CONTROLLED WASTE AS "NON-HAZARDOUS, CLEAN RECYCLABLES"

The most frequent misuse is declaring waste as **B3011**, which applies only to **clean, well-sorted, almost contamination-free plastic destined for recycling**.

Misuse examples include:

- Mixed plastic (e.g., PP + PET + PVC) declared as **B3011**
- Dirty agricultural film declared as **B3011**
- Waste with >2% contamination declared as **B3011**

INCORRECT USE OF THE OLD GREEN-LIST CODE FOR PLASTICS

Before 2021, **B3010** was often used to classify shipments as "non-controlled".

Even though B3010 is now replaced by B3011 for plastics, some exporters still declare **B3010** – to avoid the stricter post-2021 controls.

This is widespread in parts of Asia.

MIS-DECLARING CONTROLLED WASTE AS "OTHER WASTES"

To minimise regulatory checks:

- **Y48** – Plastic waste not meeting B3011 criteria
- **A3210** – Hazardous plastic waste (e.g., halogenated polymers, residues, or contaminated waste)

Exporters sometimes declare Y48 or A3210 waste simply as:

- **B3011** (to bypass PIC requirements)
- Or even omit Basel codes entirely, relying solely on an incorrect HS code.

MISCLASSIFICATION OF WEEE AS UEEE

Shipments of plastic waste have also been misclassified as Used Electrical And Electronic Equipment (UEEE). These products, such as second-hand computers, laptops and mobile phones, should still be functional or can be reasonably repaired, should not be considered waste. However, many shipments of UEEE are economically or practically unrepairable (e.g. the work on redundant operating systems) and should have been classed as Waste Electrical And Electronic Equipment (WEEE).

COMMON HS MISCLASSIFICATIONS FOR USED EEE / WEEE

DECLARING WASTE AS "WORKING SECOND-HAND GOODS"

Exporters frequently declare end-of-life or non-functional electronics under product HS codes rather than waste codes. Typical misclassifications include:

HOUSEHOLD APPLIANCES
- **HS 8516** – Electric heaters, cookers, kettles
- **HS 8508** – Vacuum cleaners
- **HS 8509** – Small household appliances

IT AND COMMUNICATION EQUIPMENT
- **HS 8471** – Computers, laptops, printers
- **HS 8517** – Mobile phones, routers, telecoms gear
- **HS 8528** – Monitors and screens

CONSUMER ELECTRONICS
- **HS 8521 / 8525 / 8528** – TVs, recorders, cameras
- **HS 8518** – Speakers, audio equipment

These are legitimate product codes but are often used for **mixed or non-functional loads** that should be classified as waste.

HIDING WEEE WITHIN "PARTS" CODES

A classic evasion technique is to declare complete units as "spare parts":
- **HS 8473** – Parts for computers
- **HS 8529** – Parts for televisions, audio equipment
- **HS 8503** – Parts for motors and generators

Used and stripped-down electronics are often declared as parts to bypass waste controls.

WRONGLY DECLARING WEEE AS METAL OR PLASTIC SCRAP

- Mixed WEEE is sometimes incorrectly shipped under broader scrap codes such as:
- **HS 7204** – Ferrous scrap
- **HS 7602** – Aluminium scrap
- **HS 3915** – Plastic scrap

This is common when devices are shredded without removing hazardous components.

MISCLASSIFICATION OF WEEE AS UEEE

BASEL CONVENTION MISCLASSIFICATIONS

DECLARING WEEE AS "NON-WASTE USED EQUIPMENT"

The most frequent misuse involves omitting Basel controls entirely by claiming:

- "Used EEE for reuse"
- "Refurbishable equipment"
- "Tested working second-hand goods"

If items are untested, damaged, incomplete or mixed, they fall under **Basel waste** definitions, not equipment for reuse.

INCORRECT USE OF NON-PLASTIC BASEL CODES

Some shippers put WEEE under generic non-hazardous waste codes such as:

- **B3xx series** (various other waste streams)
  These do not apply, and WEEE should not be declared as B-code "clean recyclables".

TYPICAL BORDER-LINE CASES

- Mixed used electronics labelled as "charity donations"
- Broken screens declared as "repairable screens"
- Desktop units missing RAM, HDDs, or power supplies declared as "tested working"
- Cathode ray tube televisions declared as "plastic scrap" or "metal scrap" after partial dismantling

BASEL CODES ACTUALLY APPLICABLE TO WEEE (AND THEREFORE OFTEN AVOIDED)

Y CODE (WHEN MIS-DECLARED AS NON-WASTE):

- **Y45** – WEEE and discarded electronic products
  (This is the correct Y-code for many WEEE consignments.)

A CODES (FOR HAZARDOUS WEEE):

- **A1180** – Waste electrical and electronic assemblies containing hazardous components (e.g., cathode ray tubes, batteries, mercury lamps, capacitors with PCBs)
  Frequently avoided because it triggers Prior Informed Consent and strict controls.

MISUSE PATTERN

Exporters declare hazardous WEEE as:

- "Used computers – HS 8471"
- "Second-hand televisions – HS 8528"
- "Mixed household goods"
  without any Basel code at all.

SOLID RECOVERED FUELS (SRF)

Solid Recovered Fuel (SRF) is a high-specification fuel produced from non-hazardous waste often contains a **high proportion of plastics** because plastic-rich fractions from municipal, commercial and industrial waste streams have a high calorific value, making them ideal for use as fuel. During sorting processes at MRFs and similar facilities, mixed or low-quality plastics that cannot be economically recycled are separated out and diverted into SRF production. These plastics burn efficiently and help SRF meet the energy requirements demanded by cement kilns and other energy-recovery facilities

COMPOSITION

SRF typically contains:

- Plastic-rich fractions (PP, PE films, mixed plastics)
- Paper and card residues
- Textiles
- Light combustible fractions from MRFs or C&I waste

It is engineered to meet standards such as **CEN/TS 15359** (classification by calorific value, chlorine and mercury content).

CORRECT HS CODES FOR SRF

There is **no dedicated HS code for SRF**. It is normally shipped under:

- **HS 3825.10 / 3825.41 / 3825.49** – Waste, residues and scrap; municipal waste; other wastes (these encompass non-hazardous waste-derived fuels)

Sometimes countries use:

- **HS 3601–3606** (fuel-related codes) – **not recommended,** only for manufactured fuels
- **HS 2710** – Waste oils (only for liquid fuels)

The correct classification is usually 3825.

BASEL CONVENTION POSITION

SRF is **waste**, not a product, so Basel rules apply.

The relevant Basel codes are:

- **Y46 – Wastes collected from households**
- Covers municipal-type waste streams commonly used to produce SRF.
- **B3011 – Non-hazardous plastic waste**

As SRF often contains mixed or contaminated plastics, B3011 usually does not apply.

- **Y48 – Plastic waste (non-B3011)**

If SRF is predominantly plastic-derived, Y48 may be appropriate.

SOLID RECOVERED FUELS (SRF) MISCLASSIFICATIONS

TYPICAL MISCLASSIFICATIONS TO WATCH OUT FOR INCLUDE

Declaring SRF as a product, not a waste
Examples include:
- "Alternative fuel", "refuse-derived fuel", "RDF pellets", "energy pellets"
- HS **4401** (wood pellets) – often used incorrectly
- HS **2711 / 2713** (fuel oils/bitumen) – incorrect
- HS **3901–3915** (polymer granules) – used when SRF contains shredded plastics

Declaring SRF as "clean plastic recyclables"
- Misuse of **HS 3915** (plastic scrap)
- Misuse of **Basel B3011** to bypass PIC requirements

Declaring SRF as paper or textile waste
When made from mixed streams:
- **HS 4707** (paper waste)
- **HS 6309** (used clothing)

Declaring SRF as general "combustible waste" without controls
- "Commercial & industrial waste", "combustible fraction", "light fraction"
  Often used to avoid stricter Basel procedures.

GENERAL RULE

SRF is usually treated as **non-hazardous mixed waste** requiring:

- **Prior Informed Consent (PIC)** for transboundary movements
  unless a bilateral agreement provides other arrangements.

If SRF contains hazardous components (e.g., high chlorine, heavy metals), A-codes may apply, but this is uncommon for compliant SRF.

REFUSE DERIVED FUEL (RDF)

Refuse Derived Fuel (RDF) is a fuel produced from **mixed residual** waste that remains after recyclable materials have been removed. It usually contains a blend of plastics, paper, card, textiles, and other combustibles. The material is shredded, sometimes dried, and processed to remove metals and inert fractions. Its quality varies because it is made from heterogeneous waste streams.

RDF differs from Solid Recovered Fuel (SRF) as the latter is a more **tightly specified, higher-quality fuel** produced from residual waste. It is manufactured to meet standard **EN 15359**, which sets requirements for calorific value, chlorine content, and mercury content. SRF is more consistent and predictable than general RDF and is typically used in **industrial co-incineration**, especially **cement kilns**, where tight fuel specifications are critical.

Aspect	RDF	SRF
Feedstock	Broad range of mixed residual waste	Better-selected residual waste with tighter input control
Processing level	Basic shredding and removal of metals/inerts	More intensive processing and refinement
Quality/consistency	Variable; not produced to a formal standard	Produced to **EN 15359** with defined classes
Typical uses	Waste-to-energy plants; mass-burn facilities	Industrial users requiring stable fuel quality (cement kilns, lime plants)
Calorific value	Moderate but inconsistent	Higher and more consistent
Plastic content	Usually higher and less controlled	Managed carefully to meet specification limits (e.g., on chlorine)

RDF vs SRF: BASEL CODE COMPARISON

RDF and SRF are both considered **waste under Basel**. They are normally controlled as Y48 plastic waste unless hazardous (A3210). Neither qualifies for B3011, since they are fuels, not recyclable plastics.

BASEL CONVENTION CLASSIFICATION

The Basel Convention does not explicitly define RDF or SRF. Instead, it classifies them according to their waste composition and hazard characteristics.

Neither RDF nor SRF meets the criteria for B3011, as this code applies to recyclable plastic waste, not fuel.

Item	Basel Category	Explanation
RDF	Usually **Y48 – Plastic waste** (if predominantly plastic), or **A3210** if hazardous	• RDF often contains a high proportion of mixed plastics and may include contaminants. • If it contains hazardous components (e.g., persistent organic pollutants, hazardous additives), it falls under **A3210**, requiring Prior Informed Consent (PIC). • Even when non-hazardous, if it contains mixed plastics, it normally falls under **Y48**, subject to Basel controls.
SRF	Generally, **Y48** unless produced from very clean, non-plastic-rich feedstocks (but this is rare)	• SRF is better refined but still commonly contains plastics, especially films and mixed fractions. • If it contains hazardous characteristics, it can fall under **A3210**. • SRF is **not B3011** because it is not “clean, sorted, almost contamination-free” and is not destined for material recycling.

RDF vs SRF: BASEL CODE COMPARISON

Under the HS, the classification depends on their composition: 3915.90 if mainly plastic; 3825.6x where “waste-derived fuel” codes are implemented.

HS CODES

The Harmonised System has no dedicated HS code for RDF or SRF.

They are generally classified according to their material composition.

ASEAN AHTN (8-DIGIT)

Many ASEAN Member States still classify RDF/SRF under:

- **3915.90.00** – if predominantly plastic
- **3825.69.00** – other waste-derived fuels (where implemented)
- **3825.61.00** – containing >= 50% biomass (where implemented)

Adoption varies by country.

Material composition	Typical HS Code	Why
Predominantly plastic-derived RDF/SRF	3915.90 (Waste, parings and scrap of plastics – other)	• Applied when the fuel is mainly composed of plastic waste fractions. • This is the most frequent classification.
Mixed waste-derived fuel with significant non-plastic combustible content	3825.61 or 3825.69 (Waste-derived solid fuels) – in the newer HS versions	• HS 2022 introduced specific subheadings under 3825 for waste-derived fuels, depending on their composition. • Not all countries have adopted HS 2022 or these subheadings.
If the shipment is judged as ‘household waste or mixed municipal waste’	3825.10	• Used if the material is insufficiently processed and resembles mixed municipal waste.

PLASTIC WASTE IMPORT STATUS INTO ASEAN MEMBER STATES (FROM ANY COUNTRY)

ASEAN country	Relevant Laws/Regulations	Lead Authority	Allows B3011?	Pre-shipment inspection	Lab testing	Digital system	Overall stance
Brunei Darussalam	Environmental Protection and Management Act, Chapter 240; Hazardous Waste (Control of Export, Import and Transit), Chapter 274	DEPR	With PIC	✗	Not required	ASEAN single window	Moderate restrictions
Cambodia	Sub-Decree No. 36 (1999); Env. Code No.0623/007 (2023); SW Guidelines (2006)	MoE + Customs	Only to support domestic investment. Allowed is clean & sorted.	Conditional	Based on high-risk and require approval from environment ministry	ASEAN single window	Moderate restrictions
Indonesia	MOE No. 13 (2012); Law 18/2008; MOT Reg. 84/2019	KLHK MOT + MOI + MOEF + Customs	✗	✗	✗	National single window	Full ban
Lao PDR	MOIC No. 0682 (2020); Env. Law (2012); MoNRE No. 0233	PCD, MONRE+ MOIC + Customs	Limited	Conditional	Based on high-risk and require approval from environment ministry	ASEAN single window	Tight, licensed

PLASTIC WASTE IMPORT STATUS INTO ASEAN MEMBER STATES (FROM ANY COUNTRY)

ASEAN country	Relevant Laws/Regulations	Lead Authority	Allows B3011?	Pre-shipment inspection	Lab testing	Digital system	Overall stance
Malaysia	EQA (1974); Scheduled Wastes Regs (2005); EPR Roadmap 2021–2030	DOE + JPSPN + Customs	Limited. Allowed if clean & sorted.	Mandate	Mandate COA and Lab analysis report by SIRIM	EPermit, SIRIM	Tight, licensed
Myanmar	Env. Conservation Law (2012); Rules (2014); Notification 74/2023	ECD, MONREC + MOC+ Customs	Limited	Conditional	Based on high-risk and require approval from environment ministry	Automated Cargo Clearance System	Tight, licensed
Philippines	RA 9003; EPR Act 2022; DAO 2004-0036	DENR-EMB + Customs	Limited	Conditional	Based on high-risk and require approval from environment ministry	National single window	Tight, licensed

PLASTIC WASTE IMPORT STATUS INTO ASEAN MEMBER STATES (FROM ANY COUNTRY)

ASEAN country	Relevant Laws/Regulations	Lead Authority	Allows B3011?	Pre-shipment inspection	Lab testing	Digital system	Overall stance
Singapore	Hazardous Waste (Control of Export, Import and Transit) Act (Cap.122A):1997; Singapore's Technical Guidelines for the Import and Export of Plastic Waste (2025)	NEA + Customs	With permit. Allowed if clean & sorted.	Conditional	Certificate or test report (upon request)	TradeNet	High-compliance
Thailand	Public Health Act; Factory Act; Notification No. 112 (2024)	PCD + MOI + Customs	✗	✗	✗	National single window	Full ban
Viet Nam	LEP (2014); Decree 08/2022; QCVN 32:2018	MONRE + Customs	Limited	Mandate	Environmental technical compliance certificate and contamination test report	National single window	Tight, controlled

TRANSBOUNDARY MOVEMENTS OF PLASTIC WASTE FROM THE EUROPEAN UNION

In 2023, just under 650,000 metric tonnes of plastic waste classed as HS 3915 were exported from the European Union (EU) to ASEAN Member States. Since then, a new EU Regulation has come into force that will ban the export of plastic waste to AMS as of November 2026. This is summarised below.

CURRENT STATUS

On the 20 May 2024 the EU adopted a comprehensive revision of its waste-shipments legislation: the **Waste Shipments Regulation (EU) 2024/1157**.

- Under this new Regulation (and associated delegated legislation), a phased ban on exports of plastic waste from the EU to non-OECD countries was adopted.
- As of 21 November 2026, all exports of plastic waste to non-OECD countries **will be prohibited unless** the country had formally submitted a request to the EU by 21 Feb 2025.
- The Commission will draw up a first list of authorised third countries by 21 November 2026; countries not on the list will be barred from receiving EU exports of those wastes from the date the prohibition starts for each waste stream.

CRITERIA TO CONTINUE TO RECEIVE PLASTIC WASTE

- AMS must demonstrate that they can manage plastic waste exported from the EU in an environmentally sound manner.
- The facility intended to receive the waste must undergo an independent audit demonstrating that it operates to standards that guarantee protection of human health and the environment.
- Exports are only allowed if the facility passes that audit.
- Once approved, the facility must be listed in the register maintained by the European Commission
- Exporters should refer to this register when notifying shipments.
- The AMS must show it has a national regulatory framework capable of controlling plastic-waste imports in a sound way (i.e. laws/regulations, enforcement capacity, monitoring).

THE EU'S REQUIREMENTS FOR 'ENVIRONMENTALLY SOUND MANAGEMENT'

- **Proper waste-handling infrastructure**: similar to EU standards.
- **Safe treatment or recovery operations**: no open burning, uncontrolled landfilling, or dumping.
- **Occupational health and safety** compliant operations: workers' health, pollution control, emissions & effluent control.
- **Capacity and track record**: ability to receive, process and recycle the quantity and type of plastic waste sent.
- **Traceability, transparency and record-keeping**: full documentation of movements, processing, final fate of waste and by-products.
- **Legal and regulatory compliance**: facility authorised, with required environmental licences/permits; subject to effective enforcement.

PRE-EXPORT & IMPORT REQUIREMENTS

A number of conditions need to be met **before plastic waste can be exported** from a third-country to an ASEAN member state.

1. PRIOR INFORMED CONSENT (PIC) MUST BE GRANTED

If the waste falls under Basel-controlled categories (e.g., Y48 or A3210), the importing competent authority must **formally consent in writing** to the shipment *before* it is dispatched.
The exporter's authority must also verify that all conditions set by the importer have been met.

2. THE IMPORTER MUST HAVE A VALID IMPORT PERMIT

Most ASEAN states require:

- an **import licence** for the specific Basel code or HS code category of plastic waste,
- proof that the importer is an **approved recycler or recovery facility**, and
- evidence that **domestic demand** for feedstock exists.

3. THE RECEIVING FACILITY MUST BE AUTHORISED & COMPLIANT

Authorities usually require confirmation that:

- the recycling plant is **licensed**,
- it has **adequate capacity**,
- its technology meets national **environmental and safety standards**, and
- it has the means to handle residues responsibly.

4. SHIPMENT DOCUMENTS MUST BE PREPARED & PRE-APPROVED

Customs and environment agencies will expect:

a completed **Basel movement document**,

an **exporter's notification** and consent documents,

the **contract** between exporter and importer (including financial guarantees for take-back),

a detailed **waste description**, polymer codes, contamination levels, and intended recycling process,

the relevant **HS/AHTN classification**,

the **bill of lading**, packing list, and invoice.

5. TRANSPORT CONDITIONS MUST COMPLY WITH BASEL AND NATIONAL RULES

This includes:

appropriate packaging or baling,

clear and correct labelling,

carrier details,

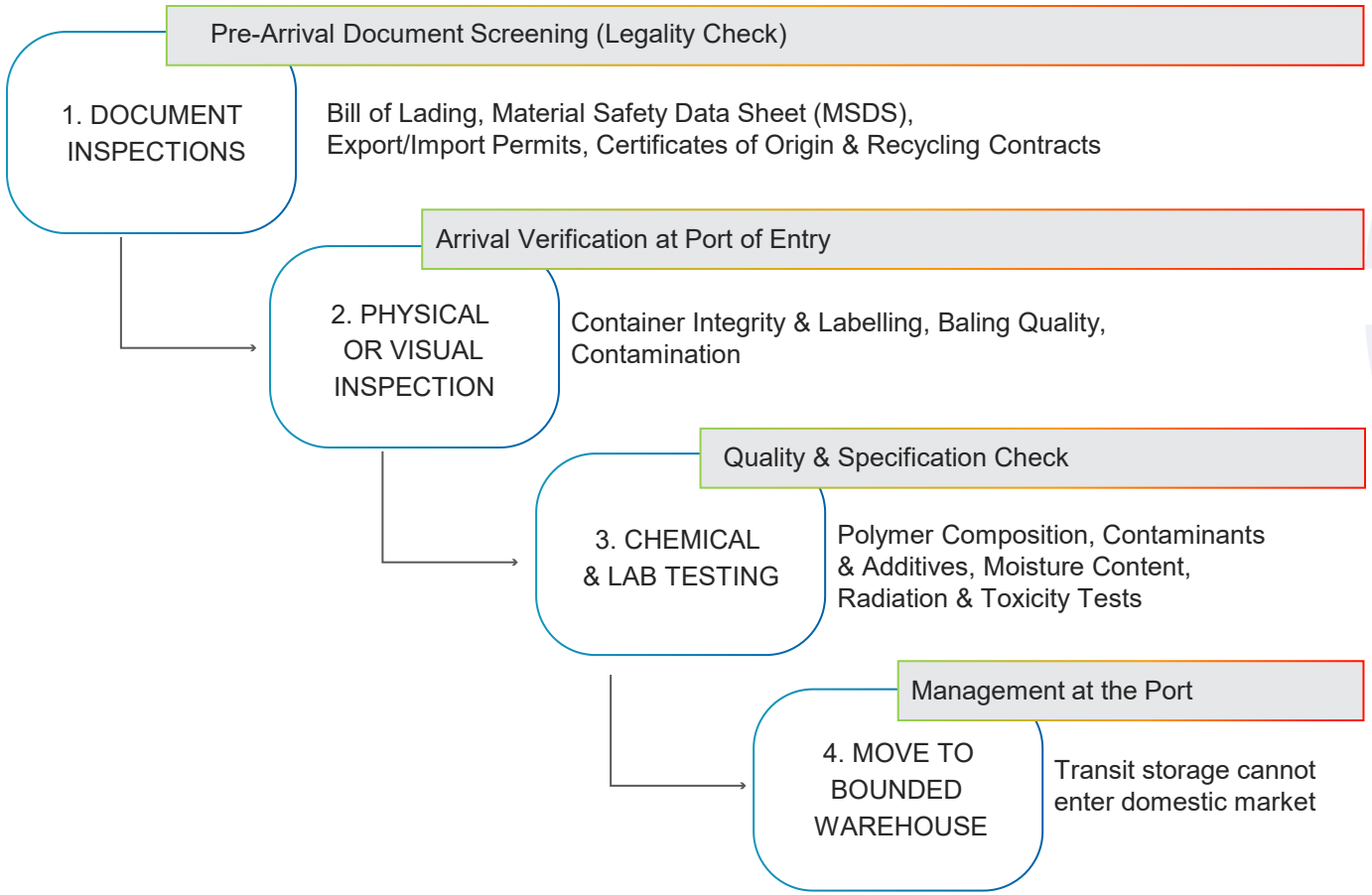
routing that matches what was approved in the PIC.

4.2 TECHNICAL CONTEXT: IMPORT ACCEPTANCE PROCEDURES AT PORTS

This section outlines the checks and procedures that should be carried out at seaports on consignments of plastic waste before they are released into the country.

ACCEPTANCE PROCEDURES FOR PLASTIC WASTE AT PORTS

Once a shipment of plastic waste has arrived at the port of an ASEAN member state, several steps need to be carried out. In practice, these requirements come from the Basel Convention (especially the Prior Informed Consent procedure), each country's customs law, and national waste-import regulations. The essentials are shown below:



SAMPLING PROTOCOL

- **Follow ISO 13906** sampling for waste plastics or national guidelines.
- **Minimum 5% of bales** or 1–3 bales per container depending on risk.
- **Random grab** sampling from different layers.

DOCUMENT INSPECTIONS

CORE DOCUMENTS CUSTOMS/ WASTE-CONTROL AUTHORITY WILL CHECK

- **Bill of Lading (BoL)** (or other transport document) — to verify shipment, container number, seal number, mode of transport, ports of loading/entry.
- **Origin (exporting country) and supplier/exporter information** — in many AMS import requirements, details of exporter/supplier, country of origin etc. are mandatory.
- **Commercial invoice and/or packing list** —item description (type of plastic waste), quantity, value, packaging details.
- **Import declaration / customs import permit or clearance documentation** — as required under national customs laws. For instance, in AMS where waste import is regulated, the importer must submit a customs import declaration (or equivalent).
- **HS code / tariff classification / product code** — the waste must be correctly classified under Harmonised System (e.g. HS 39.15 for plastic waste) or national equivalent. Authorities often verify that the HS/product code corresponds to allowed waste-type.

IF ANY REQUIREMENT FAILS

- The shipment may be held, inspected, rejected or subject to re-export.
- The competent authority may require the exporter to take the waste back under Basel rules.

WASTE-SPECIFIC / REGULATORY DOCUMENTS (FOR PLASTIC WASTE UNDER BASEL OR AMS NATIONAL RULES)

- **A permit or "permit equivalent" under Basel framework (e.g. a "Basel import permit")**, if the waste is classified under categories subject to prior informed consent (PIC) or hazardous status.
    - The Basel-permit application typically requires supporting documents such as a copy of the waste-movement notification form (as per the Basel Convention), a contract between exporter and importer, and a financial guarantee (e.g. bank guarantee) among other things.
- **Waste-movement / notification documents** — e.g. notification forms and movement documents as per Basel Convention procedures.
- **Certificate of Approval (CoA) or national-level import approval**, where required by national legislation.
    - The CoA confirms that the imported plastic waste meets regulatory requirements (e.g. recyclability, source, contamination thresholds, homogeneity, packaging).
- **Supporting documentation attesting to the cleanliness / homogeneity / non-contamination of the waste**, especially if national rules require certain purity or segregation standards (e.g. no mixed hazardous contaminants, minimal contamination, separate polymer streams, acceptable contamination levels).
- **Contractual agreement between exporter and importer** — required under Basel-permit procedures to ensure responsibility for proper waste handling and ESM recycling.
- **Bank guarantee or financial security** — in some jurisdictions, when applying for a Basel permit or for plastic-waste import approval.

AMS SPECIFIC DOCUMENTS REQUIRED BY CUSTOMS

COUNTRY	WASTE-SPECIFIC / REGULATOR DOCUMENTS CUSTOMS EXPECT TO SEE	CORE TRANSPORT & COMMERCIAL DOCUMENTS CUSTOMS WILL CHECK								
		BoL	SDS	Permit or Licence	CoO	Recycling contract	Invoice/ Packing list	Custom declare	HS	PIC
Brunei Darussalam	Registration as recyclers and exporter/importer of hazardous waste under DEPR. Import and Export permit issued by DEPR. Technical and verification report of plastic waste to ensure cleanliness and homogeneity.	✔					✔	✔	✔	✔
Cambodia	Approval from Ministry of Environment and Ministry of Trade (imports restricted); documentation proving the waste is non-hazardous, intended end-use, and any Ministry recommendations for import permit.	✔	✔	✔	✔	✔		✔	✔	✔
Indonesia	National import permit / environmental permit where applicable; proof of recyclability/cleanliness, supplier/exporter details, any Ministry of Environment or trade approvals required (depends on waste class).	Full ban								
Lao PDR	**Import certificate** for plastic waste to be submitted by recycling operator; evidence plastic is clean and recyclable (e.g. sheets/bags/bars) and meets national NPAP / technical guidance; permits from competent agencies.	✔	✔	✔	✔	✔		✔	✔	✔
Malaysia	**Certificate of Approval (CoA)** / SIRIM requirements (recently tightened): Manufacturing licence or ICA10 confirmation, MISW licence, pre-shipment inspection reports, bank guarantee and supporting technical evidence (cleanliness, polymer type).	✔		✔	✔	✔	✔	✔	✔	✔

AMS SPECIFIC DOCUMENTS REQUIRED BY CUSTOMS

COUNTRY	WASTE-SPECIFIC / REGULATOR DOCUMENTS CUSTOMS EXPECT TO SEE	CORE TRANSPORT & COMMERCIAL DOCUMENTS CUSTOMS WILL CHECK								
		BoL	SDS	Permit or Licence	CoO	Recycling contract	Invoice/ Packing list	Custom declare	HS	PIC
Myanmar	Official policy varies — some sources indicate strict prohibitions or limited allowance only for clean homogenous scrap used as raw material; where allowed, environmental approval and technical evidence required.	✔	✔	✔	✔	✔				✔
Philippines	Import licence issued by Ministry of Commerce (MOC) upon recommendation from environment authority (ECD/MONREC); technical requirements on allowed types, pre-shipment inspection and declaration of end-use.	✔	✔	✔	✔	✔				✔
Singapore	**Basel permit / TradeNet permit/ Cargo Clearance Permit** for waste controlled under Basel; movement/notification forms where required; evidence of material composition (polymer type, contamination level); contract between exporter/importer; bank guarantee when required.	✔	✔	✔	✔	✔	✔		✔	✔
Thailand	**(From Jan 2025) Import ban** on plastic waste — customs will check and detain shipments; if any import allowed (e.g. specific exemptions) the importer must hold the stated national permits.	Full ban								
Viet Nam	National technical regulations (e.g. QCVN) requiring washed/clean, shredded/crushed, defined permitted HS lines; import permit / environmental approval for plastic scrap meeting QCVN32/2018 criteria.	✔	✔	✔	✔	✔				✔

INSPECTING & TESTING PLASTIC WASTE CONSIGNMENTS

Customs officials may carry out physical inspections or send samples for laboratory analysis to confirm that the plastic waste matches its declared classification and is suitable for import, especially where contamination or mixed materials are suspected. These checks help detect mis-declared or illegal shipments, ensure compliance with Basel and national rules, and prevent the entry of waste that could harm the environment or overwhelm local recycling capacity.

PHYSICAL CHECKS AT THE PORT

The main physical checks at ports typically include a **visual inspection** of bales or loose plastics to look for contamination, moisture, mixed materials, or residues.

Officials may also conduct **manual probing or opening of bales** to examine the inner material and verify polymer types and cleanliness.

In addition, they may take **grab samples for rapid field tests** (such as moisture or polymer identification) and, where necessary, prepare **representative samples** for formal laboratory analysis.

WEIGHT CHECKS

- Is the mass in line with expectations given the type of waste declared?

VISUAL INSPECTIONS

- Levels of contamination
- Smell
- Moisture

POLYMER TYPES

- Test kits

LABORATORY TESTING

The main laboratory tests on plastic waste shipments include **moisture determination** using an oven-dry method to establish accurate water content and confirm whether the material is dry enough for recycling.

Laboratories may also carry out **polymer identification** using techniques such as Fourier Transformation Infrared Spectroscopy (FTIR) or Differential Scanning Calorimetry (DSC) to verify the declared polymer type and detect incompatible mixes.

Further analyses can include **contamination testing**, such as measuring organic residues, dirt, or non-plastic components, to determine whether the load falls under B3011 or requires control as Y48.

MOISTURE

- Oven drying

POLYMER IDENTIFICATION

- FTIR
- DSC

CONTAMINATION

- Organic residues, metals etc.

PHYSICAL INSPECTIONS AT PORTS

Physical inspections in ASEAN states follow broadly similar steps, but each country applies its own legal framework and port-level procedures. The outline below reflects how inspections are typically carried out across the region for plastic waste consignments subject to Basel controls.

1. OPENING OF CONTAINERS

Physical examination is usually undertaken jointly by:

- **Customs**
- **Environmental / pollution control officers**
- Sometimes **port health** or **quarantine**

Steps include:

- Breaking seals and recording the seal number.
- Opening doors and conducting an initial visual check for odour, signs of putrefaction, moisture, mould or mixed waste.
- Assessing the general appearance of bales or bags.

2. DETAILED INSPECTION AND SAMPLING

Depending on national rules and risk assessments, officials may:

- **Pull out sample bales or sacks**, cut them open, and inspect the contents.
- **Estimate contamination**, either visually or by taking a representative sample (some states use a rough benchmark similar to the <2% contamination expectation for B3011-type shipments).
- **Check polymer types**, looking for the presence of incompatible plastics.
- **Identify prohibited items**, such as household residues, medical waste, electronic waste, organics, or construction debris.
- **Verify moisture content**, especially where excess moisture indicates improper cleaning or the presence of organics.

Field test kits may be used for polymer identification, though some ports still rely entirely on visual judgement.

3. PHOTOGRAPHIC AND WRITTEN DOCUMENTATION

Inspecting officers also record:

- Photos of the opened container and any problem materials.
- Notes on contamination level, odour, liquids, and the composition of the sample.
- The identity of officers present, date, start and end time of the inspection.
- Seal numbers before and after opening.

This evidence supports decisions on clearance, re-export, or enforcement.

4. DECISION ON CLEARANCE

Based on the findings, the competent authority may:

- **Release the shipment** for domestic transport to the authorised recycling facility.
- **Order repacking or segregation** (rare and depends on national law).
- **Deny entry and require re-export** to the country of origin.
- **Initiate enforcement action**, including seizure, administrative penalties, or prosecution if fraud or smuggling is suspected.

5. FOLLOW-UP OVERSIGHT

- Some states conduct:
- **Post-clearance audits** of the receiving facility.
- **Verification of downstream recycling** (e.g. checking that the authorised plant really processed the waste and did not divert it).

RISK-BASED SELECTION CRITERIA FOR PHYSICAL INSPECTIONS

Across ASEAN ports, the choice of whether a plastic-waste consignment is physically inspected is usually driven by a mix of **statutory requirements** and **risk-based targeting**. The following selection criteria are commonly used.

1. MANDATORY CATEGORIES

Several ASEAN Member States apply automatic inspection to:

- **All plastic waste imports**, regardless of origin (a rule introduced after 2018–2019 import surges).
- **All Basel-controlled waste shipments**, including those declared under codes equivalent to Y48 or A3210.
- **All first-time importers** or newly licensed recycling facilities.
- **Shipments routed through transhipment hubs** or with a history of "port hopping".
- In some ports, particular HS codes (e.g. 3915 for plastic waste/scrap) trigger automatic red-channel routing.

2. LICENCE- AND PERMIT-BASED TRIGGERS

A consignment will normally be selected if:

- The importer's **annual quota is nearly exhausted.**
- The importer's **licence is newly issued, suspended, or under review**.
- The receiving facility has **not yet been verified** or audited.
- The Basel consent documents **show discrepancies**, missing signatures, or late notifications.

3. EXPORTER AND ROUTE RISK FACTORS

Authorities look at the risk profile of the exporter and transport chain, including:

- **Past non-compliance** by the exporter, broker, or carrier.
- **Shipments from ports or countries associated with mis-declared waste** (based on intelligence bulletins).
- **Use of complex supply chains**, multiple freight forwarders, or unusual routing patterns.
- **Repeated use of "low-value" declarations** or inconsistent polymer descriptions.

RISK-BASED SELECTION CRITERIA FOR PHYSICAL INSPECTIONS

Across ASEAN ports, the choice of whether a plastic-waste consignment is physically inspected is usually driven by a mix of **statutory requirements** and **risk-based targeting**. The following selection criteria are commonly used.

4. DOCUMENT AND DECLARATION ANOMALIES

Many inspections arise simply because paperwork looks suspicious or incomplete:

- HS code inconsistent with the described material (e.g. 3915 plastic waste declared as "regrind granules").
- **Weights that do not match** typical container loads.
- **Missing pre-shipment inspection reports** (where required).
- Incorrect or mismatched seal numbers.
- Discrepancies between photos submitted in advance and the declared bale type.

.

5. MATERIAL-SPECIFIC RISKS

Certain materials automatically attract scrutiny:

- **Mixed plastics** (e.g. mixed PE/PP/PS), or anything not clearly single-polymer.
- **Low-grade or low-value bales**, which statistically carry higher contamination.
- **Post-consumer waste from municipal sources**.
- **Material described as "clean" without any supporting evidence**.
- Some states apply a higher inspection frequency to PET bottles than to industrial scrap; others prioritise flexible films because they carry more cross-contamination risk.

6. BEHAVIOURAL AND CONTEXTUAL FACTORS

- Sudden spikes in **volume from a particular** exporter or country.
- **Last-minute amendments to the manifest**.
- **Vessel switching** or unexpected changes to arrival times.
- Weather-related or operational concerns (e.g. odour reports from the quay).
- Intelligence from other ASEAN ports on recent seizures.

LABORATORY TESTING CRITERIA

Laboratory tests on imported plastic waste in ASEAN are **not automatic**. They are carried out **only when one or more inspection "triggers" occur.** In practice, most consignments are released after document checks and a visual inspection; only a minority are sampled and sent to a lab. The most common reasons are set out below:

1. WHEN THE DOCUMENTATION RAISES DOUBT

Lab referral is common when:

- the shipment declaration (HS/Basel code, polymer type, end-use) seems inconsistent;
- missing or questionable permits (e.g. pre-inspection certificate, recycling licence);
- declared polymer does not match typical appearance (e.g. declared as PET flakes but looks like mixed film).

Why: documentation problems are a major risk indicator.

2. WHEN THE VISUAL INSPECTION SUGGESTS CONTAMINATION OR MIXED MATERIAL

A laboratory test is usually triggered if inspectors find:

- visible food residues, organics, moisture, sludge, or oil;
- mixed or incompatible plastics;
- materials that resemble e-waste, PVC, carpets, textiles or composites;
- bad odour suggesting biological decomposition.

Why: visual signs are the strongest predictor of non-compliance.

3. WHEN RAPID *FIELD SCREENING* GIVES AN UNCERTAIN OR "FAIL" RESULT

Most ASEAN ports with enhanced capacity now use **portable FTIR/NIR** and **XRF**.
Lab tests are ordered when:

- the portable FTIR cannot obtain a clean spectral match;
- results suggest mixed polymers;
- XRF detects high chlorine (possible PVC) or heavy metals;
- the moisture metre indicates high water content;
- rapid tests contradict the declaration.

Why: field instruments are for screening only; confirmation must be done in a lab.

4. WHEN THE CONSIGNMENT COMES FROM A HIGH-RISK EXPORTER OR ORIGIN

Customs often maintain internal risk profiles. Shipments go to lab when:

- the exporter previously failed inspections;
- the shipment comes from a country known for non-compliant plastic waste exports;
- the importer has a history of incorrect declarations.

Why: risk-based inspection focuses lab resources on likely violations.

LABORATORY TESTING CRITERIA

Laboratory tests on imported plastic waste in ASEAN are **not automatic**. They are carried out **only when one or more inspection "triggers" occur**. In practice, most consignments are released after document checks and a visual inspection; only a minority are sampled and sent to a lab. The most common reasons are set out below:

5. WHEN NATIONAL RULES REQUIRE MANDATORY LAB TESTING FOR CERTAIN CATEGORIES

Some ASEAN states require lab checks in specific cases, for example:

- **Malaysia (post-2024 SIRIM system):** certain plastic waste categories require verification of polymer purity and contaminants when pre-inspection documentation is incomplete.
- **Thailand and Indonesia:** lab testing occurs when purity claims (e.g. ">98% clean") need confirmation.

Why: some national systems embed testing as part of enforcement.

6. WHEN THE CONTAMINATION APPEARS CLOSE TO A LEGAL THRESHOLD

If inspectors believe the contamination might be near the national limit (often **2% non-plastic content**), they take a sample and send it to the lab for a gravimetric contamination test.

Why: contamination percentages must be defensible; only the lab can quantify them.

7. WHEN HAZARDOUS CONTAMINATION IS SUSPECTED

Lab analysis is done immediately if any of the following are found:

- suspected **oil, lubricants, solvents**, or unusual odours;
- presence of **medical waste**, pharmaceuticals, or sharps;
- possible **PCBs**, **POPs**, or burned/charred residues;
- inclusion of **batteries**, **electronics**, or **metallic sludge**.

Why: these may fall under hazardous waste rules, not ordinary plastic waste.

8. WHEN A PORT IS UNDERGOING INCREASED ENFORCEMENT OR NATIONAL INSPECTION CAMPAIGNS

Some ASEAN ports occasionally operate **targeted enforcement weeks** where incoming plastic waste or e-waste undergoes systematic sampling and laboratory verification.

Why: targeted action boosts compliance and helps detect illegal imports.

9. WHEN ANOTHER AGENCY FORMALLY REQUESTS TESTING

Lab testing is initiated if:

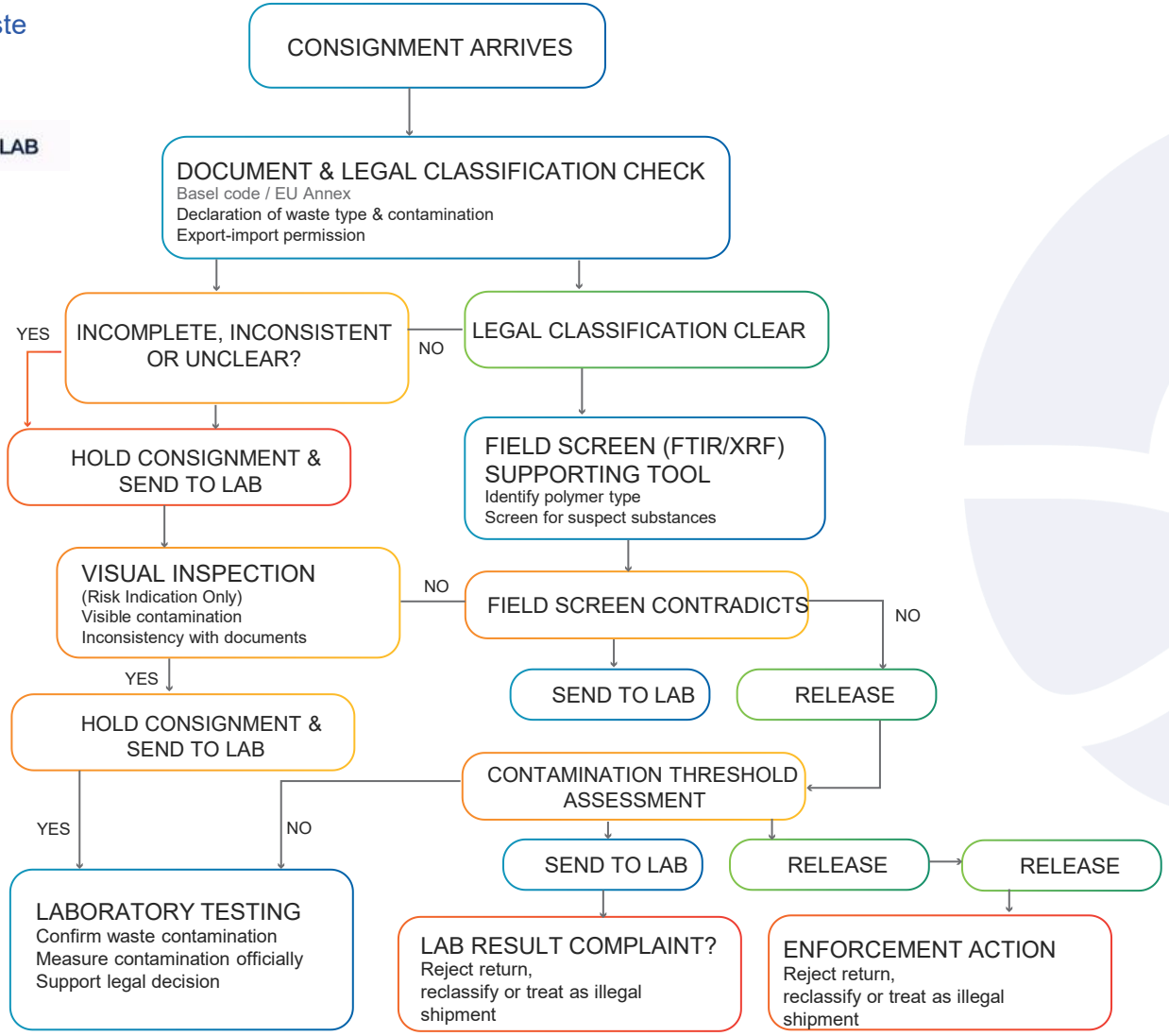
- environmental regulators request sampling;
- police or customs intelligence units flag the container;
- the Basel Secretariat or regional networks request verification during a joint operation.

Why: multi-agency interventions are common in waste shipment enforcement.

DECISION FLOW CHART: WHEN TO SEND SAMPLES TO LAB FOR TESTING

When to escalate plastic waste imports to laboratory testing (EU-compliant)

PASS | FAIL | SEND TO LAB



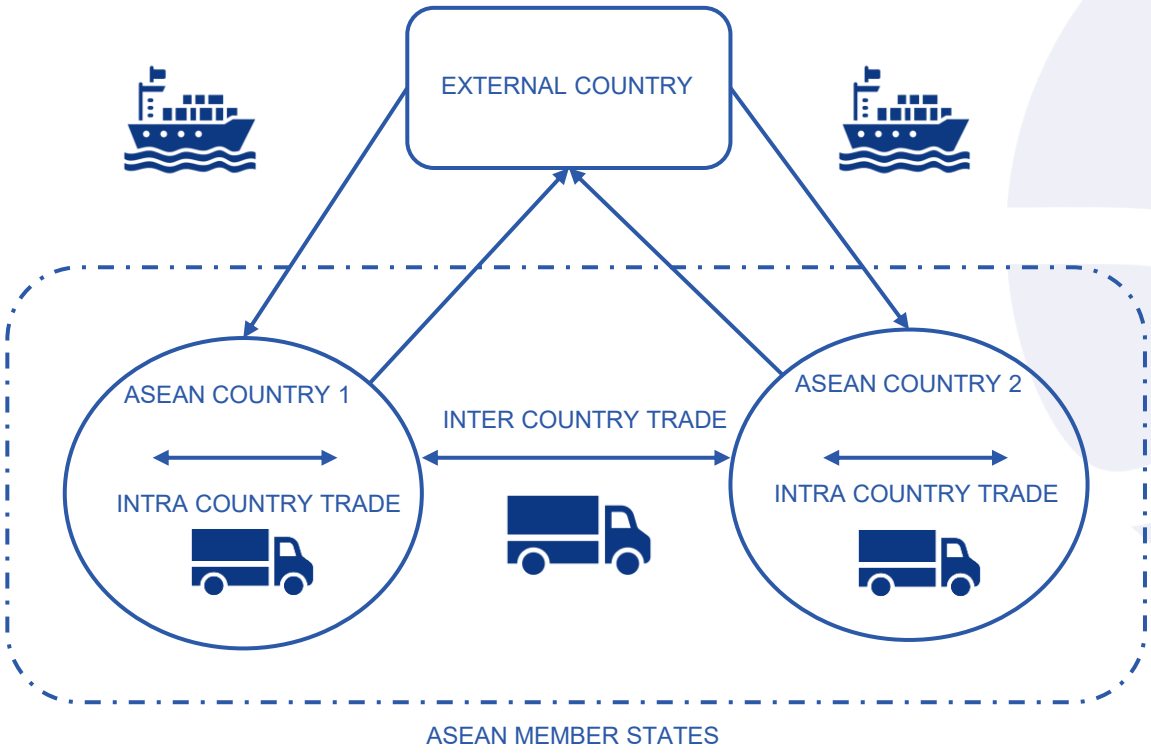
4.3 TECHNICAL CONTEXT: WASTE TRANSPORTATION BY ROAD

Although the focus of this Guidebook is on the entry of plastic waste from third countries at seaports, where countries have land borders there is potential for trade via the road network.

This section explains some of the aspects that should be considered.

TRANSPORTATION BY ROAD

Irrespective of whether sorted plastic waste has been sourced nationally or internationally, it will need to be transported by road. Although transport regulations vary in each ASEAN member state, there are a few good practice measures that need to be put in place in order to protect the environment and the safety of drivers and other road users.



TRANSPORTING PLASTIC WASTE BY ROAD

OPERATIONAL / VEHICLE & LOAD CONTROLS

Ensuring that all vehicles transporting sorted plastics from MRFs are safe and fit for purpose is important in order to prevent accidents and safeguard the materials so that they arrive for reprocessing in the same condition they left the sorting facility. This is particularly important in the formal sector, where the weight of stacked baled plastics represent a safety hazard during loading/unloading and transportation.

Operators and logistics companies should ensure that the following are carried out as a minimum:

- Regular servicing and condition checks: this should include the overall roadworthiness of the vehicle (including tyres, suspension and brakes), and to ensure that load decks are stable and intact.
- Bale containment and restraint requirements: all bales should be stacked in a safe manner with the load evenly distributed over the surface of the deck; heavier bales should be at the bottom.
  Bales should be secured to stop them moving during transportation, preferably using ratchet straps; ropes may be used for small loads.
  The driver's cabin should also have a secure headboard at the back to prevent the load moving forwards during braking.
- Sheeting and/or netting: trucks should have a covering system (e.g. a sheet or a net), to protect and secure the load during transportation. It is particularly important whenever loose or minimally compacted plastics are moved, in order to prevent fugitive releases into the environment. Guidance is included here.
- Segregation of polymer grades: some polymers will need to be kept separate from other plastic grades, especially those intended for recycling into food contact materials. It should also help avoid cross-contamination of polymer grades or contaminated loads.
- Driver and loader training: ideally, drivers and loaders should receive adequate and periodic training on safe stacking and unstacking of bales, load security, contamination risks and emergency responses.
- Pre-departure inspection & documented checks: all drivers should carry out a pre-departure safety and load check using a standardised checklist. They should also carry a copy of all relevant documentation.



DOCUMENTATION FOR TRANSPORTATION BY ROAD

The transportation of plastic waste must take into account the safety of drivers and road users, the prevention of leakage into the environment, and the maintenance of material quality for recycling.

DOCUMENTATION & TRACEABILITY

Once waste has been sorted and is ready to be transferred to a recycling facility, the aggregator or materials reclamation facility operator should ensure that all loads are appropriately documented. This should form part of the facility's **quality management system**. A copy of the documents should be held by the driver, and a copy retained by the operator, where it should be filed for auditing purposes.

In the case of plastic waste that will be recycled into **food contact materials** (e.g. PET drinks bottles) this chain of custody is essential.

DOCUMENTATION SHOULD INCLUDE:

- **Complete waste transfer documentation, including chain-of-custody and consignment notes:** These should list the national waste codes, sender/receiver details, description of the material including the standard it complies with (e.g. one of the ISRI specifications), its weight, packaging type and transporter details.
- **Photographic evidence:** Some authorities may request photographic proof of the plastic condition as part of import/export declarations. This is a simple way of demonstrating compliance with a quality standard (e.g. the ESA standard).
- **Customs and transit papers:** where loads cross national borders, all necessary documentation including designated codes will be required.

DOCUMENTATION FOR TRANSPORTATION BY ROAD

BALE ASSESSMENT

STACKING GUIDELINES

- Heavy bales at the bottom, lighter ones on the top.
- Align bales in rows with even weight distribution.
- Avoid double stacking unless bale height and stability allow.

SECURING

- Use ratchet straps for large roads.
- Ensure headboard behind driver's cabin for safety.

CHECKLIST FOR DRIVERS

BEFORE DEPARTURE

- Vehicle condition (brakes, tyres, suspension)
- Load secured with straps/ropes
- Sheeting/netting in place to prevent debris escape
- Documentation complete (consignment note, waste transfer note)
- Polymer segregation confirmed
- Emergency kit available

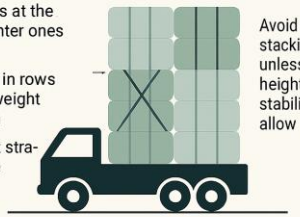
DURING TRANSPORT

- Drive with weight limits
- Avoid sudden braking or sharp turns
- Check straps periodically on long trips

TRANSPORTATION OF PLASTIC WASTE BY ROAD

EXAMPLE OF PROPER BALE ARRANGEMENT

- Heavy bales at the bottom, lighter ones on top
- Align bales in rows with even weight distribution
- Use ratchet straps for large loads



Avoid double stacking unless bale height and stability allow

CHECKLIST FOR DRIVERS

BEFORE DEPARTURE

- ✔ Vehicle condition (brakes, tires, suspension)
- ✔ Load secured with straps/ropes
- ✔ Sheeting/netting in place to prevent debris escape
- ✔ Documentation complete (consignment note, waste transfer note)
- ✔ Polymer segregation confirmed

DURING TRANSPORT

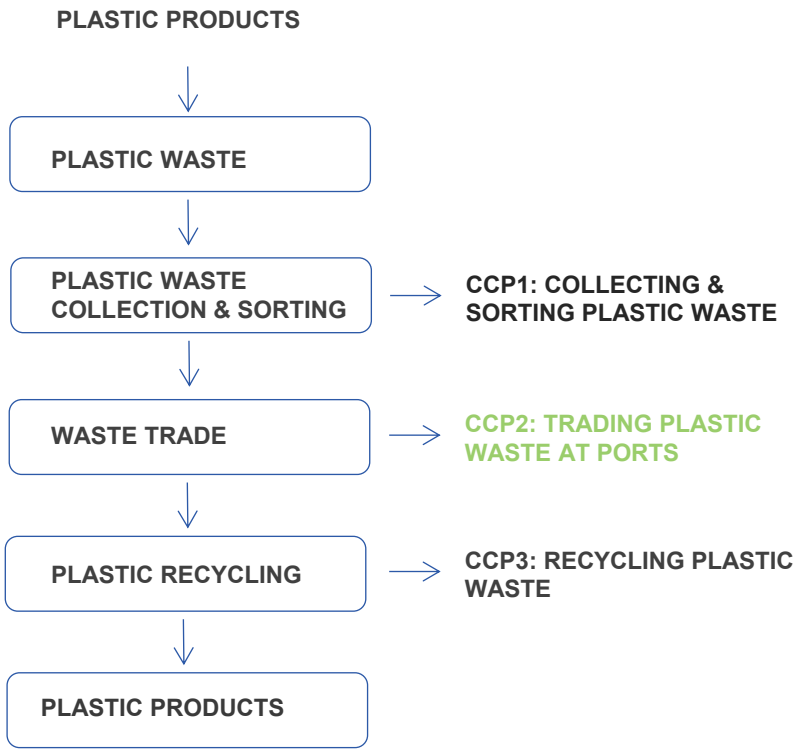
- ✔ Drive within weight limits
- ✔ Avoid sudden braking or sharp turns
- ✔ Check straps periodically on long trips

4.4 MANAGING QUALITY: CCP2

This section summarises how a Hazard Analysis Critical Control Point methodology can be applied to international plastic waste trade at ports.

CRITICAL CONTROL POINT 2: PLASTIC WASTE INTERNATIONAL TRADE, CUSTOMS & PROCEDURES AT PORTS

GUIDEBOOK



The majority of plastic waste traded internationally arrives at ASEAN Member States through seaports, rather than by land. **Inspection** by **customs officials / competent authorities** at ports is therefore a very important mechanism, controlling what is, and importantly, what is not allowed to enter a country for recycling.

This entry point is therefore a **critical control point (CCP)** in the responsible recycling of plastic waste.

In this Guidebook, this has been designated **CCP2.**

Similar procedures should, in theory, **apply at land borders** between countries.

Guidance in this section is of particular relevance to **customs, environment ministries and port authorities.**

National trade in plastic waste (i.e. within a country) is not subjected to the same levels of control. The guidance set out in Section 3 is relevant here and should be consulted instead.

CRITICAL CONTROL POINT 2

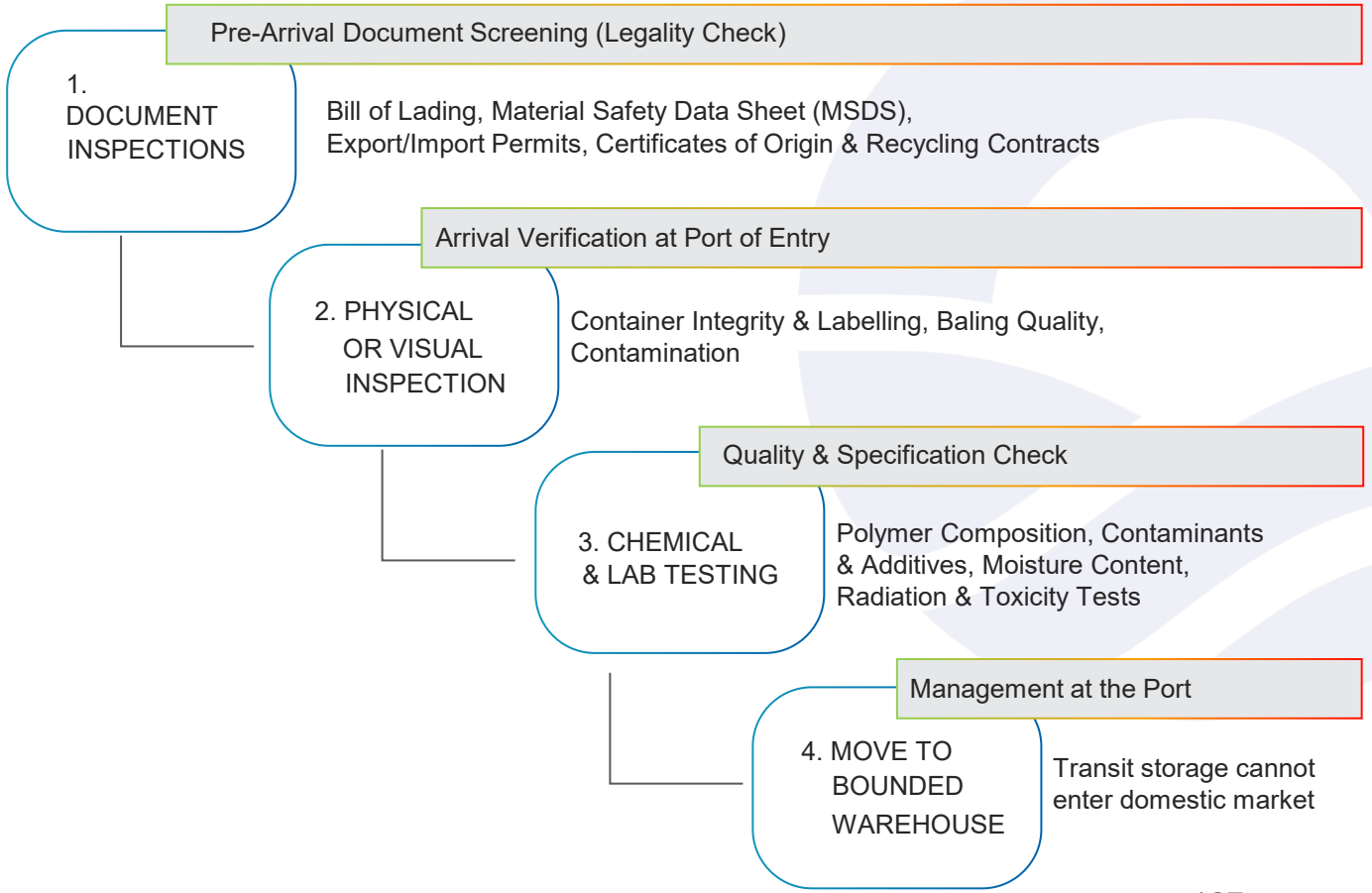
The decision to allow the import of a consignment of plastic waste from third countries will depend on the controls and decision-making criteria applied at seaports. In practice, this can be considered to be a **Critical Control Point (CCP)** using the HACCP principles outlined in the introductory section.

This **CCP ultimately acts as a gateway**, with a binary decision being made: **yes, allow the import for recycling**, or **no, reject the import**.

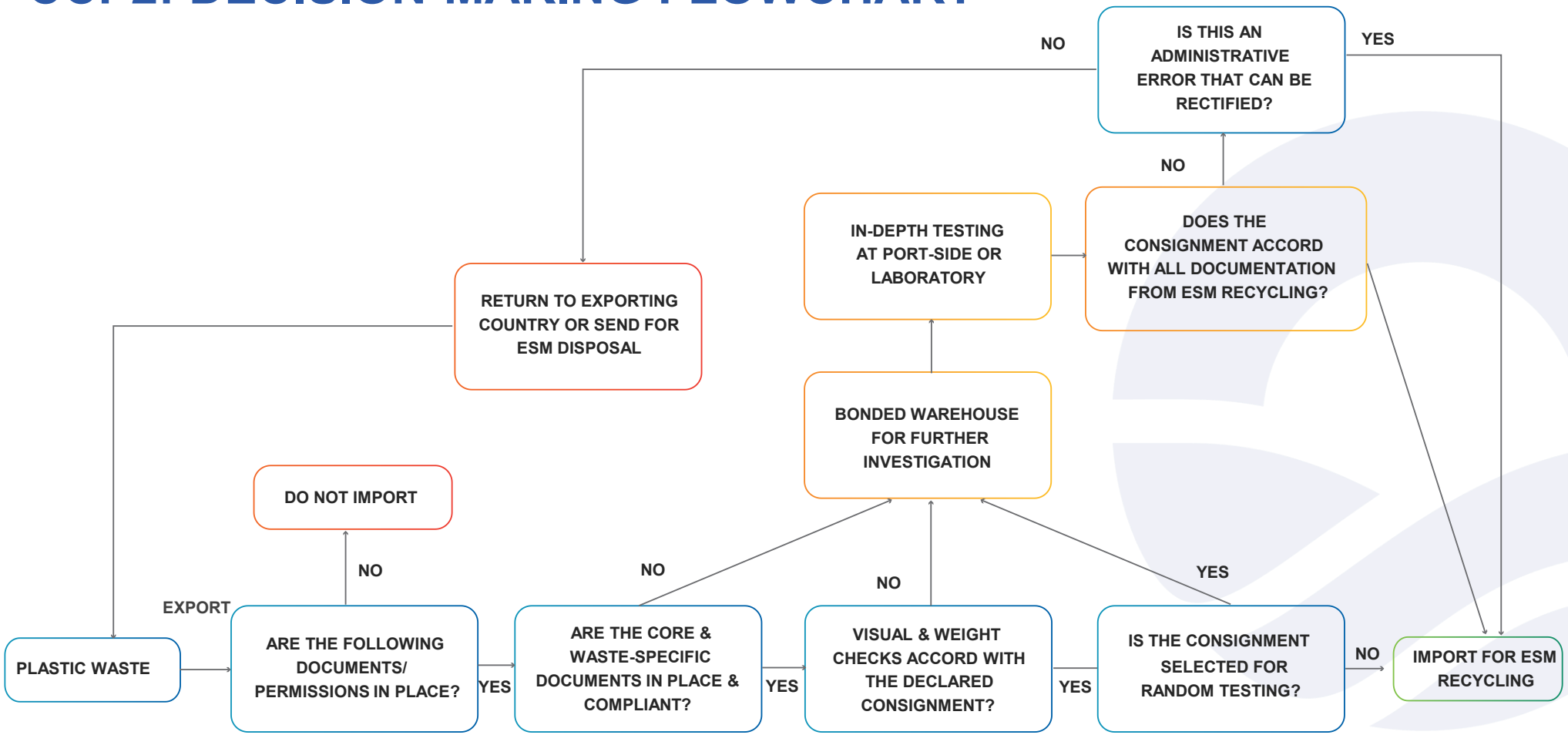
In order to reach this decision, there are a number of different criteria that need to be met. These have already been described in the previous two sections 4.1 and 4.2.

The purpose of this section is to consolidate this into a HACCP-style checklist, summarising these decision-making criteria and the routes to acceptance or rejection of the consignment.

PLEASE NOTE: Due to the multiple approval steps required at the port, the CCP2 form differs from those shown for CCP1 and 3; however, the principles remain the same.



CCP2: DECISION-MAKING FLOWCHART



CCP2: ACCEPTANCE/REJECTION FORM AT PORT - PART 1 (EXAMPLE)

CONSIGNMENT NUMBER	123456789
DATE	dd/mm/yyyy
PLASTIC TYPE	Baled polyethylene terephthalate (PET) bottles.
SOURCE	**Collected** as mixed plastic packaging from households. Kept separate from other recyclable fractions and residual waste. **Sorted** at an automated materials reclamation facility in the European Union.
MASS	X tonnes
HS CODE	391590 (Other plastic waste, parings and scrap)
AHTN CODE	39159020
BASEL CODE	B3011
HAZARDS	**Allowable Contaminants at Low Levels (< 2% by mass)**: HDPE or LDPE rigid plastic, PP, PS, any other non-PP rigid plastic, including other (no. 7) and compostable plastic, e.g. PLA and PHA. **Prohibited Contaminants**: PVC in any form, containers that held hazardous materials (e.g. pesticides), plastic bags or film, plastic foam, metal, wood, glass, batteries, electronics scrap, bio-medical waste/items, rocks, stones, mud, oils, grease.
RECORD KEEPING	All samples and measurements logged on a standard form, then stored in accordance with port procedures as per **EN 15348:2024.**
VERIFICATION/ AUDITING	Breaking open a minimum 5% of bales or 1–3 bales per container depending on risk. Quarterly audit of all records.

CCP2: ACCEPTANCE/REJECTION FORM AT PORT - PART 2 (EXAMPLE)

STAGE	DOCUMENTATION	VISUAL & WEIGHT CHECKS	IN-DEPTH TESTING AT PORT OR LABORATORY (IF REQUIRED)
CRITICAL LIMIT:	All documents completed appropriately & all permissions in place. Positive 'yes' answers to all of the following:	Visual & weight checks accord with declared consignment. Positive 'yes' answers to all of the following:	In-depth testing confirms plastic consignment accords with declared HS, AHTN and Basel codes. Positive 'yes' answers to all of the following:
MEASURE:	❑ PIC granted, if required ❑ Importer has valid permit ❑ Receiving facility is authorised & ESM compliant ❑ Shipment documents ❑ HS Code is correct ❑ Basel code is correct ❑ Bill of Lading (BoL) ❑ Origin information (CoO) ❑ Waste movement documents ❑ Commercial invoice ❑ Guarantees	❑ Seal intact ❑ Label matches declared contents ❑ No damage or leakage ❑ No malodours ❑ Visual check of bales indicates < five items of each non-hazardous non-plastic visible on five sides of a bale ❑ Mass of consignment accords with anticipated mass for type of plastic waste ❑ Compression/stacking is safe. ❑ Overall, it's a single type (e.g., PET bottles). ❑ No prohibited items: PVC, electronics, medical, liquids, batteries. ❑ Approximate total contamination ≤ 2%.	❑ Single plastic type (PET) > 98% ❑ Absence of prohibited contaminants ❑ Absence of hazardous substances (if tested) ❑ Suitable for ESM recycling ❑ Rapid screening (if available) • NIR/FTIR clearly identifies polymers • Average moisture content < 1–2% (indicating) • XRF does not detect abnormally high chlorine/heavy metal levels
DECISION:	**☑ All documents & permissions correct = PASS** **⚠ Some documents & permissions incomplete = Hold & carry out further checks** **☒ Permissions absent, documents incorrect or plastic waste not permitted by importing country = FAIL & reject consignment**	**☑ All visual & weight checks correct = PASS** **⚠ Some checks suggest tampering of consignment, inappropriate/ hazardous waste, levels of contamination > 2% = Hold & carry out further in-depth testing at port or laboratory**	**☑ All tests confirm low/ acceptable levels of contamination, plastic waste accords with declared codes and suitable for ESM recycling = PASS** **⚠ Incomplete = Hold & carry out further checks (if required)** **☒ Plastic waste contains > 2% contamination, hazardous substances or is not suitable for ESM recycling = FAIL & reject consignment**
OVERALL DECISION:	**ONLY allow import** if the consignment **passes ALL of the critical limit criteria**: ✓ **Documentation = PASS** ✓ **Visual & weight checks = PASS** ✓ **In-depth testing (if required) = PASS**		

CASE STUDY VIET NAM: INSPECTION & APPROVALS

1. PRE-ARRIVAL DOCUMENT SCREENING

Operator: Importer, State inspecting agency (DONRE), Designated Inspection Body

Action:

• Importer registers for state inspection of scrap quality.

• DONRE verifies scrap type is permitted (per List of scrap allowed for import).

• Ensure inspection body is designated/accredited under Decree 74/2018/NĐ-CP.

Reference: QCVN 32:2018 §3.1.1, §3.1.2; Decree 40/2019/NĐ-CP.

4. ANALYTICAL SAMPLING

Operator: Designated Inspection Body (with Importer present)

Action:

Bulk: take 50 kg samples from 5 positions.

Containers: take 10 kg samples from 5 positions per container, build representative samples.

Special sampling for >10 cm pieces and HS-code mix.

Reference: QCVN 32:2018 §3.2.1, §3.2.4, §3.2.5.

2. SITE VISUAL INSPECTION

Operator: Designated Inspection Body

Action:

Inspect containers or bulk scrap.

Photograph inspection points.

Identify obvious non-conformities (hazardous, prohibited scrap, banned categories).

Reference: QCVN 32:2018 §3.1.3; §2.3–§2.4 (banned scrap, prohibited impurities).

5. LABORATORY ANALYSIS

Operator: Accredited Laboratory (registered in environmental monitoring network)

Action:

Determine impurity ratio (≤2%).

Determine % of >10 cm pieces (≤5%).

Determine % of plastics of undeclared HS codes (≤20%).

Analyze radioactive levels per TCVN 7469:2005.

Analyze hazardous characteristics per QCVN 07:2009/BTNMT & Circular 36/2015/BTNMT.

Reference: QCVN 32:2018 §3.2.2–3.2.6; TCVN 7469:2005; QCVN 07:2009/BTNMT.

3. DECISION: CLEAR OR UNCLEAR

Operator: Designated Inspection Body

Action:

If visually conforming → proceed.

If unclear or suspected non-conformity → trigger sampling.

Reference: QCVN 32:2018 §3.1.3(b).

6. COMPLIANCE DECISION

Operator: Designated Inspection Body & DONRE

Action:

Compare results against QCVN 32:2018 technical requirements:

Impurity ≤ 2%

10 cm pieces ≤ 5% (if required)

HS-other ≤ 20%

No banned scrap types, no prohibited impurities

Radioactivity within exemption limits

Prepare inspection record and certificate.

Reference: QCVN 32:2018 §2.5.3, §2.1.3, §2.2.4, §2.3–2.4.

4.5 GUIDANCE: BORDER CHECKLISTS

This section summarises some of the checklists that may be of use to importers, customs officials and competent authorities.

CHECKLIST FOR IMPORTERS

Any **importer** of plastic waste into an AMS should ensure that the following documents and criteria are met:

- **Classify the plastic waste precisely** using correct HS code (e.g. HS 39.15) and check whether it is subject to Basel-controlled waste list (Annex II or Annex VIII) or exempt list (e.g. under Annex IX category B3011) under the Basel Convention.
- **Obtain the relevant authorisation/permit or Certificate of Approval** from the national competent authority (e.g. SIRIM in Malaysia, NEA-CCMD in Singapore) *before* the shipment.
- **Prepare and submit full documentation package**: invoice, packing list, bill of laden, customs declaration, contract, waste-movement / Basel-notification (if required), bank guarantee or financial security (if required), and technical / compliance documentation (e.g. evidence of homogeneity, contaminant levels, recyclability, source).
- **Ensure traceability and transparency**: include accurate descriptions, material type, origin, destination, recycling facility or end-user, and ensure that shipping containers, seal numbers, etc. are properly declared.
- **Confirm compliance with national technical standards and import-control criteria** (e.g. contamination thresholds, packaging requirements, acceptable waste types) — failure to meet these could lead to rejection, return, or legal consequences.

COMPLIANCE TIPS FOR IMPORTERS INTO AMS

Country	Compliance Tips
Brunei Darussalam	Brunei Darussalam strictly prohibits the importation of waste into the country. However, to support economic development, diversification, and in alignment with the national economic blueprint to achieve economic circularity, the importation of waste including plastic waste for recycling may be considered on a case-by-case basis, provided that it is managed in an environmentally sound manner and will be subjected to a thorough assessment.
Cambodia	Obtain Ministry of Environment approval for clean, homogeneous scrap only.
Indonesia	Imports prohibited from 2025. Previously required PSI and strict documentation.
Lao PDR	Secure permits for recyclable plastic waste and ensure cleanliness.
Malaysia	Mandatory PSI for HS 3915. Use ePermit & SIRIM systems. Ensure contamination below threshold.
Myanmar	Register as importer and obtain permits. Plastic waste must be clean and recyclable.
Philippines	Comply with Basel Convention PIC procedure. Obtain permits and ensure waste is sorted and clean.
Singapore	Follow Basel Convention PIC procedure. Ensure waste is clean and recyclable.
Thailand	Plastic waste imports banned from 2025. Avoid import attempts.
Viet Nam	Obtain permits and comply with Basel Convention. Ensure waste is clean and recyclable.

ENTRY CHECKLISTS FOR PLASTIC WASTE IMPORTS AT PORTS

BEFORE SHIPMENT LEAVES THE EXPORTING COUNTRY

- Prior Informed Consent (PIC) granted by the importing authority.
- Consent from all transit countries (if applicable).
- Valid contract between exporter and receiving facility, including take-back clause.
- Import licence or quota issued to the receiving company (where required).
- Receiving facility holds a valid recycling/processing permit.
- Laboratory analysis or declaration of contamination level provided.
- Pre-shipment inspection certificate obtained (for countries that require it).

DOCUMENTS THAT MUST ACCOMPANY THE SHIPMENT

- Basel movement document (completed and signed).
- Copy of PIC consent letter(s).
- Notification documents.
- Bill of lading.
- Commercial invoice and packing list.
- Waste classification details (Basel code, HS/AHTN code).
- Import licence documentation.
- Contract with the facility (some countries require it to be carried on board).

REQUIREMENTS CHECKED AT THE PORT

- Shipment matches paperwork:
  - correct Basel code (B3011, Y48 or A3210)
  - accurate HS/AHTN code
  - correct quantity and polymer type
- Contamination level within nationally permitted limits (some require <2%).
- Waste is clean, sorted and suitable for recycling—no prohibited materials.
- Containers properly sealed; bales and packaging in acceptable condition.
- Customs and environmental authorities clear the load before unloading.

IF ANY REQUIREMENT FAILS

Shipment may be held, inspected, rejected or subject to re-export.

Authority may require the exporter to take the waste back under Basel rules.

As the quality of plastic waste destined for recycling depends on both the **collection system, the level of instruction and guidance** provided to the producers of the waste and the ways in the waste has been **sorted**, importers should ensure that the exporting company adequately declares the following:

- **Source** of the plastic waste
- The **type of collection system** used (e.g. single stream, co-mingled or mixed waste), and
- The **type and level of sorting** undertaken, including compliance with any quality standards.

DIFFERENCES BETWEEN UEEE & WEEE

UEEE = Used Electrical and Electronic Equipment

WEEE = Waste Electrical and Electronic Equipment

CORRECT HS CODES

Used equipment must still be declared under the same HS codes as new equipment, *provided the items are fully functional*.

Common groups include:

- **8471** – Computers, laptops, printers
- **8517** – Phones, telecoms equipment
- **8528** – Monitors, TVs and screens
- **8525** – Cameras
- **8509 / 8516 / 8508** – Household appliances
- **8518** – Audio equipment

If items are non-functional, incomplete, damaged, untested or mixed → these codes become incorrect.

HS CODES COMMONLY MISUSED TO CONCEAL WEEE

- **3901–3915** – Polymers in primary form (for shredded plastics from WEEE)
- **7204 / 7602** – Ferrous or aluminium scrap
- **8473 / 8529** – "Parts" for computers or TVs
- **6309** – Used clothing (common for mixed charity loads)

BASEL CODES RELEVANT TO WEEE

Correct Codes:

- **Y45** – WEEE and discarded electronic products
- **A1180** – WEEE containing hazardous components or mixed/untested equipment (e.g., CRTs, mercury lamps, batteries, capacitors containing PCBs)

Misclassifications to Look For:

- No Basel code at all
- WEEE declared as:
    - **B3011 / B3010** (plastic recyclables)
    - **B3xx** (other non-hazardous wastes)
    - "Used equipment for reuse" (without evidence)

INDICATORS OF REAL UEEE (AND NOT WEEE)

- To qualify as used equipment for reuse, units must be:
- Tested and proven working
- Complete and unbroken
- Properly packaged to prevent damage
- Accompanied by:
    - Functional test reports
    - Reuse declarations
    - Serial number lists
    - Contracts with the receiving facility

If any of these are missing or unclear → treat as suspected WEEE.

BORDER INSPECTION CHECKLISTS: UEEE vs WEEE

DOCUMENT VERIFICATION

- Are functional test reports included, recent, and item-specific?
- Is there a list of serial numbers?
- Is there a contract for direct reuse, not recycling?
- Are Basel codes declared correctly (Y45 or A1180 when relevant)?
- Does the shipment use product HS codes without supporting evidence of functionality?

PHYSICAL INSPECTION

Check a representative sample of the load:

Condition

- Are items unbroken and complete?
- Are screens cracked?
- Are cables cut or missing?
- Are components removed (e.g., HDDs, RAM, batteries)?
- Are there signs of corrosion, water damage or burnt parts?

Functionality

- Is there any visible reason the item could not work?
- Are items stacked loosely or thrown into bulk containers, indicating waste behaviour?

Homogeneity

- Is the load mixed (computers, microwaves, fans, TVs together)?
  → Mixed = almost always WEEE.

Packaging

- Are items protected individually (bubble wrap, palettes, cartons)?
  Or dumped in a heap (indicative of waste)?

RED FLAGS

“Used goods” with no testing documentation

Monitors with missing stands or cracked displays

Desktop towers with HDDs or RAM removed

Items with hazardous components mixed in (batteries, lamps)

“For repair” or “refurbishment” claims – these fall under Basel waste unless fully documented

Serial numbers repeated, missing, or obviously incorrect

False HS codes: scrap metals, plastics, “parts”, or general household goods

DECISION TRIGGERS

Treat the shipment as WEEE (Basel-controlled) if:

- Items are untested, broken or incomplete
- Load is mixed or bulk-packed
- Any hazardous components are present
- Documentation is missing or inconsistent
- Basel codes are incorrect or absent

Treat as UEEE for direct reuse only if ALL are true:

- Each item is tested & functional
- Complete and unbroken
- Properly packaged
- Serial-numbered and documented
- Clear evidence of direct reuse and customer at destination

BORDER INSPECTION CHECKLIST: SRF

DOCUMENT REVIEW

- Is the shipment declared as **waste,** not as a product?
- HS code **3825** present?
- Basel code listed (usually Y46 or Y48)?
- Is PIC documentation provided when required?
- Does the shipment reference **CEN/TS 15359** or other fuel specification?
- Is the receiving facility a **licensed energy recovery plant?**

RED FLAGS IN DOCUMENTS

- Product descriptions (“pellets”, “flakes”, “granules”, “fuel”) with no waste paperwork
- Missing Basel code
- Incorrect HS codes (wood pellets, virgin polymers, metal scrap)
- Vague destination like “warehouse”, not a recovery facility

PHYSICAL INSPECTION

Appearance

- SRF is normally:
  - Shredded
  - Heterogeneous
  - Light and fibrous
  - Plastic-rich
- Pellets or fluff depending on production method
- Clearly not uniform like virgin plastic pellets
- **Sampling indicators**
- **High plastic content** → likely Y48 plastic waste
- **Presence of metals, glass, wet organics** → may not be SRF at all
- **Strong odours** → indicates biological waste, not engineered fuel

PACKAGING

- Typically packed in:
  - 1–2 tonne big bags
  - Bales (wrapped)
  - Loose bulk in containers
- Poor packaging or leaking material → low-quality RDF, not SRF

RED FLAGS

- Mixed household waste in bags
- Unprocessed materials (bottles, foil, cartons visible)
- Damaged bales leaking fines

COMPLIANCE INDICATORS

A shipment is more likely to be **genuine** SRF if:

- Fuel specification sheet is provided (Net Calorific Value, Cl, Hg)
- Consistent particle size
- No visible hazardous components
- Destination is a cement kiln, combined heat & power (CHP) plant, or dedicated waste-to-energy facility
- PIC paperwork complete
- Exporter is a licensed waste operator

A shipment is **likely to be non-compliant** if:

- Declared under polymer codes (3901–3915)
- Declared as wood pellets (4401)
- Declared as “non-waste product fuel”
- Highly mixed content visible
- Basel paperwork absent or incorrect

COMPARISON TABLE: SRF vs RDF

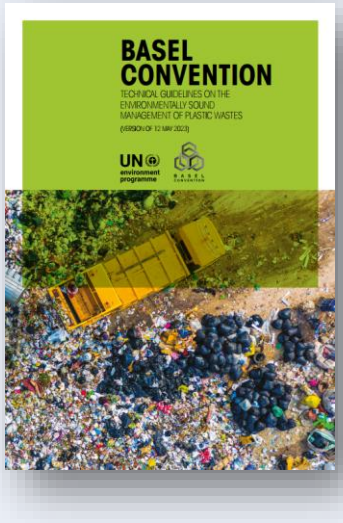
SRF = Engineered fuel made from non-hazardous waste, typically plastic-rich, paper, card, and textiles.
RDF = A fuel produced from mixed residual waste that remains after recyclable materials have been removed. It usually contains a blend of plastics, paper, card, textiles, and other combustibles.

Feature	SRF (Solid Recovered Fuel)	RDF (Refuse-Derived Fuel)
Status	Engineered fuel	Pre-treated waste
Standard	CEN/TS 15359	No unified standard
Quality	High, consistent	Variable, often coarse
HS Code	3825	3825
Basel Codes	Y46 / Y48	Usually Y46
Processing	Fine shredding, quality control	Basic sorting and shredding
Packaging	Wrapped bales, big bags, bulk	Mostly bales or bulk
Calorific Value	Guaranteed range	Variable
Typical Issues	Mis-declared as products	Mixed waste, contamination
Inspection Priority	Specification sheets essential	Check for unprocessed waste

PLASTIC WASTE CLASSIFICATION GUIDANCE

In addition to the information in this Guidance document, external references are available.

TECHNICAL GUIDELINES ON THE ENVIRONMENTALLY SOUND MANAGEMENT OF PLASTIC WASTE



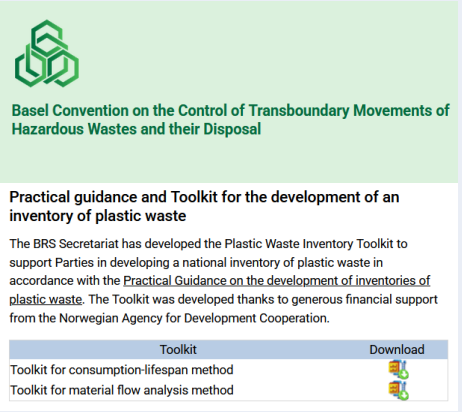
Source: UNEP

COURSE: PLASTIC WASTE AND THE BASEL CONVENTION



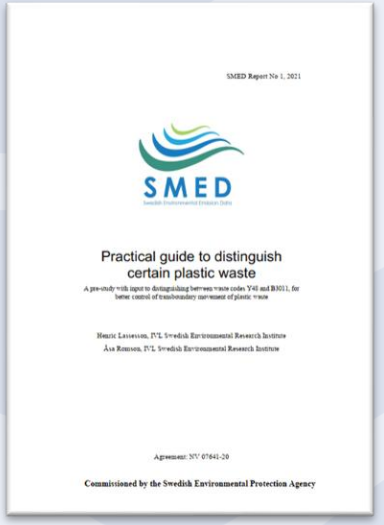
Source: UN CC: e-Learn

PRACTICAL GUIDANCE AND TOOLKIT FOR THE DEVELOPMENT OF AN INVENTORY OF PLASTIC WASTE



Source: the Basel Convention

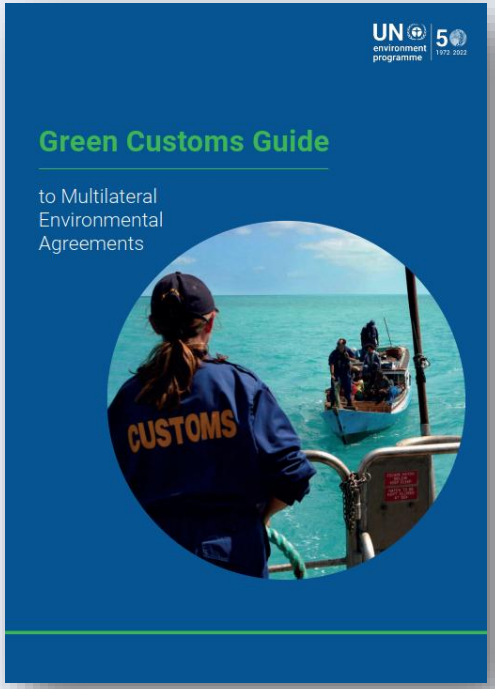
PRACTICAL GUIDE TO DISTINGUISH CERTAIN PLASTIC WASTE (Y48 & B3011)



Source: Swedish Environmental Protection Agency

GREEN CUSTOMS GUIDE

The **Green Customs Guide** is a practical resource aimed at customs and border control officials, helping them understand and implement key multilateral environmental agreements (MEAs) that regulate environmentally sensitive international trade and combat illegal trafficking. It explains the mechanisms and obligations established under these treaties to ensure legitimate trade in hazardous wastes and other regulated commodities while protecting human health and the environment.



A core component of the Guide is the **Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal**. This treaty seeks to reduce and control cross-border movements of hazardous wastes and other wastes, ensuring they are treated and disposed of in an environmentally sound manner as close as possible to their source of generation. Under the Convention, any shipment of covered wastes between countries requires a prior informed consent (PIC) from the importing and transit States. Exports to or imports from non-party countries are generally prohibited unless equivalent environmental safeguards are in place.

The **Guide stresses the critical role of customs officers** in enforcing Basel's provisions, as they are often the first line of defence against illegal shipments crossing international borders. It outlines customs responsibilities in identifying and monitoring regulated wastes, applying notifications and consent procedures, and recognising potential violations that may constitute illegal traffic under the Convention. Overall, the Green Customs Guide positions the Basel Convention within the broader suite of Multilateral Environmental Agreements, emphasising compliance, environmental protection, and capacity building for frontline enforcement.

United Nations Environment Programme (2022). Green Customs Guide to Multilateral Environmental Agreements. Nairobi.
https://www.greencustoms.org/sites/default/files/2023-05/Green_customs_guide-english.pdf

4.6 GUIDANCE: INSPECTIONS & TESTING

This section sets out checklists and guidance on how to sample and test plastic waste consignments.

PHYSICAL INSPECTIONS: SAMPLING

RATIONALE

It is important to ensure that a **sampling protocol** is adhered to in order to obtain representative data. This should include:

- **Following ISO 13906** sampling for waste plastics or national guidelines.
- **Breaking open a minimum 5% of bales** or **1–3 bales per container** depending on risk.
- **Random grab** samples from different layers.

Sampling principles and developing a strategy were described in the previous chapter on plastic waste sorting:

VISUAL INSPECTION

The UK plastic standard defines bale inspection criteria, which are applicable for visual inspections at ports for:

- Mixed Plastic Bottles, Pots, Tubs & Trays (HDPE, PET, PP, PS), and
- LDPE films.

It specifies that bales should be **visually inspected on five sides**, and sets out three quality levels:

- **Green**: Suitable for export (B3011)
- **Amber**: Requires further inspection and sampling (possibly Y48)
- **Red**: Banned from exporting

The specific criteria are summarised on these slides:

CONTAMINATION TYPES AND HOW TO JUDGE THEM

CONTAMINATION TYPE	EXAMPLES	COUNTS TOWARD 2%?	NOTES FOR INSPECTORS
Organic residues	Food residues, soil, biomass	Yes	Look for odour, staining
Paper/card	Labels, tickets, cardboard fragments	Yes	Includes adhesives
Metals	Caps, clips, wires	Yes	Even small pieces count
Liquids/moisture	Water pockets, drinks, oils	Yes	Moisture affects density
Incompatible polymers	PVC in PET, PS in PP, multilayers	Yes	Use NIR/density tests
Composites/laminates	PET–aluminium pouches, PE–PA films	Yes	Automatically non-B3011
Foreign materials	Wood, glass, textiles, rubber	Yes	Remove during sampling
Dirt/dust	Surface dirt, soil, fine particles	Yes	Estimate proportion
Production residues	Clean sprues, runners, purgings	No (if same polymer)	If clean and mono-grade

2% CONTAMINATION "LIMIT" QUICK REFERENCE

PURPOSE

To determine whether plastic waste qualifies as **B3011** (clean, sorted, single polymer).

DEFINITION

Up to **2% by mass** of combined non-plastic impurities is acceptable.

- Above 2% → **Y48** (or **A3210** if hazardous).

CLASSIFICATION GUIDE

- Single polymer + ≤2% contamination → **B3011**
- Mixed polymers or >2% contamination → **Y48**
- Hazardous contamination/additives → **A3210**

HOW TO ASSESS

Visual check (surface and interior of bales).

Representative sampling from several points.

Hand-sorting to remove foreign materials.

Weighing of contaminants vs sample weight.

Polymer tests (NIR, density tests) for impurity plastics.

Photograph and record findings.

COUNTED AS CONTAMINATION:

- Dirt, organics, food residues
- Paper, labels, tapes, adhesives
- Metal caps and closures
- Liquids
- Incompatible polymers (e.g. PVC in PET)
- Multilayers and composites
- Other foreign matter

QUALITY REQUIREMENTS: EXAMPLE SINGAPORE

Technical Guidelines for the Import and Export of Plastic Waste issued in 2021 by the National Environment Agency, Government of Singapore. It sets quality criteria for imported plastics categorised **under Harmonised System (HS) code 3915.**

The document states that the "source of the plastic waste should be generated directly from post-industrial and/or post-consumer use, and not from any landfill or waste disposal sites". Limit levels are shown below.

THRESHOLD LIMITS FOR PLASTIC CONTAMINATION (OTHER POLYMERS)

Plastic waste type	Threshold limit for other plastic waste type(s) per bale/bag (by weight unless otherwise stated)
Single-stream plastic waste allowed under the Basel Convention	0.5%
Mixtures of PP, PE and PET	0.5%

THRESHOLD LIMITS FOR NON-PLASTIC CONTAMINANTS

Type of non-plastic contaminants (non-exhaustive)	Threshold limit per bale/bag (by weight unless otherwise stated)
Household waste, including food waste and beverages	0%
Hazardous waste, biohazardous waste, e-waste, radioactive waste	0%
Other types of recyclable waste materials, e.g. waste paper, woodchips, scrap metal, glass, rubber/tyres	0.5%
Water	2%
Others (e.g. stones, dirt)	0.5%
Total allowable non-plastic contaminants (inclusive of all contaminants mentioned above)	**2.5%**

https://www.nea.gov.sg/docs/default-source/tiw/plastic-waste/technical-guidelines-for-transboundary-movement-control-of-plastic-waste_jul-2025.pdf

CONSIGNMENT WEIGHT CHECK: BALE SIZE, MASS ESTIMATES & CONTAINER STACKING

The **bulk density** of baled plastic waste can vary, depending on the polymer, the type of waste (e.g. its 3-dimensional form), baling compression equipment and pressure, the level of moisture and type of tie holding the bale together. Estimated bulk densities were provided in Section 3.4.

Plastic bales do not follow a single global standard, but most fall within a fairly similar size range determined by typical two-ram balers and container-loading constraints.

STANDARD "MILL-SIZE" BALES

Length: ~1.0–1.2 m
Width: ~0.7–0.8 m
Height: ~1.0–1.2 m
Mass: usually **250–350 kg** (PET/HDPE bottle bales)

Typical for PET/HDPE bottles and rigid plastics

HIGH-DENSITY COMPACTED BALES

Length: ~1.2–1.5 m
Width: ~0.8–1.1 m
Height: ~1.0–1.5 m
Mass: often **400–700 kg**, sometimes higher for dense material (PVC, rigid PP)

Film bales / mixed plastics / LDPE

"EXPORT-OPTIMISED" CONTAINER BALES

Length: ~1.1–1.3 m
Width: ~0.75–1.0 m
Height: ~1.0–1.3 m
Mass: typically **300–500 kg**

Rectangular strapped for stacking

A 20-foot container has about 33 cubic metres of usable space, while a 40-foot container provides around 67 m^3. Both share similar internal width and height, with the 40-foot unit mainly differing in length. Plastic bales are normally arranged in rows on a single layer, as their height usually prevents stacking two layers safely. Some exporters adjust bale dimensions so that two layers can fit when conditions allow. Estimated number of bales are shown in the table opposite.

Bale Type	20-ft Container	40-ft Container	Notes
Standard mill-size	16	36	Most common for PET/HDPE bottles & rigid film; grid-packing (rows × columns × layers).
High-density compacted	8	20	Very large / tall bales — fewer per container.
Export-optimised	10	20	Designed to maximise container footprint; may be re-sized to allow two layers.

STANDARD: PD CEN/TS 16010:2020

PD CEN/TS 16010:2020 Plastics — Recycled plastics — Sampling procedures for testing plastics waste and recyclates

This is a technical standard that defines a systematic approach to sampling procedures for testing plastics waste and recyclates. Its main goal is to ensure that testing samples are representative of the material batch, enabling reliable and consistent quality assessments throughout all stages of the recycling process.

It applies to **all types of plastics waste and recyclates**; covers **all stages** in the plastic recycling process, from collection to final product; and **takes into account the variability and heterogeneity** of plastic waste streams.

Key Features

- **Representative Sampling**: Focuses on obtaining samples that accurately reflect the composition and properties of the full batch or lot, which is critical due to the diverse origins and prior uses of plastics waste.
- **Statistical Methods**: Incorporates statistical techniques and calculations to enhance the reliability and representativeness of samples.
- **Material Variability Considerations**: Addresses challenges such as:
    - Mixtures of different plastics
    - Source and previous use of the plastics
    - Residual or inert contents (such as adhesives or moisture)
- **Sampling at All Process Stages**: Provides guidance for sampling at various points in the recycling chain.

Main Procedures

The standard defines a structured procedure, including:

- Identifying quality characteristics to be measured.
- Determining the precision required for these characteristics and calculating the number and size of samples accordingly.
- Employing increments—subsamples taken from the batch—ensuring every particle has an equal chance of selection.
- Using systematic or stratified random sampling, especially for heterogeneous materials.
- Calculating minimum sample sizes and volumes based on material characteristics, typically involving at least ten times the mass of the largest particle in the lot.
- Mixing and combining increments to form gross or composite samples for testing.

Statistical Approach

- Utilizes statistical tools (e.g., standard deviation, mean, variance) to assess sample representativeness.
- Suggests the use of t-distribution to determine confidence levels about the reliability of measured properties from the samples (such as polymer content, particle size, moisture, or contaminant levels).
- Provides calculation methods to estimate the effectiveness and precision of the sampling plan.

Importance

Adherence to PD CEN/TS 16010:2020 ensures:

- More consistent and quality-assured recycled plastics.
- Reduced risk of systematic sampling bias.
- Greater comparability of results between laboratories, purchasers, and recyclers.

TYPES OF TESTING

Test type	What it identifies/assesses	Where it is useful	Limitations / what it does not do well
Handheld NIR / portable analysers (like PlasTell, generic NIR analysers)	Identifies polymer type (PE, PP, PET, PVC, PS, ABS, etc.) via spectral "fingerprint"	Port inspections, sorting plants, quick scrutineering of plastic waste or scrap	Performance drops on very dirty, wet, carbon-black or mixed/composite materials; limited for multi-layer or heavily soiled waste
Melt-flow / melt index testers	Measures polymer melt behaviour — helps confirm polymer type and quality for processing (virgin resin or cleaned recyclate)	Recycling facilities, QC labs, resin acceptance, pre-processing verification	Not useful on unprocessed bales, contaminated scrap, films, or mixed waste; requires melting/pellet form material
Laboratory-grade thermal/physical property testers (melting point, mechanical, impact)	Provide detailed polymer characterisation (melting point, mechanical properties) which support identity verification and quality grading	QC labs, processing plants, certification checks	Not practical for container inspections, port-level screenings, or contaminated waste
Simple manual "field tests" (density, float–sink, hot-needle, burn tests) — not in product list above	Give approximate, quick discrimination (e.g. PE vs PET vs PVC) at low cost	Preliminary sorting, urgent checks, low-cost operations	Very approximate, destructive, sometimes unsafe or imprecise; not reliable for enforcement-level verification

POLYMER IDENTIFICATION FIELD TEST KITS

Field test kits for polymer identification are simple, rapid tools used by customs, environmental inspectors, and recycling-plant staff to distinguish different plastics when laboratory analysis is not practical. They are designed for **use at the quayside, in warehouses, or during container inspections**.

FLOAT–SINK DENSITY KITS

Small trays or tubes contain liquids of known density (usually water, ethanol, salt solutions, or commercial density media).
Common plastics behave predictably:

- **PP** floats in water
- **PE (HD/LD)** floats in water
- **PET, PVC, PS** sink in water
- Additional solutions of higher density allow inspectors to separate **PET** from **PVC** or **PS**

Advantages: Quick, low cost, works even on heavily contaminated fragments.
Limitations: Cannot reliably identify filled or composite plastics.

HOT-NEEDLE OR HEATED-PROBE TOOLS

A handheld probe is heated and applied gently to the plastic surface. Different polymers soften, deform, or melt at characteristic temperatures.

- Typical responses:
- **PE/PP** soften easily at lower temperatures.
- **PET** resists softening until much higher temperatures.
- **PVC** chars slightly and emits characteristic acidic fumes (though officers avoid inhalation).

Advantages: Extremely portable, very fast.
Limitations: Destructive, qualitative only, fumes may be hazardous.

SIMPLE BURNING AND FLAME-CHARACTER TESTS

(Some ASEAN ports still use these informally, though many authorities discourage open-flame tests at the quay.)
Characteristic behaviours:

- **PE/PP:** Drip as they burn, smell like candle wax, blue/yellow flame.
- **PVC:** Does not sustain flame; green edges on the flame due to chlorine.
- **PS:** Sooty smoke and distinctive odour.

Advantages: No equipment needed.
Limitations: Safety concerns, not suitable in ports, very approximate.

HANDHELD NEAR-INFRARED (NIR) SCANNERS

Small battery-powered devices that scan the surface of a plastic item and match its spectral signature to a built-in library.
Can differentiate **PE, PP, PET, PS, PVC, ABS**, etc.
Many models provide direct read-outs (“PET”, “HDPE”, “PVC”).
Advantages: Rapid, non-destructive, reliable.
Limitations: Limited performance on black plastics or dirty/opaque surfaces; more expensive than manual kits.

SOLVENT-REACTION KITS

A drop of solvent is applied to the plastic. Certain polymers swell, dissolve, or resist the solvent.
Examples:
PVC softens in cyclohexanone.
ABS is attacked by acetone.
PE/PP are solvent-resistant under short exposure.
Advantages: Useful for tricky or contaminated samples.
Limitations: Hazardous solvents; needs safe handling; less common in ports now.

ODOUR AND APPEARANCE REFERENCE CARDS

Not proper “kits”, but inspectors may use laminated cards illustrating:
Typical fracture patterns
Odour descriptors
Surface feel and stiffness
Standard contamination indicators
These are quick aids when examining bales or sample fragments.

INSPECTION CHECKLIST: MOISTURE IN PLASTIC WASTE

A. DOCUMENTATION AND PRE-INSPECTION

- ❑ Waste classification declared correctly (B3011/Y48).
- ❑ Description matches physical load.
- ❑ Pre-treatment process stated (e.g., washing, sorting).
- ❑ Declared weight checked against container weighbridge data.
- ❑ Known risk factors flagged (origin, exporter history, previous non-compliance).

B. VISUAL AND PHYSICAL INSPECTION

- ❑ No visible water pooling.
- ❑ No dripping water from bales/bags.
- ❑ Bale surfaces appear dry.
- ❑ No plastic film wrapping containing condensation.
- ❑ No mould, algae, or biological growth.
- ❑ No strong organic odour indicating wet residues.
- ❑ No evidence of recent rainfall exposure, leaks, or seawater ingress.

C. SAMPLING

- ❑ Random selection: ≥5% of bales or representative loose samples.
- ❑ Safe access confirmed.
- ❑ Inner material inspected (core sample).
- ❑ Moisture inconsistent across load? (Yes/No)

D. RAPID TESTING (PORTABLE METER)

- ❑ Probe inserted into several points on each selected bale.
- ❑ Readings recorded and averaged.
- ❑ Readings within acceptable indicative range (typically <1–2%).
- ❑ If high/inconsistent → prepared sample for oven-dry test.

E. OVEN-DRY TEST (IF REQUIRED)

- ❑ Composite sample collected.
- ❑ Wet weight recorded.
- ❑ Oven-dry completion confirmed (constant weight).
- ❑ Moisture percentage calculated.
- ❑ Result compatible with B3011 requirements.

F. DECISION

- ❑ Load meets dryness expectations → classify as B3011.
- ❑ Moisture high → classify as Y48.
- ❑ Serious water presence → reject or detain shipment.
- ❑ Non-compliance recorded and escalated.

G. RECORDKEEPING

- ❑ Photographs taken.
- ❑ Meter readings logged.
- ❑ Lab results filed.
- ❑ Final classification recorded in inspection report.

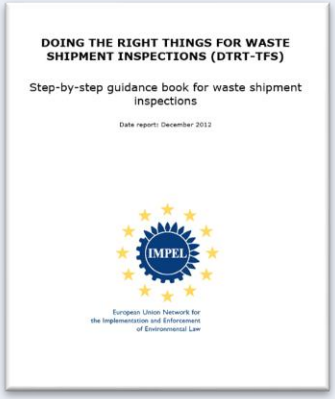
GUIDANCE ON INSPECTING & TESTING LOADS AT PORTS

The guidance section of this chapter contains a number of different checklists and tables to assist customs officials and competent authorities determine the contents and quality of plastic waste. It can be used to inform whether or not a plastic waste consignment should be accepted for import or rejected.

DOING THE RIGHT THINGS FOR WASTE SHIPMENT INSPECTIONS (DTRT-TFS)

Step-by-step guidance book for waste shipment inspections
Date report: December 2012

A core methodology for creating effective inspection plans, following a cycle of planning, execution, and monitoring, helping countries meet EU regulations.



IMPEL (European Union Network for the Implementation and Enforcement of Environmental Law)

GUIDANCE ON THE INSPECTION OF WASTE SHIPMENTS: GUIDELINES FOR RANDOM INSPECTION OF WASTE CONTAINERS AND PLASTIC SORTING AT PORTS

Specific help for inspectors on enforcing rules for plastic waste, clarifying terms like "contamination" and "almost exclusively consisting of" under the Basel Convention's plastic amendments.



IMPEL (European Union Network for the Implementation and Enforcement of Environmental Law)

5 PLASTIC WASTE RECYCLING: CONTENTS

This chapter describes how plastic waste is recycled, some of the controls that need to be established for food contact materials, and the role quality standards play.



5.1 Technical Context: Recycling Methods & ESM

5.2 Technical Context: Recycled Plastics Quality Standards

5.3 Managing Quality: CCP3

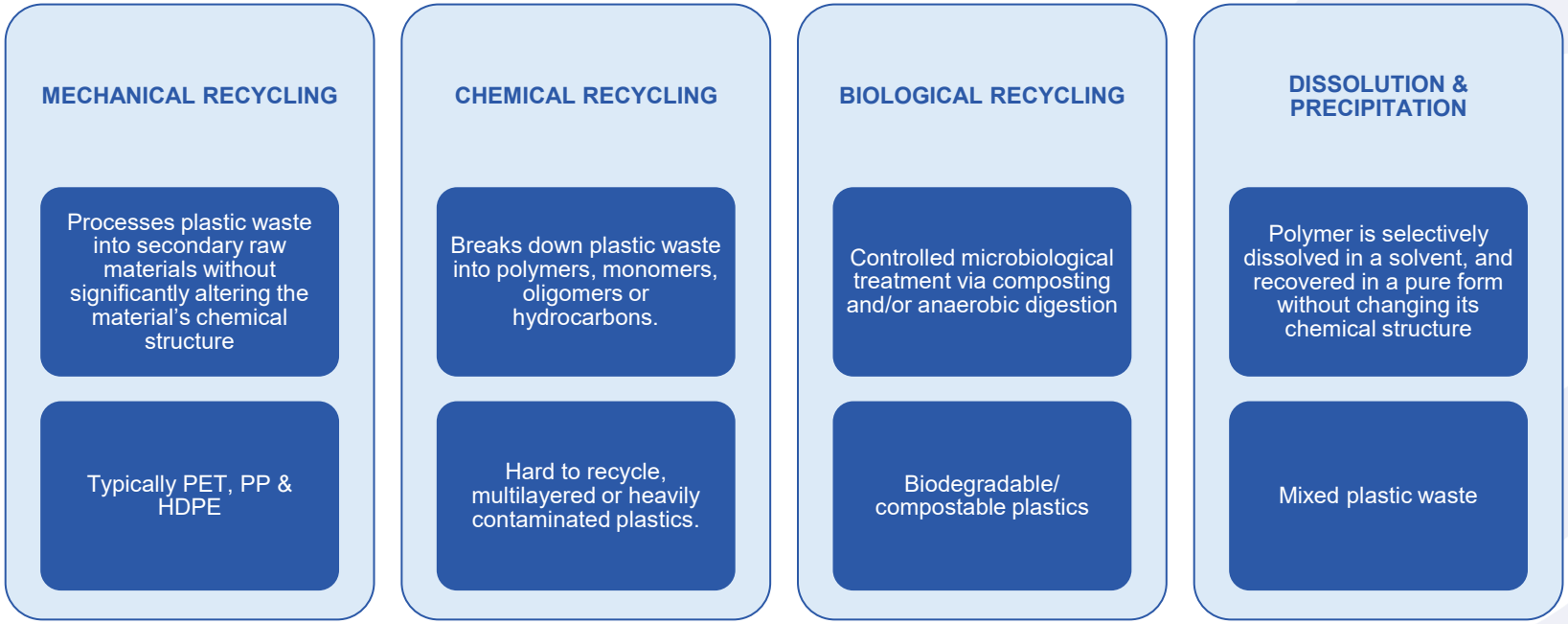
5.4 Guidance: ESM Checklists

5.1 TECHNICAL CONTEXT: RECYCLING METHODS & ESM

This section describes the different stages involved in the mechanical recycling of plastic waste and the systems and infrastructure required to ensure environmentally sound management practices are adhered to.

PLASTIC WASTE RECYCLING METHODS

Plastic waste can be treated through several different recycling approaches, with each suited to different polymers and contamination levels. Mechanical recycling remains the most common route, but newer methods such as chemical, biological and dissolution/precipitation processes are expanding the options for difficult or degraded plastics. These approaches vary in how far they break down the material, from simple reprocessing to complete depolymerisation or selective purification. Together, they provide a broader toolkit for recovering value from plastic waste streams that were previously considered unrecyclable.



Mechanical recycling forms the backbone of plastic recycling across the ASEAN region; whilst alternative methods are still at an early stage of development. Infrastructure for chemical, biological, and dissolution-based processes is limited or, in many cases, absent.

This Guidebook therefore focusses solely on mechanical recycling.

PLASTIC RECYCLING OPTIONS

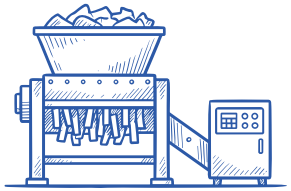
MECHANICAL RECYCLING: THE ESTABLISHED PATH

1. SORT & SEPARATE



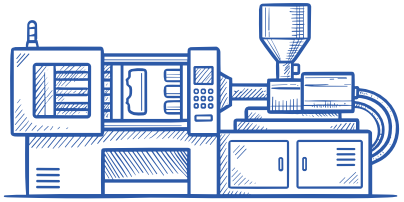
COLLECTED PLASTIC WASTE IS MANUALLY OR AUTOMATICALLY SORTED BY POLYMER TYPE AND COLOUR

2. SHRED, WASH & DRY



SORTED PLASTICS ARE SHREDDED INTO FLAKES, WASHED TO REMOVE CONTAMINANTS, AND THEN DRIED

3. MELT & REFORM



CLEAN FLAKES ARE MELTED, EXTRUDED INTO STRANDS, AND CUT INTO PELLETS FOR NEW PRODUCTS

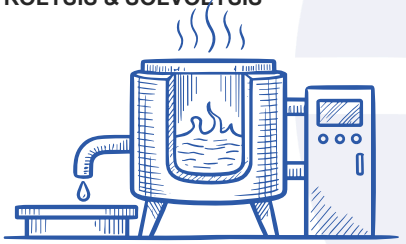
CHEMICAL RECYCLING: THE EMERGING PATH

1. BREAKING DOWN POLYMERS



USE HEAT OR SOLVENTS TO BREAK PLASTICS DOWN INTO THEIR BASIC CHEMICAL COMPONENTS

2.PYROLYSIS & SOLVOLYSIS



PYROLYSIS USES HEAT WITHOUT OXYGEN. SOLVOLYSIS USES SOLVENTS TO DEPOLYMERISE SPECIFIC PLASTICS

3. OUTPUT: NEW RAW MATERIALS



MONOMERS HYDROCARBONS FUELS

PRODUCES MONOMERS OR HYDROCARBONS FOR NEW VIRGIN-QUALITY PLASTICS, CHEMICALS OR FUELS.

TYPICAL STEPS IN THE MECHANICAL RECYCLING OF PLASTIC WASTE BY THE FORMAL SECTOR

1. SORT & SEPARATE



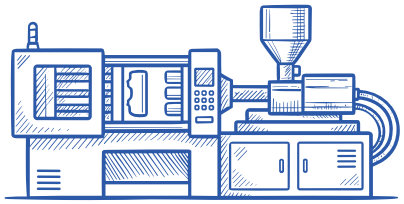
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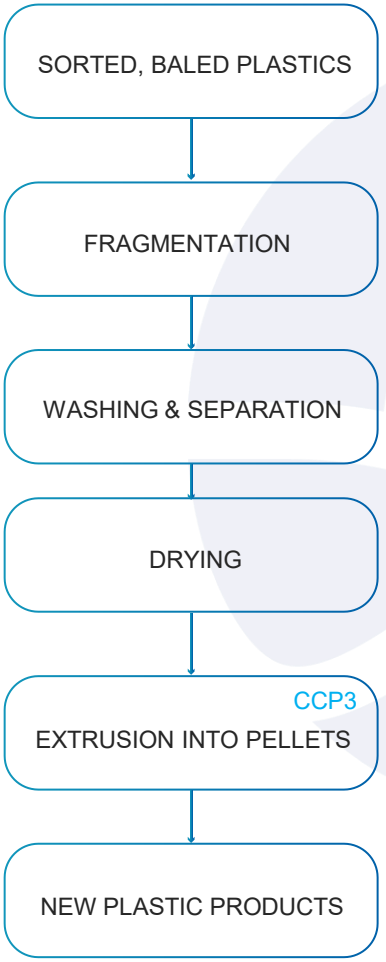


SORTED PLASTICS ARE SHREDDED INTO FLAKES, WASHED TO REMOVE CONTAMINANTS, AND THEN DRIED

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CLEAN FLAKES ARE MELTED, EXTRUDED INTO STRANDS, AND CUT INTO PELLETS FOR NEW PRODUCTS



TYPICAL STEPS IN THE MECHANICAL RECYCLING OF PLASTIC WASTE

Mechanical recycling is the physical processing of plastic waste into new granules (sometimes called 'nurdles') so that they can be re-manufactured into new products. The process relies on mechanical steps like grinding and melting, with the aim of keeping the polymer chains intact. The steps are broadly similar in both the formal and informal sectors, differing mainly in the degree of automation, complexity of the equipment, the level of quality control and quality of the recycled output.

The main steps are described below:

DEBALING

Bales of plastic waste are typically broken open using mechanical debaling equipment designed to loosen and separate compressed material before it enters the size-reduction line.

SHREDDING

Shredding is carried out using purpose-built size-reduction machines (shredders) that cut, tear, or shear plastic waste into smaller, uniform fragments suitable for downstream sorting and washing. Shredded plastics are often screened to remove over-sized fragments; these are then recirculated through the shredder until they reach a specified size.

WASHING

The shredded plastic is washed through a sequence of mechanical and hydraulic cleaning operations designed to remove dirt, labels, organics, residual product, and fine contaminants.

The washing process usually includes the following stages:

Pre-washing: Shredded material is agitated in water-filled tanks or friction-based pre-wash units to loosen surface contamination and separate easily removable fines.

Friction washing: High-speed friction washers use rapidly rotating paddles or a centrifuge-like rotor to scrub the plastic. The intense mechanical action dislodges adhered residues while simultaneously conveying the material forward.

Float–sink separation: Plastics are passed through tanks where density differences allow floating polymers (e.g. PE, PP) to rise while heavier materials (e.g. PET, PVC, metals, stones) sink. This both cleans and separates material streams.

Hot washing (where required): For demanding applications, PET or high-value streams undergo hot caustic washing with controlled detergents to remove glues, inks, and labels. Temperature, residence time, and chemical dosing are strictly controlled.

Rinsing and dewatering: After washing, plastics are rinsed in clean water and then dewatered using centrifuges, mechanical dryers, or thermal dryers to reduce moisture ahead of extrusion or further processing.

TYPICAL STEPS IN THE MECHANICAL RECYCLING OF PLASTIC WASTE

Shredded and washed plastics are then converted into pellets (‘nurdles’) through a controlled melt-processing step carried out in an extruder. The process typically follows these stages:

FEEDING & MELTING

Clean, dry flakes are fed into a screw extruder. As the screw conveys the material forward, controlled heat and shear progressively melt the polymer. Temperature zones along the barrel are precisely regulated to avoid degradation.

FILTRATION

The molten plastic passes through fine metal screens or melt filters to remove remaining contaminants such as paper fibres, aluminium, dirt, or un-melted fragments. Continuous or backflush filters are used for higher contamination levels.

HOMOGENISATION

Within the extruder, mixing sections ensure the melt becomes uniform in composition, colour, and viscosity. Additives (e.g. stabilisers or colourants) may be dosed at this stage.

PELLETISING

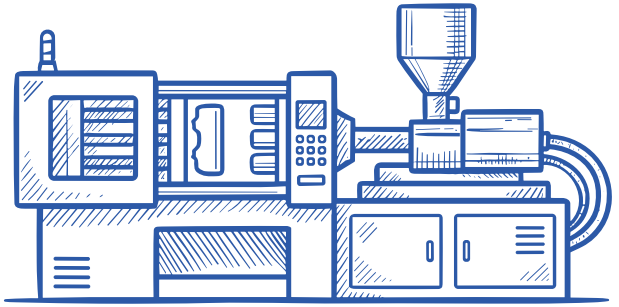
Strand pelletising: The melt exits the die as continuous strands, which are cooled in a water bath and then chopped into uniform pellets.

Underwater pelletising: The melt is cut into pellets directly at the die face while submerged in water, producing more uniform, spherical pellets suited to high-quality applications.

Hot-face air-cooled pelletising: The pelletiser cuts the melt at the die face without water, with air cooling the granules.

DRYING AND COOLING

Pellets are dewatered (if necessary), air-dried, and cooled before being conveyed to storage silos or bagging stations.



CLEAN FLAKES ARE MELTED, EXTRUDED INTO STRANDS, AND CUT INTO PELLETS FOR NEW PRODUCTS

ESM RECYCLING OF PLASTIC WASTE

The Basel Convention defines Environmentally Sound Management (ESM) as **"taking all practicable steps to ensure that hazardous wastes or other wastes are managed in a manner which will protect human health and the environment against adverse effects."** Facilities must meet adequate standards of technology and pollution control, manage residuals appropriately and have legal authorisation. Recycling must avoid contamination, prevent release of pollutants (including microplastics, chemicals, leachates, emissions), and manage water, residual waste, and by-products responsibly. These criteria are summarised below:

LEGAL & ADMINISTRATIVE COMPLIANCE

- Facility holds all required permits and operates within national regulatory frameworks.
- Waste shipments received comply with Basel classification and transboundary-movement controls (including PIC where applicable).
- Documented procedures for receiving, tracking, and recording waste inputs and outputs.

INFRASTRUCTURE & TECHNOLOGY REQUIREMENTS

- Adequate, well-maintained equipment for sorting, size reduction, washing, separation, extrusion, and pelletising.
- Pollution-control systems in place (air filtration, wastewater treatment, noise and odour mitigation).
- Proper storage areas for raw waste, intermediates, and outputs, with containment to prevent leakage or dispersal.

OPERATIONAL PRACTICES

- Waste is pre-sorted to remove hazardous components, incompatible polymers, and contaminants.
- Closed or controlled washing systems that avoid untreated discharge.
- Melt filtration and process controls to minimise emissions and thermal degradation.
- Proper management and disposal of residuals (fines, sludge, labels, non-recyclables).

OCCUPATIONAL HEALTH & SAFETY

- Workers provided with PPE, training, and safe-work protocols for handling plastics, chemicals, and machinery.
- Emergency response plans for fires, chemical spills, and equipment failures.
- Measures to prevent exposure to dust, fumes, noise, and contaminated materials.

ENVIRONMENTAL PROTECTION & MONITORING

- Regular monitoring of emissions, wastewater, and solid residues.
- Systems to prevent release of microplastics, pellets, and wash-water contaminants into soil, waterways, or the wider environment.
- Energy- and water-efficient operations with measures to minimise greenhouse gas emissions.

PRODUCT QUALITY & TRACEABILITY

- Clear documentation of feedstock origin, processing steps, and output specifications.
- Quality-control testing for recyclate.
- Mechanisms to ensure traceability and accountability throughout the supply chain.

CONTINUOUS IMPROVEMENT

- Periodic audits and performance reviews to identify environmental and safety improvements.
- Training and capacity building for staff to maintain ESM standards.
- Systems for stakeholder reporting and transparent communication with regulators.

ESM PLASTICS RECYCLING

MANAGEMENT CRITERIA AT A PLASTICS RECYCLING FACILITY IN SOUTHEAST ASIA

AS MANDATED BY THE BASEL CONVENTION

DESIGN
Facility is designed and operated to avoid and minimize pollution

PREVENT
Measures to prevent accidents and risks to human health

STORAGE
Sufficient containment to prevent environmental contamination

MONITOR
Systems for monitoring missions and discharges

EMERGENCY
Preparedness and response for emergencies

INFRASTRUCTURE

Adequate, well-maintained equipment for sorting, size reduction, washing, separation, exhaustion, and pelletising

Pollution-control systems in place (air filtration, wastewater treatment, noise and odour mitigation)

OPERATIONAL PRACTICES

Waste is pre-sorted to remove hazardous components, incompatible polymers and contaminants

Closed or controlled washing systems to avoid untreated discharge

Melt filtration and process controls to minimize emissions and thermal degradation

Proper management and disposal of residuals (fines, sludge, labels, non-recyclables)

REGULATING PLASTICS RECYCLING FACILITIES IN AMS

The regulation of plastics recycling facilities in ASEAN integrates **national environment and waste permits, Basel Convention controls on waste imports/exports, emerging extended producer responsibility (EPR) frameworks**, and ongoing policy reforms under the ASEAN Regional Action Plan. Implementation across AMS is heterogeneous:

- Some countries (Singapore, Philippines, Viet Nam) have **well-defined frameworks** with mandatory EPR and clear import/permit systems.
- Others (Malaysia, Thailand, Indonesia) are in **transition**, especially around waste import bans and EPR laws.
- Several (Cambodia, Lao PDR, Myanmar, Brunei Darussalam) are **early stage** or implementing basic environment and waste controls with limited formal recycling or EPR law.

FACILITY PERMITTING

Across most AMS, plastics recycling facilities generally require:

- **Environmental / waste management permit** from the national environmental agency or equivalent (often with an environmental impact assessment or screening if thresholds are met).
- **Scheduled or hazardous waste permits** if the process handles contaminated materials, chemical additives, or generates hazardous residues (storage and disposal controls apply).
- **Local authority consents** including zoning and land-use permissions.

National examples:

- **Malaysia** categorises waste streams and treatment activities under national environmental acts; recycling operators will need a licence and must align with scheduled waste controls where applicable. Local state implementation may vary.
- **Singapore's** permitting incorporates pollution control, workplace safety, and ongoing compliance with reporting and monitoring standards.

POLLUTION CONTROL / OCCUPATIONAL SAFETY

National limits on air emissions, wastewater discharge (effluent), noise and odour are embedded in facility licences or environmental permits.

Health and safety compliance for workers is standard across jurisdictions, enforced by labour or safety authorities in parallel with environment agencies.

RECORDKEEPING AND REPORTING

Most frameworks require routine monitoring, recordkeeping and reporting to regulators (e.g. quantity of waste handled, origin of feedstock, disposal manifests, emissions results).

INFORMAL SECTOR RECYCLING

By definition, it is only the formal recycling sector that is permitted. The **informal sector largely falls outside of regulatory control;** these are characterised by **small-scale operations**, use of **basic technologies**, and a f**ocus on recovering high-value materials**. Polluting practices, such as **open burning of waste** may also occur.

QUALITY MANAGEMENT SYSTEMS & ESM RECYCLING

Environmentally Sound Management (ESM) of plastics recycling mandates the implementation **of robust management frameworks** and **specific operational controls** to **protect human health and the environment.** As described previously, a Quality Management System forms part of a Hazard Analysis Critical Control Point (HACCP) framework and is essential in the processing and delivery of consistently high-quality plastic waste for recycling.

ESM does not necessarily mandate a single specific quality management system; several interconnected systems and core elements are therefore required to ensure **environmentally sound recycling practices**.

ESM REQUIREMENTS

To ensure the physical handling and transformation of plastics meet ESM standards, facilities must integrate systematic checks and procedures throughout the process:

- **Quality assurance and quality control measures** must be applied to sampling, analysis, and monitoring activities conducted by trained professionals using approved methods.
- Facilities are required to have an **adequate monitoring, recording and reporting programme.**
- Strict adherence to **good housekeeping practices** is essential for operational control under ESM, ensuring a clean working environment and promptly dealing with spills of fragments or pellets to minimise risk of contamination and leakage.
- **A comprehensive training programme for personnel** is mandated. This must cover procedures for material management, **emergency preparedness**, and ensuring the use of appropriate **protective equipment** to safeguard **occupational health** and **environmental protection**.

All management systems **must operate within a clear regulatory framework**:

- ESM requires facility operators to demonstrate **due diligence in compliance** with all necessary approvals.
- The system must adhere to transparent permitting and approval processes that specify mandatory criteria for **operation, emission levels and monitoring**.

ISO 14001:2026

ENVIRONMENTAL MANAGEMENT

This standard defines the requirements for an environmental management system. It helps organisations identify, manage, monitor, and improve their environmental performance. It:

- Provides a structured framework for pollution prevention, control of environmental impacts, legal compliance.
- Directly supports environmentally sound management of waste principles such as reducing emissions, managing leachate and preventing fires.
- Strengthens regulatory assurance for permitting, auditing, and reporting.

This is described in further detail here.

ESM PLASTICS RECYCLING BY THE INFORMAL SECTOR

The requirements of Environmentally Sound Management for plastic waste recycling set a high bar for operational control, environmental protection, traceability and worker safety. Many informal-sector practices sit outside these frameworks, creating a structural compliance gap.

CHALLENGES FOR THE INFORMAL SECTOR

LIMITED INFRASTRUCTURE AND TECHNOLOGY

ESM requires controlled sorting, washing, separation, storage, and pollution-prevention systems. Informal operators typically use manual sorting, basic tools and minimal environmental controls.

OCCUPATIONAL HEALTH AND SAFETY GAPS

Informal workers often operate without protective equipment, safe handling procedures or access to medical coverage, making compliance with ESM's worker-protection expectations impractical.

REGULATORY STATUS AND TRACEABILITY BARRIERS

ESM presumes legally registered operations with verifiable permits, documentation and record-keeping. Informal collectors and aggregators generally lack licences, contracts or tracking systems.

FINANCIAL AND MARKET-ACCESS CONSTRAINTS

ESM-equivalent upgrades require investment in equipment, storage, waste-water treatment and training. Informal actors rarely have access to credit, stable offtake markets or inclusion in producer-funded mechanisms.

QUALITY AND CONTAMINATION ISSUES

ESM relies on well-segregated, low-contamination input streams. Informal collection is volume-driven and tends to prioritise value, leading to variable quality and elevated contamination rates.

SOCIAL VULNERABILITY AND LIVELIHOOD RISKS

Rapid enforcement of ESM without a transition pathway can suppress incomes, concentrate market power in formal companies, and create unintended environmental leakage if collection rates fall.

IMPLICATIONS FOR ASEAN POLICYMAKING

- ESM reforms that ignore the informal sector risk reducing recycling rates and increasing unregulated processing.
- Inclusion strategies raise material quality, support compliance and stabilise supply chains.
- International expectations (Basel Convention controls, national EPR frameworks, import restrictions) are increasing scrutiny and require more formal, documented systems of management. This is also import for the recycling of plastics intended for use as Food Contact Materials.

INTEGRATE THE INFORMAL WASTE SECTOR



Formally recognize & support informal waste workers to improve safety & recycling rates.

ESM requirements can only be met at scale across ASEAN if informal workers — who currently underpin the region's plastic-waste collection systems — are formally integrated and supported. A structured transition that combines recognition, investment, capacity building and market access will improve environmental outcomes, protect livelihoods and strengthen compliance with emerging regional and international obligations

ESM PLASTICS RECYCLING BY THE INFORMAL SECTOR

Plastics can be released into the environment at every stage of the plastic waste value chain. Indeed, the effective collection and containment of plastic waste for recycling is an effective way of reducing plastic pollution. Plastics in the environment are commonly categorised by **size, physical form, and polymer type**, each of which influences how they behave and the harm they cause. The two most widely used size-based categories are **macroplastics and microplastics**, with **nanoplastics** increasingly recognised as a further concern.

MACROPLASTICS

Macroplastics are plastic items or fragments **typically larger than 5 mm**. They include bottles, bags, packaging films, fishing gear, and other durable consumer and industrial products. In the environment, macroplastics cause direct physical harm through **entanglement** and **ingestion** by wildlife, leading to injury, suffocation, starvation, or death. They can smother habitats such as coral reefs, seagrass beds, and soils, and they degrade visual amenity, affecting tourism and community wellbeing. Over time, macroplastics fragment into smaller particles, becoming a continuing source of microplastics.

MICROPLASTICS

Microplastics are plastic particles **smaller than 5 mm.** They are generally divided into two types:

- **Primary microplastics**, which are intentionally manufactured at small sizes, such as microbeads formerly used in cosmetics, industrial abrasives, and pre-production plastic pellets.
- **Secondary microplastics**, which result from the breakdown of larger plastic items due to sunlight (UV radiation), mechanical abrasion, and weathering.

Microplastics are readily transported by wind and water and are now found in marine, freshwater, terrestrial, and atmospheric environments. They are easily ingested by a wide range of organisms, from plankton and soil invertebrates to fish and birds. Once ingested, microplastics can cause **physical damage**, reduce feeding efficiency, and act as vectors for **toxic additives**, persistent organic pollutants, and pathogenic microorganisms. Their small size also makes them difficult to remove from the environment.

NANOPLASTICS (EMERGING CONCERN)

Nanoplastics are typically defined as plastic particles smaller than 1 µm. Although less well understood, they are of particular concern because they can cross biological membranes, enter cells and tissues, and potentially interfere with physiological and biochemical processes. Their behaviour and impacts are an active area of scientific research.

POLYMER TYPES AND ADDITIVES

Different polymers (such as polyethylene, polypropylene, polystyrene, PVC, and PET) and their associated chemical additives influence environmental harm. Some plastics leach **plasticisers, flame retardants, stabilisers, and colourants**, which may be toxic, endocrine-disrupting, or bioaccumulative. Lighter polymers tend to float and disperse widely, while denser plastics may sink and accumulate in sediments.

MICROPLASTIC RELEASES DURING RECYCLING

The containment of plastic waste during collection, aggregation and transportation has been discussed in Section 3. Collectively, these are integral components of the environmentally sound management (ESM) of plastic waste.

However, plastic items (macroplastics) are broken down into small fragments during mechanical recycling. This inevitably results in the formation of micro and nanoplastics, both of which have potential to be released into the environment.

SHREDDING AND GRINDING

Abrasions and Fragmentation:
Mechanical processes like size reduction (shredding, grinding, crushing) generate plastic debris and particles, including **microplastics and powder**.

Airborne Particles (Dust):
Dust release is common in **open grinder designs**, particularly in older or rudimentary models used in craft villages, leading to airborne plastic particles settling on surrounding surfaces. Poor ventilation in facilities exacerbates this problem, posing an inhalation risk to workers.

EXTRUSION AND PELLETISING

Cooling Water:
Microplastic particles may be present in the **cooling water baths** used after melting and extruding plastic strings into pellets. This water, containing plastic particles, is often subsequently discharged into the sewer system.

Spillage:
Plastic losses also occur during hopper loading, extrusion, and cutting, contributing to the spillage of **pellets, flakes, and powder** in the working area.

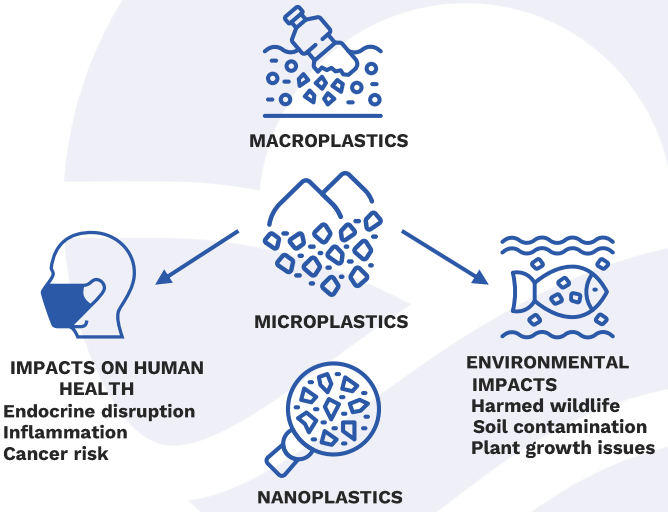
WASHING AND WASTEWATER DISCHARGE

Wastewater Contamination:
Washing operations, essential for removing contaminants, generate **copious amounts of wastewater** containing microplastics, flakes, and chemical residues. Flake washing is a major contributor to this large volume of waste.

Shearing and Abrasion:
Mechanical shearing and abrasion during friction washing, particularly for flexible plastics like LDPE bags, cause **fine shreds, strands, filaments, and microplastics** to be deposited in the water column and sludge.

Improper Discharge:
The absence of treatment facilities means microplastic-loaded effluents frequently enter drainage systems and water bodies.

Spillage and Housekeeping:
Water leakages or spillovers from washing drums and conveying systems onto floors, especially unpaved areas, wash microplastics into wastewater channels or soil.



MEASURES TO MINIMISE MICROPLASTIC LEAKAGE

Minimising microplastic leakage requires implementing Best Available Technology and Best Environmental Practice solutions, focusing particularly on improving containment, water management and operational practices.

ENHANCING CONTROL IN MECHANICAL PROCESSING (SHREDDING/GRINDING)

Containment and Ventilation:

Implement containment measures in working areas, such as paved floors with slopes and berms, to trap plastics released during shredding.

Dust Mitigation:

Use **covers or enclosures on shredding machines** (especially old models) to prevent airborne plastic debris and dust particles from escaping. Facilities should invest in **dust capture and filtering devices** to mitigate airborne plastic particles, particularly where ventilation is poor.

Good Housekeeping:

Conduct regular, strict **good housekeeping** routines to maintain a clean working environment and promptly remediate spills of fragments or pellets.

IMPROVING WASTEWATER MANAGEMENT (WASHING & CLEANING)

Filtration and Treatment:

Since washing is a major source of microplastic effluent, install **multi-stage filtration systems** (e.g., stainless steel filter nets or screens) along washing tanks to remove small plastic pieces and microplastics before discharge.

Sludge and Residue Management:

Ensure that filter cakes and **sludge containing microplastics** are properly handled, **treated, and disposed of** in compliance with national regulations, avoiding disposal in open soils and vegetation.

Water Recirculation:

Install tanks to collect and **recirculate wash water and cooling water** (e.g., using cooling towers) to reduce water consumption and minimise wastewater discharge.

Containment:

Install **mechanisms to prevent water spill out of washing tanks** and design floors to contain wastewater spills.

OPERATIONAL TRAINING & POLICY SUPPORT

Personnel Training:

Provide **training and education** to all personnel, especially informal workers, on the proper **handling of materials** and **safe processing techniques** to minimise plastic pollution risks.

Prohibit Polluting Practices:

Crude and polluting methods like indiscriminate dumping of residuals and **open burning** of low-value plastic waste must be **prohibited**, as they generate dust and air pollutants.

Segregation at Source:

Promote **segregation of wastes at the source** (household level) to reduce contamination of input materials, thereby increasing sorting efficiency and reducing the need for intensive cleaning which generates polluted wastewater.

RECYCLING & FOOD CONTACT MATERIALS (FCM)

Controls on the recycling of plastic waste intended for **food-contact applications are stringent**, as the regulatory focus is on **preventing chemical or microbiological contamination from entering the food chain.**

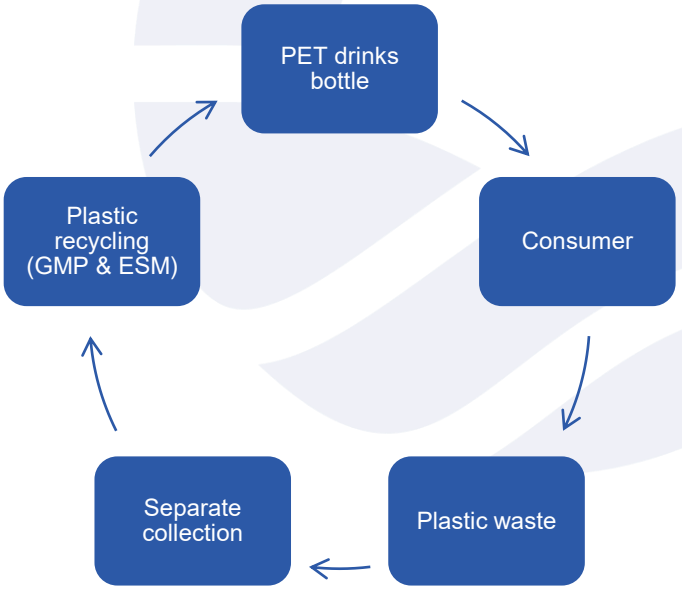
Only plastic waste streams with **demonstrably low risk** (e.g. typically pre-consumer or well-characterised post-consumer materials) may be used, and they must **undergo tightly controlled sorting, cleaning, and decontamination processes.**

Recycling technologies must be authorised or assessed as capable of reliably removing potential contaminants to safe levels, and production must operate under validated, traceable, and auditable quality-assurance systems.

Finished recyclate must meet defined purity, migration, and performance specifications before it can be used in food-contact articles.

International brand owners often rely on **European Union or the United States Food and Drug Administration food-contact requirements** when sourcing or producing recycled plastics in ASEAN Member States because these frameworks provide well-defined, science-based safety benchmarks that are not yet fully established across much of the region.

Many AMS have general food-safety laws but lack detailed, prescriptive rules on recycling processes, contaminant removal, decontamination efficiency, or authorised input streams. By **defaulting to EU or FDA standards, brand owners can ensure consistent global compliance, reduce regulatory risk, and maintain consumer trust in the safety of packaged products**. These benchmarks also support supply-chain due diligence, facilitate export to markets with stringent controls, and provide clear technical expectations for recyclers operating in regions with variable regulatory maturity.



RECYCLING & FOOD CONTACT MATERIALS (FCM)

EUROPEAN UNION REQUIREMENTS

In the EU, the requirements for producing recycled plastic for food-contact applications are governed primarily by Regulation (EU) 2022/1616.

The Regulation mandates that **only recycling technologies authorised by the European Commission** may be used, and each recycling process must undergo a European Food Safety Authority safety assessment demonstrating that it can reliably remove contaminants to levels that do not endanger human health.

Recyclers must operate under a quality-assurance system, including full traceability of input materials, documented process controls, and validation of decontamination efficiency.

Only plastic inputs originating from materials and articles manufactured in accordance with the EU food-contact framework (notably Regulation (EU) No 10/2011) may be used.

Recyclate and finished articles must comply with relevant migration limits and purity criteria, and all operators must be included in the EU Register of authorised recycling technologies, recyclers, and facilities.

UNITED STATES OF AMERICA

In the United States, recycled plastics for food-contact use must comply with the same regulatory requirements as virgin materials under Title 21 of the Code of Federal Regulations, and safety is demonstrated primarily through the **Food and Drug Administration**'s voluntary No Objection Letter (NOL) system.

Recyclers must show that their processes effectively **remove contaminants from post-consumer food-contact plastics** (typically PET or HDPE) using **challenge testing, process validation, and migration or exposure assessments**.

Inputs must originate from **controlled, food-contact applications**, and manufacturers must operate under **Good Manufacturing Practice** to ensure continued safety.

NOLs are process-specific and may include restrictions on food type or conditions of use.

GOOD MANUFACTURING PRACTICE

Good Manufacturing Practice (GMP) in the context of food-contact plastic recycling refers to the **set of operating, hygiene and quality-assurance measures that ensure recycled materials are consistently produced to a standard that prevents contamination and safeguards food safety**. It requires recyclers to manage risks systematically by controlling input quality, maintaining clean and well-organised facilities, operating validated decontamination and processing steps, and ensuring staff are trained and competent.

CORE PROCESS CONTROL

- GMP requires defined, validated, and documented processes, which **helps environmentally sound management** (ESM) recycling lines run with controlled parameters (e.g., sorting, washing, extrusion) and reduces variability in recycled material properties.
- Integrating these GMP controls into a **quality management system** (QMS) ensures process changes are formally assessed, approved, and trended, improving long-term stability of recyclate quality.

DOCUMENTATION AND TRACEABILITY

- GMP emphasises detailed records and batch documentation, enabling recyclers to trace inputs (waste streams), processing steps, and outputs, which is essential for ESM quality claims and audits.
- Embedding this in a quality management system standardises document control and retention of records needed for certification or customer qualification of ESM streams.

RISK AND CONTAMINATION MANAGEMENT

- GMP's focus on cleanliness, segregation, and contamination control helps recycling facilities design layouts and procedures that minimise cross-contamination between different ESM grades or between hazardous and non-hazardous streams.
- Within a QMS, GMP-style risk assessments and controls (e.g., HACCP-like steps, risk registers) can be applied to critical points in the recycling process where contaminants or off-spec materials are most likely to occur.

GOOD MANUFACTURING PRACTICE

GMP also obliges operators to document all critical controls, monitor process parameters, prevent cross-contamination, calibrate equipment, and maintain full traceability from input materials through to finished recyclate.

In practice, GMP provides the operational backbone that ensures a recycling process—whether or not formally authorised—delivers safe, reliable, and compliant food-grade plastic.

SUPPLIER AND INPUT CONTROL

- GMP requires qualifying and monitoring suppliers, which translates in ESM recycling to systematic assessment of waste suppliers, collection schemes, and pre-treatment quality before material enters the plant.
- QMS procedures aligned with GMP ensure that non-conforming input batches are identified, segregated, and either reworked or rejected, protecting downstream ESM product quality.

DEVIATION, CAPA, AND IMPROVEMENT

- GMP links non-conformances to structured deviation management **and corrective and preventive actions (CAPA),** helping recyclers systematically investigate off-spec batches and prevent recurrence.
- When CAPA is fully integrated into the QMS, trend analysis of deviations (e.g., recurring contamination types or equipment failures) drives continuous improvement in recycling yields and performance consistency.

DIGITAL QMS AND GMP IN RECYCLING

- Electronic QMS platforms can embed GMP requirements into workflows for ESM recycling, covering training, calibration, audit management, and change control in a single system.
- This digital integration improves data integrity and audit readiness, enabling recyclers to demonstrate robust GMP-aligned quality control to brand owners and regulators for ESM applications.

GMP, ESM and HACCP

Good manufacturing practice (GMP), the environmentally sound management (ESM) of plastics recycling and Hazard Analysis Critical Control Point (HACCP) are complementary systems that together ensure the safety and integrity of recycled plastics intended for food-contact applications.

In essence, **GMP provides the operational baseline, ESM ensures responsible and well-controlled waste management**, and **HACCP adds a formal, preventive risk-analysis framework.** Together, they form an integrated system that supports the production of safe, high-quality, food-contact recycled plastics.

GOOD MANUFACTURING PRACTICE

This provides the foundational operational controls: clean facilities, trained staff, calibrated equipment, documented procedures, and prevention of contamination. It ensures that the recycling environment is stable, well managed, and capable of producing consistent, safe outputs.

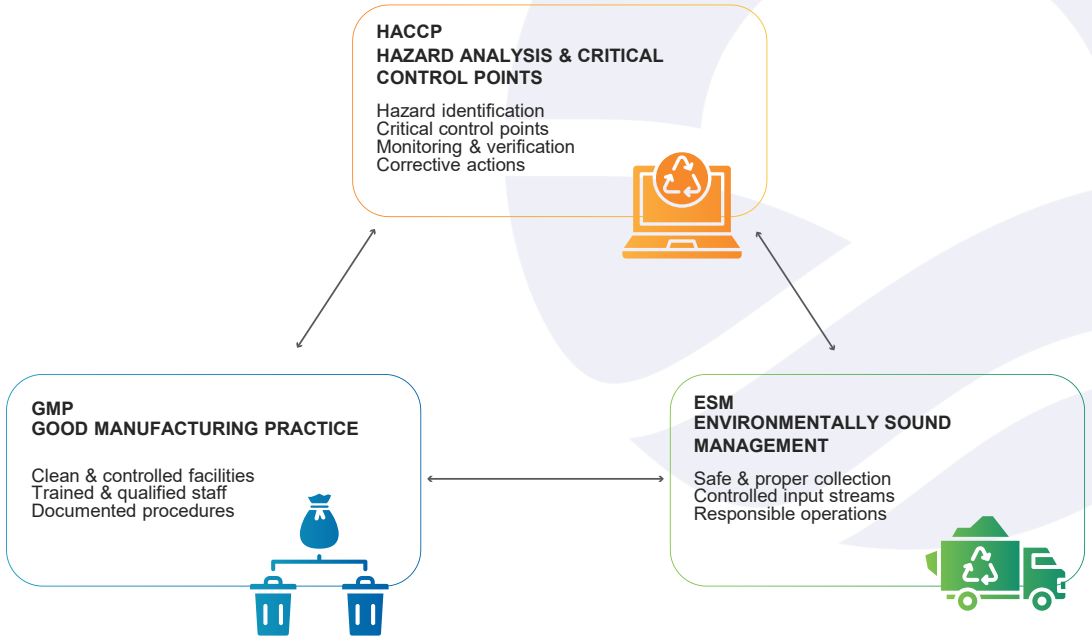
ENVIRONMENTALLY SOUND MANAGEMENT

This extends GMP by ensuring that the entire waste-handling chain—collection, sorting, storage, transport, and recycling—meets standards that prevent environmental and human-health risks. In practice, ESM ensures that only appropriate, well-controlled input streams enter the recycling process and that the facility operates responsibly.

HAZARD ANALYSIS AND CRITICAL CONTROL POINTS

This sits on top of GMP and ESM as a structured risk-management methodology. It identifies hazards specific to food-contact plastics recycling (e.g., chemical contaminants, misuse substances, cross-contamination) and requires operators to establish Critical Control Points, monitoring systems, corrective actions, and verification procedures.

INTEGRATED SYSTEMS FOR PLASTIC WASTE RECYCLING



STATUS OF FCM CONTROLS IN AMS

Controls on the use of recycled plastics for food-contact materials in ASEAN Member States (AMS) are less harmonised and generally less prescriptive than in the EU, but several common elements exist across the region. The picture varies widely, with some AMS having structured food-contact frameworks and others relying on general food-safety legislation or standards adopted from international sources.

GENERAL FOOD-SAFETY AND PUBLIC-HEALTH LAWS

Most AMS regulate food-contact materials under overarching food-safety acts that prohibit the sale of food in contact with materials that could render it unsafe, contaminated, or injurious to health. These provisions apply equally to virgin and recycled plastics.

CONTROLS ON INPUT MATERIALS

Most jurisdictions require that only well-characterised post-consumer streams—typically PET beverage bottles—may be used for food-contact recycling. Inputs must be clean, suitable for food-contact use, and sourced from controlled collection and sorting systems.

MIGRATION TESTING AND CONFORMITY ASSESSMENT

Finished recycled material must meet applicable overall and specific migration limits, using testing protocols aligned with national or international food-contact standards. Some AMS require a Declaration of Conformity or a technical dossier on request.

POSITIVE LISTS OR REFERENCE TO INTERNATIONAL STANDARDS

A few AMS maintain national positive lists for polymers and additives, while others reference Codex standards, US FDA requirements, or EU rules as benchmarks. For recycled plastics, this often translates into a requirement that any material used must meet the same safety and migration limits as virgin polymers.

PROCESS-CONTROL AND HYGIENE REQUIREMENTS

Recycling operations producing food-grade material must demonstrate adequate cleaning, decontamination, and quality-assurance controls. While detailed authorisation systems like the EU's are rare, regulators usually expect evidence that processes can reliably remove contaminants.

5.2 TECHNICAL CONTEXT: RECYCLED PLASTICS QUALITY STANDARDS

This section summarises the principal quality standards and explains the differences between standards, specifications and grading.

PLASTIC WASTE INPUT SPECIFICATIONS AT A RECYCLING FACILITY

The **quality** of the sorted, baled plastics should correspond with those **specified by the recycling facility.** This will depend upon:

- The type(s) of plastic **polymer** e.g. HDPE
- The former **product use**(s) e.g. food containers
- The quality of the **recycled resin** nurdles the **recycler will manufacture.**

These factors will dictate the recycled resin's **price** and the potential **new products** that may be subsequently manufactured by converters.

Depending on the plastic waste suppliers, input quality should correspond to either of the following:

MRF OUTPUT SPECIFICATION (FOR NATIONALLY SOURCED PLASTICS):

From the **materials recovery facility** (MRF) or the **aggregation point** (informal sector).

In practice, the **output specification** from the MRF should be **determined by the plastics recycler** and be the same as the **recycler's input specification**.

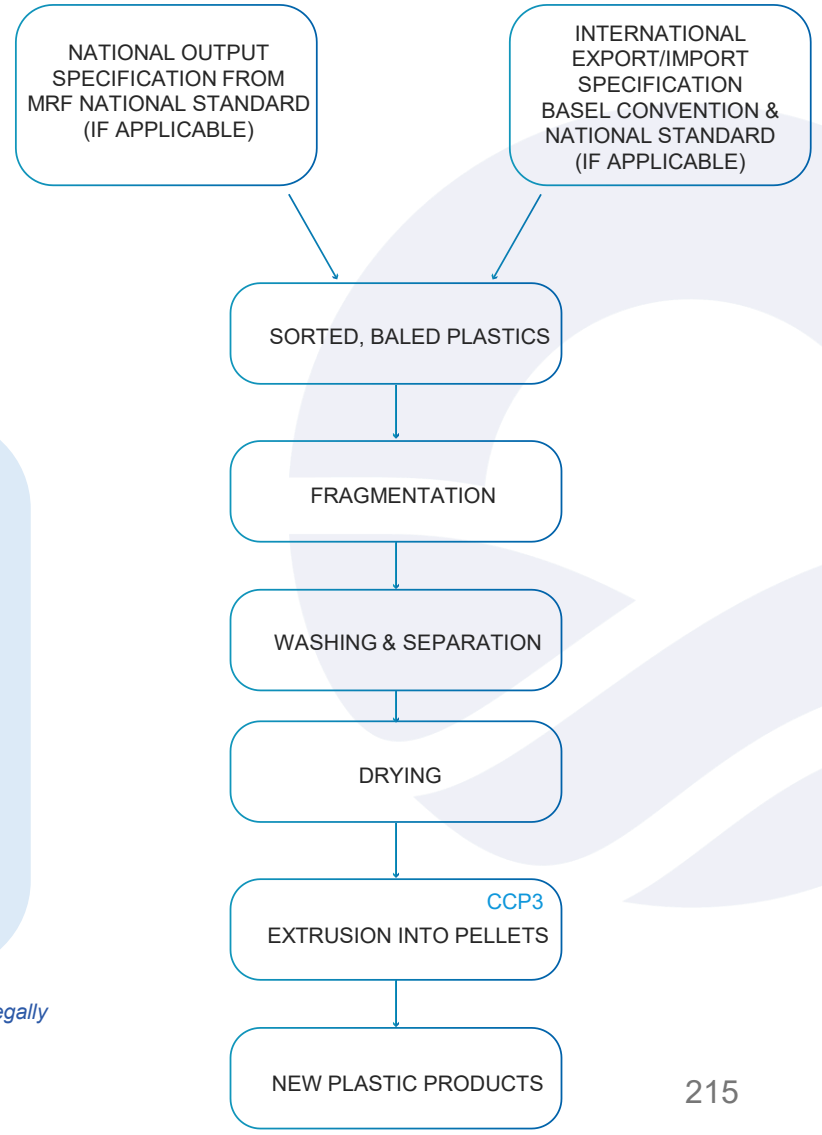
Information on Baled Plastic Quality Specifications can be found here.

BASEL CODES B3011, Y48 OR A3210* (FOR INTERNATIONALLY SOURCED PLASTICS)**

Green-listed plastics classified as **B3011** must be "**almost free from contamination**".

This is often taken to be a maximum of 2% (mass/mass) contamination.

** This corresponds to plastics with hazardous additives and is unlikely to be exported to ASEAN Member States legally*
*** Some AMS have now banned the importation of any plastic waste from third countries. See summaries here.*



RECYCLED PLASTIC OUTPUT SPECIFICATION CRITERIA

International standards and grades for recycled plastic resins focus on both **material quality** and **traceability of recycled content**. Recycled plastic resins are typically characterized by melt flow index, density, colour, and allowable contamination levels, which define whether they can substitute virgin grades in specific processes. Additional testing may include mechanical properties, thermal behaviour, and flammability, particularly for electrical and engineering uses. The categories detailed below are broadly recognised across international markets, although exact specifications vary by standard, certifier, or customer requirements.

MELT FLOW INDEX (MFI)

Recycled resins are commonly classified by **melt flow characteristics**, as this determines processability in extrusion, injection moulding, film blowing, and thermoforming.
Typical ranges are:

Low-MFI (e.g., <1 g/10 min): suitable for pipes, thick-walled products, and blow-moulding.

Medium-MFI (1–10 g/10 min): used for injection moulding.

High-MFI (>10 g/10 min): used for thin-wall items and film applications.

ODOUR AND SENSORY PERFORMANCE

Increasingly included in specifications, especially for PP and PE from post-consumer waste:

Odour rating

Requirements for deodorisation or super-clean processing.

PHYSICAL PURITY & CONTAMINATION LEVELS

Specifications often include maximum thresholds for:

Moisture content (commonly <0.2–0.5%).

Volatile content (e.g., <0.5%).

Black specks / gels (count per kg or per granule mass).

Foreign materials (metals, paper, organics, other polymers).

Odour intensity (subjective but critical in food-grade applications).

COLOUR GRADES

Colour significantly affects pricing and usability:

Natural (near-colourless, highest value, especially PET and HDPE).

Mixed-colour (used in black or dark-coloured products).

Black / re-pigmented grades (common from post-consumer polyolefins).

MECHANICAL PROPERTIES

Grades are sold based on typical resin performance, including:

Density
Tensile strength and elongation
Impact strength
Heat deflection temperature
Crystallinity (for PET)

Values must fall within minimum bands for each grade.

APPLICATION-SPECIFIC GRADES

Recyclers increasingly market resins tailored to identified uses:

Blow-moulding grade rHDPE.

Film grade rLDPE / rLLDPE.

Injection grade rPP.

Fibre grade rPET.

Sheet/thermoforming grade rPET.

Strapping grade rPET.

Each grade adheres to specified ranges of viscosity, MFI, purity etc.

COMPARATIVE SPECIFICATIONS OF RECYCLED RESINS

PROPERTY/POLYMER	PET	HDPE	LDPE	PP	PS
MELT FLOW INDEX (MFI)	IV 0.70-0.85 MFI 2-30 g/10 min.	<1 to 10 g/10 min.	0.5>10 g/10 min.	1-50 g/10 min.	3-20 g/10 min.
PURITY STANDARDS	EFSA, FDA, EN 15348	EN 15344, EuDertPlast	EN 15344, RecyClass	EN 15345, ISO 15270	EN 15347, RecyClass
MOISTURE CONTENT	<0.3%	<0.3%	<0.3%	<0.3%	<0.3%
CONTAMINATION LIMITS	PVC <100 ppm	Metals <50 ppm	Gels <0.5% volatiles	Other Polymers <0.2%	Black Specks <10/kg
POLYMER PURITY	>99% PET	>95% HDPE	>95% LDPE	>95% PP	>95% PS
FOOD-CONTACT GRADES	rPET Food-Grade	Food-Grade rHDPE	Emerging HDPE		
COLOUR GRADES	Natural, Mixed, Black				
ODOUR CONTROL	Low Odour < Odour 2-3	Deodorised Grades	Odour <3-4	Sensory Tested	Low Odour Scale 0-5
MECHANICAL PROPERTIES	IV, Tensile, Impact	Density, Impact	Tensile, Heat Deflection	Izod / Charpy Tests	Density, Flexual Strength

TECHNICAL SPECIFICATION TRENDS IN ASEAN

Recycled plastic resins in ASEAN markets are graded according to performance characteristics, purity, and suitability for downstream applications. **Although the region uses broadly similar criteria to international markets, quality variation is significant due to diverse collection systems, differing regulatory frameworks, and varying levels of technological maturity among recyclers.** Increasing attention to quality standards is being driven by brand owners, exporters, and the emergence of Extended Producer Responsibility frameworks.

MELT FLOW AND VISCOSITY CRITERIA

Resins are typically classified by either Melt Flow Index (MFI) for polyolefins or Intrinsic Viscosity (IV) for PET:

- rHDPE: <1–10 g/10 min.
- rPP: 3–20 g/10 min.
- rPET flakes: IV 0.70–0.85; pellets vary by process.

ASEAN recyclers frequently offer wider tolerance windows because of heterogeneous feedstocks. Export-oriented facilities maintain tighter ranges suitable for specific moulding or film applications.

COLOUR GRADES

Recyclates are purchased according to consistent colour categories:

- Natural (clear or lightly pigmented).
- Light mixed.
- Mixed-colour.
- Black.

Colour significantly affects value and reprocessing options, and mixed-colour resins dominate the ASEAN market.

PURITY AND CONTAMINATION LEVELS

Key specifications include moisture, metals, PVC content, and organics:

- Moisture: typically <0.3–0.5%.
- Metals: <20–100 ppm.
- PVC content in PET: <150–300 ppm in the region; <50–100 ppm for export-grade flakes.
- Organics: controlled operationally; not always declared explicitly.

These parameters influence the usability of recyclate in films, moulding applications, and food-contact applications.

ODOUR AND SENSORY QUALITY

Odour issues arise from poorly segregated post-consumer waste, tropical climate conditions, and insufficient washing.

Sensory grading is often informal but may follow numerical odour scales.

Deodorisation and hot-wash systems are becoming more common in premium facilities.

POLYMER PURITY AND ADDITIVES

Polymer purity is central to grade classification:

- **Polyolefins**: >90–95%.
- **PET**: >98–99% for bottle-to-bottle grade flakes.

Additive disclosure remains limited unless required by buyers, though stability packages and pigmentation are increasingly specified for traceability.

MECHANICAL AND PHYSICAL PROPERTIES

Specifications include:

- Tensile strength & elongation (polyolefins).
- Flexural strength (PS and blends).
- Impact resistance (Izod or Charpy).
- Density.
- IV for PET.

Tolerance levels vary widely across facilities; export-grade processors typically align with international norms.

ASEAN MARKET CHARACTERISTICS

ASEAN recyclers predominantly produce non-food grade polyolefin recyclates (rHDPE, rLDPE, rPP) and clear or light-blue rPET flakes. Resin grading is influenced by:

Heterogeneous post-consumer feedstocks.

High informal sector involvement.

Limited regulatory harmonisation across Member States.

Growing pressure from brand owners and exporters to meet EU and FDA benchmarks for Food Contact Materials.

Premium, traceable, or food-contact grades remain limited but are expanding, especially in Thailand, Malaysia, Indonesia & Singapore.

IMPLICATIONS FOR ASEAN PLASTICS MARKETS

High-grade recyclates are available but concentrated in a small number of advanced facilities.

Most recyclate in the region remains suitable for **non-food packaging, construction products, household goods, and agricultural applications**.

As Extended Producer Responsibility (EPR) laws emerge, technical specifications are expected to tighten, increasing demand for certification and traceable input streams.

TECHNOLOGICAL VARIATION

The sector includes high-end, internationally certified recyclers alongside small-scale informal operations. Only the former consistently achieve specification-aligned outputs suitable for international buyers or food-contact materials.

CERTIFICATION & QUALITY FRAMEWORKS

Adoption is growing but not yet uniform. Common frameworks include:

- **EuCertPlast** (traceability and processing conditions).
- **RecyClass** (recyclate quality and application suitability).
- **ISO 14001** and **ISO 9001** for environmental and quality management.

Food-contact certifications remain limited mainly to rPET and emerging rHDPE.

IMPLICATIONS FOR TRADE AND REGIONAL INTEGRATION

As ASEAN moves towards regional harmonisation of plastic waste and recyclate standards, consistent grading will become more important for:

- Cross-border trade.
- Meeting brand-owner specifications.
- Strengthening EPR implementation.
- Increasing the value of domestically produced recyclate.

ASEAN RECYCLED RESIN GRADING MATRIX

POLYMER	COMMON ASEAN GRADES	TYPICAL MFI / IV RANGE	PURITY BENCHMARKS	COMMON CONTAMINATION LIMITS	TYPICAL APPLICATIONS
rPET	Bottle-to-bottle grade; Standard clear flakes; Mixed-colour flakes	IV 0.70–0.85 (flakes)	>98–99% PET	PVC <150–300 ppm; moisture <0.3%	Beverage bottles (BTB), strapping, sheets, fibres
rHDPE	Natural blow-moulding grade; Mixed-colour regranulate; Black grade	<1–10 g/10 min	>90–95%	Metals <20–100 ppm; moisture <0.3%	Bottles, jerrycans, pipes, crates
rLDPE / rLLDPE	Film-grade pellets; Mixed-colour pellets	0.5–>10 g/10 min	>90–95%	Gels; volatiles <0.5%	Films, bags, sheets
rPP (rigid)	Injection-moulding grade; Black grade	1–20 g/10 min	>90–95%	Other polymers <0.2%	Automotive parts, crates, household items
rPP (flexible)	Film grade; Mixed-colour	2–20 g/10 min	>90%	Moisture <0.3%	Films, ropes, non-woven fibres
PS (HIPS/GPPS)	General-purpose recyclate; Black grade	3–20 g/10 min	>95%	Black specks <10/kg	Electronics housings, office equipment
rPS (expanded)	Reprocessed EPS	N/A	High purity	Contamination <1%	Moulded products, insulation

STANDARDS, SPECIFICATIONS AND GRADING

In the context of plastic waste recycling in ASEAN, **standards, specifications and grading** serve distinct but complementary functions along the value chain. Confusion between them is common, yet their roles are materially different.

STANDARDS

WHAT THEY ARE

Harmonised standards are formally agreed normative documents that define **how systems, processes or products shall be managed, measured or controlled.** They are usually developed by recognised standards bodies and adopted (fully or partially) across multiple jurisdictions.

PURPOSE IN PLASTIC WASTE RECYCLING

In ASEAN, harmonised standards are intended to align practices across Member States so that recycling activities meet consistent expectations for:

environmental protection,

occupational health and safety,

quality management, and

traceability and control of materials.

TYPICAL SCOPE

Facility-level management systems (e.g. environmental management, quality assurance).

Process controls (e.g. handling, storage, contamination prevention).

Testing and measurement methods.

EXAMPLES

Environmental management system standards applied to recycling facilities.

Standardised test methods for determining contamination or polymer identity.

KEY POINT

Standards focus on **how recycling is done** and **how performance is demonstrated**, **rather than defining tradable material quality**.

SPECIFICATIONS

WHAT THEY ARE

Specifications define **what a material or output must be**, in technical terms. They translate market and regulatory requirements into measurable criteria for plastic waste, flakes or recyclate.

PURPOSE IN PLASTIC WASTE RECYCLING

Harmonised specifications in ASEAN support:

clearer buyer–seller expectations,

reduced disputes in cross-border trade,

improved confidence among regulators and brand owners.

TYPICAL SCOPE

Polymer type and allowable blends.

Maximum contamination thresholds (e.g. other polymers, paper, metals).

Physical properties (e.g. moisture content, bulk density).

Intended application (e.g. non-food contact, industrial use).

EXAMPLES

A specification for recycled PET flakes suitable for fibre production.

A specification defining acceptable levels of PVC contamination in HDPE recyclate.

KEY POINT

Specifications describe **the technical characteristics a material must meet** to be **considered fit for a particular use or market**.

STANDARDS, SPECIFICATIONS AND GRADING

In the context of plastic waste recycling in ASEAN, standards, specifications and grading serve distinct but complementary functions along the value chain. Confusion between them is common, yet their roles are materially different.

GRADING

WHAT IT IS

Grading is a classification system that sorts plastic waste or recyclate into quality tiers based on defined criteria, often derived from specifications.

PURPOSE IN PLASTIC WASTE RECYCLING

In ASEAN, harmonised grading helps:

- make quality differences transparent,
- link material quality to price,
- facilitate trade where laboratory testing capacity may be limited

TYPICAL SCOPE

- Facility-level management systems (e.g. environmental management, quality assurance).
- Process controls (e.g. handling, storage, contamination prevention).
- Testing and measurement methods.

EXAMPLES

- Grade A, B and C post-consumer PET bales.
- High-, medium- and low-grade mixed polyolefin streams.

KEY POINT

Grading **simplifies quality assessment** for the market; it is **comparative, not prescriptive**.

HOW THEY RELATE TO EACH OTHER

Element	Primary role	Focus	Used by
Standards	Governance and assurance	Processes, systems, methods	Regulators, auditors, facility operators
Specifications	Technical definition	Material properties and limits	Buyers, sellers, recyclers
Grading	Market differentiation	Relative quality tiers	Traders, aggregators, procurement

In practice:

Standards underpin credible and environmentally sound recycling operations.

Specifications define whether a plastic waste or recyclate is technically acceptable.

Grading translates those specifications into practical market categories.

CCP 3: INTERNATIONAL STANDARDS

Standards are voluntary unless specified in legislation.

ORGANISATION	DESCRIPTION	
International Organization for Standardization (ISO)	• ISO 15270:2008 Guidance for the development of standards and specifications covering plastics waste recovery, including recycling, arising from pre-consumer and post-consumer sources.	New international standards are currently under development, which will replace ISO 15270:2008
European Committee for Standardization (CEN)	• EN 15342 Plastics - Recycled Plastics - Characterisation of Polystyrene (PS) recyclates • EN 15343 Plastics—Recycled Plastics - Plastics recycling traceability and assessment of conformity and recycled content • EN 15345 Plastics - Recycled plastics - Characterization of Polyethylene (PE) recyclates • EN 15346 Recycled plastics—Characterisation of poly(vinyl chloride) (PVC) recyclates • EN 15348 Plastics. Recycled plastics. Characterization of poly(ethylene terephthalate) (PET) recyclates • EN 180672 Plastics — Recycled plastics — Characterization of acrylonitrile-butadiene-styrene (ABS) recyclates	EN 1534x series Many were updated in 2024
ASTM International	• D5814-18 Standard Practice for Determination of Contamination in Recycled Poly(Ethylene Terephthalate) (PET) Flakes and Chips Using a Plaque Test • D5991-17 Standard Practice for Separation and Identification of Poly(Vinyl Chloride) (PVC) Contamination in Poly(Ethylene Terephthalate) (PET) Flakes • D5577-19 Standard Guide for Techniques to Separate and Identify Contaminants in Recycled Plastics • D6265-17 Standard Practice for Separation of Contaminants in Polymers Using an Extruder Filter Test • D6288-17 Standard Practice for Separation and Washing of Recycled Plastics Prior to Testing • D7611/D7611M-21 Standard Practice for Coding Plastic Manufactured Articles for Resin Identification • WK87117 Standard Guide for Circular Plastics	

CERTIFICATION

Independent third-party certification to a standard for recycled plastics means an **external**, **impartial and competent organisation** (a **certification body**) audits a recycler, converter, or supply chain against a **recognised standard**, and issues a certificate confirming compliance. It is different from **self-declaration** (first party) or a **customer audit** (second party): the assessment is performed by an independent third party using defined rules and evidence requirements.

For recycled plastics, certification mainly provides confidence in three areas: **traceability, recycled content claims, and quality/safety controls.** Auditors typically check input acceptance and supplier due diligence (including legal compliance), procedures for inspecting and rejecting unsuitable loads, and controls to prevent mixing or mislabelling. They review **chain-of-custody systems** (segregation, batch tracking, record keeping, mass balance calculations) to verify claims such as “post-consumer recycled (PCR)” content. They also assess process controls (sorting, washing, extrusion/filtration), testing and specifications for recyclate quality (polymer identification, contamination levels, melt flow index, moisture, etc.), and management systems such as training, internal audits, corrective actions, and document control.

In ASEAN, certification is especially valuable because recycled plastic supply chains can involve multiple traders, informal collection, variable sorting quality, and sometimes cross-border movements of waste and recyclate. Third-party certification therefore functions as a **trust and risk-management mechanism**, helping brands and buyers reduce fraud risk, support credible environmental claims, meet procurement requirements, and improve market access—particularly for international supply chains and high-spec applications.

Certification: Formal confirmation by an independent third party that a product, process, or system meets a specified standard or requirement.

Certification body: An organisation authorised to conduct audits and issue certificates verifying compliance with standards or regulatory requirements.

Accreditation: Official recognition that a certification body is competent to perform audits against specific standards, ensuring impartiality and technical credibility.

Accreditation body: An authority that evaluates and grants accreditation to certification bodies, confirming their competence, independence, and adherence to international rules.

EN 17065: European standard specifying requirements for bodies certifying products, processes, or services, focusing on impartiality, competence, and consistent certification practices.

CERTIFICATION FRAMEWORKS

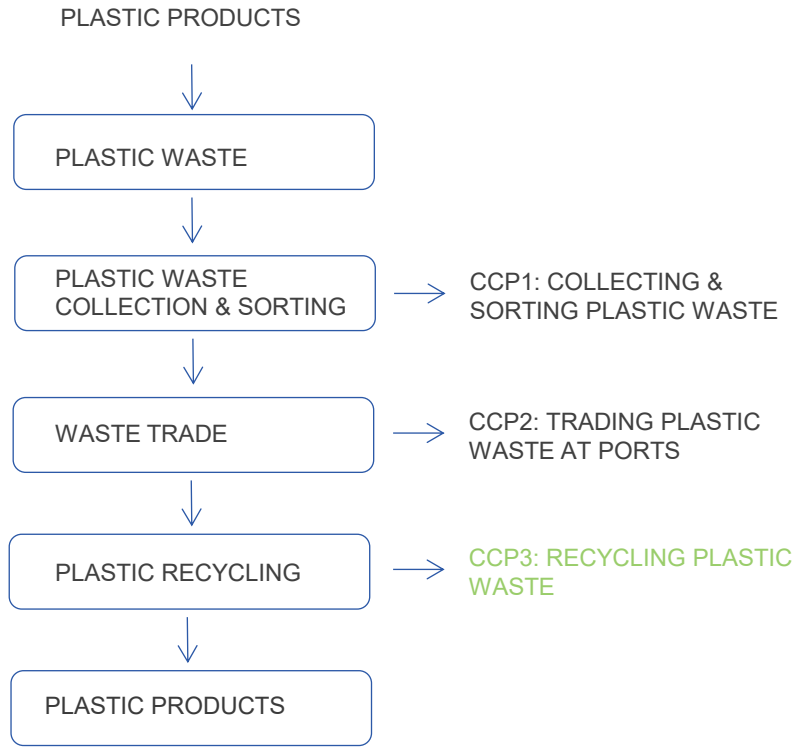
Certification scheme	What it certifies	Chain of custody / audit approach	Reference / URL
CHAIN OF CUSTODY / RECYCLED CONTENT			
Recycled Claim Standard (RCS)	Recycled content traceability	Full CoC tracking through supply chain (transaction-based)	textileexchange.org
Global Recycled Standard (GRS)	Recycled content + environmental & social requirements	Full CoC; more demanding than RCS	textileexchange.org
ISCC PLUS	Circular / bio-based claims including chemical recycling outputs	Mass balance, segregation or controlled blending	iscc-system.org
SCS Recycled Content Certification (SCS-103)	Verification of recycled content % in products	Mass balance / verification-based CoC	scsglobalservices.com
RECYCLER / PROCESS CERTIFICATION (FACILITY-FOCUSED)			
RecyClass Recycled Plastics Traceability Certification	Traceability of recycled plastics, verification of exact recycled content %	Facility audit; supports CoC claims	recyclass.eu
EuCertPlast / RecyClass Recycling Process Certification	Recycler operations: input controls, traceability, process & QA	Facility audit; includes traceability controls	eucertplast.eu

5.3 MANAGING QUALITY: CCP3

This section sets out how Hazard Analysis Critical Control Point principles can be applied at recycling facilities.

CRITICAL CONTROL POINT 3: PLASTIC WASTE RECYCLING

GUIDEBOOK



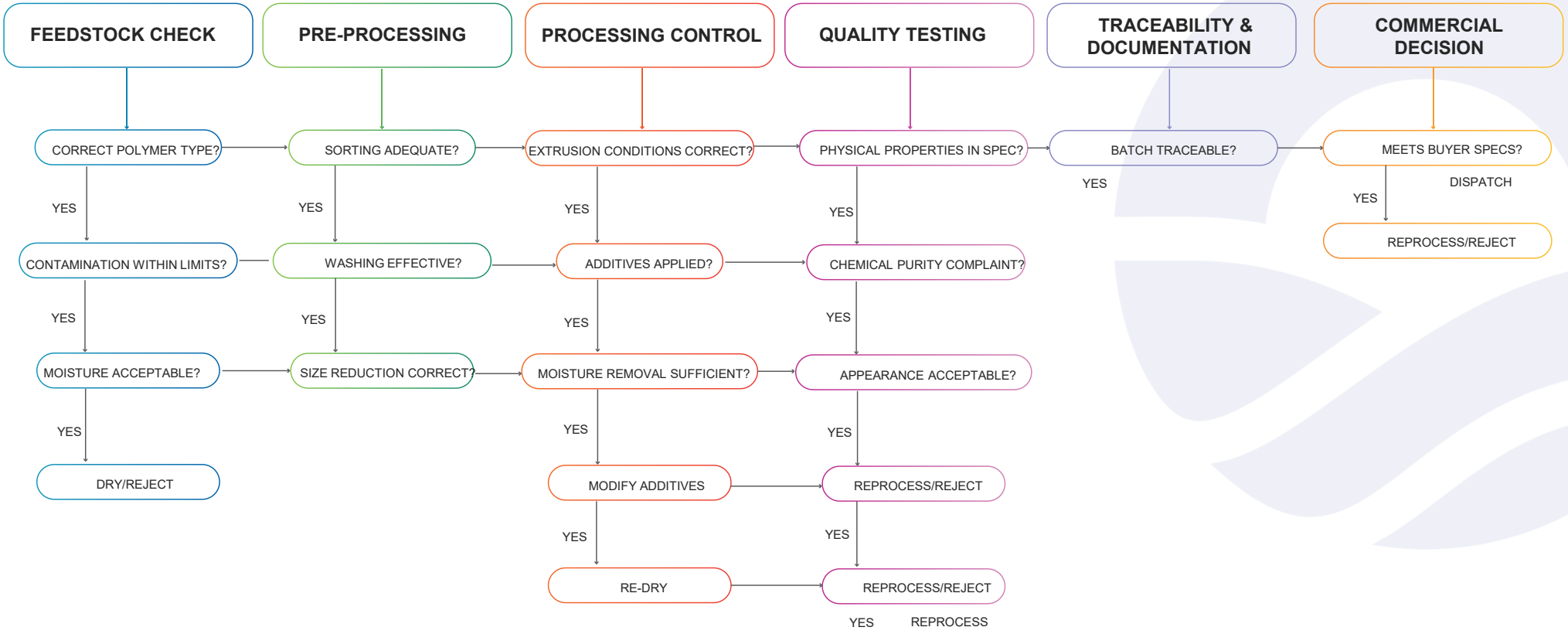
A plastics recycling operator must ensure that recyclate meets standards and buyer specifications through a structured decision-making process.

Key criteria include **feedstock selection**, verifying polymer type, contamination, and source reliability; **pre-processing**, using appropriate sorting, washing, and size reduction; **process control**, adjusting extrusion conditions, additives, and moisture removal; **quality assurance**, testing physical, chemical, and visual properties against standards; **traceability and documentation**, maintaining chain of custody and certifications; and **commercial considerations**, aligning with buyer requirements, balancing cost and quality, and meeting delivery timelines.

Decisions at each stage may involve reprocessing, blending, or rejecting unsuitable material.

CCP3: DECISION MAKING CRITERIA

PLASTICS RECYCLATE QUALITY DECISION-TREE



CCP3 EXAMPLE SHEET: QUALITY OF RECYCLED PET

STAGE	CCP3: PLASTICS RECYCLING OF PET
Description of plastics	Polyethylene terephthalate (PET)
Hazards	Physical contaminants e.g. metal, cardboard Other polymer types
Critical limit	Determined by the **customer** or **end use specifications for recycled products**
Who is responsible	Facility manager
How it is measured	**EN 15348:2024** Plastics — Recycled plastics — Characterization of poly(ethylene terephthalate) (PET) recyclates
How it is monitored	Every batch according to **ISO 3534-2**
Measures to reduce contamination	If above critical limit, review: upstream source of plastics including collection and sorting methods. Contracts with suppliers, including quality specifications & return policies.
Record keeping	All samples and measurements logged on a standard form, then stored in site office as per **EN 15348:2024.**
Verification/auditing	Operations director to review records monthly and to sample random batches. Review feedback from customers regarding quality.

5.4 GUIDANCE: ESM CHECKLISTS

This section contains checklists for Environmentally Sound Management of plastic waste recycling facilities.

ESM CHECKLIST FOR PLASTIC-WASTE RECYCLING FACILITIES (BASEL CONVENTION)

1. LEGAL & ADMINISTRATIVE REQUIREMENTS

Facility holds valid permits and operates under national waste-management legislation.
Incoming waste complies with Basel controls, including PIC where required.
Records maintained for all waste received, processed, stored, and shipped.

2. FACILITY INFRASTRUCTURE

Adequate equipment for sorting, shredding, washing, separation, extrusion, and pelletising.
Containment systems for storage areas to prevent leakage, spills, and pellet loss.
Pollution-control systems installed for air emissions, odours, and wastewater.

3. OPERATIONAL CONTROLS

Pre-sorting to remove hazardous components, incompatible polymers, and contaminants.
Controlled washing systems with wastewater treatment and no untreated discharge.
Melt filtration and temperature control to prevent degradation and emissions.
Residuals (sludge, fines, non-recyclables) managed and disposed of appropriately.

4. WORKER HEALTH AND SAFETY

PPE provided and used; workers trained in safe handling and emergency procedures.
Machinery guarded, with lock-out systems and safe operating protocols.
Monitoring and mitigation of exposure to dust, fumes, chemicals, and noise.

5. ENVIRONMENTAL PROTECTION MEASURES

Monitoring of wastewater, emissions, and solid residues.
Controls to prevent release of microplastics and pellets to the environment.
Measures to reduce energy and water consumption and manage greenhouse gas emissions.

6. PRODUCT QUALITY & TRACEABILITY

Documented material flows and traceability for all recyclate produced.
Quality-control testing of outputs (e.g. contamination, melt flow index).
Clear labelling and storage procedures for finished pellets or flakes.

7. CONTINUOUS IMPROVEMENT

Regular internal audits and compliance checks. Staff training and capacity development. Processes in place to address non-compliance and implement corrective actions.

CHECKLIST TO PREVENT PLASTICS LEAKING INTO THE ENVIRONMENT DURING RECYCLING (EQUIPMENT)

Mechanical recycling involves size reduction (shredding/grinding), washing, extrusion, and pelletising, which are major hotspots for macro- and microplastic leakage. Some of the measures to prevent and control this are listed below.

SHREDDING & GRINDING

Machine Enclosures: Use **covers or enclosures** on shredding machines, especially older models, to **prevent plastic debris and particles (dust and flakes) from escaping** into the ambient air.

Dust Mitigation: Invest in **dust capture and filtering devices** to mitigate airborne plastic particles, particularly in facilities with poor ventilation.

Operational Integrity: Regularly maintain machines to ensure optimal function and **reduce downtime**, which contributes to plastic losses. Place **collection trays** under discharge and loading valves to capture escaping plastic scraps.

WASHING & DRYING (MICROPLASTIC CONTROL)

Wastewater Filtration and Treatment: Since washing generates large volumes of wastewater containing microplastics, facilities must install multi-stage **filtration systems** (e.g., stainless steel filter nets or screens) to remove plastic particles before discharge into sewers or water streams.

Water Spillage Containment: Install **mechanisms to prevent water spill out of washing tanks** to reduce material and water loss. Design pavement floors with **slopes and berms** to act as containment barriers for wastewater spills.

Washing System Improvements: Replace chemical detergents with **bio-detergents** for a more environmentally friendly effluent. For floatation tanks, installing a **rotating net** or side drainage screws helps collect small materials and sediment missed by conveying blades.

Water Reuse: Install **tanks and cooling towers** to collect and **recirculate wash water and cooling water** (from the stringing/pelletising step) to reduce water consumption and increase efficiency.

Drying Control: If avoiding open-air drying is not possible (which is discouraged due to contamination risk), ensure drying areas are enclosed and clean, away from waterways or vegetation, to contain potential flake losses caused by wind or floods.

EXTRUSION & PELLETISING (RESIN PELLET LEAKAGE)

Pellet Containment: Implement appropriate, area-specific containment measures at the pelletising line, such as using catch trays or heavy-duty tarpaulins, to contain pellets, flakes, and powder within paved areas.

Waste Management: Address extrusion lumps, startup cleaning waste, and rejected extrudates that are generated during the process.

Thermal Management: Install an **insulation layer** on the extruder to reduce heat loss, energy consumption, and the hot working conditions for staff.

Filter Residues: Avoid intentional waste burning, especially of filter mesh residues, as this releases persistent pollutants (e.g., dioxins, heavy metals) and harmful gases. Instead, install **automatic filter systems** to remove dust and particles during extrusion.

CHECKLIST TO PREVENT PLASTICS LEAKING INTO THE ENVIRONMENT DURING RECYCLING (OPERATIONS)

Good management practices are essential requirements of a quality management system and operation of a plastics recycling facility to environmentally sound management principles. The following activities can help prevent the fugitive release of plastic waste into the environment.

GOOD HOUSEKEEPING & INTERNAL MONITORING

Cleanliness: Implement rigorous **good housekeeping** practices, including regular cleaning of the facility and working areas to quickly remediate spills and minimize the risk of accumulating plastics.

Monitoring: Conduct regular **internal site audits** to quantify leakage levels and identify areas needing improvement.

Workers should maintain a **record of plastic waste** received, sold, and processed

WASTE DISPOSAL

Segregation: Recycling facilities must be properly equipped with multiple **disposal bin systems** to effectively segregate and dispose of solid waste, electronic waste (WEEE), and hazardous materials according to relevant regulations

Alternative Disposal: For residues and rejected plastics that cannot be recycled further, explore converting them into products like **plastic bricks or tiles** (downcycling) rather than indiscriminately dumping or burning them.

TRAINING AND AWARENESS

Provide **comprehensive training** to all personnel, especially informal workers, on proper waste management practices, safe handling of materials, emergency preparedness, and the dangers of plastic pollution

Educate employees on waste segregation standards and the use of appropriate protective equipment

APPENDICES: CONTENTS



A Abbreviations & Definitions

B Case Studies

C AMS Policies & Legislation

APPENDIX A: ABBREVIATIONS & DEFINITIONS

This section includes:

- Abbreviations used in the Guidebook, and
- Definitions of key terms used.



ABBREVIATIONS

2D	2 Dimensional
3D	3 Dimensional
ABS	Acrylonitrile Butadiene Styrene
ACCSQ	ASEAN Consultative Committee for Standards and Quality
AFTA	ASEAN Free Trade Area
AHTN	ASEAN Harmonised Tariff Nomenclature
AI	Artificial Intelligence
AMS	ASEAN Member States
APR	Association of Plastics Recyclers (USA)
ASEAN	Association of Southeast Asian Nations
ASTM	ASTM International, formerly known as the American Society for Testing and Materials
B	Billion
BoL	Bill of Lading
BRN	Brunei Darussalam
BS	British Standard
BSI	British Standards Institution
CCP	Critical Control Point
CE	Circular Economy
CEN	European Committee for Standardization
CoA	Certificate of approval
CoO	Certificate of Origin
DSC	Differential Scanning Calorimetry
EMS	Environmental Management System
EN	European Standard
EoL	End of life
EPR	Extended Producer Responsibility
EPS	Expanded polystyrene
ESA	Environmental Services Association (UK)
ESF	Environmental and Social Framework (World Bank)
ESM	Environmentally sound management
ESS	Environmental and Social Standards
EU	European Union
EVOH	Ethylene Vinyl Alcohol
FCM	Food Contact Material
FDA	Food and Drink Administration (USA)
FTIR	Fourier Transformation Infrared Spectroscopy

ABBREVIATIONS

GMP	Good manufacturing practice
HACCP	Hazard Analysis Critical Control Point
HDPE	High Density Polyethylene
HS	Harmonised System (code)
IDN	Indonesia
ISO	International Organization for Standardization
ISRI	Institute of Scrap Recycling Industries
IV	Intrinsic viscosity
kg	kilogram
KHM	Cambodia
LAO	Lao (Lao People's Democratic Republic)
LDPE	Low Density Polyethylene
M	Million
m/m	Mass/mass (when referring to a percentage)
m^3	Cubic meter
MFI	Melt flow index
MMR	Myanmar
MRF	Materials reclamation facility
MYS	Malaysia
NGO	Non-governmental organisation
NIR	NEAR Infrared
NIR	Near infrared
NOL	No Objection Letter
OECD	Organisation for Economic Co-operation and Development
OSH	Occupational Safety & Health
PA	Polyamide (Nylon)
PAH	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated biphenyls
PET	Polyethylene Terephthalate
PFAS	Per- and Polyfluoroalkyl Substances
PHA	Polyhydroxyalkanoates
PHL	Philippines
PIC	Prior Informed Consent
PLA	Polylactic acid

ABBREVIATIONS

PMMA	Polymethyl Methacrylate (Acrylic)
POM	Placed on market
PP	Polypropylene
PS	Polystyrene
PVC	Polyvinyl chloride
PWG	Product Working Group
QA	Quality Assurance
QC	Quality Control
QMS	Quality Management System
QR	Quick Response (code)
r	Recycled (when used as a pre-fix before the abbreviation for a plastic polymer e.g. rPET)
RDF	Refuse derived fuel
ReMA	Recycled Materials Association (USA)
SDS	Safety Data Sheet
SEA-MaP	Southeast Asia Regional Program on Combating Marine Plastics
SGP	Singapore
SIRIM	SIRIM Berhad, formerly known as the Standard and Industrial Research Institute of Malaysia
SRF	Solid recovered fuel
t	Tonne (metric)
TEI	Thailand Environment Institute
THA	Thailand
tpy	Tonnes (metric) per year
UEEE	Used Electrical and Electronic Equipment
UNOPS	United Nations Office for Project Services
UV	Ultraviolet
VNM	Viet Nam
WEEE	Waste Electrical and Electronic Equipment
XRF	X-ray fluorescence
y	Year

DEFINITIONS

Accreditation	Official recognition that a certification body is competent to perform audits against specific standards, ensuring impartiality and technical credibility.
Accreditation body	An authority that evaluates and grants accreditation to certification bodies, confirming their competence, independence, and adherence to international rules.
Aggregation	The consolidation, sorting and preparation of plastics into marketable quantities and qualities that meet buyer requirements.
Aggregation point	Place where ‘aggregation’ takes place.
Agricultural Waste	Residues produced from various agricultural operations.
Baling	Compressing loose plastic materials into compact, dense bundles or bales
Basel code	A code used to classify plastic waste according to how strictly its movement must be controlled when it crosses borders. (Defined in the Basel Convention)
Certification	Formal confirmation by an independent third party that a product, process, or system meets a specified standard or requirement.
Certification body	An organisation authorised to conduct audits and issue certificates verifying compliance with standards or regulatory requirements.
Chemical recycling	Converting waste materials (especially plastics) into monomers, fuels, or chemical feedstocks through chemical processes that change their molecular structure.

Circular economy	"economic system that uses a systemic approach to maintain a circular flow of resources, by recovering, retaining or adding to their value, while contributing to sustainable development" (ISO 59004:2024)
Commercial Waste	Waste produced by businesses such as shops, restaurants, offices, hotels, and markets. A subset is often managed with MSW but can also be counted separately.
Construction/ Demolition	Waste derived from construction, renovation, or demolition of buildings and infrastructure. Includes concrete, bricks, metals, wood, glass, plastics, and soil.
Contaminant	A hazard that has potential to harm human health, the environment, recycling equipment or the quality of the recycled plastic.
Critical Control Point (CCP)	A step in a process where control measures can be applied to prevent, eliminate, or reduce a hazard to an acceptable level.
Critical Limit	Maximum levels of contamination deemed acceptable to ensure that plastic waste is sufficiently safe to be moved along the value chain
Differential Scanning Calorimetry (DSC)	Measures how a material's heat flow changes as it is heated and cooled. Different polymers melt and crystallise at characteristic temperatures, so DSC is used to determine polymer purity, detect mixtures, and assess whether the waste is suitable for mechanical recycling.
Disposal	The final management of waste by sending it to landfill, incineration (with or without energy recovery), or other permanent removal routes rather than recovery or reuse.
Downstream (plastic life cycle)	This is where plastic products reach the end of their life and become waste.
Dumpsite	A designated or informal location where waste is disposed of by being deposited on the ground, without proper environmental controls.
Environmental Management System (EMS)	A structured framework that enables an organisation to systematically manage its environmental responsibilities, comply with regulations, and continually improve environmental performance. (ISO 14001)

Environmentally sound management (ESM)	The processes and strategies aimed at minimising harm to the environment and human health through prevention, collection, containment, sorting, recycling and proper disposal of plastic materials
Extended Producer Responsibility (EPR)	A policy a policy approach that makes producers responsible for the entire lifecycle of their products, especially for take-back, recycling, and final disposal.
Extended producer responsibility (EPR)	Extended Producer Responsibility (EPR) is an environmental policy approach that extends the responsibility of producers—such as manufacturers, brand owners, importers, or packers—for a product to include its post-consumer stage.
Food contact material (FCM)	Any material or article intended to come into direct or indirect contact with food, including packaging, containers, utensils, and processing equipment.
Formal recyclers	Typically large recycling sites with large-scale equipment that hold suitable business and waste permits and licenses for their operations.
Formal sector	Collective term for municipal (or licensed collectors) and fully permitted/licensed aggregators and recyclers.
Fourier Transform Infrared Spectroscopy (FTIR)	A technique that identifies polymers by measuring how a material absorbs infrared light. Each polymer has a distinct spectral “fingerprint”, allowing inspectors to confirm whether a plastic sample matches its declared type or contains incompatible blends.
Good manufacturing practice (GMP)	The set of operating, hygiene and quality-assurance measures that ensure recycled materials are consistently produced to a standard that prevents contamination and safeguards food safety.
Grade	A classification system that sorts plastic waste or recyclate into quality tiers based on defined criteria, often derived from specifications.
Hazard	A contaminant that has potential to harm human health, the environment or the quality of a product.

Hazard Analysis Critical Control Point	A system used to identify, evaluate and control hazards that are significant for safety and/or quality.
Hazardous waste	Waste that poses a significant risk to human health or the environment because it is toxic, corrosive, flammable, reactive, infectious, or otherwise dangerous.
Healthcare Waste	All types of waste generated from healthcare facilities including hospitals, clinics, and laboratories.
HS Code	Internationally agreed six-digit tariff code used to classify goods in trade. (Defined by the World Customs Organization)
Industrial Waste	Waste produced from manufacturing activities and industrial processes.
Informal (waste sector)	People who earn an income from managing waste but are not formally employed to do so. Roles include collection (including picking), sorting, and other pre-processing and recycling.
Informal recycler	Typically small recycling facilities that operate without full licenses and permits.
Junk shop	Aggregation point operated by the informal sector.
Leakage	The loss of waste materials (especially plastics) from managed systems into the environment through littering, dumping, or inadequate collection, transport, or treatment.
Legislative instruments	This broadly refer to formal legal documents and mechanisms through which laws, regulations, treaties, and agreements are enacted, implemented, and harmonized within the region.
Macroplastic	Plastic fragments greater than 5 mm in size.

Materials recovery facility (MRF)	A specialised facility where mixed recyclable materials are sorted, cleaned, and prepared for sale or further processing into new products.
Mechanical recycling	Processing waste materials (e.g., plastics) into new products through physical methods such as sorting, washing, shredding, and remelting, without changing the polymer's chemical structure.
Microplastic	Tiny plastic particle less than 5 mm in size.
Middlemen	Collective term used to describe intermediaries involved in the downstream plastic value chain.
Midstream (plastic life cycle)	This involves the design, manufacture, distribution and use of plastic products.
Municipal Solid Waste	Waste generated by households, public institutions and commercial establishments. Usually excludes industrial, agricultural and hazardous wastes.
Nurdles	Small plastic pellets, typically 2–5 millimetres in diameter, used as the primary raw material in plastic manufacturing. They are produced during polymerisation or mechanical recycling and are melted down by converters to make new products such as packaging, films, and moulded components
Per capita	Per person
Plastic	Material which contains as an essential ingredient a high polymer and which, at some stage in its processing into finished products, can be shaped by flow. ISO 472:2013(en) Plastics — Vocabulary
Plastic waste	Plastic materials and products which are disposed of, intended to be disposed of, or required to be disposed of.
Polymer	A large molecule made of repeating chemical units (monomers), forming the basis of plastics and many natural materials.

Prior Informed Consent (PIC)	A procedure requiring the exporting country to notify and obtain written approval from the importing country (and sometimes transit countries) before shipping certain regulated wastes or hazardous materials.
Quality	How well recycled plastic material retains or recovers its distinct characteristics throughout the recycling process, enabling it to be re-used effectively in new products.
Quality management system (QMS)	A formal framework of policies, processes and procedures that an organization uses to consistently deliver products and services that meet customer and regulatory requirements.
Recyclate	Material recovered from waste that has been processed and is suitable for use as a raw material in manufacturing new products.
Recycling	Collecting and processing waste materials to convert them into new products, materials, or substances for further use.
Recycling Centre	Aggregation point operated by the informal sector
Refuse derived fuel (RDF)	A fuel produced from mixed residual waste that remains after recyclable materials have been removed.
Risk	The chance or likelihood that a hazard will cause harm to human health and/or the environment or impair the quality of a product.
Risk	The chance or likelihood that a hazard will cause harm to human health and/or the environment or impair the quality of a product.
Separate collection	The process of collecting different types of solid waste separately according to their material type or nature, usually at the point of generation, such as households or businesses
Single-use plastic	Single-use plastic is plastic designed to be used once (or for a very short time) before being thrown away, such as bags, bottles, straws, and food packaging.

Solid recovered fuel (SRF)	A high-specification fuel produced from non-hazardous waste
Source separation	See ‘separate collection’
Specification	This defines what a material or output must be, in technical terms.
Standard	Officially established criteria that define the quality, safety and compatibility requirements for products, services and systems
Transfer station	A facility where collected waste is temporarily deposited, compacted, or sorted before being transported to final disposal or recycling sites.
Upstream (plastic life cycle)	This involves polymerisation of precursor monomers into long chain plastic polymers.
Value Chain (plastic)	The full sequence of processes and stakeholders involved in the life cycle of plastics, from raw material extraction through manufacturing, product use, and end-of-life management such as recycling or disposal.
Waste	Substances or objects which are disposed of or are intended to be disposed of or are required to be disposed of by the provisions of national law. (Basel Convention)
Waste prevention	Actions and strategies aimed at reducing the generation of waste at its source by using fewer materials, designing products for longer life, or promoting reuse.

APPENDIX B: CASE STUDIES

This section summarises case studies from different ASEAN Member States.



CASE STUDIES: SUMMARY

AMS	RELEVANT CCP	COLLECTION OF PLASTIC WASTE	CO-OPERATION	DIALOGUE & INFO	FORMAL SECTOR	FOOD CONTACT MATERIAL	INFORMAL SECTOR	RECYCLING	SINGLE USE PLASTICS	TOURISM	TRADE	CASE STUDY
BRN	Overarching		■	■								Stakeholder dialogue
KHM	CCP1 CCP3	■	■				■	■	■			Plastic credit system
IDN	CCP1 CCP3	■	■		■	■	■	■	■			PET bottle recycling
LAO	CCP1	■	■	■			■					Smart Cities initiative
MYS	Overarching			■								Circularity toolkit
MMR	CCP3				■	■		■	■			PET bottle recycling
PHL	CCP3		■	■			■	■				Precious plastics
SGP	CCP2				■						■	Digitised trade
THA	CCP1 CCP3	■	■	■	■			■	■			Rayong Less Waste
VNM	CCP1		■						■	■		Plastic-free Ha Long Bay

BRUNEI DARUSSALAM : STAKEHOLDER DIALOGUE

"Private Sector Initiatives to Reduce Marine Plastics: Brunei's Journey to Plastic Sustainability: Hands-on Initiatives in Action" was a seminar held in Bandar Seri Begawan in June 2024. It brought together government, industry, research and civil society to explore practical solutions for plastic waste and marine debris, with a strong emphasis on stakeholder dialogue and collaborative action.

The event was organised by the Regional Knowledge Centre for Marine Plastic Debris (ERIA), supported by the Department of Environment, Parks and Recreation (JASTRe) and GIZ's 3RproMar programme, and drew participants from across ASEAN and neighbouring regions.

PRESENTATIONS

Speakers emphasised the importance of cross-sector engagement.

ERIA representatives provided an overview of regional plastic pollution challenges and highlighted collaborative frameworks, while JASTRe outlined national policies, including bans and public education campaigns.

GIZ offered insights on pilot initiatives and voluntary EPR schemes.

Private sector and community perspectives were central: Tebalik Plastik demonstrated circular business approaches to repurpose waste, Kaimana Brunei discussed obstacles to scaling sustainable packaging solutions, and Precious Plastic Brunei showcased grassroots recycling workshops and community mobilisation efforts.

PARTNERSHIPS

The event showcased formal cooperation between ERIA, national authorities and international partners, with GIZ linking policy and practice across ASEAN.

The seminar's hybrid format facilitated engagement from over 100 participants across 24 countries, fostering exchanges between public officials, entrepreneurs, academics and civil society organisations

The reintroduction of the Regional Knowledge Centre's online Private Sector Platform was presented as a tool to broaden business engagement in plastic reduction efforts.

KEY TAKEAWAYS

Participants stressed that tackling plastic waste effectively requires integrated action across sectors.

A life-cycle approach combining regulation, economic incentives, and product design was recommended to improve recyclability and reduce waste. Elevating the value of plastics, raising community awareness, and encouraging participatory initiatives were highlighted as essential.

The seminar concluded that sustained collaboration among government, business, and local communities is essential to advancing circular economy objectives in Brunei Darussalam and the wider ASEAN region.

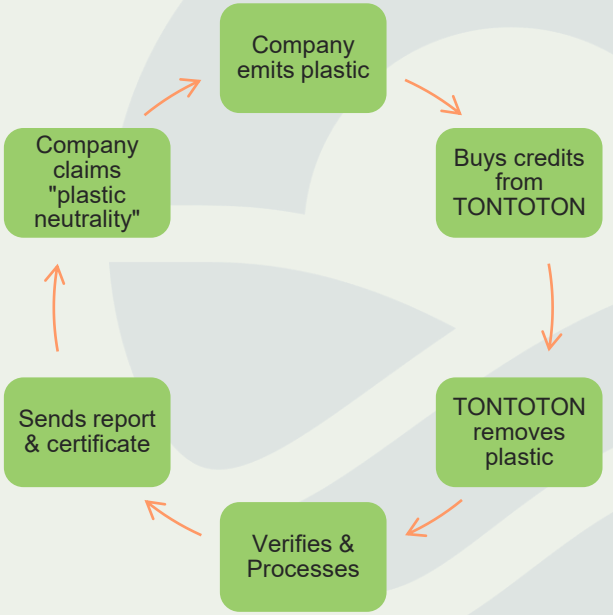
https://rkcmpd-eria.org/news/seminar-on-brunei-s-plastic-sustainability-strategies-marks-world-environment-day

CAMBODIA: PLASTIC CREDIT SYSTEM

TONTOTON is a community-led social enterprise working in Sihanoukville and nearby coastal villages in Cambodia. Its focus is on "orphan plastics"—low-value post-consumer materials such as flexible packaging, polystyrene, straws and similar items that are often not accepted by mainstream recycling markets. The organisation operates a Materials Recovery Facility (MRF) where plastics are sorted and processed, and it also runs a certified plastic credit scheme. This credit system is independently verified by Control Union under the Ocean-Bound Plastic Neutrality Standard

KEY STAKEHOLDERS

These include a large network of **informal waste collectors**, involving **400+ households** across coastal communities and hundreds of individual collectors, with **women representing around 57%** of participants. Institutional support comes from the **Ministry of Environment** and the **Provincial Government of Sihanoukville**, alongside partners such as **UNDP**, **UN-Habitat**, the **Embassy of Japan**, the **Global Plastic Action Partnership**, local NGOs (including **M'Lop Tapang**), and private-sector collaborators such as **Chip Mong Insee** and **ClimeCo**.



KEY ATTRIBUTES

TONTOTON combines inclusive livelihoods for vulnerable workers with community education and environmental action. Since launching in 2021, it has **removed an estimated 1,000–3,000+ tonnes of plastic waste from coastal areas**, scaled collection from small quantities to **up to 10 tonnes per day per centre**, and expanded operations into multiple villages. Its plastic credit model provides market-based funding to support collection and environmentally sound disposal.

FURTHER INFORMATION

https://adw-cambodia.org/wp-content/uploads/2021/04/BSfD_SectorBrief_Cambodia_WasteManagement_WEB-1.pdf
www.undp.org/cambodia/projects/ending-plastic-pollution-innovation-challenge-eppic?utm

INDONESIA: PET BOTTLE COLLECTION, SORTING & RECYCLING

The **National Circular Economy Movement (GESN)**, launched in 2021, is a nationwide initiative led by partners including Le Minerale, ADUPI and the waste pickers' network (IPI) to support Indonesia's waste reduction and circular economy policy under Ministerial Regulation P.75/2019. It aims to greatly increase the collection, sorting and recycling of plastics—especially PET bottles and refill gallon containers—by building an organised supply chain from recovery through to new products.

In pilot stages it demonstrated a closed-loop approach, sending returned packaging to be processed into food-grade recycled PET (such as at PT Bumi Indus Padma Jaya), and achieved collection volumes of more than 500 tonnes of PET per month through collaboration with waste pickers and waste bank networks.

KEY STAKEHOLDERS

Corporate lead and programme catalyst: Le Minerale, a domestic bottled-water company, drives and coordinates GESN's implementation.

Recycling industry coordination: ADUPI oversees recycling operations, quality assurance, and supports the uptake of recycled PET in new products.

Waste picker mobilisation: IPI activates and connects waste collectors and waste pickers across Indonesia.

Government endorsement: The Ministry of Environment and Forestry recognises GESN as aligned with national targets, highlighting its multi-stakeholder collaboration and circular economy approach.

KEY ATTRIBUTES

- **Scalable impact**: In three years, GESN processed **35,000+ tonnes**.
- **Closed-loop value**: Sorts and recycles into **food-grade rPET** for industrial reuse.
- **Stakeholder integration**: Connects producers, industry, collectors (including the informal sector), and regulators.
- **Policy-aligned**: Supports P.75/2019 and has won awards (e.g., **Green Economy Awards**).



FURTHER INFORMATION

ADUPI is a registered not-for-profit association. It was established to bring together plastic recycling stakeholders across Indonesia, enabling networking, knowledge sharing, and coordination to build an organised recycling ecosystem.
www.adupi.org

LAO PDR: PLASTIC SMART CITIES INITIATIVE

Luang Prabang, a UNESCO World Heritage City in northern Lao PDR, joined **the Plastic Smart Cities initiative** in December 2024, marking the first Lao city to participate. The programme, coordinated by WWF-Lao PDR, focuses on reducing plastic pollution through community-led, sustainable interventions while protecting the city's cultural and ecological heritage.

KEY ATTRIBUTES

The programme combines multiple, complementary approaches. **Plastic Smart Schools** integrate environmental education, waste segregation, and student-led reduction initiatives across ten pilot institutions. **Plastic Smart Offices** aim to demonstrate responsible plastic management within organisations while enhancing staff awareness and recovery rates. **Community engagement** is strengthened through a recyclable marketplace, promoting at-source segregation and responsible consumption. In heritage areas, interventions focus on improving waste infrastructure, minimising waste production, raising awareness among residents and tourists, and fostering local ownership. The initiative respects the autonomy of informal waste workers by providing support, protective equipment, and training rather than forcing formal integration.

ACHIEVEMENTS

The programme has successfully implemented educational campaigns, distributed waste segregation tools, and initiated community collection efforts. Religious settings have also been incorporated through the Clean and Green Temples initiative, which introduces tailored waste sorting stations. Household-level interventions include workshops and door-to-door collection, all conducted with Free, Prior, and Informed Consent to ensure community ownership. The programme has improved waste management during major events, such as the Boat Racing Festival, by deploying bins, PPE, and volunteer education campaigns. Efforts to identify public-private financing and sustainable recycling systems are underway, creating potential for scalable impact.

STAKEHOLDERS

Key actors include WWF-Lao PDR as programme lead, municipal authorities for infrastructure and public education, universities for research and technical support, households for participatory segregation, and informal waste workers, who are engaged with tools, training and protective equipment. This collaborative framework ensures interventions are inclusive, locally driven, and adaptable to Luang Prabang's social and cultural context.

PLASTIC SMARTCITIES

https://plasticsmartcities.org/luang-prabang

MALAYSIA: PLASTIC CIRCULARITY TOOLKIT

The **WWF-Malaysia Plastic Circularity Toolkit** was introduced on 2 July 2025 at a joint event with the Business Council for Sustainable Development Malaysia. It was designed as a practical resource to help companies evaluate and strengthen their approach to plastic management and circularity.

RATIONALE

Research conducted by WWF-Malaysia indicated that many businesses in the country — particularly small and medium-sized enterprises — have little or no awareness of plastic pollution or of how their own plastic use contributes to the problem. Even among those with some awareness, there is often uncertainty about what actions can realistically be taken.

Through its *No Plastic in Nature* initiative, WWF-Malaysia seeks to support local businesses in reshaping their models, operations and processes to become more resource-efficient. The toolkit forms part of this effort, offering structured guidance and examples of good practice to help organisations begin transitioning towards a circular economy for plastics.

KEY FEATURES

The self-assessment tool enables companies to review their current performance and identify practical next steps on their circularity journey.

It is tailored to three key sectors:

- Manufacturers and brand owners of fast-moving consumer goods
- Retailers
- The hospitality sector

Delivered as an online platform, the toolkit uses a structured series of multiple-choice questions across eight thematic areas to help businesses gauge their existing initiatives and performance levels.

REPORTING

The outputs are organised into five tiers, with each tier outlining the company's present position and offering tailored guidance on how to strengthen its approach to plastic circularity:

Level 0 – Conventionalist: Minimal awareness of plastic circularity and no action taken; priority is to build basic understanding and seek guidance.

Level 1 – Explorer: Early awareness and beginning to review plastic use; should assess packaging, explore policy support, and learn from industry peers.

Level 2 – Initiator: Setting targets and testing pilot projects; needs structured planning, stakeholder engagement, clear responsibilities, and monitoring systems.

Level 3 – Adopter: Implementing a defined action plan with partners and tracking progress; focus on collaboration, transparency, consumer engagement, and continuous improvement.

Level 4 – Advocate: Circularity embedded across operations; able to influence the supply chain and contribute to policy discussions while driving ongoing organisational change.

MYANMAR: PET BOTTLE-TO-BOTTLE RECYCLING

Commercial Plastics Co. Ltd. is a Yangon-based initiative in Myanmar that recycles post-consumer PET bottles into high-quality recycled PET, with a strategic focus on food contact-grade material and bottle-to-bottle reuse in packaging.

KEY ATTRIBUTES

Commercial Plastics Co. Ltd. (CPC) was established in 2016. Its facility uses a specialised PET washing and recycling line supplied by Sorema of Italy, which includes pre-washing, de-labelling and wet separation stages tailored to the region's typical bottle feedstock, which often contains complex contamination such as PVC labels and sand.

With capital from a USD 12.6 million investment led by Delta Capital Myanmar and Daiwa PI Partners, CPC has positioned itself to be the first recycler in Myanmar capable of producing food-grade rPET. This enables the company to supply verified food contact material to domestic and export bottle converters and beverage manufacturers.

The configuration of the plant enables production of PET flakes that can be reintegrated at high percentages into new bottle production. It has been specified to **produce approximately 2,200 kg of PET flakes per hour of operation** under typical conditions.

ACHIEVEMENTS

Achievements of the initiative include successful commissioning of the Sorema line with a substantial output capacity and the production of rPET that major brand owners regard as suitable for direct reuse in packaging.

CPC aims to collect and recycle a significant portion of Myanmar's PET bottles, with projections of meaningful carbon emission reductions through displacement of virgin resin.



FURTHER INFORMATION

https://myanmarwaterportal.com/news/latest-news/plastic-recycler-gets-funding-as-pollution-awareness-rises

www.recyclingtoday.com/news/commercial-plastics-co-starts-up-sorema-line-to-recycle-pet-bottles

STAKEHOLDERS

These include the company and its investors, such as Delta Capital Myanmar and Daiwa PI Partners, local collectors and aggregators who supply PET bottles, and end users of rPET flakes, including packaging and beverage manufacturers.

PHILIPPINES: PRECIOUS PLASTICS PHILIPPINES

Precious Plastics Philippines is a decentralised, community-based recycling initiative that transforms plastic waste into new products while building local skills, enterprises and circular economy awareness.

KEY ATTRIBUTES

The initiative adapts the global open-source Precious Plastics model to the Philippine context by promoting small-scale, locally operated recycling hubs. These hubs are equipped with modular machinery such as shredders, extruders and injection moulders capable of processing roughly 100–150 kilograms of plastic per day.

Rather than relying solely on large centralised facilities, the model distributes capacity across communities, reducing transport distances and improving access to recycling infrastructure.

A strong emphasis is placed on training and capacity building: local partners receive technical instruction not only in machine operation, but also in product design, safety, quality control and basic enterprise management. The initiative also promotes transparency through digital tracking tools that record volumes collected and processed, helping to strengthen accountability within emerging recycling value chains.

ACHIEVEMENTS

Since its establishment, Precious Plastics Philippines has supported the deployment of more than 300 recycling machines nationwide, contributing to the growth of dozens of collaborative workspaces in cities including Manila, Davao and Cagayan de Oro.

Individual hubs are capable of diverting several tonnes of plastic annually, depending on feedstock supply and operating frequency. Data from early 2024 indicate that approximately 8,000 kilograms of plastic were logged in a single month through its tracking system, with a significant proportion reprocessed into usable material.

The initiative has also positioned participating hubs to generate revenue through the Philippines' Extended Producer Responsibility framework, where verified recycling can attract payments of around PHP 8 per kilogram, strengthening financial sustainability.



STAKEHOLDERS

The network operates through partnerships with local government units, community groups, schools, non-governmental organisations and private companies seeking compliant recycling channels.

Entrepreneurs and informal sector collectors play an important role in feedstock supply, while brands and producers engage through EPR-linked mechanisms. This multi-actor structure enables technical innovation, livelihood creation and policy alignment to reinforce one another.

https://www.switch-asia.eu/site/assets/files/4051/precious_plastics_philippines.pdf

SINGAPORE: DIGITISED TRADE & PERMITTING

Singapore has digitised trade and environmental permitting through **TradeNet** and the **National Environment Agency (NEA) Licensing System**, creating a single, efficient process for both customs clearance and regulatory compliance.

TradeNet enables traders to submit import, export and transhipment declarations **once**, with the information automatically routed to all relevant government agencies.

This "single window" approach has substantially reduced administrative burden, cutting processing times to around **10 minutes** and lowering documentation costs.

TRADENET (NATIONAL SINGLE WINDOW)

- **Overview**: Introduced in 1989, TradeNet is widely recognised as the first nationwide electronic single-window system for trade declarations.
- **Purpose**: Supports one-time submission of trade declarations across multiple agencies.
- **Performance gains**: Faster approvals and reduced paperwork-related costs.
- **System links**: Connects with wider digital trade infrastructure, including the Networked Trade Platform (NTP), enabling re-use of submitted data.

KEY OUTCOMES

- An average of 30% reduction in approval times for plastic waste imports, easy traceability, and no cases of illegal shipments detected since 2020
- 100% paperless digital declaration system
- Risk-profiling system
- Real-time data connectivity between Customs and the NEA
- Lower compliance costs through reduced manual submissions
- Improved transparency via a traceable digital audit trail

NEA LICENSING SYSTEM

- **Role**: Provides the environmental licensing component within Singapore's trade framework.
- **Coverage**: Regulates controlled goods such as hazardous substances, including import/export controls and related environmental safety requirements.
- **TradeNet interface**: Where goods fall under NEA oversight (e.g., via CCMD controls), TradeNet permit applications must include correct regulatory codes and required details such as allowable quantities.

FURTHER INFORMATION

https://www.customs.gov.sg/doing-business/import-operations/import-procedures/importing-goods-for-destruction-or-recycling/

https:/hscodechecker.gobusiness.gov.sg/

THAILAND: RAYONG LESS WASTE PROJECT

The Rayong Less Waste Project is a public-private partnership launched in Rayong Province to improve waste management and reduce plastic pollution through community engagement, education and circular economy principles. It builds on a pilot started in 2019 and has since expanded to cover dozens of municipalities across the province.

KEY ATTRIBUTES

The project focuses on strengthening local capacity for waste sorting, collection and recycling, encouraging households, schools and local groups to participate in source separation and engage with recyclers to improve the quality and quantity of materials recovered. It supports national plastic waste reduction and recycling targets and aims to increase the amount of plastic diverted from landfills by fostering better waste literacy and sustainable behaviours among citizens and officials alike. With participation from government bodies, industry associations and international partners, Rayong Less Waste aims to create jobs, enhance livelihoods and demonstrate a scalable model for community-based circular waste management in Thailand.

KEY ACHIEVEMENTS

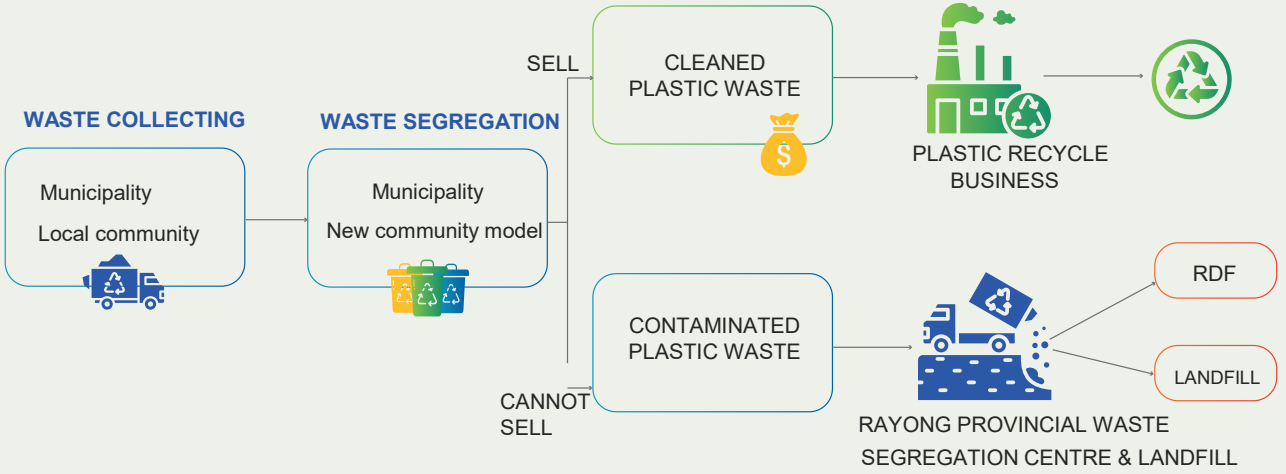
Province-wide community recycling network across most Rayong municipalities, linking schools, households, temples and local authorities.
Practical circular economy: single-use plastics collected via plastics banks/institutions and converted into recycled products and income.
Demonstrated results: ~3,000 tonnes of plastic diverted, livelihoods supported, and notable greenhouse gas reductions.

KEY STAKEHOLDERS

Federation of Thai Industries, coordinating industrial engagement and project rollout.

PPP Plastics (Public–Private Partnership for Sustainable Plastics & Waste Management) is a national coalition including government ministries, industry associations, NGOs, and businesses

Technical Partners: Including Thailand Institute of Scientific and Technological Research, Bangkok Metropolitan Administration for urban implementation, and SCG Chemicals, Dow Thailand and Insee Ecocycle among private sector contributors. Local community, temples & local institutions.



FURTHER INFORMATION

https://www.tei.or.th/en/environment_news_detail.php?eid=2461

VIET NAM: PLASTIC-FREE HA LONG BAY INITIATIVE

The Plastic-Free Ha Long Bay Initiative is a flagship environmental programme in Quang Ninh province, Viet Nam, targeting plastic pollution at the UNESCO World Heritage Site of Ha Long Bay. Launched in 2019, the scheme prohibits the use of single-use plastic products in tourism and related service activities across the bay, requiring operators and visitors to replace plastic bags, bottles, straws and disposable food containers with alternatives such as glass, paper or biodegradable materials. This initiative demonstrates how strong policy, collaborative enforcement, and community awareness can transform tourism practices.



KEY ATTRIBUTES

The initiative is enforced through awareness campaigns, signage at ports and attractions, commitments from businesses and households operating boats and services, and strengthened communications urging tourists not to bring single-use plastics on cruises.

Early results show a significant behavioural shift: the programme has reduced single-use plastic waste at key tourism sites by around 90 % and cut the use of expanded polystyrene buoys in floating structures by roughly 94 %.

By integrating community engagement with regulatory measures, the initiative forms part of broader efforts to protect the bay's marine ecosystems and promote sustainable, low-impact tourism.

ROBUST ENFORCEMENT

Infractions are taken seriously. In May 2025, a cruise ship was suspended from operating for a week for allowing single-use plastic bottles onboard.

https://news.tuoitre.vn/cruise-ship-suspended-in-ha-long-bay-for-allowing-use-of-single-use-plastic-bottles-10325052312100633 2.htm?utm

KEY STAKEHOLDERS

Bay management board, local authorities, tourism sector, United Nations Development Programme, NGOs, academic partners and local communities.

FURTHER INFORMATION

www.oneplanetnetwork.org/knowledge-centre/projects/halong-bay-eliminating-single-use-plastics?utm

APPENDIX C: POLICIES & LEGISLATION IN ASEAN MEMBER STATES



ASEAN MEMBER STATES

The **Association of Southeast Asian Nations (ASEAN)** is a regional intergovernmental organisation founded in 1967, in Bangkok, Thailand. Its primary purpose is to promote economic growth, cultural exchange, peace and stability among its member countries in Southeast Asia. There are currently 11 ASEAN Member States (AMS), with a collective population of over 700 million people. It is home to some of the world's fastest-growing economies and is considered the world's fifth-largest economy.

Research for this Guidebook was completed before 26 October 2025, when Timor-Leste formally joined ASEAN. Consequently, this Guidebook does not include Timor-Leste–specific member state information. However, the background information, risk management approaches, technical context and practical guidance remain relevant to all ASEAN Member States, including Timor-Leste.

MEMBER STATE	ISO 3-DIGIT CODE	FLAG
Brunei Darussalam	BRN	
Cambodia	KHM	
Indonesia	IDN	
Lao, People's Democratic Republic	LAO	
Malaysia	MYS	
Myanmar	MMR	
Philippines	PHL	
Singapore	SGP	
Thailand	THA	
Timor-Leste	TLS	
Viet Nam	VNM	

ASEAN countries face a complex array of challenges in waste management, driven by rapid urbanisation, economic growth, and rising consumption. Many lack sufficient infrastructure for waste collection, sorting and processing.

More than half of the waste generated in the region is uncollected, and less than a quarter is recycled. Limited landfill space and reliance on open dumping or burning are common, leading to environmental pollution and harm to human and ecosystem health.

AMS RESPONSIBLE MINISTRIES

Country	Key Responsible Ministries	Licensing Authority	Port Inspection Authority	Environmental Permits	Recycling Facility Standards	Data Reporting
Brunei Darussalam	Environment Dept., Customs, Trade	Trade / Environment	Customs & Port Authority	Environment Dept.	Environment Dept.	Environment Ministry
Cambodia	Environment, Commerce, Customs	Ministry of Commerce	Customs & Excise	Ministry of Environment	Environment Ministry	Environment Ministry
Indonesia	Environment & Forestry, Trade, Industry, Customs	Ministry of Trade	Customs	Ministry of Environment & Forestry	Ministry of Industry / Environment	Environment Ministry
Lao PDR	Natural Resources & Environment, Industry & Commerce, Customs	Industry & Commerce	Customs	Ministry of Natural Resources & Environment	Industry / Environment	Environment Ministry
Malaysia	Environment, Investment Trade & Industry, Customs	Ministry of Investment, Trade & Industry	Customs	Department of Environment	Department of Environment	DOE / Statistics
Myanmar	Natural Resources & Environmental Conservation, Commerce, Customs	Ministry of Commerce	Customs	Natural Resources & Environmental Conservation	Natural Resources & Environmental Conservation	Environment Ministry
Philippines	Environment & Natural Resources, Trade & Industry, Customs	Trade & Industry	Bureau of Customs	Environment & Natural Resource	Environment & Natural Resource / Industry	Environment & Natural Resource
Singapore	Sustainability & Environment, Customs, Trade	National Environment Agency	Singapore Customs	National Environment Agency	National Environment Agency	National Environment Agency
Thailand	Natural Resources & Environment, Industry, Commerce, Customs	Ministry of Commerce	Customs Department	Ministry of Natural Resources & Environment	Ministry of Industry	Pollution Control Dept.
Viet Nam	Natural Resources & Environment, Industry & Trade, Customs	Ministry of Industry & Trade	Customs	Natural Resources & Environment	Natural Resources & Environment / Industry	Natural Resources & Environment

AMS PLASTIC WASTE LEGISLATION & GUIDANCE

	Collecting	Sorting	Recycling	Trading	Ban
Brunei Darussalam					
Cambodia	● ●	● ●	●	●	● ●
Indonesia	●	●	●	●	●
Lao PDR	● ●	● ●	●	● ●	●
Myanmar	●	●	● ●	●	●
Malaysia	● ●	●	●	●	●
Philippines	● ●	● ●	●	●	● ●
Singapore	●	●		● ●	
Thailand	● ●	● ●	● ●	●	●
Viet Nam	●	●	●	● ●	

● National Law/Regulation ● National Guideline/Standard

AMS GOVERNMENT PUBLICATIONS CONTROLLING WASTE

AMS	KEY POLICIES / INITIATIVES	MAIN FEATURES
BRN	Environmental Protection and Management Act, Chapter 240	An Act to provide for the protection and management of the environment and for other purposes connected therewith.
KHM	Environmental Protection Law; AMUSE Project participation	Licensing and permits for waste disposal; community involvement; capacity building via ASEAN Municipal Solid Waste Management Enhancement (AMUSE) project.
IDN	Law No. 18/2008 on Waste Management; National Action Plans on Marine Debris	Multi-level enforcement; local government sanctions; focus on reducing marine plastic debris; producer responsibility emerging.
LAO	Environmental Protection Law; AMUSE Project	Waste management under Ministry of Natural Resources; infrastructure development; improving compliance monitoring with international support.
MYS	Environmental Quality Act; Solid Waste and Public Cleansing Act; Recent legal reforms	Licensing of waste handlers; increased penalties for violations; focus on illegal dumping and waste trafficking; promotion of 3R (Reduce, Reuse, Recycle).
MMR	Environmental Conservation Law	Permitting and penalties for waste violations; enforcement challenges due to political instability and limited resources.
PHL	Ecological Solid Waste Management Act (RA 9003); EPR Act (RA 11898)	Local government-led enforcement; Extended Producer Responsibility (EPR) for plastic packaging; active public interest litigation; waste segregation and recycling programs.
SGP	Environmental Protection and Management Act; Zero Waste Masterplan	Strict licensing and enforcement; advanced waste treatment and recycling; focus on e-waste and public education campaigns.
THA	Enhancement and Conservation of National Environmental Quality Act (NEQA); Digital waste reporting (iSingle Form); Roadmap on Plastic Waste Management	Mandatory Environmental Impact Assessments (EIA); Polluter Pays Principle; digital monitoring system; phased single-use plastic phase-out; EPR development.
VNM	Law on Environmental Protection (2014); Specialized Environmental Police	Licensing and registration of hazardous waste; centralized oversight; enforcement by environmental police; focus on combating illegal waste trafficking.

AMS ENFORCEMENT OF ENVIRONMENTAL LAWS

Environmental laws in ASEAN Member States are enforced through a combination of national legal frameworks, regional co-operation mechanisms, and emerging rights-based approaches. Whilst each AMS has enacted environmental laws regulating issues such as pollution, waste management and natural resource use, enforcement effectiveness varies widely across the region.

Enforcement of environmental and waste management laws is important because it ensures that the intended benefits of these laws—protecting the environment, public health and promoting sustainable development—are realised.

AMS	ENVIRONMENTAL & WASTE ENFORCEMENT MECHANISMS	KEY CHALLENGES
BRN	Environmental Protection and Management Act, Chapter 240 enforced by Department of Environment, Parks and Recreation, include waste management regulations and pollution controls.	Small administrative capacity and need for stronger monitoring.
KHM	Environmental Protection Law enforced by Ministry of Environment; licensing and permits for waste disposal; community-based monitoring.	Weak institutional capacity; limited resources for enforcement; informal sector involvement.
IDN	Multi-agency enforcement involving Ministry of Environment, local governments, police, prosecutors; administrative sanctions, fines, and imprisonment under Law No. 32/2009 and Waste Law No. 18/2008.	Overlapping authority; political influence; incomplete sanction regimes especially for producers; resource constraints.
LAO	Ministry of Natural Resources and Environment oversees pollution control and waste management; supported by World Bank projects for capacity building.	Limited enforcement capacity; lack of infrastructure; need for improved monitoring and compliance systems.
MYS	Department of Environment enforces Environmental Quality Act and Solid Waste Act; recent legal reforms introduce higher fines and longer imprisonment; licensing of waste handlers.	Weak implementation; enforcement uncertainty; illegal dumping and waste trafficking persist.
MMR	Environmental Conservation Law enforced by Ministry of Environmental Conservation and Forestry; permits and penalties for waste violations.	Political instability affecting enforcement; limited resources and technical expertise.
PHL	Environmental Law Enforcement and Protection Service (ELEPS) consolidates enforcement; local government units (LGUs) actively monitor waste management; strong public interest litigation.	Variable local enforcement capacity; challenges in coordination; informal sector integration.
SGP	National Environment Agency (NEA) enforces strict waste management laws including licensing, inspections, and heavy penalties; advanced monitoring systems.	High compliance but challenges in managing e-waste.
THA	Ministry of Natural Resources and Environment enforces NEQA; digital reporting system (iSingle Form) for waste data; increasing use of environmental litigation.	Compliance gaps; weak follow-up on EIAs; nearly half of factories non-compliant in reporting.
VNM	Specialized Environmental Police under Ministry of Public Security; Ministry of Natural Resources and Environment oversees licensing and hazardous waste management.	Enforcement gaps; legal inadequacies; coordination challenges; illegal waste trafficking issues.

AMS RATIFICATION OF THE BASEL CONVENTION

COUNTRY	BASEL CONVENTION STATUS	NOTES ON PARTICIPATION AND IMPLEMENTATION
Brunei Darussalam	Party since 16 Dec 2002	Active participant in regional enforcement networks; engages in cooperation to prevent illegal waste trafficking.
Cambodia	Party since 2 Mar 2001	Member of the Asian Network for Prevention of Illegal Transboundary Movement of Wastes; improving waste management capacity.
Indonesia	Party since 20 Sep 1993	Strong enforcement framework; active in regional cooperation; ratified Ban Amendment to control hazardous waste exports.
Lao PDR	Party since 21 Sep 2010	Participates in regional initiatives; working on capacity building and compliance monitoring with international support.
Malaysia	Party since 8 Oct 1993	Ratified Ban Amendment; enhanced legal framework to combat illegal waste trafficking; active in ASEAN regional networks.
Myanmar	Party 6 Jan 2015	Engaged in regional cooperation; enforcement affected by political challenges and resource limitations.
Philippines	Party since 21 Oct 1993	Active in enforcement and regional cooperation; integrates Basel Convention provisions into national waste laws.
Singapore	Party since 2 Jan 1996	Implements strict controls on hazardous and plastic waste shipments; participates in regional enforcement networks.
Thailand	Party since 24 Nov 1997	Uses digital systems for waste tracking; part of Asian Network; ratified Ban Amendment; strong regional cooperation.
Viet Nam	Party since 13 Mar 1995	Specialized environmental police enforce Basel rules; active in combating illegal waste trafficking regionally.

AMS DEFINITION OF WASTE

ASEAN Member State	Definition of Waste	Legislative Instrument	Reference
Brunei Darussalam	“Waste means a substance or object that is proposed to be disposed of; disposed of; or required by any written law to be disposed of."	Environmental Protection and Management Act, Chapter 240	EPMA Brunei Darussalam
Cambodia	"Waste means any substance or object which the holder discards or intends or is required to discard."	Law on Environmental Protection and Natural Resource Management, 1996	NEC Cambodia
Indonesia	"Waste is residual materials arising from daily activities that are solid and semi-solid in nature and considered useless and will be discarded."	Law No. 18/2008 on Waste Management	Indonesia Waste Law
Lao PDR	"Waste means any substance or object which is disposed of or intended to be disposed of."	Decree on Waste Management, No. 315/PM, 2010	Lao Decree PDF
Malaysia	"Waste means any matter whether solid, liquid or gas which is discharged, emitted or deposited in the environment in such volume, constituency or manner as to cause pollution or harm to the environment."	Environmental Quality Act 1974, amended 2019	DOE Malaysia
Myanmar	"Waste means any substance or object which the holder discards or intends or is required to discard."	Environmental Conservation Law, 2012	Myanmar Environmental Conservation Law
Philippines	"Waste means any garbage, refuse, or other discarded solid materials resulting from industrial, commercial, mining, agricultural operations, and domestic activities."	Republic Act No. 9003 - Ecological Solid Waste Management Act of 2000	Official Gazette Philippines
Singapore	"Waste means a substance or object that is (a) proposed to be disposed of; (b) disposed of; or (c) required by any written law to be disposed of."	Hazardous Waste (Control of Export, Import and Transit) Act 1997	Singapore EPA
Thailand	"Waste means any substance in solid, liquid, or gas form resulting from human activities which is disposed of or intended to be disposed of."	Hazardous Substance Act, B.E. 2535 (1992)	Thailand Hazardous Substance Act
Viet Nam	"Waste means any solid, liquid, gaseous, or radioactive substances regarded as discarded or intended to be discarded."	Law on Environmental Protection No. 55/2014/QH13	Viet Nam Law

AMS TYPICAL WASTE COLLECTION CONTAINERS

COUNTRY	URBAN	RURAL
Brunei Darussalam	Households and public spaces typically use wheelie bins and large communal containers for kerbside collection, which are emptied regularly by licensed waste collectors.	Smaller bins or designated collection points at central locations. Waste is periodically transported to transfer stations or landfills.
Cambodia	Waste mainly stored in plastic bags. Left at kerbside for collection by contracted companies. Communal bins exist but often overfilled or absent.	Sacks, baskets, or open piles. Burning/dumping still dominant.
Indonesia	Waste usually stored in plastic bags or buckets. Transferred to communal carts (gerobak) or large bins for onward collection by trucks. Wealthier neighbourhoods may have plastic wheelie bins.	Woven polypropylene bags (rice sacks) or baskets. Collection often irregular; backyard burning is widespread.
Lao PDR	Limited formal bin provision. Households use plastic bags or sacks, left on kerbside or in communal piles.	Sacks, baskets, or burning. Collection coverage is low outside cities.
Malaysia	Plastic bags placed outside homes. Some areas have individual plastic bins (120–240 litre wheelie bins) provided by local councils. Recycling bins (blue, green, orange) provided in public areas.	Sacks, open piles, or makeshift containers.
Myanmar	Waste usually in plastic bags. Transferred to communal skips or metal bins placed at neighbourhood points.	Rice sacks, baskets, or open dumping. Rural areas often rely on burning.
Philippines	Households commonly use plastic bags (often colour-coded for biodegradable vs non-biodegradable where local law enforces segregation). Collected at kerbside by barangay (local authority) collection crews. Communal bins are less common; direct handover to trucks or carts is usual.	Waste placed in sacks, baskets, or boxes. Burning or backyard burial is still frequent.
Singapore	Public housing: Waste goes via chutes directly into central bins/compactors. Recyclables: collected in blue bins provided in each block. Private housing: 120–240 litre wheelie bins issued per household for general waste. Recyclables go in separate blue bins.	
Thailand	Households mainly use plastic bags (shopping bags, black bags). Brought to communal roadside bins or left on kerbside for collection trucks. Some municipalities provide green or blue plastic bins for organics/recyclables, but uptake is patchy.	Rice sacks or baskets are common. Often open dumping or burning still occurs.
Viet Nam	Plastic bags are left at communal collection points or handed directly to collectors. Some metal communal bins on wheels are still in use. Pilot programmes for separate collection (e.g. organics vs recyclables) exist but are not widespread.	Sacks, buckets, or baskets. Informal waste burning/dumping is common.

AMS PLASTIC WASTE IMPORT STATUS (FROM ANY COUNTRY)

ASEAN country	ALLOWS B3011? (Non-Hazardous & Easily Recyclable)	ALLOWS Y48? (Other Mixed/ Unsorted Waste)	ALLOWS A3210? (Restricted/Hazardous Plastic Waste)	Overall stance
Brunei Darussalam	✔ With PIC	✘	✘	Moderate restrictions
Cambodia	✘	✘	✘	Full ban
Indonesia	✘	✘	✘	Full ban
Lao PDR	✘	✘	✘	Full ban
Malaysia	✔ Limited	✘	✘	Tight, licensed
Myanmar	✘	✘	✘	Full ban
Philippines	✔ With PIC	✘	✘	Regulated
Singapore	✔ With permit	✔ Strict PIC	✔ Strict PIC	High-compliance
Thailand	✔ Limited	✘	✘	Transitioning to full ban
Viet Nam	✔ Limited	✘	✘	Tight, controlled

AMS INSPECTION SUMMARY

Criterion type	Used by which ASEAN MS	Notes
Automatic inspection of all plastic waste	Cambodia, Indonesia, Malaysia, Philippines, Thailand, Viet Nam	Driven by post-2018 import controls.
Complete import bans leading to automatic red-channel routing	Brunei Darussalam, Lao PDR, Myanmar (for plastic waste)	Any declared scrap triggers total inspection.
Mandatory pre-shipment inspection	Indonesia, occasionally Viet Nam (depending on importer)	PSI certificates checked against container content.
Quota/licence-based triggers	Indonesia, Malaysia, Viet Nam, Thailand	Used to detect over-quota or unverified facilities.
Exporter-risk criteria	All MS, especially Malaysia, Indonesia, Viet Nam, Thailand	Based on intelligence on mis-declared waste.
Material-risk triggers	All MS	Mixed plastics, films, post-consumer bales consistently flagged.
Document anomalies	All MS	Incorrect HS codes, seal mismatches, unusual manifests.

AMS SPECIFIC DOCUMENTATION REQUIRED BY CUSTOMS

Country	Core transport & commercial docs customs will check	Waste-specific / regulator documents customs expect to see	Notes / practical points & source
Brunei Darussalam	Invoice, BL/AWB, customs import declaration, HS code.	Registration as recyclers and exporter/importer of hazardous waste under Department of Environment, Parks and Recreation. Import and Export permit issued by DEPR. Technical and verification report of plastic waste to ensure cleanliness and homogeneity.	Brunei Darussalam requires recyclers to be registered; environmental/permit checks at customs for plastic scrap imports.
Cambodia	Invoice, BL/AWB, customs entry paperwork, tariff classification.	Approval from Ministry of Environment and Ministry of Trade (imports restricted); documentation proving the waste is non-hazardous, intended end-use, and any Ministry recommendations for import permit.	Cambodian law restricts import of hazardous wastes; importing plastic waste typically requires approvals from relevant ministries.
Indonesia	Commercial invoice, BL/AWB, import declaration, correct HS classification.	National import permit / environmental permit where applicable; proof of recyclability/cleanliness, supplier/exporter details, any Ministry of Environment or trade approvals required (depends on waste class).	Indonesia's rules emphasise correct classification and technical criteria (homogeneity, no hazardous contaminants); national laws and guidance set permit/approval processes.
Lao PDR	Invoice, BL/AWB, customs import declaration.	**Import certificate** for plastic waste to be submitted by recycling operator; evidence plastic is clean and recyclable (e.g. sheets/bags/bars) and meets national NPAP / technical guidance; permits from competent agencies.	Lao technical guidance requires operators to submit import certificate at border and only allows clean, recyclable plastic types.
Malaysia	Invoice, packing list, BL/AWB, customs declaration, HS/tariff code confirmation.	**Certificate of Approval (CoA)** / SIRIM requirements (recently tightened): Manufacturing licence or ICA10 confirmation, MISW licence, pre-shipment inspection reports, bank guarantee and supporting technical evidence (cleanliness, polymer type).	Malaysia introduced stricter CoA + SIRIM import controls for plastic scrap; customs will verify CoA and supporting documents.

AMS SPECIFIC DOCUMENTATION REQUIRED BY CUSTOMS

Country	Core transport & commercial docs customs will check	Waste-specific / regulator documents customs expect to see	Notes / practical points & source
Myanmar	Invoice, BL/AWB, customs declaration (but practices variable).	Official policy varies — some sources indicate strict prohibitions or limited allowance only for clean homogenous scrap used as raw material; where allowed, environmental approval and technical evidence required.	Myanmar's regulatory situation is mixed: recent guidance shows imports of waste are generally heavily restricted or prohibited except under strict conditions; customs will insist on environmental approvals.
Philippines	Invoice, packing list, BL/AWB, customs declaration, HS code.	Import licence issued by Ministry of Commerce (MOC) upon recommendation from environment authority (ECD/MONREC); technical requirements on allowed types, pre-shipment inspection and declaration of end-use.	Philippines publishes AMS administrative/technical requirements; MOC/ECD recommendation needed for import licences for allowable plastic scrap.
Singapore	Commercial invoice, packing list, Bill of Lading / AWB, customs import declaration (TradeNet submission).	**Basel permit / TradeNet permit** for waste controlled under Basel; movement/notification forms where required; evidence of material composition (polymer type, contamination level); contract between exporter/importer; bank guarantee when required.	Singapore requires TradeNet declarations, Cargo Clearance Permit (CCP), and a Basel permit prior to import of controlled wastes; technical guidance and TradeNet rules published by NEA.
Thailand	Invoice, BL/AWB, customs entry paperwork.	**(From Jan 2025) Import ban** on plastic waste — customs will check and detain shipments; if any import allowed (e.g. specific exemptions) the importer must hold the stated national permits.	Thailand implemented a ban on plastic-waste imports (effective Jan 2025); customs action is to verify and refuse/return shipments.
Viet Nam	Commercial invoice, BL/AWB, customs import declaration, HS code.	National technical regulations (e.g. QCVN) requiring washed/clean, shredded/crushed, defined permitted HS lines; import permit / environmental approval for plastic scrap meeting QCVN32/2018 criteria.	Vietnam's national technical regulation (QCVN) defines allowed plastic scrap criteria (washed, not dirty, specified HS lines). Customs check conformity with QCVN and permit.

AMS FOOD CONTACT MATERIAL REGULATION

AMS	Food-Contact Framework	Controls on Recycled Plastics	Migration / Safety Testing	Import & ESM-Related Controls
Brunei Darussalam	General food-safety law; limited specific FCM rules.	Case-by-case acceptance; recycled plastics must meet same safety standards as virgin materials.	Generally aligned with Codex/EU benchmarks if testing is required.	Environmental and waste-import controls apply, referencing Basel obligations.
Cambodia	General food-safety provisions; no dedicated FCM regulation.	Recyclate for food contact expected to come from clean, well-characterised inputs.	International standards referenced where applicable.	Import controls on plastic waste strengthened under Basel; ESM sorting expectations present.
Indonesia	National Agency of Drug and Food Control (BPOM) manages food-contact rules; SNI standards apply for plastics.	Recycled PET for food contact is allowed if meeting SNI and BPOM safety requirements.	Mandatory testing against SNI migration limits.	Strict controls on waste imports; facilities require licensing and ESM documentation.
Lao PDR	Food-safety legislation; limited FCM-specific standards.	Recycled plastics accepted only if proven safe; practice relies on reference to international standards.	Testing may be required to demonstrate compliance with Codex/EU limits.	Basel-aligned import controls govern recycled plastics and waste.
Malaysia	Malaysian Food Regulations include detailed FCM rules; Standards Malaysia develops MS standards.	Limited approval of recycled plastics for direct food contact; recycled PET permitted under strict conditions.	Migration tests required to MS or international standards.	Import controls include contamination thresholds and ESM compliance for recyclers.

AMS PLASTIC WASTE IMPORT STATUS (FROM ANY COUNTRY)

AMS	Food-Contact Framework	Controls on Recycled Plastics	Migration / Safety Testing	Import & ESM-Related Controls
Myanmar	General food-safety legislation; no detailed FCM rules.	Recycled plastics allowed only if meeting safety requirements; reliance on foreign standards.	Testing requirements applied case-by-case.	Basel-influenced waste-import restrictions; ESM-based inspection for plastic waste.
Philippines	Food and Drug Administration (FDA) issues FCM guidance and standards.	Recycled PET for food contact may be accepted with evidence of safety, including process validation.	Migration testing required for conformity.	Strict oversight of plastic-waste imports; ESM compliance expected for sorting and recycling.
Singapore	SFA has structured FCM guidelines; strong alignment with EU/US standards.	Recycled plastics accepted only with robust safety evidence; high reliance on EFSA/FDA benchmarks.	Migration testing to EU/FDA standards.	Tight import controls; ESM requirements tied to environmental licensing.
Thailand	Thai FDA provides detailed FCM regulations; TIS standards widely applied.	Recycled PET allowed for food contact if meeting TIS specifications and validated process controls.	Migration tests to Thai and international standards required.	Regulated waste imports; ESM licensing of recycling facilities.
Viet Nam	Food Safety Law and technical regulations apply to plastics.	Recycled plastics for food contact accepted with supporting technical documentation and testing.	Compliance with national or EU-aligned migration limits required.	Basel-compliant import restrictions; ESM criteria applied to plastic-waste recycling.

AMS NATIONAL STANDARDS BODIES

AMS	Standards Body	Website
BRN	National Standards Centre, Ministry of Finance and Economy	https://www.mofe.gov.bn/div_psabd_history/
KHM	Institute of Standards of Cambodia	http://www.isc.gov.kh/en
IDN	National Standardization Agency	http://www.bsn.or.id
LAO	Department of Intellectual Property, Standardization & Metrology	http://www.laotradeportal.gov.la/...
MYS	Department of Standards Malaysia / SIRIM Berhad	http://www.standardsmalaysia.gov.my
MMR	Myanmar Scientific and Technological Research Dept / National Standards & Quality Department	http://www.most.gov.mm
PHL	Bureau of Philippine Standards, Dept of Trade & Industry	http://www.bps.dti.gov.ph
SGP	Enterprise Singapore / formerly SPRING Singapore	https://www.enterprisesg.gov.sg
THA	Thai Industrial Standards Institute	https://www.tisi.go.th/asean
VNM	Directorate for Standards, Metrology and Quality	http://www.tcvn.gov.vn