

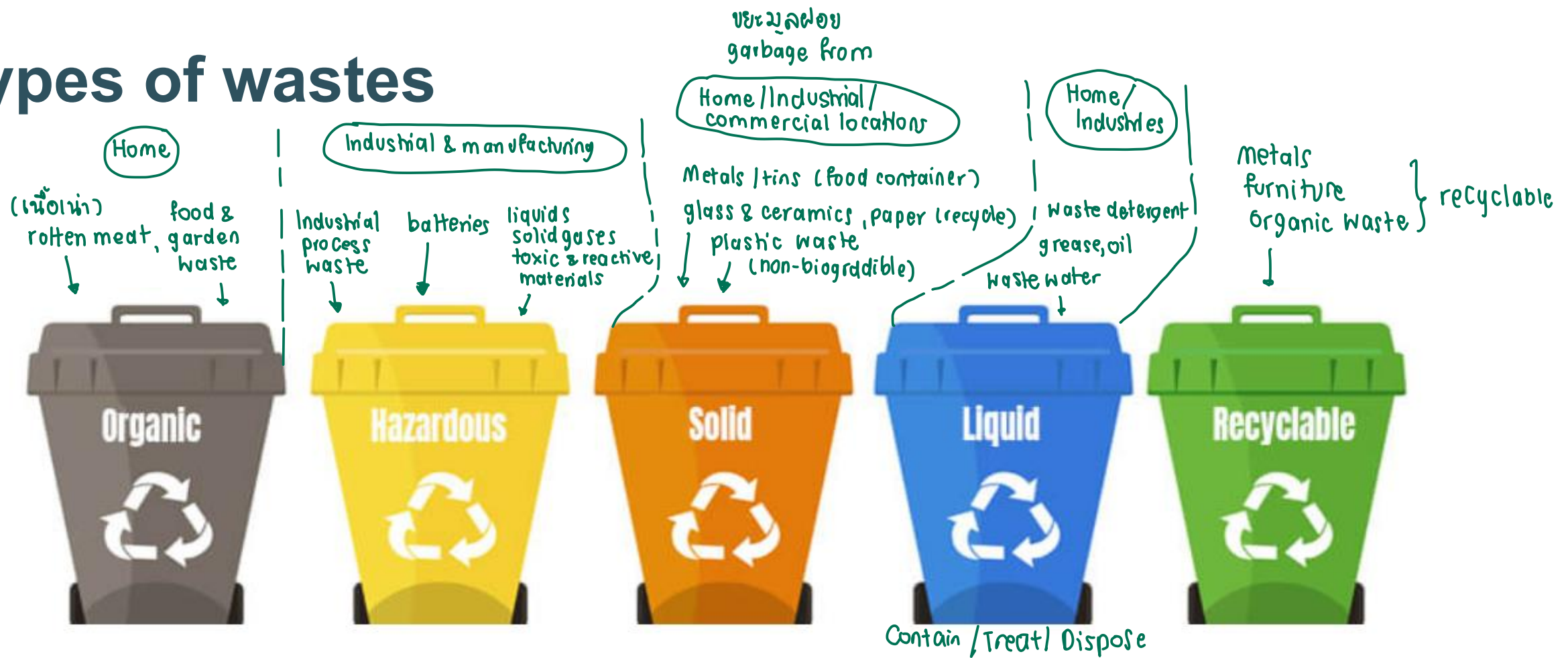
A large pile of plastic waste, including various colored plastic bottles, containers, and debris, is shown under a sunset sky. The sun is low on the horizon, casting a warm glow over the scene. The plastic waste is piled high, and the foreground is filled with a dense layer of colorful plastic trash.

# Waste and toxic substances: Set the Scene

**Class EE375**

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# Types of wastes



Each type of waste requires different ways to dispose and different waste management.

# From cradle to grave: Hazardous waste management program

EPA established a comprehensive regulatory program to ensure that hazardous waste is managed safely from "cradle to grave" meaning from the time it is created, while it is transported, treated, and stored, and until it is disposed.



Department of Transport  
→ Hazardous material regulations



public roads, highways, rails, waterways

Conserve resource & ensure protection of human health & environment



- ↓ RM consumption
- ↓ waste to be treated / disposed.
- Need proper storage (no spills, leaks, fire, contaminated soil)



- in landfill (မြန်မာ)
- or incinerators (ပတ်ဝန်းကျင်)



Generators identified managed treated } hazardous waste before

# Trends in wastes

1

## Solid waste management challenges

- increasing solid waste generation (from households / industries / commercial)
- shrinking disposal capacity
- rising disposal costs
- public opposition to the siting of new disposal facilities.

Many communities are struggling to develop cost-effective, environmentally protective solutions. The growing amount of waste generated has made it increasingly important for solid waste management officials to develop strategies to manage wastes safely and cost effectively.


# Trends in wastes

2

## Trends in waste generation:



Economic activity, consumption, and population growth → the amount of waste generated.

- In developed economies, such as the United States, generally produce large amounts of waste: **municipal solid waste** and **commercial and industrial wastes**
- Waste generation, in most cases, **represents inefficient use of materials.** 
  - Tracking trends in the quantity, composition, and effects of these materials provides insight into the efficiency with which the nation uses (and reuses) materials and resources and provides **a means to better understand the effects of wastes on human health and ecological condition.**

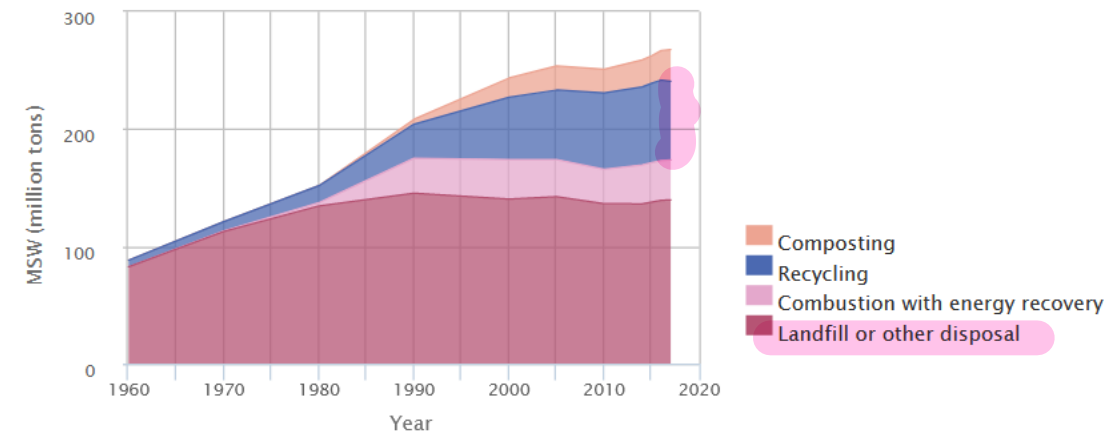
# Trends in wastes

3

## Trends in waste management:

- Wastes must be managed through **reuse, recycling, storage, treatment, and/or disposal.**
- Most **municipal solid wastes** and **hazardous wastes** are managed in **land disposal** units.
- For hazardous wastes, land disposal includes landfills, surface impoundments, land treatment, land farming, and underground injection. **Land disposal created problems** such as **ground water contamination, methane gas formation and migration, and disease vector hazards.**

Exhibit 1. Municipal solid waste generated and managed in the U.S., 1960–2017



This graph reflects data for 1960, 1970, 1980, 1990, 2000, 2005, 2010, 2015, 2016, and 2017. No composting data are available prior to the 1990 data point. "Landfill or other disposal" includes combustion without energy recovery.

Data source: U.S. EPA, 2019

# Trends in wastes

## 3.1

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### Trends in waste management: Increasing contaminated land

Waste management practices left legacies of contaminated lands including:

- Sites contaminated by improper handling or disposal of toxic and hazardous materials and wastes.
- Sites where toxic materials may have been deposited as a result of natural disasters
- Sites where improper handling or accidents resulted in release of toxic or hazardous materials that are not wastes.

These sites must be carefully managed through containment or cleanup to prevent hazardous materials from causing harm to humans, wildlife, or ecological systems.

# Trends in wastes

## 3.2

### Trends in waste management: Sustainable materials management

- Over the past 35 years, the paradigm has shifted from a “**waste management**” approach to “**sustainable materials management**” focusing on resource, environmental, and human health impacts over the entire **life cycle of materials**.
- The **amount of waste generated and managed** may describe ambient conditions in terms of wastes in the environment but **does not provide any indication of the effects on human health or environmental condition**.

There have been changes in the management of wastes over the past few decades, **designed to reduce hazardous and potential exposures**, but **data** that more concretely measure the overall exposure (and thus effects on human health and the environment caused by wastes and waste management practices) and **waste-related data collection are still lacking**.

# Effects on human health and environment

## Problems with contaminated land include:

- Contaminated soils can leach **toxic chemicals into nearby ground or surface waters**, where these materials can be taken up by plants and animals, contaminate a human drinking water supply, or volatilize and contaminate the indoor air in overlying buildings.
  - In dry areas, contamination in soil can be further distributed through wind-borne dust.
  - Once soil contamination migrates to waterways, it may also accumulate in sediments, which can be very difficult to remediate and **may affect local ecosystems and human health.**
- Humans can be harmed by contact with toxic and hazardous materials on a contaminated site via exposure to contaminated land, air, surface water, and ground water.
- When contaminated lands are not properly managed, humans and wildlife can be exposed to contaminants through inhalation, ingestion, or dermal contact. The risks of human exposure are site-specific and difficult to generalize at the national level. Potential effects may be acute or chronic.

# Effects on human health and environment

Although data do not exist to directly link trends in waste with effects on human health and the environment, the management of waste may result in waste and chemicals in waste entering the environment.

## Hazardous waste

- Generation and management of hazardous wastes can contaminate land, air, and water and negatively affect human health and environmental conditions, so it is so strictly regulated.

## Municipal solid waste landfills

- The 3rd-largest source of human-related methane emissions (a type of GHG) in the U.S.
- Methane gas is released as wastes decompose, and emissions are a function of the total amount and makeup of the wastes as well as management facility location, design, and practices.
- Gas emissions can be affected by recycling and changing product use. For example, recycling office paper or aluminum can reduce environmental effects (e.g., by reducing the need to harvest trees or mine bauxite to produce aluminum), and it will also create positive environmental benefits, such as reductions in energy consumption and greenhouse gases.

# Effects on human health and environment

Current approaches to waste management evolved primarily due to such health concerns.

- In the past, waste often was deposited on land just outside developed areas.
- More recently, **excavation of land specifically for deposition of wastes** became common, often accompanied by **burning of wastes to reduce volume**, a practice eventually determined to be a contributor to **degraded air quality** in urban areas.
- **Burning of wastes** occurred at multiple levels, from **backyard burning** to large, **open-burning** dumps of **municipal solid wastes** to onsite burning of commercial and industrial wastes.

# China Case: China says 'NO' to foreign garbage

On January 1, 2018, China began enforcing a new policy to protect its borders from foreign pollution. Exporting countries had long relied on China as a main destination for their low-grade recyclables, and this bold new policy threw the global recycling industry into crisis.

Called "National Sword," the policy banned the import of 24 kinds of waste, including various plastics,<sup>4</sup> and enforced quality standards that exporting countries found nearly impossible to comply with<sup>5</sup>. This move drastically reduced imports of plastic scrap into China. From 2017 to 2018, China's imports of plastic waste dropped 99.1 percent.<sup>6</sup> According to Greenpeace East Asia's analysis, Global plastic waste exports dropped by close to 50% by the end of 2018, in comparison with 2016 levels.<sup>7</sup>

For decades, China was the center of the global plastic waste trade, absorbing the pollution and filth of plastic imports and processing in exchange for the recycled material to feed its manufacturing industry. China shipped its manufactured goods to the United States

and Europe, and the cargo ships would come back with plastic scrap. North Americans and Europeans exported not just their waste, but also the pollution that went with getting rid of it. For wealthy nations—consuming and disposing at a faster rate than ever before—it was the perfect loop.

✓ ✓  
Low shipping and labor costs allowed plastic recycling exports to be profitable, and low or poorly-implemented local environmental standards for imports made it that much easier and cheaper for towns and cities in wealthy countries to unload their plastic waste into China.

While billed as an environmentally friendly alternative to landfill disposal, the global recycling trade can be a dirty business. In China, whole villages were engulfed in plastic and the contaminants associated with it—from non-recyclable trash to the harmful chemicals leached by certain plastics when processed by the informal sector. An army of waste pickers and their families lived among the piles of foreign trash, on the frontlines of the world's rapidly-expanding plastic pollution problem.

Imported plastic d  
Photo courtesy of