Reduction of Unintentionally Produced Persistent Organic Pollutants (UPOPs) emissions by improving waste management practices at landfills

Source separation of waste

GEF Project ID: 5558 – Component 2 - Development and Implementation of a Sustainable Management Mechanism for POPs in the Caribbean

BCRC CARIBBEAN
Basel Convention Regional Centre for Training and Technology Transfer for the Caribbean

UN environment
United Nations Environment Programme

Resources & Waste Advisory Group

gef

STOCKHOLM CONVENTION

UNIDO

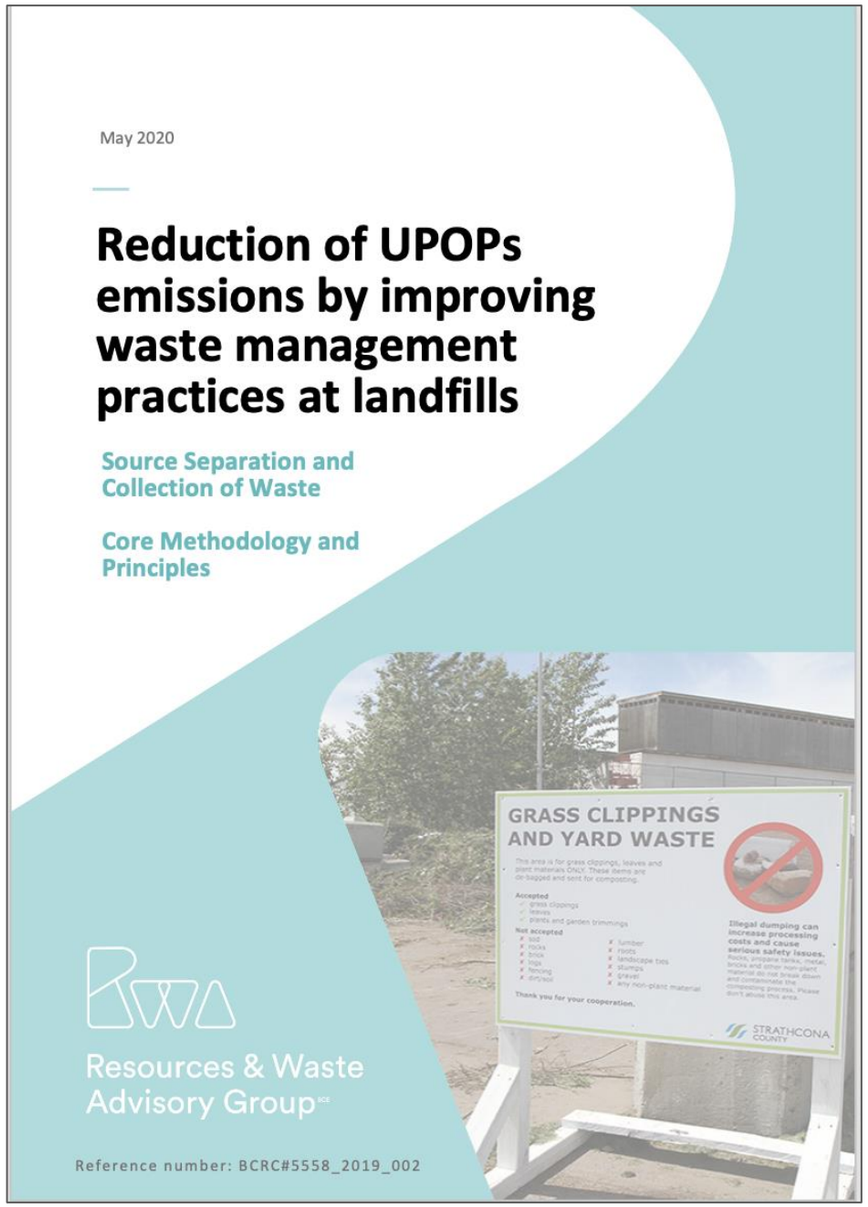
Source Separation of wastes - Core Methodology

Design principles for source segregation

Enabling environment

Resources & Waste Advisory Group

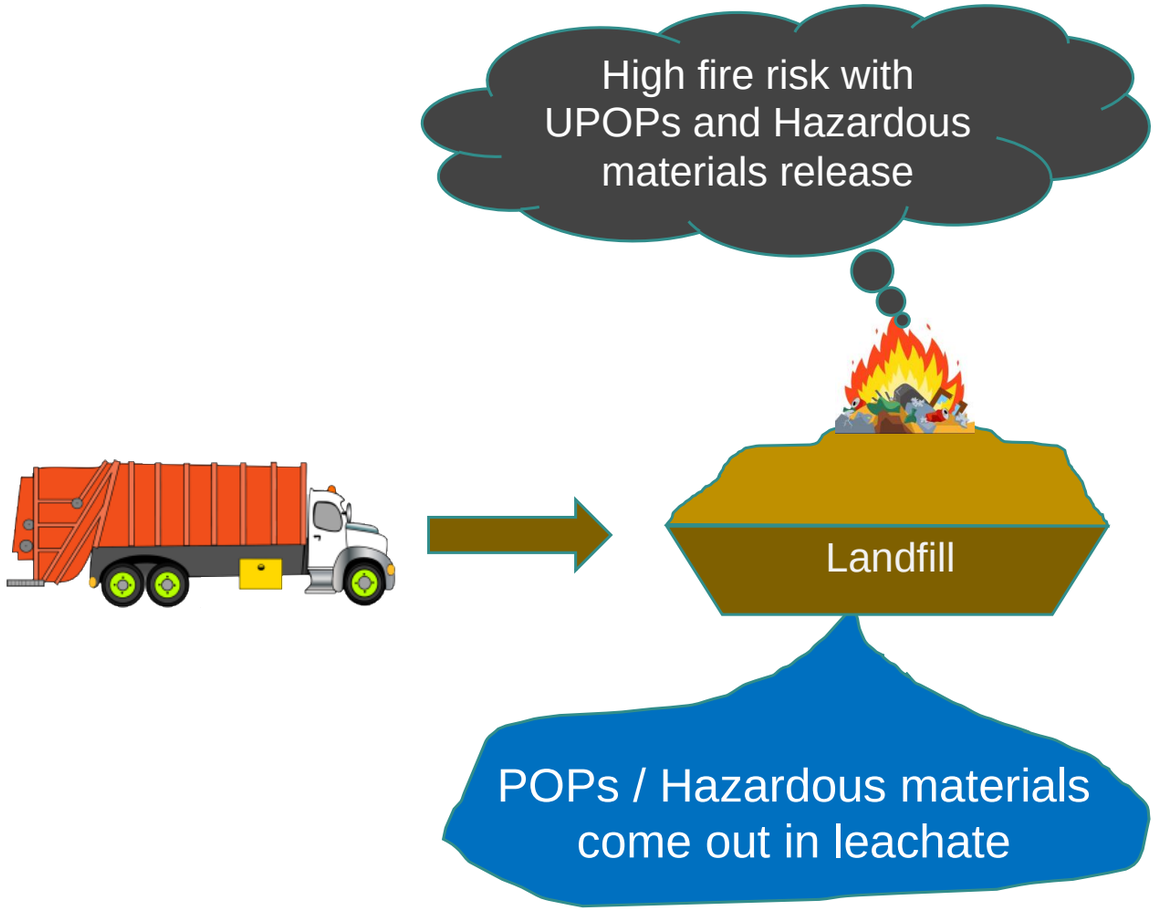
Report: Core Source Separation Methodology



Contents

Everything to landfill - what goes in, is what comes out!

- MSW
- ICI
- Green waste
- Hazardous
- WEEE
- Oils
- Chemicals
- Pesticide residues
- Medical



- Resources / material loss
- Challenging management due to quantities and types of wastes
- All material cross contaminated with hazardous substances
- High risk of POPs/UPOPs release to environment.
- Elevated toxicity of landfill emissions (gas and leachate)
- Short site life (more landfill space requiring development)
- Greater wear and tear on collection and landfill equipment
- High future liabilities

Separating the waste streams

- Each waste stream has different characteristics and End-of-Life management options
- Segregating waste streams into homogeneous fractions can dramatically increase ability to improve available management options.
- Costs and benefits exist with all segregation options.
- Three main segregation systems:

Decentralised

Segregation at source (before collection)

Distributed

Segregation at community level / transfer station / Point of Sale (mid-collection)

Centralised

Segregation at central treatment facility / Disposal Site (after collection and delivery)

A. Which waste should be priority to segregate?

Select your top three:

1. Mixed household and commercial waste
2. Food waste (including condemned food waste)
3. Green waste
4. Household hazardous waste
5. Tyres
6. Pesticides and chemicals
7. Waste Electrical and Electronic Equipment
8. Construction and Demolition waste
9. Waste oil
10. Other

Increased resilience, reduced landfill operational risks

- Recyclables
  - Packaging
  - Metals
  - Lumber
  - WEEE
  - Tyres
  - Oils

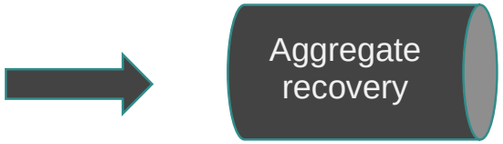
Material broker

- Material / resource recovery
- Reduced landfill space and management
- local job creation

- Green waste

- Resource / Nutrient recovery
- Reduced GHG emissions
- Saved landfill space and management
- Reduced reliance on imports
- local job creation

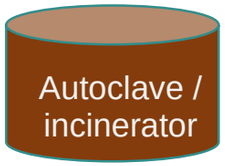
- Builders rubble



- Hazardous
  - WEEE
  - Chemicals
  - Pesticides

- Hazard containment
- Reduced cross contamination of other waste fractions.
- Reduced future liabilities

- Medical



- Reduced health risk
- Pathogen destruction

- Residual

- Less waste
- Easier management / reduced fire risk
- Less toxicity
- Extended site life
- Reduced future liabilities
- Reduced GHG and leachate emissions

Design principles for source separation and collection

1. Know your baseline - make evidence-based decisions, not trend-based decisions
2. Target the largest impactors first

B. Which waste impacts landfill operations the most?

1. Packaging
2. Food waste (including condemned food)
3. Green waste
4. Household hazardous waste
5. Tyres
6. Pesticides and chemicals
7. Waste Electrical and Electronic Equipment
8. Construction and Demolition waste
9. Medical waste
10. Other

Common guiding principles and concepts

Making the producer of waste responsible physically and/or financially for its **Environmentally Sound Management**

Manage waste as near as possible to its place of generation.

The three main guiding principles for source segregation waste management strategies.

Common guiding principles and concepts

The three main guiding principles for source segregation waste management strategies.

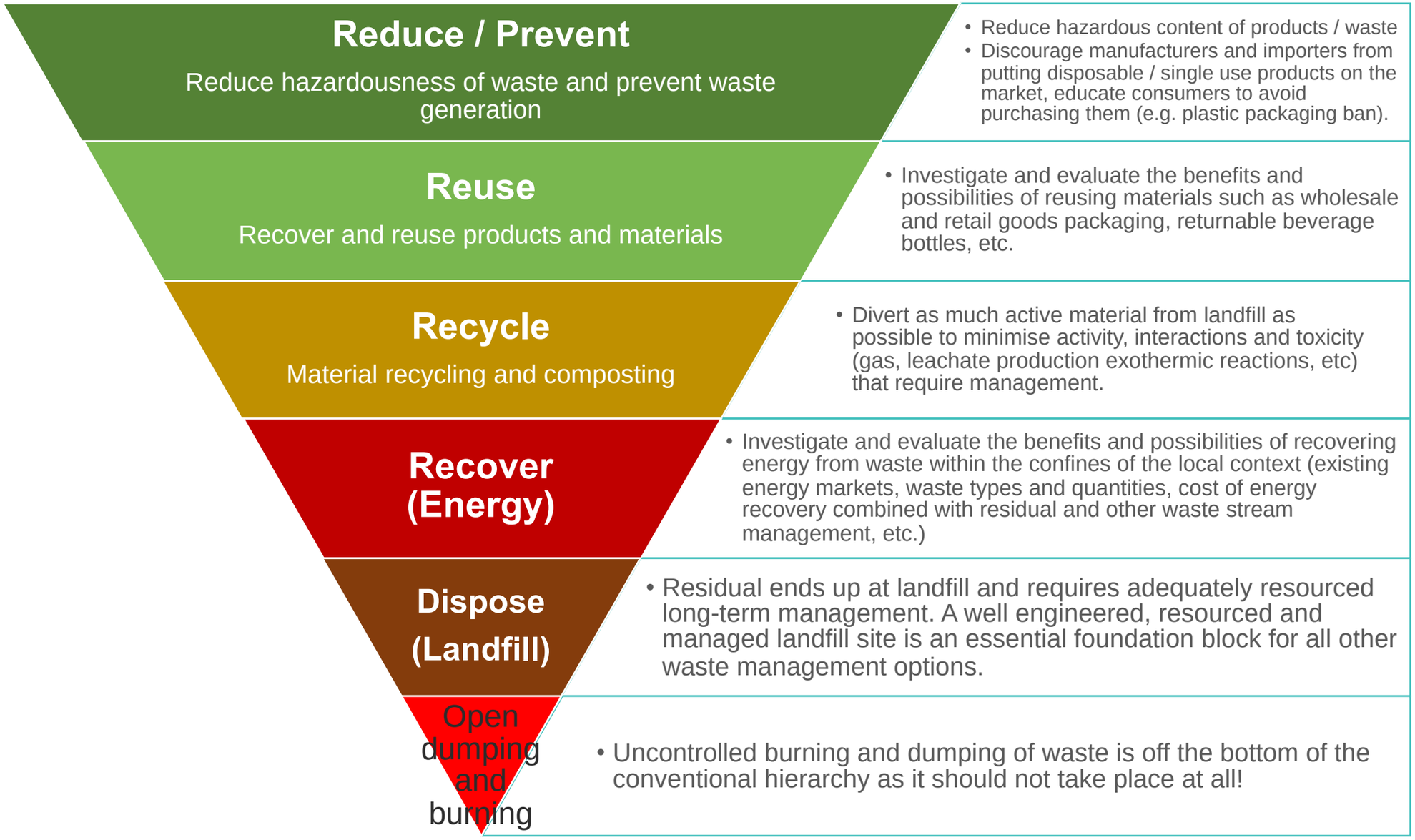
Precautionary Principle

Lack of scientific certainty should not be used as a reason for postponing cost-effective measures to prevent environmental degradation. When dealing with potentially hazardous waste, it must be assumed that waste is hazardous until proven to be safe. Where it is unknown what the hazard may be, it is important to separate it from other waste materials and take all the necessary precautions to protect human health and the environment.

Principle of cooperation and participation

Ensuring all stakeholders are invited to, are able to, and do cooperate and participate in initiatives to improve waste and resource management is essential to achieving cross sector buy-in and with full commitment and participation in implementing the management system.

Waste Management Hierarchy



Defining the purpose and scope (why do it?)

Common Source Separation Purpose / Goals	Typical source separation initiative target waste streams	
	Focus	Typical materials
Collecting cleaner, less contaminated waste fractions to enable effective and efficient processing of materials with minimum risk to health and environment	Remove small volume high toxicity / hazardous / health impacting wastes at source so remaining waste is not contaminated and can be recovered further down the waste service/value chain	• Hazardous Waste • Medical waste (hazardous and sharps) • Nappies/diapers • Glass
Optimising waste collection and /or treatment operations	Separate bulky wastes that don't compact well in collection vehicles and / or wet wastes that are heavy and corrode equipment; wastes that decompose fast/generate odours	• Green waste • Cardboard • Food • Containers with liquid waste
Facilitating producers to take responsibility for their waste production	Materials that can be readily managed under Extended Producer Responsibility legislation	• Beverage containers • Packaging • Tyres
Business strategy / directive and or Corporate Social Responsibility	Materials that help a business meet its sustainability/environmental goals, social responsibilities, or legal obligations as part of a mandated waste management plan	• Hazardous Waste • Recyclables (cardboard, plastics, metal) • Food and or Green waste • Tyres
Aligning to international environmental standards in waste management	Materials that assist compliance with international environmental conventions, initiatives and standards	• Plastics (reduce marine litter) • Hazardous (e.g. mercury, POPs/UPOPs producing) • Organics (reduce GHG emissions from landfill)

Several more included in report…

Waste streams, their impact potential and source separation treatment options

Waste Stream	Example waste products / Materials	Source (Point to target segregation)	Impact / cost of landfilling (reasons to separate)	Potential use / destination following source segregation
Food waste	• Kitchen food scraps – includes processed and unprocessed, cooked and uncooked food, vegetables, meat, dairy, fish, grains.	• Households • Institution canteens • Commercial kitchens - Restaurants & Hotels • Vegetable markets	• Greenhouse Gas production • Leachate production (acidic, leaching heavy metals and toxins from other wastes) • Odour production • Vermin/disease vector attraction	• Composting (centralised, community or home) • Nutrient upcycling - Animal feed – Black Soldier Fly Larvae (BSFL), vermicompost • Anaerobic digestion (Energy recovery)
	• Condemned food – Expired / out of date retail food	• Food Retailers - supermarkets		
Packaging - Postconsumer (Recyclable)	• Aluminium cans • Plastic Bottles (PET, HDPE) • Cardboard and Paper • Steel cans • Glass bottles • Plastic Film / Foils - LDPE • Rigid plastic pots, tubs, trays	• Households • Public / Street bins • Shopping / retail centres	• Wasted resource (material loss) • Consumes landfill void space. • Breakdown within landfill to release potentially toxic chemicals	• Clean Material Recovery Facility • Material Recycling • Promote reusable packaging • Target for product bans • Refuse Derived Fuels
	• Compostable Plastic (note that PLA - plant-based plastics – does not compost)	• Households • Public / Street bins • Shopping / retail centres	• Wasted resource (material loss) • Consumes landfill void space	• Cannot be recycled with PET and other conventional plastics and must be separated from PET • Industrial composting
Packaging – Commercial wholesale / retail (pre-consumer)	• Wooden Pallets • Cardboard • Plastic Film / Foil- LDPE • Plastic and Metal Barrels • IBC Containers	• Commercial retailers and wholesalers • Agricultural sector • Industries and manufacturers	• Wasted resource (material loss) • Consumes landfill void space • Many materials difficult to compact in compaction collection vehicles reducing collection efficiencies	• Recycling • Promote returnable / reusable packaging • Target for product bans • (Refuse Derived Fuels) • Repurpose (non-hazardous) containers (rainwater harvesting, waste containers, etc.)

Several More in report…

Schemes for collection of source separated waste

Collection Scheme	Description	Common Materials Collected	Common containers
Door-to-door collection systems	Adding an additional bag, special bag, bin, container to the existing household waste collection service to collect recyclable / compostable materials separately from mixed residual wastes. Two or more recyclable materials are commonly collected in the same container and subsequently sorted to homogenous materials at a clean Material Recovery Facility (MRF) – this requires additionally infrastructure, equipment and resources. A three-bin system is common – 1) Wet Waste (food and garden waste), 2) mixed Dry Recyclables, and 3) Residual (for disposal) – all three fractions require separate collection vehicle or compartments – commonly wet waste collected weekly (or more frequently) with dry recyclables and residual collected once every two weeks.	• Metal packaging • Plastic packaging • Paper • Glass packaging • Food • Green garden • Residual	 
	Regular kerbside collection services, provided by an organisation or private collector in partnership with the local authority – as above but operates independently from the residual waste collection service.		
	Dedicated waste stream collection, either on demand (call and collect) or as a regular (e.g. monthly or quarterly) service.	• Metal • Cardboard • Bulky goods – Furniture, large WEEE and White goods • Green garden	

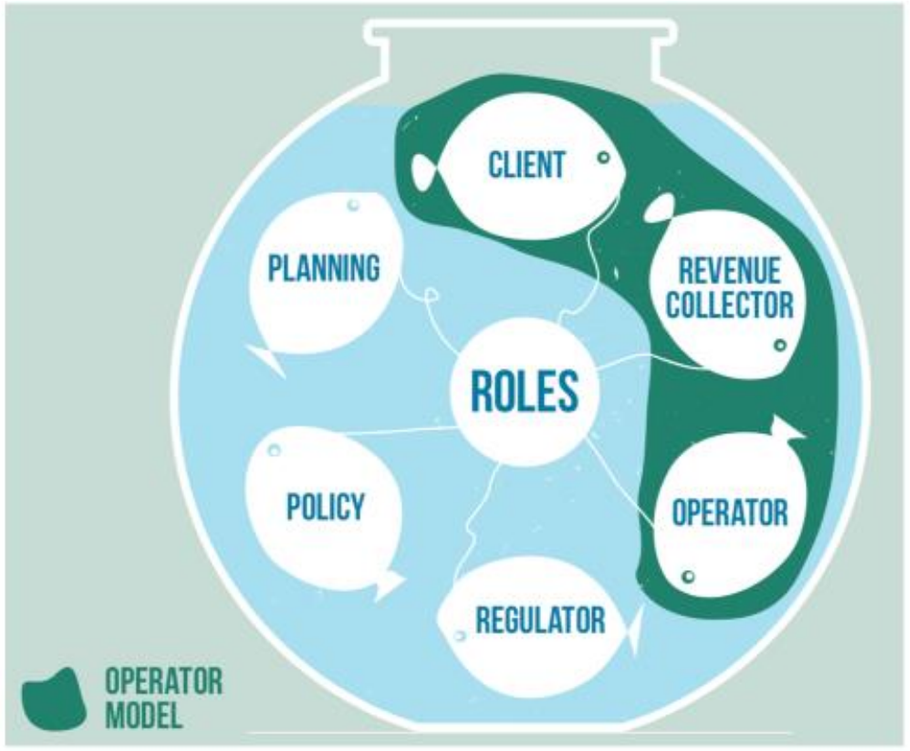
Several More in report…

Design principles for source separation and collection

1. Know your baseline - make evidence-based decisions, not trend-based decisions
2. Target the largest impactors first
3. **The right service delivery operator model is more important than the best technology**

Introduces Operator Models

An operator model defines and clarifies ownership, decision-making, responsibility, contracts and agreements, management, and money flows between the operator, client and revenue collector at the local level (GIZ 2015). The overall aim is to identify the right operational setup among key actors to provide services for the local community.



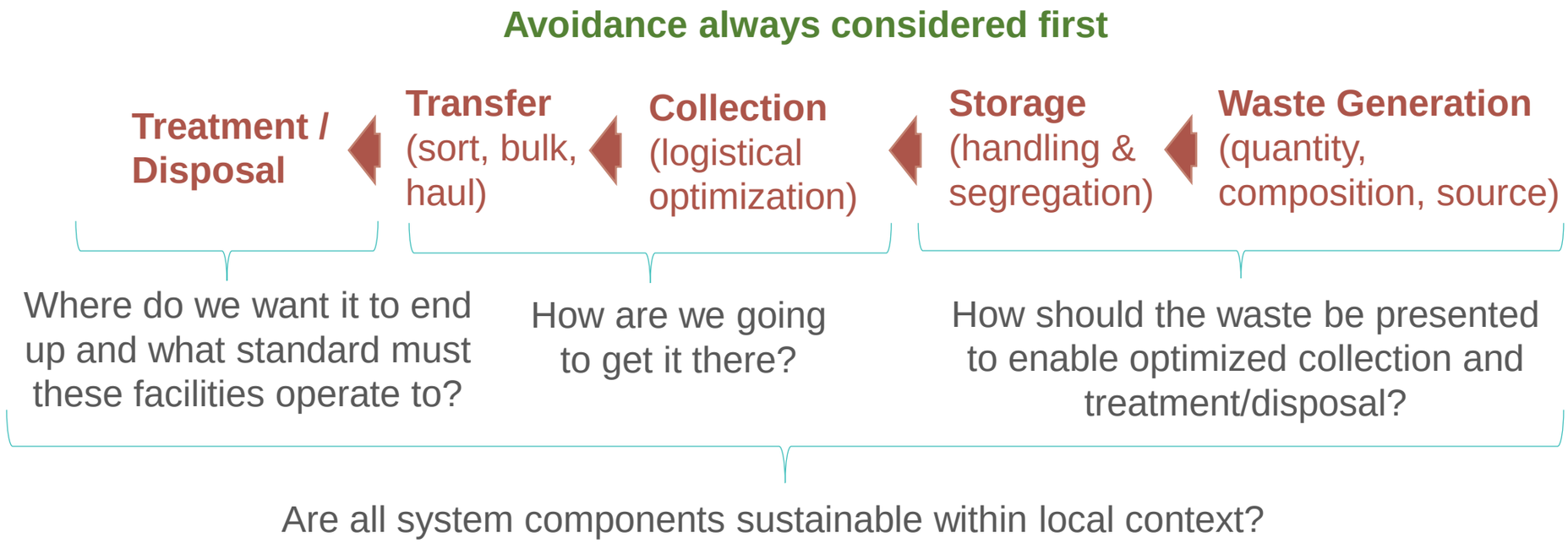
Operator Models. Respecting Diversity
Guidance Paper for Solid Waste Management Practitioners (GIZ)

Design principles for source separation and collection

1. Know your baseline - make evidence-based decisions, not trend-based decisions
2. Target the largest impactors first
3. The right service delivery operator model is more important than the best technology
4. **Start system design with the end in mind and end with a simple start**

Practical Approaches – design with the end in mind

Planning the system in reverse, starting with the end goal, can have many benefits – especially when you know the target waste stream.



- Financial
- Technical (using the Best Available Technology)
- Legal
- Institutional (can the institutions administer and enforce system)
- Environmentally and socially (following Best Environmental Practice)

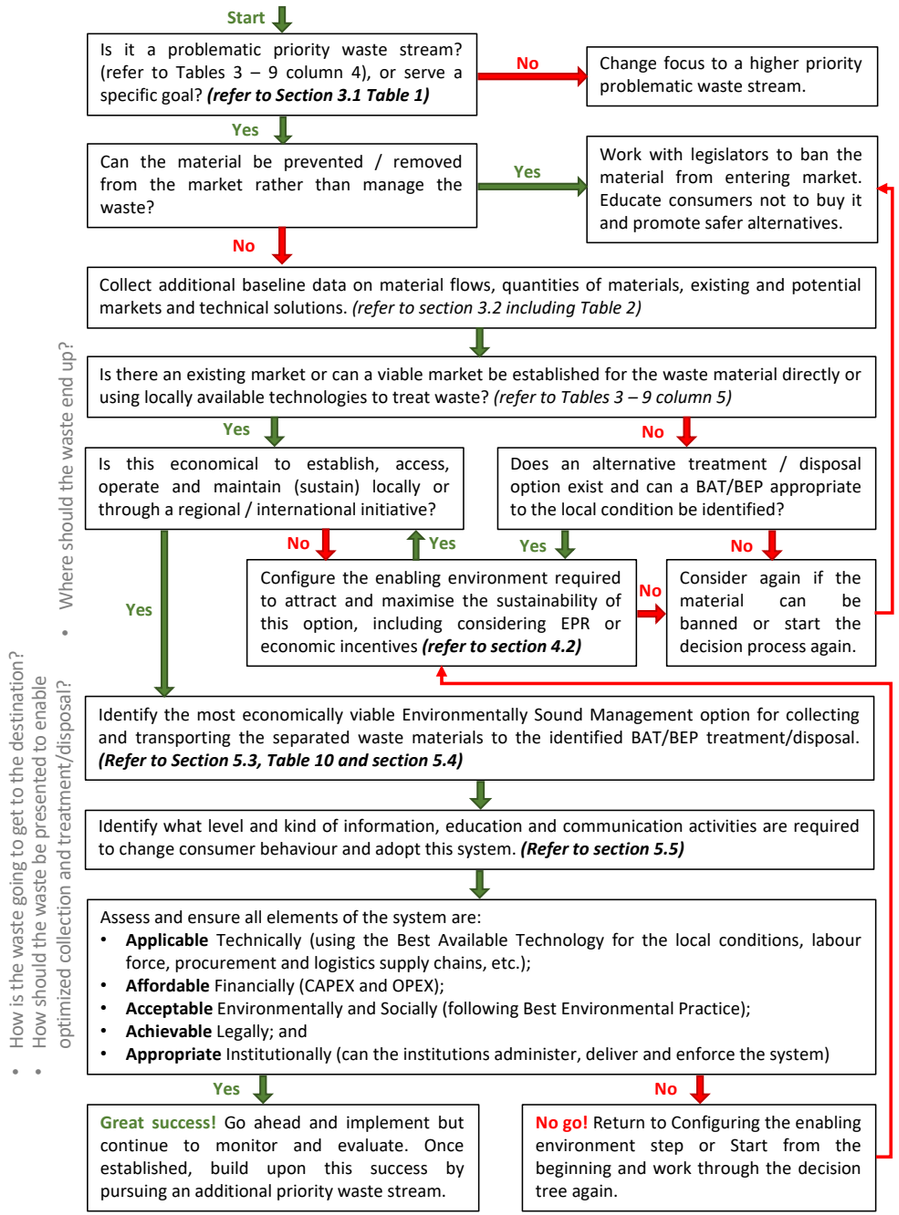
Design principles for source separation and collection

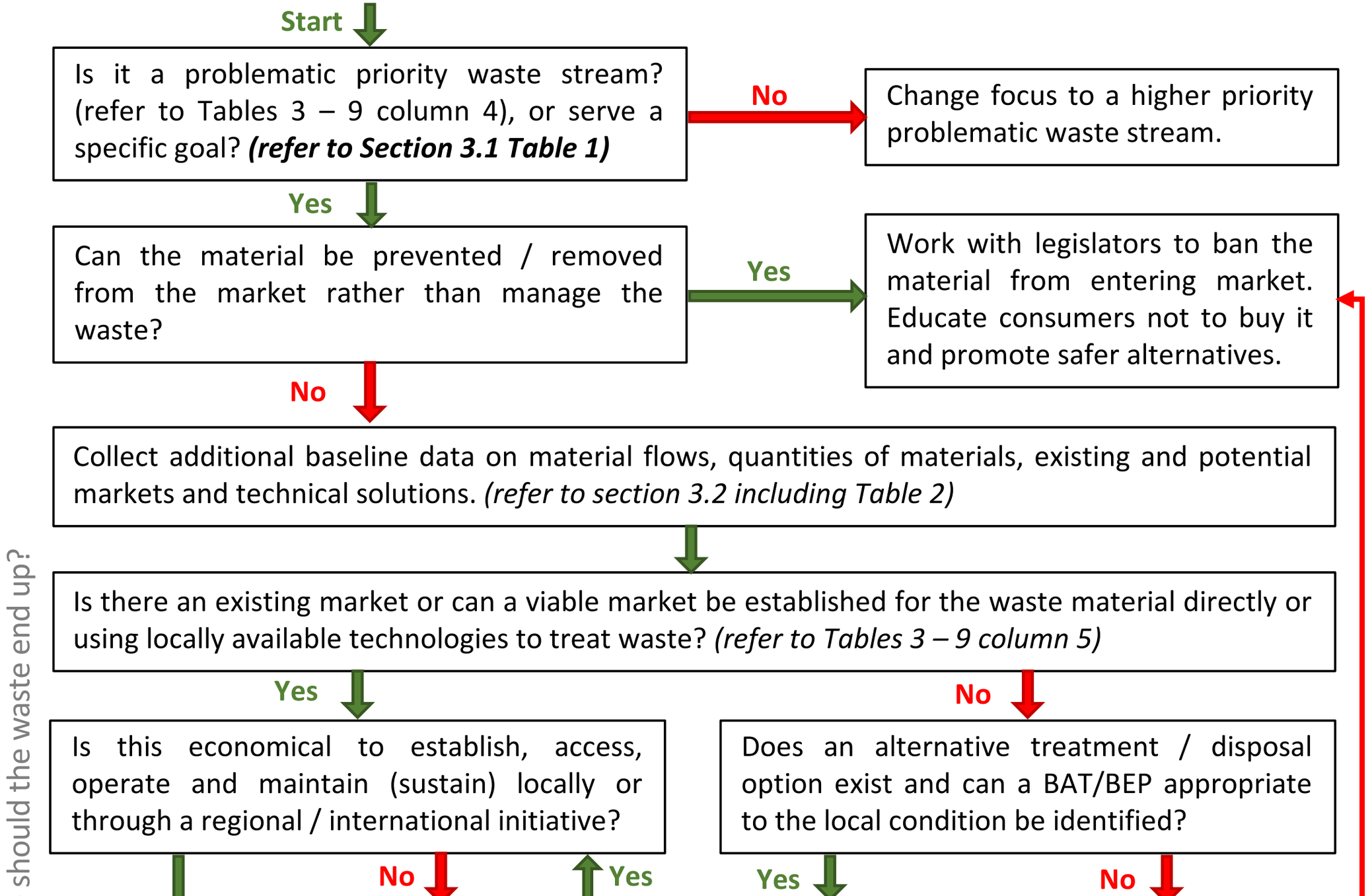
1. Know your baseline - make evidence-based decisions, not trend-based decisions
2. Target the largest impactors first
3. The right service delivery operator model is more important than the best technology
4. Start system design with the end in mind and end with a simple start
5. **Ensure Convenience – Maximise convergence with / Minimise divergence from existing habits**
6. **Keep collection and transportation costs to a minimum, maximise transportation efficiency**
7. **Establish economic incentives where appropriate**
   - **Extended Producer Responsibility**
   - **Pay-As-You-Throw**
   - **Landfill taxes / gate fees**
   - **Deposit-refund**

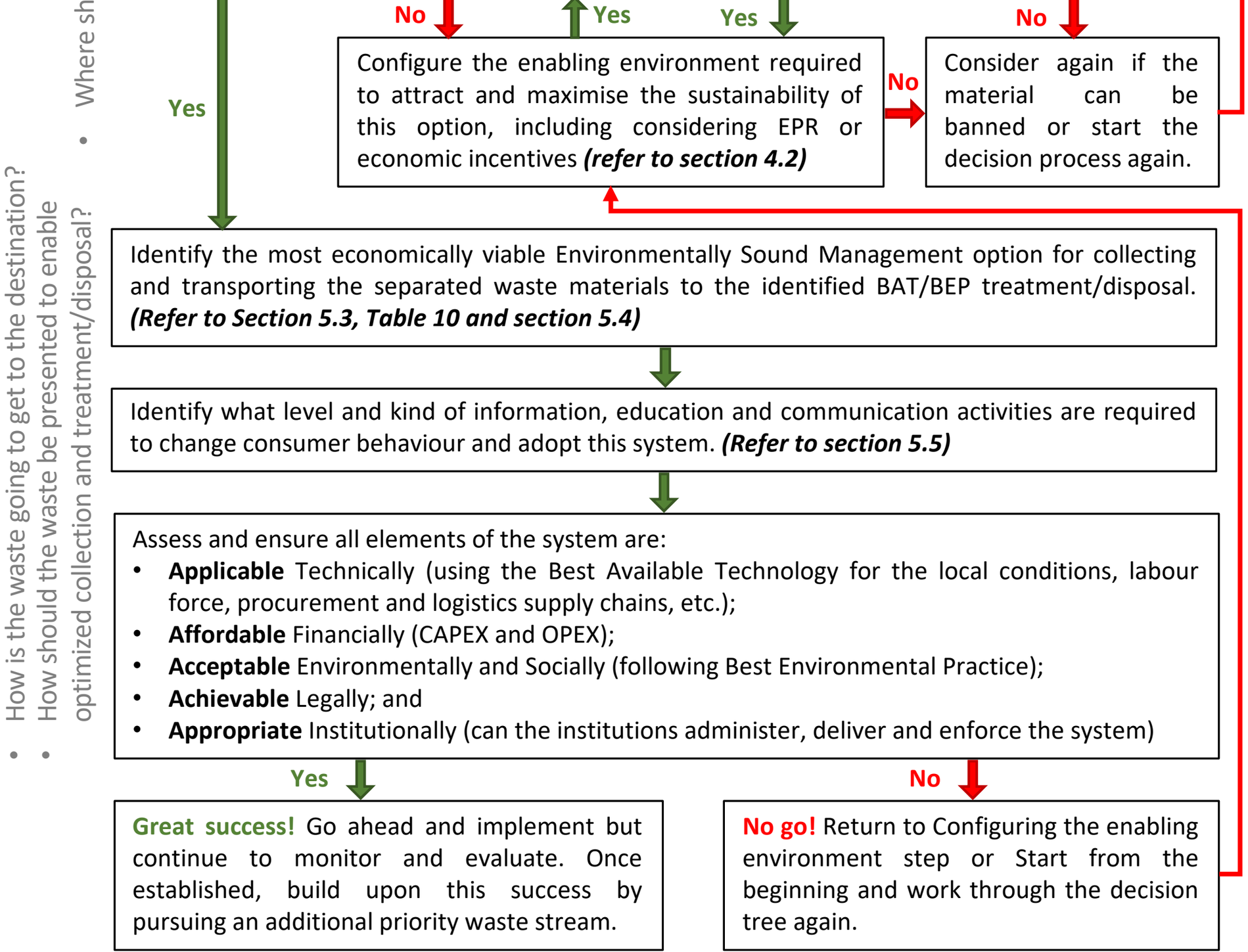
Design principles for source separation and collection

8. Act within your resource limits, promoting community and producer responsibility and ownership
9. Resilient design
10. Ensure enforceability of design Engage the target group through consistent, concise, constant and clear communication
11. Assign roles and responsibilities to specific stakeholders
12. Plan, pilot, adjust and validate effectiveness before roll-out

Source Separation Guideline Decision Tree




Start
Is it a problematic priority waste stream? (refer to Tables 3 – 9 column 4), or serve a specific goal? ***(refer to Section 3.1 Table 1)***
No
Change focus to a higher priority problematic waste stream.
Yes
Can the material be prevented / removed from the market rather than manage the waste?
Yes
Work with legislators to ban the material from entering market. Educate consumers not to buy it and promote safer alternatives.
No
Collect additional baseline data on material flows, quantities of materials, existing and potential markets and technical solutions. *(refer to section 3.2 including Table 2)*
Is there an existing market or can a viable market be established for the waste material directly or using locally available technologies to treat waste? *(refer to Tables 3 – 9 column 5)*
Yes
No
Is this economical to establish, access, operate and maintain (sustain) locally or through a regional / international initiative?
Does an alternative treatment / disposal option exist and can a BAT/BEP appropriate to the local condition be identified?
No
Yes
Yes
No
should the waste end up?


No
Yes
Yes
No
Yes
Configure the enabling environment required to attract and maximise the sustainability of this option, including considering EPR or economic incentives (refer to section 4.2)
No
Consider again if the material can be banned or start the decision process again.
Identify the most economically viable Environmentally Sound Management option for collecting and transporting the separated waste materials to the identified BAT/BEP treatment/disposal. (Refer to Section 5.3, Table 10 and section 5.4)
Identify what level and kind of information, education and communication activities are required to change consumer behaviour and adopt this system. (Refer to section 5.5)
Assess and ensure all elements of the system are:
Applicable Technically (using the Best Available Technology for the local conditions, labour force, procurement and logistics supply chains, etc.);
Affordable Financially (CAPEX and OPEX);
Acceptable Environmentally and Socially (following Best Environmental Practice);
Achievable Legally; and
Appropriate Institutionally (can the institutions administer, deliver and enforce the system)
Yes
No
Great success! Go ahead and implement but continue to monitor and evaluate. Once established, build upon this success by pursuing an additional priority waste stream.
No go! Return to Configuring the enabling environment step or Start from the beginning and work through the decision tree again.
Yes
How is the waste going to get to the destination?
How should the waste be presented to enable optimized collection and treatment/disposal?
Where sh

Tools to encourage segregation / Diversion

1. Convenience
   - Maximise convergence with / Minimise divergence from existing **habits**
2. Information, education and communication
   - Who, what, where, when and how?
   - Publication of Environmental Monitoring and Tests
   - Official Government and Civil Society
3. Economic Instruments / Market Incentives
   - Deposit refunds (EPR)
   - Subsidies, tax breaks, grants
   - Gate fee at landfill / Increased collection cost
4. Punitive Measures / Enforcement
   - Fines / other punishments for non-compliance
5. Laws / Norms and Standards
   - What should be done with the waste?
   - Landfill bans
6. Financing (CAPEX and OPEX)
   - Willingness to pay / willingness to accept
7. Voluntary codes and commitments

Example: Steps to creating enabling environment for green waste composting

1. Identify the main green waste producers to be approached in the first instance.
2. Information, Education and Communication campaign
    - Who, what, where, when and how?
    - Publication of Environmental Monitoring and Tests
    - Official Government and Civil Society
3. Provide small grants programme or tax relief to assist entrepreneurs (particularly garden services companies) invest in green waste shredders and equipment.
    - Grants to be offered to companies that successfully become licensed by SWMC/A as green waste haulers (optional step).
4. Work with key stakeholders to identify potential service providers and composting facility locations, conducting pre-selection of sites that meet composting facility licensing and Environmental Impact Assessment criteria.
5. Tender and award contracts (minimum 1 year) for bush clearing / treatment services to include condition that material is shredded on site and composted in a licensed facility

Example: Steps to creating enabling environment for green waste composting

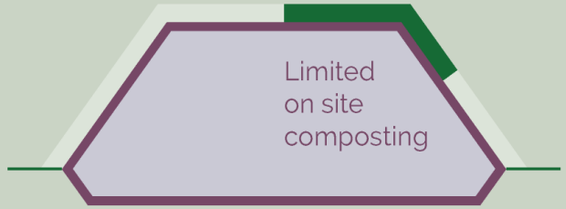
6. Assist establish compost markets through government procurement of compost.
   - Low grade compost (including ditch and road verge clearance with heavy metal contamination) purchased by SWMC/A for landfill cover (this could be mixed with shredded tyre wastes to provide a robust and resilient cover on the landfilled waste).
   - Medium grade for mulch, for agriculture and plant nurseries.
   - Fine grade compost for beautification projects.
7. Ban green waste from going to landfill / being burned and place high gate fee on green waste (that subsidizes composting operation / contract).
8. Enforce ban and illegal dumping (with enforced fixed penalties)
9. Resorts and Householders see garden services chipping service as cheaper than landfill gate fee / ban and engage service providers.

ASSIGNED RESPONSIBILITIES AND BEING HELD ACCOUNTABILE IS KEY

Roadside clearance

Anti-Dumping Enforcement

Landfill Site



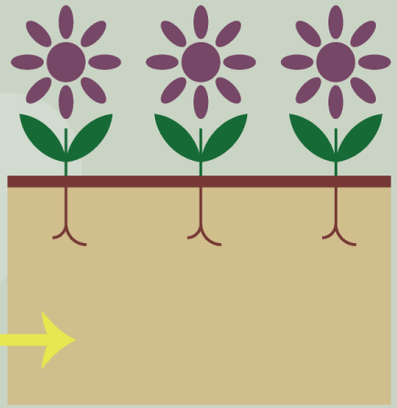
Low grade compost applied as landfill cover material

Commercial & Hotels

Households

Ban (or high gatefee) on green waste to landfill

Market

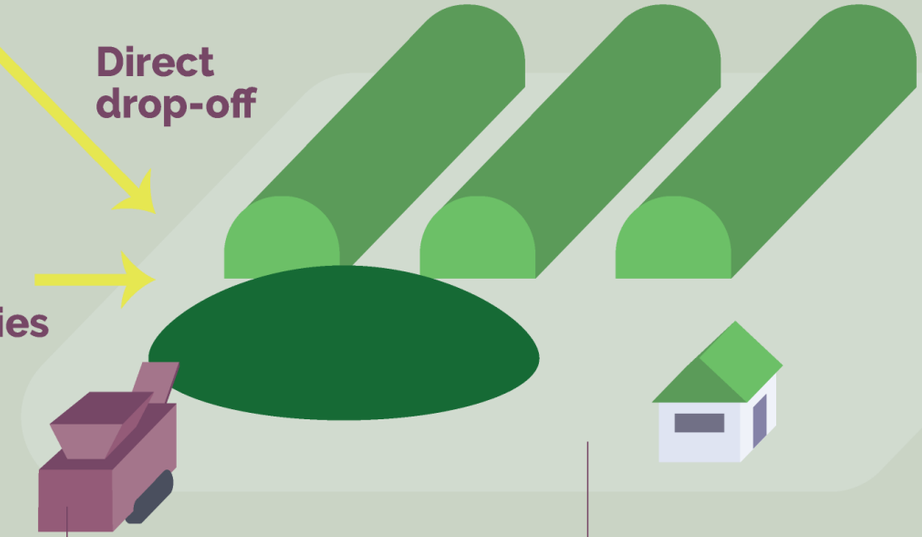


Direct drop-off

Garden services companies (with mobile shredders)

Bulk collection

Public drop-off



Quality mulch

High quality compost

On-site shredder

Commercial compost facility

Which waste should be priority to segregate next?

1. Mixed household and commercial waste
2. Food waste (including condemned food waste)
3. ~~Green waste~~
4. Household hazardous waste
5. Tyres
6. Pesticides and chemicals
7. Waste Electrical and Electronic Equipment
8. Construction and Demolition waste
9. Waste oil
10. Other