



GLOBAL ENVIRONMENT FACILITY  
INVESTING IN OUR PLANET



# MODULE 1

## Best practices in solid WM in relation to open burning of waste including case studies

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"Promotion of BAT/BEP to reduce uPOPs releases from waste open burning in the participating African countries of SADC sub-region"



**unitar**

United Nations Institute for Training and Research

# TABLE OF CONTENTS

<b>GUIDELINE .....</b>	<b>3</b>
<b>PART I - THE PROBLEM .....</b>	<b>4</b>
WHAT IS OPEN AIR BURNING OF WASTE? .....	4
WHEN AND WHY DO OPEN AIR BURNING OF WASTE OCCUR? .....	4
1. Burning municipal waste in the streets .....	4
2. Controlled burning in non-sanitary landfills or open dumps .....	5
3. Burning of plastics for material recovery .....	5
4. Materials recovery from electric and electronic waste .....	6
5. Accidents: spontaneous ignition .....	6
6. Backyards .....	7
HOW SERIOUS IS THE PROBLEM? .....	7
WHY IT CONCERNS POLICY-MAKERS AND ADMINISTRATORS .....	8
THE SUBSTANCES RELEASED BY OPEN BURNING OF WASTE CAUSE HAZARD FOR PUBLIC HEALTH .....	9
<b>Unintentional Persistent Organic Pollutants</b> .....	10
Dioxins and Furans .....	10
Polycyclic Aromatic Hydrocarbons .....	10
Heavy Metals .....	10
<b>Particulate Matter</b> .....	11
<b>PART II - THE SOLUTION - HOW TO ELIMINATE THE OPEN AIR BURNING OF WASTE AND APPLY BEST PRACTICES .....</b>	<b>13</b>
BEST PRACTICES TO BEGIN DEVELOPING AND BUILDING AN EFFECTIVE SWM SYSTEM .....	13
LONG TERM VISION: BUILD AN EFFECTIVE AND INTEGRATED SWM SYSTEM .....	14
THE FIRST BEST PRACTICES TO IMPLEMENT .....	14
<b>Give a legal definition of waste</b> .....	14
<b>Ensure 100% collection coverage and build sanitary landfills</b> .....	16
CONCLUDING OBSERVATIONS FOR POLICY MAKERS AND PRACTITIONERS .....	16

# GUIDELINE

This Guideline supports policymakers, administrators and practitioners operating in the field of solid waste management (SWM) in the SADC Countries in understanding the:

- Main causes of the open air burning of waste,
- Hazards posed by this practice
- Best Practices in SWM necessary to eliminate the practice of open air burning.

# PART I THE PROBLEM

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## WHAT IS OPEN AIR BURNING OF WASTE?

OPEN AIR BURNING OF WASTE is the combustion of any type of waste carried out in open air without the adoption of sanitary or environmental measures to reduce the high impacts it generates.

A formal definition is given by the IPPC 2006 Guidelines for National Greenhouse Gas Inventories: "Open burning is the combustion of unwanted combustible materials (e.g., paper, plastics, waste oils etc.) in nature or open dumps, where smoke and emissions are released directly into the air without passing through a stack." This definition underlines that environmentally sound combustion of any waste requires the application of BAT to control the fumes produced and to abate their hazardousness.



courtesy of S. Tunesi

When burning waste in heaps or in non-sanitary landfills, conditions are commonly poor due to heterogeneous composition, some degree of compaction and the mixing of different materials; moisture and lack of oxygen may reduce combustibility. Typically, there is no operation undertaken to select the waste that become fuels or to improve the combustion conditions.

## WHEN AND WHY DO OPEN AIR BURNING OF WASTE OCCUR?

The practice of open air burning of waste takes many forms and it may answer different needs, but it always originates from the fact that the existing solid waste management (SMW) system is ineffective.

### 1. Burning municipal waste in the streets

When the collection of waste from households and/or commercial venues is not performed with regularity by the service provider the waste accumulates in the premises, and it then overflows onto the streets.

Residents may resolve to burn municipal waste in the streets or in open land as the only means to reduce the volume, the smell, and the immediate hazardousness (attraction of insects and other animals) of the uncollected waste.

## 2. Controlled burning in non-sanitary landfills or open dumps

'Municipal landfills' are often heaps of mixed waste disposed without sanitary and engineering controls by municipalities that do not have the financial and technical resources to safely manage waste disposal.



Courtesy of S. Tunesi

In these sites, open air burning of waste, without protection neither for workers nor for nearby residents, is a common management practice: it facilitates waste volume reduction, and it increases compaction.

## 3. Burning of plastics for material recovery

Abandoned plastics rejects can be a common presence in the streets of a city where municipal waste is not collected regularly. Plastic sachets for water distribution are one of the sources of this pollution, but they could be recycled as Best Practices have shown in Countries in Africa.



Courtesy of S. Tunesi

These recycling practices are important, and they would reduce the amount of waste abandoned to open air burning; but it is essential these artisanal operations be regulated, appropriate working techniques be introduced, and protection be provided to the workers.

#### **4. Materials recovery from electric and electronic waste**

Another frequent occurrence is the burning of electronic and electrical waste (WEEE) in non-controlled dumps where WEEE are disposed as a consequence of the lack of collection and treatment capability and of the illegal trans-boundary transport from high income countries.

Cables and electronic components are burned to recover critical metals that have a sound international market.



#### **5. Accidents: spontaneous ignition**

When waste is amassed without adopting the necessary safety measures, as in non-sanitary landfills or in temporary deposits, burning accidents often result.



The mixture of municipal and industrial waste often found in these waste heaps generates a highly toxic mixture of air borne pollutants.

Unfortunately, in countries where the generation of waste per capita is high, for both municipal and industrial waste, but where the presence of treatment plants is not sufficient to ensure the efficient and sound management of the whole amount generated, the burning of waste in temporary storage areas has become a means of avoiding the cost of management while trying to profit from insurance premiums.

## 6. Backyards

Open air burning of waste in families' backyards is a global occurrence, in both high- and low-income countries. In high income regions, domestic waste burning may occur in small rural farms where it may be considered an acceptable practice of agricultural waste management or at the outskirts of vegetable markets as a means to (illegally) dispose of packaging.

Adopting these practices stems from the lack of awareness of the health and environmental damages to which people expose themselves.

## HOW SERIOUS IS THE PROBLEM?

Open burning of waste is practiced all over the world: about 41% of total municipal waste generated worldwide (972 million tonnes/y) is treated by uncontrolled burning<sup>1</sup>. Often these processes are not authorized and, thus, un-documented. Consequently, the releases from these processes tend to be underestimated because of difficulties in assessing their occurrence<sup>2</sup>.

The hazard and public health damages produced by open burning of waste are large and should be taken seriously.

The UNEP toolkit to determine the release of unintentionally produced persistent organic pollutants estimated that, from 1999 to 2009, the **most importance source of dioxin** from the 68 reporting countries was "the open burning of biomass and waste, accounting for 48% of the total release, followed by incineration of waste with 12% and conversion of energy with 10%"<sup>3</sup>.

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<sup>1</sup> Wiedinmyer Cet al. 2014. "Global emissions of trace gases, particulate matter and hazardous air pollutants from open burning of domestic waste". Environmental Science & Technology, 48, 9523-9530.

<sup>2</sup> [https://toolkit.pops.int/Publish/Main/II\\_061\\_OpenBurning.html?panel=1#SpryAccordion1](https://toolkit.pops.int/Publish/Main/II_061_OpenBurning.html?panel=1#SpryAccordion1)

<sup>3</sup> UNEP. 2011. Assessment of PCDD/PCDF Release Inventories - Status 2011.

## WHY IT CONCERNS POLICY-MAKERS AND ADMINISTRATORS

The main objective of policy makers and administrators is to protect the population. Open burning of wastes can cause serious health problems to the exposed population. Even seemingly harmless materials like paper, cardboard, yard waste, and construction debris - release a hazardous mixture of cancer-causing compounds and other toxic substances.

In the short term, exposure to smoke can cause headaches, nausea, and rashes; in the long term it can manifest the effects of dangerous carcinogens like dioxins and furans, and black carbon, a short-lived climate pollutant that contributes to climate change. Smoke and particulates from open burning sources can trigger respiratory health problems, particularly among children, the elderly, and people with asthma or other respiratory diseases, and those with chronic heart or lung disease.

### THE THREAT TO PUBLIC HEALTH AND THE ENVIRONMENT IS SERIOUS

Given that Open burning of wastes affects the wellbeing of citizens, and it might cause a financial problem to the national treasure (more people in hospitals that would require medical attention) it is a problem that **needs to be confronted by public policies**.

Information campaigns are an important element, but this practice cannot be terminated by communication only, because even those aware of the consequences may continue to burn waste when other disposal options are not available, and a well-organized collection service is not provided.

Key to stopping open air burning is the capacity of policymakers at the national level and local administrators to set in place an **EFFECTIVE SWM SYSTEM IN EVERY CITY**.

### TAKE-HOME MESSAGE FOR POLICY MAKERS AND PRACTITIONERS

Open air burning of waste is almost always caused by an **INEFFICIENT SWM SYSTEM**.

Thus, it needs to be solved by confronting the cause: policymakers, administrators and practitioners need to design and build an effective solid waste management system.



## THE SUBSTANCES RELEASED BY OPEN BURNING OF WASTE CAUSE HAZARD FOR PUBLIC HEALTH

The hazard of this practice is stated in the Stockholm Convention: "An environmentally unacceptable process that generates chemicals listed in Annex C of the Stockholm Convention and numerous other pollutant products of incomplete combustion."



### DID YOU KNOW THAT?

- The substances released can travel long distances and deposit on soil, plants, and in surface waters.
- The ash remaining in the burnt pile contains pollutants, which can migrate into soil and water.
- The most common route of human exposure to uPOPs is through the food chain. These pollutants are easily absorbed into crops and livestock fat tissues; when food is ingested the toxic compounds accumulate in human tissues.

Open waste burning activities is a leading source of unintended Persistent Organic Pollutants (uPOPs) and other priority pollutants:

- ▶ Polychlorinated dibenzo dioxins
- ▶ Polychlorinated dibenzo furans
- ▶ Polychlorinated biphenyls
- ▶ Hexachlorobenzene
- ▶ Pentachlorobenzene

Relevant for both public health and environmental quality is the emission of:

- ▶ Particulate matter (also called: black carbon, soot)

Depending on the composition of the burnt waste, the pollutants released in the smoke can also include:

- ▶ Arsenic
- ▶ Mercury
- ▶ Lead
- ▶ Carbon monoxide
- ▶ Nitrogen oxides
- ▶ Sulphur oxides
- ▶ Hydrochloric acid.

## Unintentional Persistent Organic Pollutants

Unintentional persistent organic pollutants (uPOPs) resist degradation once released and, thus, “persist” in the environment and can migrate long distances.

### Dioxins and Furans

Open waste burning is likely the dominant source of dioxin and related compounds worldwide; they are prevalent when plastics and e-waste (electronic waste) are burned.

Exposure to dioxins and furans has been linked to:

- Increase risk of certain types of cancers
- Liver problems
- Impairment of the immune system, the endocrine system, and reproductive functions
- Effects on the developing nervous system and other developmental events.

### Polycyclic Aromatic Hydrocarbons

Polycyclic Aromatic Hydrocarbons are a toxic part of particulate matter and are produced during the incomplete combustion that occurs in oxygen deprived conditions and at lower temperatures. PAHs can be inhaled or ingested and circulate in the respiratory system; many PAHs are known carcinogens, usually associated with cancer of the lungs, skin and bladder. PAHs also have been found to have toxic effects through dermal contact.

### Heavy Metals

Emitted heavy metals include cadmium, chromium, manganese, antimony, arsenic, lead, and mercury. Open burning of waste can lead to deposition of heavy metals in both fly ash and bottom ash, creating the potential for further air, water, and soil pollution. The quantity and type of heavy metals emitted varies significantly based upon the content of waste being burned: electronic and electric waste are a known source of air borne pollutions.

## Particulate Matter

Particulate matter is produced and released in large quantities when waste is burned in open air, and it may contain a variety of different toxic substances. Coarse particulates (PM10) have diameters between 2.5  $\mu\text{m}$  and 10  $\mu\text{m}$ ; fine particulates (PM2.5) a diameter less than 2.5  $\mu\text{m}$  and include black carbon. PM2.5 are thought to be most harmful as they can easily penetrate the respiratory system and travel long distances impacting a wider population. Open waste burning contributes to a large percentage of global PM2.5 emissions.



### DID YOU KNOW THAT?

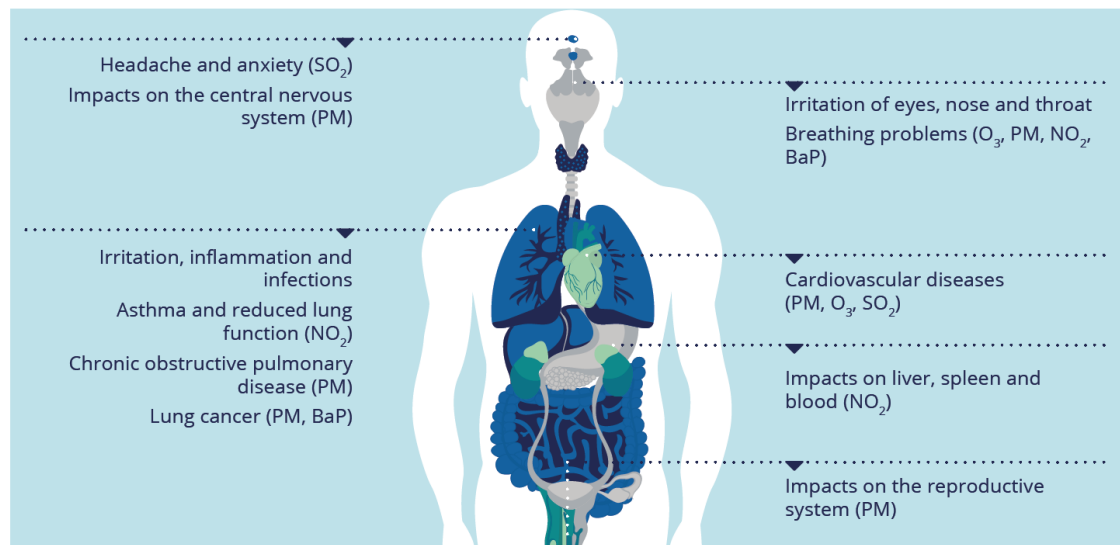
The estimated yearly emissions of PM10 due to open burning of waste is 12 million tons per year or 24% of total PM10 emissions.

With respect to **CLIMATE CHANGE**, it has been estimated that globally "the CO2 emitted from open waste burning was equivalent to 5% of the 2010 global annual anthropogenic emission".

Specific short-term effects of inhalation of particulate matter are aggravation of asthma, shortness of breath, coughing, wheezing and chest pains. Effects of long-term exposure can include heart failure, respiratory disease, and lung cancer. Children, the elderly, and those with pre-existing respiratory conditions are particularly susceptible to PM health impacts. In addition, pregnant mothers and their babies are at serious risk for mortality and health complications due to PM exposure.

The image<sup>4</sup> summarizes the main air borne pollutants' effects on human health.

**Figure 4.3 Major sources of ambient air pollution and potential human health impacts**



#### **SWM MANAGERS SHOULD KNOW THAT**

The risk generated by open air burning is incomparably higher than deriving from the thermal treatment in plants adopting BATs for emissions clean-up.

It was estimated that about 3-40 households burning their trash daily in barrels can produce an emission of PCDD/PCDF comparable to a 200 tonnes/day modern municipal waste thermal treatment plant serving thousands of families.<sup>5</sup>

<sup>4</sup> EEA Report. 21/2019. "Healthy environment, healthy lives: how the environment influences health and well-being in Europe"

<sup>5</sup> Lemieux P, Met al. 2000. "Emissions of Polychlorinated Dibenzo-p-dioxins and PCDF from the Open Burning of Household Waste in Barrels". Environ. Sc. Technol. 34, 3, 377-384.

# PART II - THE SOLUTION - HOW TO ELIMINATE THE OPEN AIR BURNING OF WASTE AND APPLY BEST PRACTICES

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The main cause of the open air burning of waste is the lack of an effective and efficient SWM system.

## **BEST PRACTICES TO BEGIN DEVELOPING AND BUILDING AN EFFECTIVE SWM SYSTEM**

To design a path leading to the realization in time of an effective SWM system, where open air burning of waste will not be perceived as a necessary operation, policymakers, administrators, and practitioners need the understanding of how to design and build an effective SWM system.

Best Practices must be applied to enable the timely provision of the appropriate and sufficient Solid Waste Management facilities and plants so that the needs of the interested community are met.

The Best Practices necessary to begin building an effective SWM system are summarized in the Table:

<b>BEST PRACTICES TO BEGIN PLANNING AND BUILDING AN EFFECTIVE SWM SYSTEM</b>
<ul style="list-style-type: none"><li>• Policymakers and practitioners understand how an effective SWM system works and what plants and infrastructure are necessary to build it</li><li>• The legislation provides the basic definitions necessary to classify waste</li><li>• Quantify the amount of waste generated by the different sources</li><li>• The legislation defines hazardous waste and the procedure to classify it</li><li>• The waste hierarchy is adopted respecting the local SWM conditions</li><li>• The legislation must provide definitions necessary to define all phases of an integrated SWM system </li><li>• Organize source segregation</li><li>• Policymakers understand what different SWM plants and equipment are useful for</li><li>• Describe the current SWM system by quantifying flows of waste</li></ul>

## LONG TERM VISION: BUILD AN EFFECTIVE AND INTEGRATED SWM SYSTEM

An integrated SWM system puts into practice the principles of the circular economy and performs all the steps of the **WASTE HIERARCHY**:

- ✓ Prevention/minimisation
- ✓ Reuse
- ✓ Recycling (recovery of materials)
- ✓ Recovery of energy
- ✓ And, as the least favoured option, disposal in sanitary landfill of waste that cannot be recovered.

An integrated SWM system is composed of:

- ✓ *Technical* elements: it recovers both materials and energy from waste; it deals with household and other sources of waste, such as waste from commercial units, restaurants, agriculture, industries. The safe treatment of healthcare waste is guaranteed
- ✓ *An economic* perspective: an integrated SWM system is financially sustainable in repaying any debt incurred by the national or municipal government for the building of SWM infrastructure and the operations and maintenance of the improved system
- ✓ *A social* perspective that:
  - guarantees the protection of public health and the environment
  - provides collection services to all citizens irrespective of their ability to pay for the service
  - guarantees safe working conditions to both formal and informal workers
  - involves stakeholders in the decision-making process.

## THE FIRST BEST PRACTICES TO IMPLEMENT

THE FIRST BEST PRACTICE TO PERFORM WHEN ORGANIZING AN EFFECTIVE SWM SYSTEM IS SETTING UP THE APPROPRIATE LEGISLATION

### Give a legal definition of waste

The **DEFINITION OF WASTE** is an essential starting point.

OECD define waste as "materials that are not prime products (i.e., products produced for the market) for which the generator has no further use for own purpose of production, transformation or consumption, and which he discards, or intends or is required to discard".

### TAKE-HOME MESSAGE FOR POLICY MAKERS AND PRACTITIONERS

All definitions underline that **WASTE** is associated with the criteria of something being **DISCARDED**.

When a material of a production cycle doesn't become part of the final product but could easily be reused in the same production cycle, or by other industries, it could be considered a **by-product** (and not a waste) and the recovery of this material should be facilitated by the legislation, in coherence with the principles of the **Circular Economy**.

The **SOURCES / ORIGIN** of waste include:

- households
- businesses
- commerce and restaurants
- green waste from public and private parks
- construction & demolition
- industries
- agriculture
- hospitals and health structures

Waste can be classified by source as:

<b>MUNICIPAL</b>	Household
	SIMILAR: commerce, business, hospitals
<b>OTHER SOURCES</b>	Industry Agriculture Sanitary C&D WEEE

**SIMILAR WASTE:** waste which in nature and composition is similar to household waste, even if from other origins, and it can thus be collected, disposed of and treated together with household waste.

Waste can be classified by **TYPE**: these are types of waste that need to be collected separately and managed by specific treatments, and may require specific legislation, including:

- Construction & Demolition waste (C&D)
- WEEE
- Car batteries
- PCB containing fluids.

## Ensure 100% collection coverage and build sanitary landfills

For low and middle-income Countries, the development of a fully integrated Solid Waste Management System will take several years, and it will go through several stages, but a few conditions can be set in place from the beginning of policy-makers action.

### TAKE-HOME MESSAGE FOR POLICY MAKERS AND PRACTITIONERS

The initial stages of development of an effective SWM system must ensure:

- 100% collection coverage to all citizens irrespective of their capability to pay for service fees
- easy and constant access for the service providers to the equipment and infrastructure necessary to safely dispose of collected waste, thus eliminating waste abandonment and the need to use open air burning as a means of waste management
- at the beginning of the development the infrastructure and plants needed are:
  - Transfer Stations to reduce the need for long distance transport
  - Sanitary Landfills.

## CONCLUDING OBSERVATIONS FOR POLICY MAKERS AND PRACTITIONERS

- ❖ Consider the hazard posed by open burning of waste
- ❖ Adopt these Best Practices step-by-step with the awareness that designing an effective SWM system is a long path that requires to connect a long-term vision with the ability to rapidly gather funds and technical expertise.
- ❖ The first action to reduce open air burning of waste is to ensure 100% collection of waste from all households and working premises.







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