

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

Landfill Operations - Cost of inaction

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

6th October 2021



Cost of waste management



Financial

- Investment
- Operations



Economic

- Project wrap-up
- Environment
- Health
- Social
- Local businesses

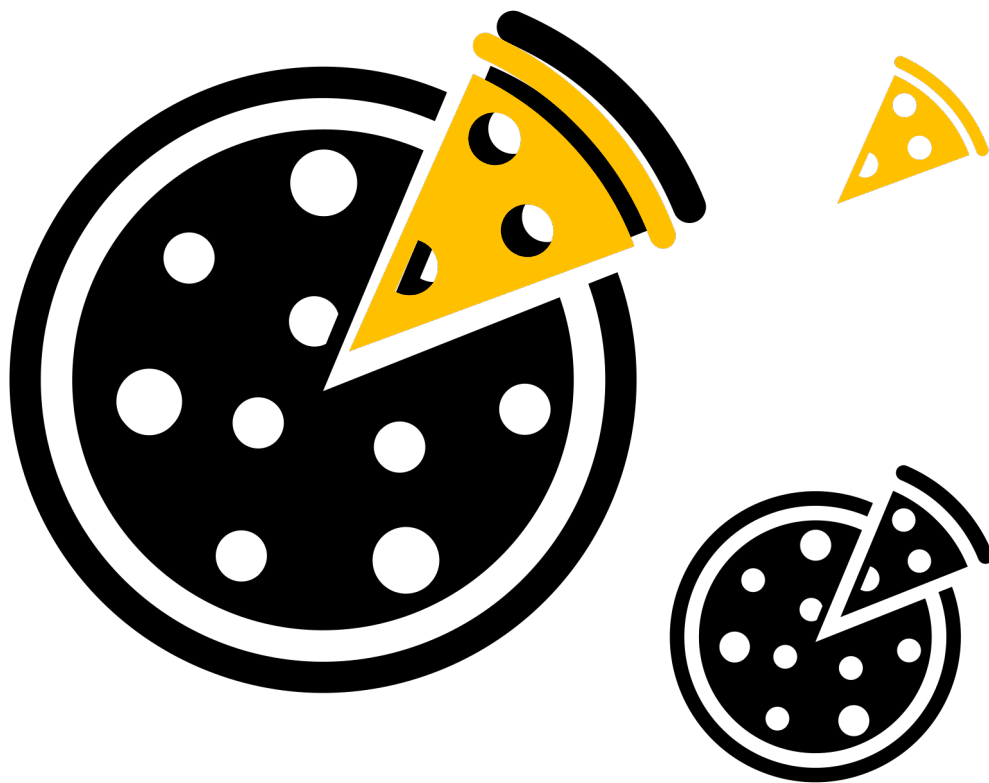


Total

Cost of waste management



Cost of waste management



Investment and operation costs – usually accounted for in assessing the cost of waste management in countries

Economic cost – includes project wrap-up expenditures, negative externalities of pollution, impact on human health and societal functions, impact on tourism, fishing, etc. – largely unaccounted for

Pollution from waste = Market failure – the market does not price the limited capacity of the environment to absorb emissions, discharges and waste



Full cost accounting of MSW (1/2)

US-EPA Full cost accounting for MSW

Up-Front costs

- Public education and outreach
- Land acquisition
- Permitting
- Building construction/modification

Operating costs

- 'Normal' costs
 - Capital costs, O&M, debt service
 - Unexpected costs

Back-End costs

- Site closure & post-closure care
- Building/equipment decommissioning
- Retirement/health benefits for current employees



Full cost accounting of MSW (2/2)

US-EPA Full cost accounting for MSW

Remediation costs at inactive sites/ open dumping sites

- Investigation, containment, and cleanup of known releases
- Closure and post-closure care at inactive sites

Contingent costs

- Remediation costs (undiscovered and/or future releases)
- Liability costs (e.g. property damage, personal injury, natural resources damage)

Environmental costs

- Environmental degradation
- Use or waste of upstream resources
- Downstream impacts

Social costs

- Effects on property values
- Community image
- Aesthetic impacts
- Quality of life

Financial costs of action

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Financial costs of action

The distinction between:

Direct investment

- Project preparation
- Planning
- Feasibility studies
- Permitting
- Detailed design
- Land costs
- Equipment
- Facilities
- Construction

Operation

- Labour
- Fuel
- Energy
- Maintenance and repair
- Public communication / management / administration
- Awareness raising campaigns
- Training and capacity building
- Private sector participation: tendering, contract negotiation, supervision, inspection, insurance

Direct revenues

- Revenue streams from resource recovery activities

Investment and operation costs

Based on World Bank data

PART A: WORLD BANK PROJECT DATA (NOMINAL DATE 2006) ¹¹	LOW INCOME COUNTRIES	LOWER MIDDLE INCOME	UPPER MIDDLE INCOME	HIGH INCOME COUNTRIES
Income (GNI/capita) 2006	< 876 USD	876-3 465	3 466-10 725	> 10 725 USD

Table 2: Comparative costs of Residual Waste collection in selected countries¹

Country	Costs per ton	Costs per hhld	Frequency
<i>Belgium (Flanders)</i>	€75/t	€18/hhld	Biweekly mainly
<i>Denmark</i>	€126/t	€62/hhld	Weekly
<i>Germany</i>	€67/t	€30/hhld	Biweekly mainly
<i>Ireland</i>	€65/t	€75/hhld	Weekly
<i>Spain</i>	€60/t	€25/hhld	Daily
<i>United Kingdom</i>	€42/t	€31/hhld	Weekly mainly

waste-to-energy incineration	NA	40-100	60-130	70-200
Anaerobic digestion	NA	20-80	50-100	65-150

Investment and operation costs

PART B: RESEARCH STUDY COMPARING ALTERNATIVE TECHNOLOGIES (2012 DATA)¹³	LOW INCOME COUNTRIES	LOWER MIDDLE INCOME	UPPER MIDDLE INCOME	HIGH INCOME COUNTRIES	'TYPICAL' INVESTMENT COST
GDP [USD/capita/year]	<2700	2700-5400	5400-8100	34000-41000	USD million for 100 000 tonnes per year capacity
Waste processing technology	[USD/t]	[USD/t]	[USD/t]	[USD/t]	
Material recovery facility (MRF) for separately collected dry recyclables	25-40	35-50	45-60	80-95	8-10
Sorting of high-calorific value fractions + preparation of refuse derived fuel (RDF)¹⁴	20-35	25-40	35-50	65-80	13-20
Windrow composting of separately collected bio-waste	25-40	25-40	25-40	50-70	13-20
In-vessel composting/anaerobic digestion (AD) of separately collected bio-waste	65-80	65-80	65-80	95-120	25-50
Simple mechanical biological treatment (MBT) of mixed waste	20-35	25-40	25-40	50-70	7-13
MBT of mixed waste + aerobic/anaerobic treatment prior to landfill disposal	50-70	50-70	60-75	100-120	40-60
MBT/biodrying (partial stabilization) to produce RDF	50-70	50-70	60-75	90-110	35-45
Energy from waste (EfW) using RDF	80-110	80-110	90-115	120-160	80-100
Energy from waste using mixed waste	95-120	95-120	100-130	150-190	80-100
Sanitary landfill	15-30	15-30	20-35	50-80	12-25 ¹⁵

Affordability

Upper limit for affordability

	LOW INCOME COUNTRIES	LOWER MIDDLE INCOME	UPPER MIDDLE INCOME	HIGH INCOME COUNTRIES
PART C: CALCULATED FOR GWMO¹⁶	UPPER LIMIT ON AFFORDABILITY CALCULATED AT 1% OF GNI¹⁷ (USD/TONNE)			
Affordability limit for total cost of solid waste management	< 40	40-120	120-255	> 255

- Lowest income countries collection costs make up 90% of the costs
- As systems become more complex and income levels rise, disposal can reach 30% of total costs
- With the increase of the income level, the more sophisticated technologies become more affordable, even though the cost of technology rises

Impact and cost of inaction

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Impacts of inaction

On public health and the environment



Public health impacts of uncollected waste

- Gastrointestinal and respiratory infections, particularly in children
- Blocked drains aggravate floods and spread infectious disease
- Endocrine disruptors released during waste burning lead to lower fertility rates, cancer, etc.

Environmental impacts of open dumping and burning

- Severe land pollution and freshwater, groundwater and sea pollution
- Local air pollution and climate change

Impact on public health

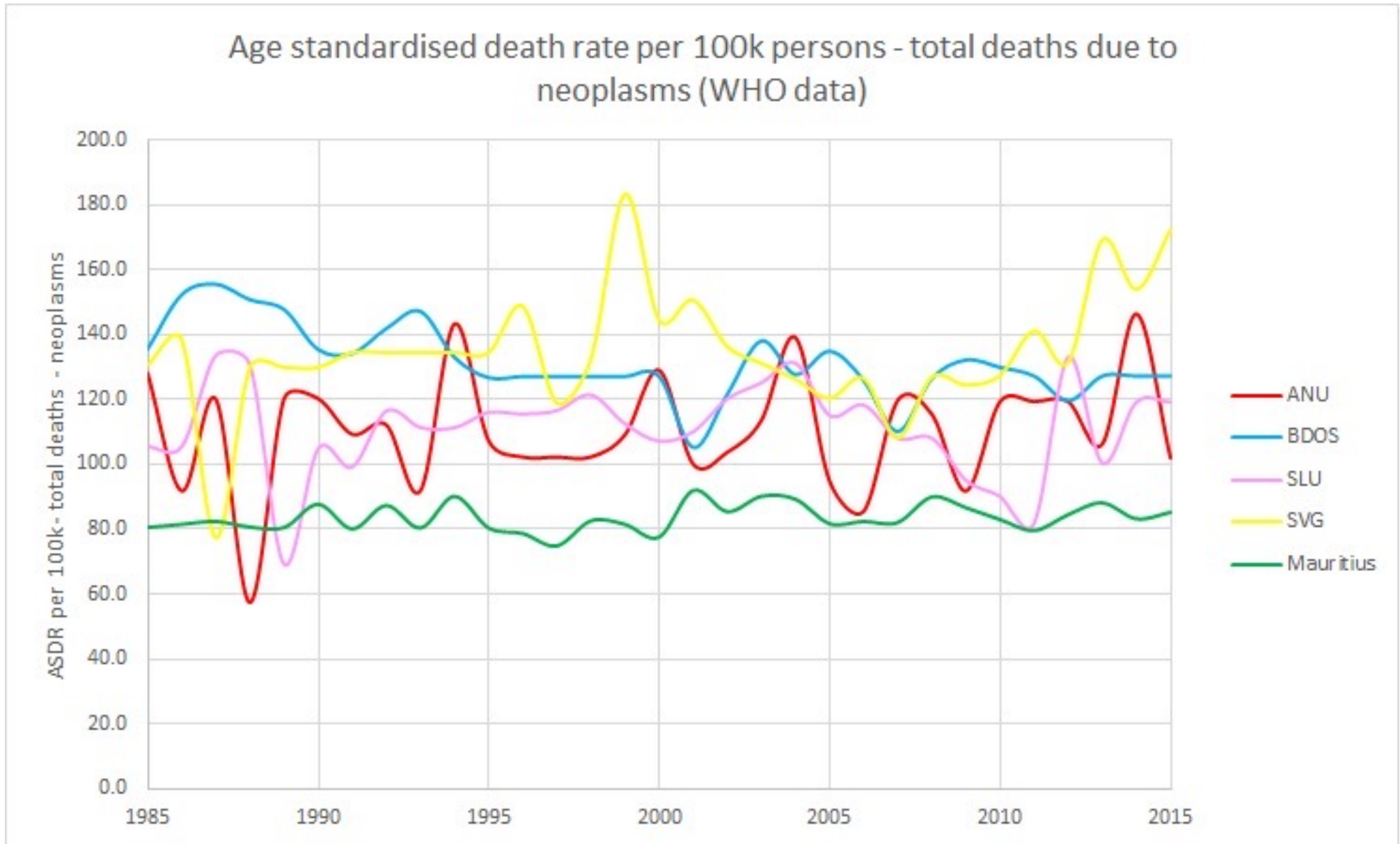
Unquantified cost items



- Health impacts on those living near open dumps
- Burden of disease to those living near waste sites receiving hazardous waste
- Health impacts on waste workers
- Health impact on children in households where waste is dumped or burned in the yard
- Health impacts on wider population due to environmental pollution

Impact on public health

Are the 'savings' worth it?



Impact on the environment

Unquantified cost items

- Groundwater contamination
- Fish and soil contamination by heavy metals – impact on agricultural exports
- Environmental impacts associated with open burning of accumulated waste
- Marine litter



Tangible and costly effects

The cost of litter control, including cleaning marine litter from beaches, is **orders of magnitude greater** per tonne of waste than proper waste management (prevention of litter).

Groundwater contamination in Jamaica has led to the closure of about 25% of groundwater sources (Planning Institute of Jamaica, 2007).

The **emissions associated with open burning of waste** include dioxins, polyaromatic hydrocarbons (PAHs) and black carbon, which are highly toxic, carcinogenic and powerful short-lived climate pollutants leading to **increased, but avoidable, medical expenses**

The cost of inaction

Cost estimation for different forms of environmental impact

Monetizing
the
negative
impacts
on:

Population*

Economic sector (tourism/fishing)

Value of assets

Quality of life

Wasted resources

*especially those living near waste facilities or waste workers

The cost of inaction

Economic valuation methods

Abatement costs

What it takes to clean up pollution

Willingness to pay

Asking people what they would be willing to pay for a cleaner environment or to save a particular landscape or ecosystem

Market price

Looking up the value of a service or good in places where it does exist;

Comparing property prices based on distance from a waste facility

The cost of inaction

Cost estimations – public health impacts

Impact	Evidence for economic cost	Estimate USD/capita/year
Health and illness costs due to solid waste-related pollution (leptospirosis, dengue fever, gastroenteritis)	Total solid waste-related health cost for Palau (population: 19,000) estimated at 700,000 USD per year (pharmaceutical costs, time in hospital and lost labour productivity).	36
	Avoided public health damage in Saint Lucia (pop: 176,000) estimated in the first year of new SWM system at 3 million USD	16
	Avoided public health damage/risks in Trinidad and Tobago (pop: 1,328,019) estimated in the first year of new SWM system at 23 million USD.	17
Groundwater contamination and illness to population near uncontrolled disposal sites which received hazardous waste	USEPA data for Superfund sites. Clean-up is expected to take 50+ years, at a cost of somewhere between 1bn-5bn USD per year.	4-20

The cost of inaction

Cost estimations – Environmental pollution in absence of proper SWM

Impact	Evidence for economic cost	Estimate USD/capita/year
Water contamination from inappropriate solid waste disposal and health impacts	A World Bank report puts the environment cost of water contamination from improper waste disposal at ~ 30 million USD each year (10 billion Nigerian Naira) and the lives of about 40 million Nigerians as being at risk.	1.4
Pollution of beaches by solid waste and marine litter	Estimate of loss of tourist income for Palau is 960,000 USD/year	26-50
Loss of near-shore fish catch from water pollution due to solid waste dumping	Palau's near shore fisheries resources include reef fish, lobsters and crabs, which are consumed on a subsistence basis and also marketed. The total value of fish resources lost due to land-sourced pollutants is estimated at 88,000 USD per year.	4.5
Impact on residents and tourism from loss of aesthetic value	Based on willingness to pay for preservation of the environment. Estimated at: (i) 27m USD for Saint Lucia (ii) 3m USD for Trinidad and Tobago.	(i) 156 (ii) 2

Cost of inaction

Cost estimations



Poll:



Do you think the costs of poor waste management to society exceed the financial costs per capita of sound waste management?

If 'yes' - how much?

Cost of inaction

Cost estimations



Costs of poor waste management to society exceed the financial costs per capita of sound waste management by a factor of 5-10

- Health care
- Lost productivity
- Flood damage
- Damage to businesses and tourism

Cost of inaction

Cost estimations

South
East
Asia

Economic cost of **uncollected household waste that is burned, dumped, or discharged to waterways**

US\$ 375/tonne

What-A-Waste 2.0

Integrated waste management costs for **basic systems meeting good international hygienic standards**

US\$ 50-100/tonne

World Bank

Cost of action

GWMO (2015) estimate



Cost of proper waste management

5-7 USD / capita



Cost of inaction

20-50 USD / capita



Benefits of action

Categories of benefits

Business and public benefits of resource efficiency and waste prevention

Improved livelihoods and cleaner working conditions for the informal sector

Green jobs

Reduction in GHG emissions from prevention, recycling and waste disposal

Reduction of food loss

Energy recovery by using waste to generate energy

Air, water and soil pollution control

Improved public health

Improved resilience of operations and communities

Data needs to inform decision making

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Data needs

Data collection needs for informed decision making

- Quantities of waste per each waste stream:
 - Generated
 - Collected
 - Diverted
- Monitoring of environmental emissions
 - Groundwater upstream and downstream of landfill
 - Leachate monitoring
- Health monitoring
 - Workers in waste management
 - Population living nearby landfill
 - General population (for comparison)
- Costs
 - Collection, transfer/transport, treatment, landfilling – per month, per capita, per tonne, etc.; any revenues.
 - Cleanup and remediation; wrap-up and end-of-life care for facilities