

ENSb1303 Local Environmental Risks,  
Autumn 2024

# Waste

*How should we deal with it?*

Filip Marek, Zuzana Morochovičová,  
Pavla Kabátová, Lea Anna Polívková



# Contents

- Organic waste
  - Recyclable waste
  - Non-recyclable waste
  - Hazardous and E-waste
-

# Organic waste

- Definition and types of organic waste
- Risks for the environment and humans
- Waste management practices



# Organic waste: definition

*Create pairs and discuss the definition of organic waste. Try to come up with as many examples of organic waste as you can.*

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# Organic waste: definition

*Create pairs and discuss the definition of organic waste. Try to come up with as many examples of organic waste as you can.*

**Definition:** The biodegradable component of the waste stream that is of biological origin (*Environmental Protection Authority*). It can be decomposed by natural processes (by microorganisms and invertebrates) and turned into smaller organic compounds, while releasing CO<sub>2</sub>, CH<sub>4</sub> and other gases.

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# Organic waste: types and examples

## 1. Household and municipal organic waste

- e.g. food waste from households and businesses, garden and park waste, fireplace ashes

## 2. Commercial and industrial waste

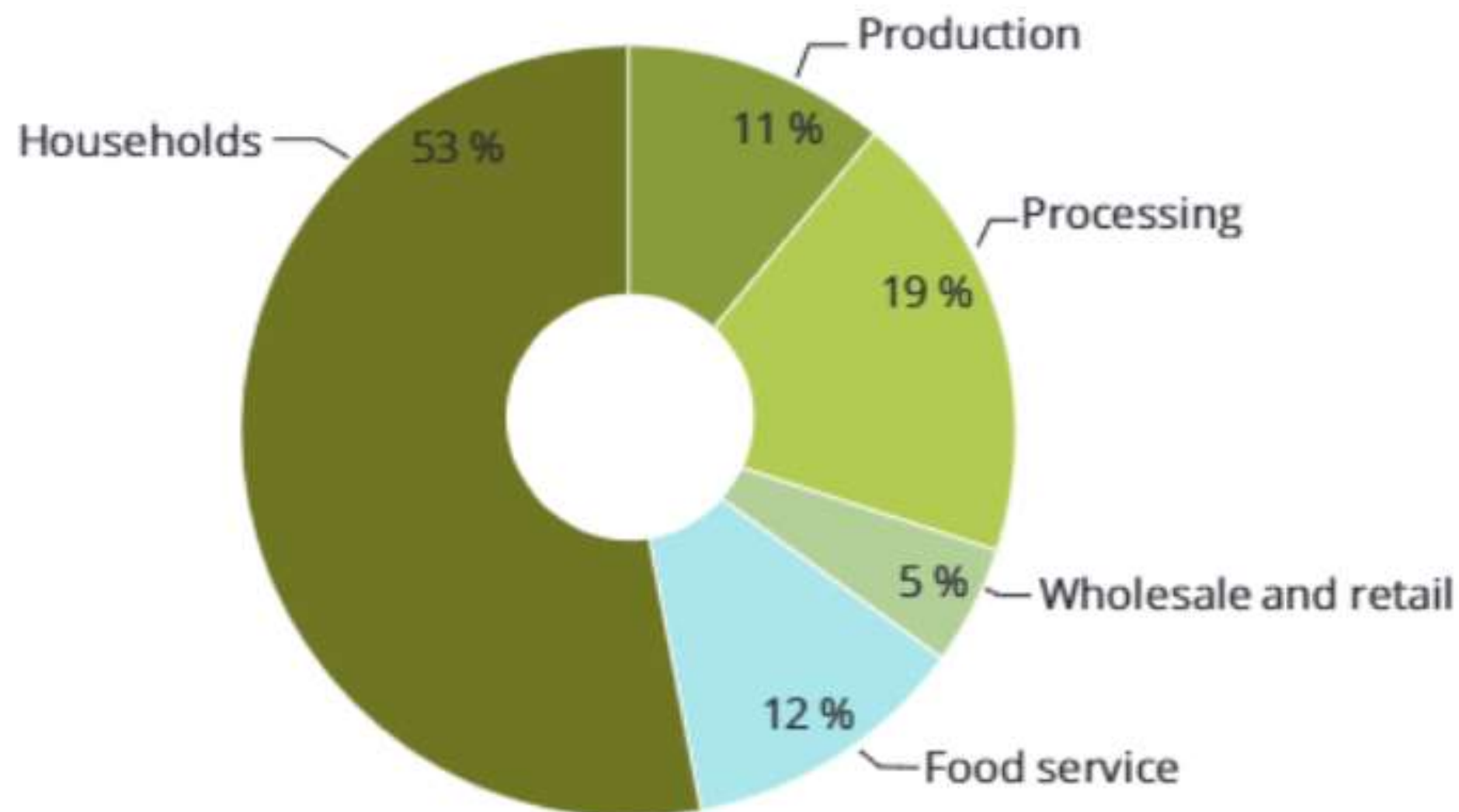
- e.g. waste from food-processing plants, organic part of wastewater, wood waste

## 3. Agricultural waste

- e.g. crop residues, animal manure, natural fertilizer residues



**Figure 4.2** Food waste generation by sector, EU, 2012



**Note:** Includes food and inedible parts associated with food. The production sector includes harvested crops leaving the field/cultivation and intended for the food chain and mature crops not harvested, for example for economic reasons. Again, manure and gleanings are not counted as food waste. A detailed definition of the sectors is given in Tostivin et al. (2016).

**Source:** Stenmarck et al. (2016).

# Risks for the environment and humans

- GHG emissions
  - Decomposition in landfills -> methane
  - Czech Republic - close to 5% of GHG emissions
- Depletion of resources
- Environmental pollution
- Negative impact on biodiversity
  - e.g. eutrophication
- Contamination





# Organic waste management practices

- Landfills
- Incineration
- Composting
- Anaerobic digestion (biomethanization)
- Ethanol fermentation
- Biohydrogen production
- Pyrolysis



# Organic waste: Quiz

Biogas is produced through a process called...

- a. Ethanol fermentation
- b. Aerobic composting
- c. Anaerobic digestion
- d. Dark fermentation



# Organic waste: Quiz

Approximately ...% of greenhouse gas emissions in the Czech republic come from waste.

- a. 2
- b. 5
- c. 9
- d. 13



# Organic waste: Quiz

The product of pyrolysis, among others, is ...

- a. Compost
- b. Biohydrogen
- c. Biochar
- d. Ethanol



# Organic waste: Quiz

Vermicomposting involves ... in the composting process.

- a. Yeast
- b. Earthworms
- c. Fermentation
- d. An anaerobic environment



# Resources

- <https://www.repsol.com/en/energy-and-the-future/future-of-the-world/organic-waste/index.cshtml>
  - <https://climate.mit.edu/explainers/organic-waste>
  - [https://www.epa.sa.gov.au/files/4771336\\_guide\\_waste\\_definitions.pdf](https://www.epa.sa.gov.au/files/4771336_guide_waste_definitions.pdf)
  - <https://faktaoklimatu.cz/infografiky/emise-cr>
  - <https://millerrecycling.com/organic-waste-and-how-to-handle-it/>
  - European Environment Agency, Linden, A. and Reichel, A., Bio-waste in Europe – Turning challenges into opportunities, Publications Office, 2020, <https://data.europa.eu/doi/10.2800/630938>
-

# Recyclable waste

- Definition and types of recyclable waste
  - Risks for the environment and humans
  - Waste management practices
-

Quiz time

# Which materials are recyclable?





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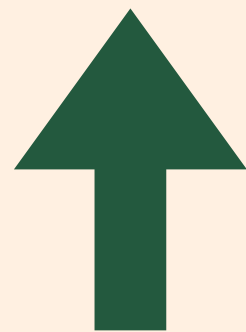


**Which of these things are recyclable ?**

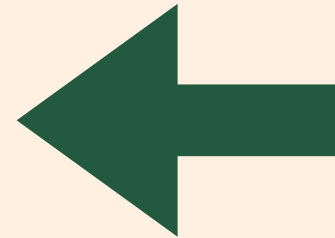
① Start presenting to display the poll results on this slide.

# All of the things can be recycled...

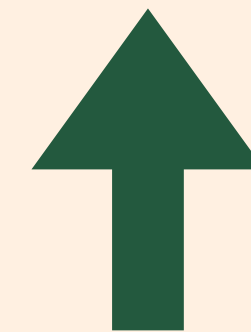
It is not profitable  
to recycle it



The government does  
not subsidise it  
polystyren

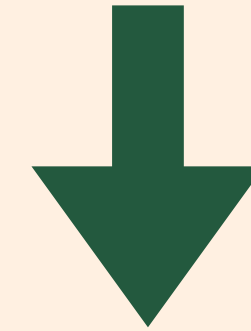


It consist of many materials which are  
hard to separate from each other  
milk box



The product was not designed  
to be recycled some day  
Batteries

Due to safety measures  
car windows



# Definition

"Any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes"

# Types



**Are considered recyclable**

Activity



# **Risks for humans and the environment**

# E-waste

## Human Health Risks

- Toxic Exposure: *Lead, mercury, cadmium.*
- Occupational Hazards: *Injuries, chronic illnesses.*
- Genotoxic Effects: *Harmful compounds affecting communities.*

## Environmental Risks

- Soil Contamination: *Toxic leaching into soil.*
- Water Pollution: *Contaminated groundwater.*
- Air Pollution: *Harmful gases from burning waste.*
- Biodiversity Loss: *Habitat destruction, ecosystem damage.*



# Textile





# Textile

## Human Health Risks

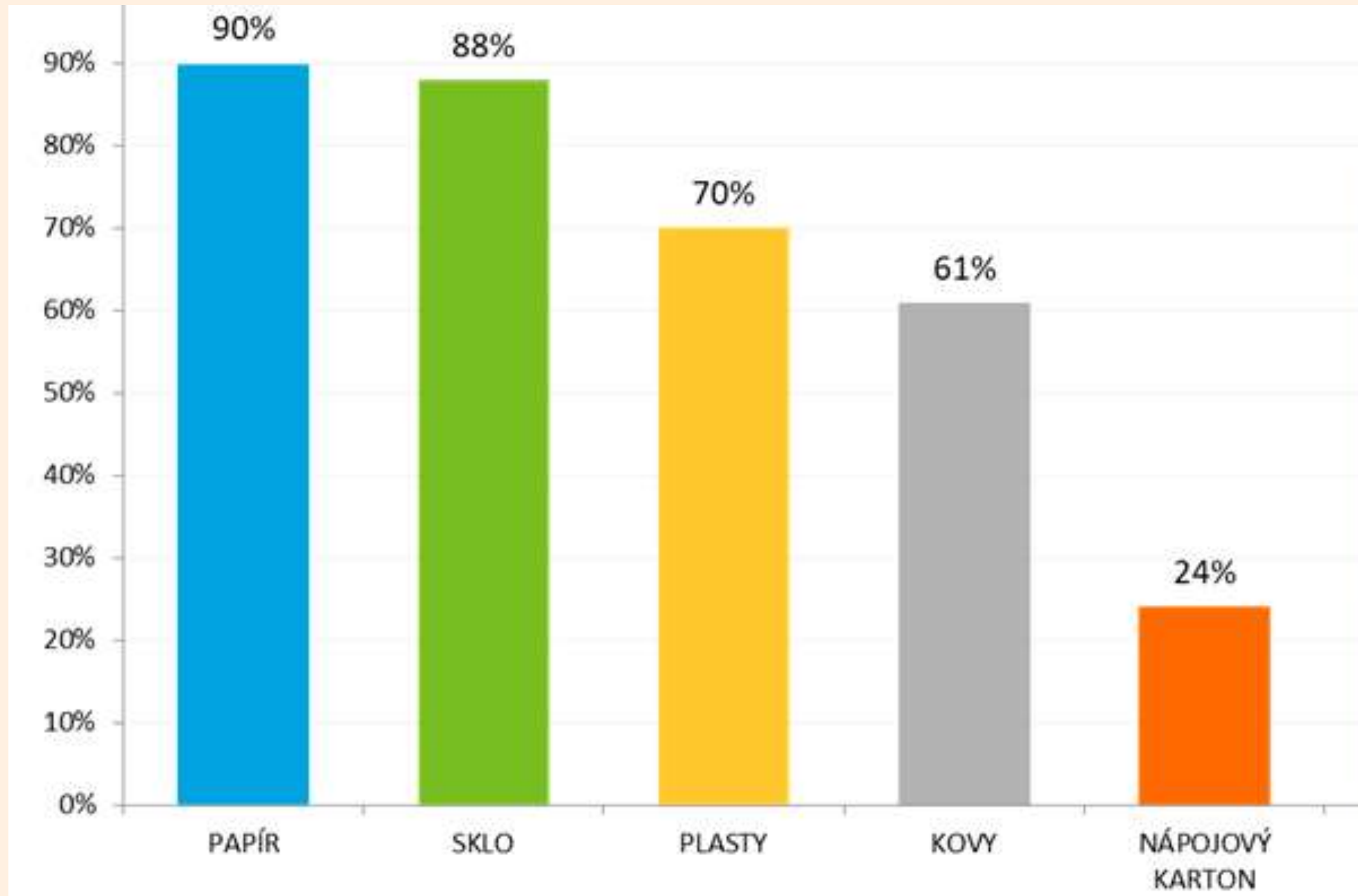
- Chemical Exposure: *Harmful substances causing skin and respiratory issues.*
- Microfiber Pollution: *Microfibers entering food chains.*

## Environmental Risks

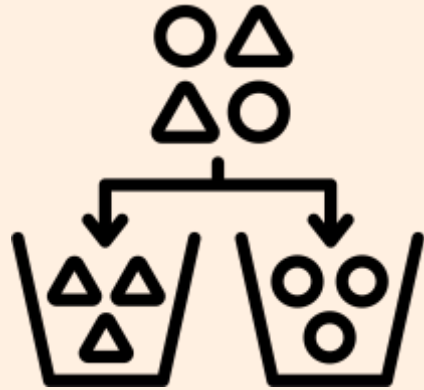
- Landfill Overload: *Long decomposition time, methane emissions.*
- Water Pollution: *Toxic dyes contaminating water sources.*
- Greenhouse Gas Emissions: *Methane from decomposing textiles.*
- Resource Depletion: *High water and energy use in production.*



# Waste management practices



# The management of plastics



# THE TOXIC PLASTIC RECYCLING STREAM:



## TOXIC EXPOSURES WHEN PLASTIC WASTE IS COLLECTED AND SORTED

Plastics are made with over 3,200 chemicals known to be hazardous or of potential concern.

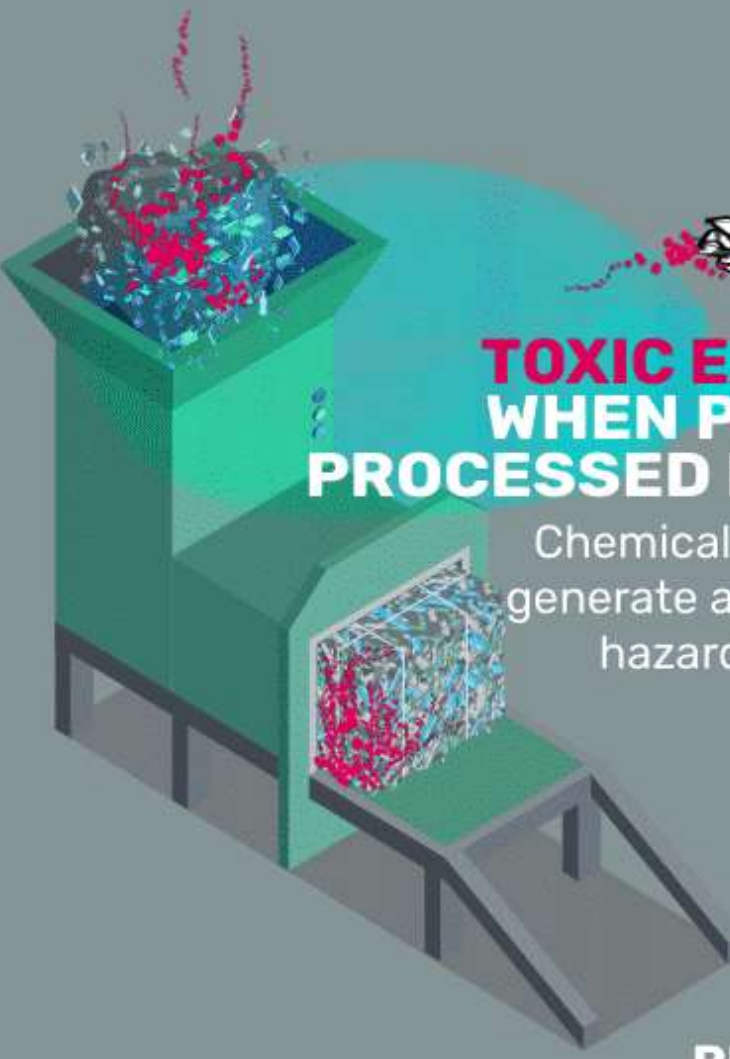


## TOXIC EXPOSURES WHEN EXPORTED PLASTICS ARE DUMPED

22 million tonnes of plastics (and chemicals from these plastics) are released into the environment every year.

## TOXIC EXPOSURES WHEN PLASTIC IS PROCESSED FOR RECYCLING

Chemical recycling can generate as much as 80% hazardous waste



## TOXIC EXPOSURES WHEN WE USE RECYCLED PLASTIC PRODUCTS

Globally banned chemicals have been found in products made from recycled plastics

# RECYCLING PLASTICS IS RECYCLING TOXIC CHEMICALS

PLASTICS POISON RECYCLING - WE SHOULD NOT RECYCLE TOXIC CHEMICALS  
WE NEED TOXICS-FREE MATERIALS FOR A TRULY SAFE, CIRCULAR ECONOMY



# Resources

[https://joint-research-centre.ec.europa.eu/scientific-activities-z/less-waste-more-value/definition-recycling\\_en](https://joint-research-centre.ec.europa.eu/scientific-activities-z/less-waste-more-value/definition-recycling_en)

<https://pmc.ncbi.nlm.nih.gov/articles/PMC4446940/>

<https://indianexpress.com/article/world/climate-change/recycling-gone-up-last-5-years-67-e-waste-remains-unprocessed-8530613/>

<https://www.gy4es.org/post/e-waste-in-india-a-closer-look-at-the-environmental-impact>

<https://pmc.ncbi.nlm.nih.gov/articles/PMC2963874/>

<https://www.genevaenvironmentnetwork.org/resources/updates/the-growing-environmental-risks-of-e-waste/>

[https://www.youtube.com/watch?v=YvBS6qagQdE&ab\\_channel=DWPlanetA](https://www.youtube.com/watch?v=YvBS6qagQdE&ab_channel=DWPlanetA)

[https://www.youtube.com/watch?v=00NIQgQE\\_d4&ab\\_channel=DWPlanetA](https://www.youtube.com/watch?v=00NIQgQE_d4&ab_channel=DWPlanetA)

<https://pubs.rsc.org/en/content/articlelanding/2021/ee/d1ee00691f>

<https://internationalfireandsafetyjournal.com/the-environmental-impact-of-battery-disposal/>

<https://www.jeeng.net/pdf-189187-110778?filename=Environmental+Impact.pdf>

<https://www.samosebou.cz/2021/02/11/kolik-odpadu-vyprodukuje-prumerne-kazdy-cech/>

<https://stoppoisonplastic.org/chemicals-health-and-plastics/disposal-and-plastic-recycling/>

# Non-recyclable waste

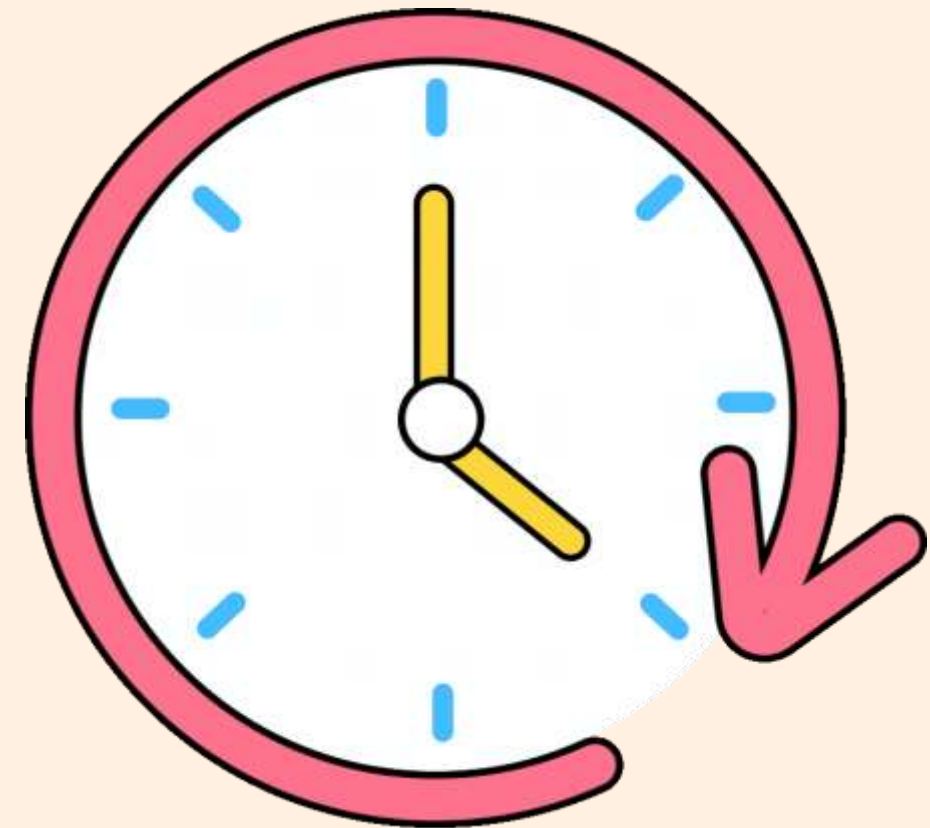
- Definition and types of non-recyclable waste
  - Waste management practices
  - Risks for the environment and humans
-

# Definition of Non-Recyclable Waste

“Waste that cannot be processed for reuse due to composition, contamination, or lack of recycling options.”

**Write down as many things as  
you know that are non-  
recyclable**

**(1 minute)**





# Not Recyclable



Alkaline batteries & cell phones (fire hazard)



CDs & DVDs



Dinnerware or glassware (broken or unbroken glass)



Diapers & pet waste



Food waste



Clothing, textiles, & shoes



Foam containers



Medical supplies & sharps



Fluorescent bulbs, CFLs, & incandescent



Kleenex, tissues & toilet paper



Bagged plastic bags (newspaper, dry cleaner and shopping bags)

4540 360th St.  
Sheldon, IA 51201

712-324-4026



Ziploc, food & single plastic bags

# Types of Non-Recyclable Waste

- **Plastic Waste**: Multi-layered or mixed materials (e.g., plastic + metal/paper)
- **Electronic Waste** (E-Waste): Small electronics with hazardous components (e.g., lead, mercury)
- **Contaminated Waste**: Items heavily soiled with food, chemicals (e.g., greasy containers)
- **Composite Materials**: Mixed textiles, construction materials difficult to separate

# Overview of Non-Recyclable Waste Challenges in the EU

- **Growth of Packaging Waste:** Between 2013 and 2020 increased by 15%, (80 million tons)
- **Recycling Rate and Material Types:** 64% of packaging waste is recycled, the rate varies by material
  - High Recycling Rates: 75% for paper, cardboard, and metal packaging
  - Low Recycling Rate for Plastics: 40%, highlighting challenges in recycling non-biodegradable materials

# The Non-Recyclable Waste Challenge in Plastics

- **Critical Issue with Plastics:** Many EU countries risk not meeting the 50% recycling target for plastic packaging by 2025
  - Impacts on Circular Economy Goals: Non-recyclable plastic waste remains **a major barrier to achieving circular economy objectives**
- **Case Study:** *Czech Republic's Performance*
  - *2022 Improvement in Plastic Recycling: Although plastic recycling rose from 43% to 46% in the Czech Republic, much work remains for hard-to-recycle plastics*
  - *Comparison with Other Materials: Paper, glass, and metal see far higher recycling rates, showing the gap for plastics*

# Waste Management Practices in the Czech Republic

- **Landfilling**

- Heavy reliance on landfills (shifting towards reducing landfill use)



- **Public Awareness and Initiatives:**

- Government campaigns promote waste reduction and responsible sorting (reducing single-use plastics and safely disposing of hazardous waste)

- **Sorting and Waste-to-Energy:**

- Rigorous sorting and collection systems help minimize non-recyclable waste (Waste-to-energy plants reduce landfill needs but raise environmental concerns)

# Video

## Waste to energy



# Waste-to-energy facilities

## NAKLADANIE S ODPADOM V EURÓPE

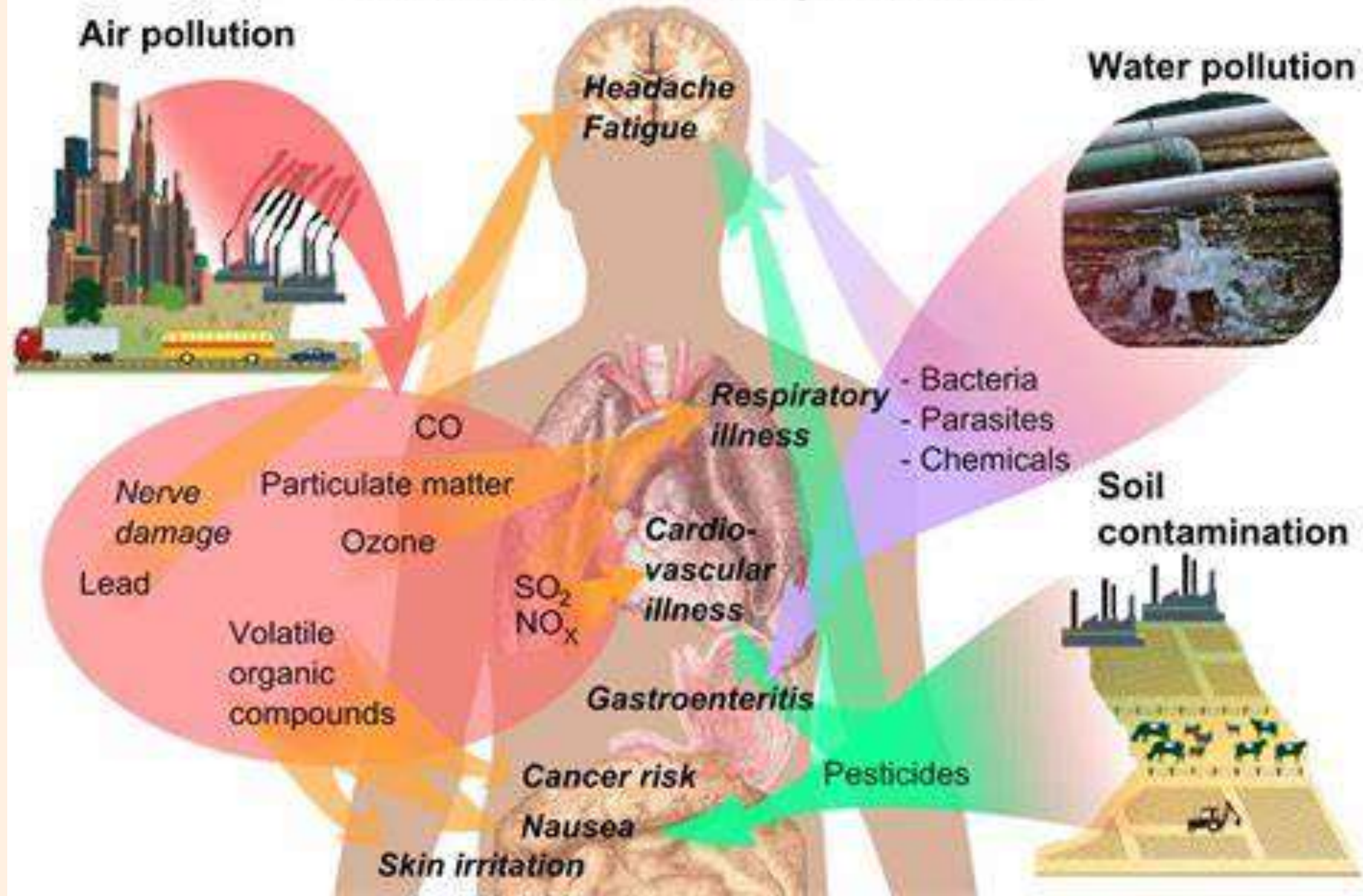
Zariadenia na energetické využitie odpadov

(2016; CEWEP, mimo nebezpečných odpadov)

Krajina	Počet ZEVO	Kapacita (mil. ton ročně)
Francúzsko	126	14,10
Nemecko	121	26,00
UK	46	9,96
Taliansko	41	6,21
Švédsko	34	5,99
Švajčiarsko	30	4,00
Dánsko	26	3,47
Belgicko	18	3,41
Nórsko	17	1,61
Holandsko	12	7,80
Španielsko	12	2,88
Rakúsko	11	2,50
Fínsko	8	1,47
Poľsko	5	0,50
Česká republika	4	0,70
Portugalsko	4	1,20
Slovenská republika	2	0,29
Litva	1	0,26
Luxembursko	1	0,16
Maďarsko	1	0,35
Estónsko	1	0,24
Írsko	1	0,23
<b>SPOLU</b>	<b>522</b>	<b>93,90</b>



# Health effects of pollution





# Risks for the Environment and Humans

- **Environmental Pollution:**

- Plastics take centuries to decompose, forming microplastics that harm ecosystems

- **Health Risks:**

- Toxic substances in e-waste (e.g., lead, mercury) can leach into soil and water
- Potential health impacts: respiratory issues, developmental problems

- **Greenhouse Gas Emissions:**

- Incineration releases CO<sub>2</sub> and greenhouse gases, contributing to climate change

# Resources

- <https://www.obaly21.cz/cesko-patri-mezi-devet-zemi-eu-ktere-jsou-na-ceste-ke-splneni-recyklacnich-cilu/>
- <https://nwialandfill.com/recycle/nonrecyclable/>
- <https://www.youtube.com/watch?v=tAZmzfGHUd8>
- <https://www.youtube.com/watch?v=Pu9rT5VdZRE>

<https://vamosarema.com/>

# Hazardous and E-waste

- Definition and types of hazardous and electronic waste
  - Waste management practices
  - Risks for the environment and humans
-

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**What comes to your mind when I say hazardous waste?**

**i** Start presenting to display the poll results on this slide.

# Hazardous waste - definition

- **according to Czech law** - any waste that has the properties of being:

**1)Explosive 2)Ecotoxic 3)Flamable 4)Releasing toxic gas**

- **general definition:**

“Hazardous waste is any solid or liquid substance that results from human activity and that, if not properly stored or disposed of, can present a serious danger to the life and health of people and the environment because they are toxic, chemically reactive, flammable, or corrosive.”

# Hazardous waste

- Regulation No. 273/2021 Coll. – waste that contains:
  - **Substances hazardous to human health or the environment**  
– heavy metals, organic compounds, PCBs (polychlorinated biphenyls), pesticides, acids, and bases
  - **Infectious substances** – biological materials, medical waste, and chemical waste,
  - **Radioactive substances** or other sources of ionizing radiation
-

# Nine Classes of Hazardous Materials

## Class 1: Explosives

Divisions: 1.1, 1.2, 1.3, 1.4, 1.5, 1.6



## Class 6: Poison (Toxic) and Poison Inhalation Hazard

## Class 2: Gases

Divisions: 2.1, 2.2, 2.3



## Class 7: Radioactive



## Class 3: Flammable Liquid and Combustible Liquid



## Class 8: Corrosive



## Class 4: Flammable Solid, Spontaneously Combustible, and Dangerous When Wet

Divisions 4.1, 4.2, 4.3



## Class 9: Miscellaneous



## Class 5: Oxidizer and Organic Peroxide

Divisions 5.1, 5.2



## Dangerous



Revised 04/13



GHS01 - výbušné  
látky



GHS02 - hořlavé  
látky



GHS03 - oxidační  
látky



GHS04 - plyny pod  
tlakem



GHS05 - korozivní a  
žiravé látky



GHS06 - toxické  
látky



GHS07 - dráždivé  
látky



GHS08 - látky  
nebezpečné pro  
zdraví



GHS09 - látky  
nebezpečné  
pro životní prostředí



# Examples of hazardous waste

- used oil
- used acids
- used solvents
- paint sludge
- oil tank bottoms
- obsolete pesticides
- toxic gas waste



# Activity

You need to dispose of :

1)nuclear factory waste

2)dangerous medical waste

3)obsolete pesticides

Which methods would you choose for each one? Confer in pairs and share

# Disposal methods for hazardous waste - treatment prior to disposal

- **Chemical treatment** – e.g., neutralization, precipitation, ion exchange, reduction, or oxidation;
- **Thermal treatment** – e.g., incineration;
- **Biological treatment** – e.g., landfarming; and
- **Physical treatment** – e.g., solidification, flotation, sedimentation, evaporation, or filtration.

# Disposal methods - Can you guess?

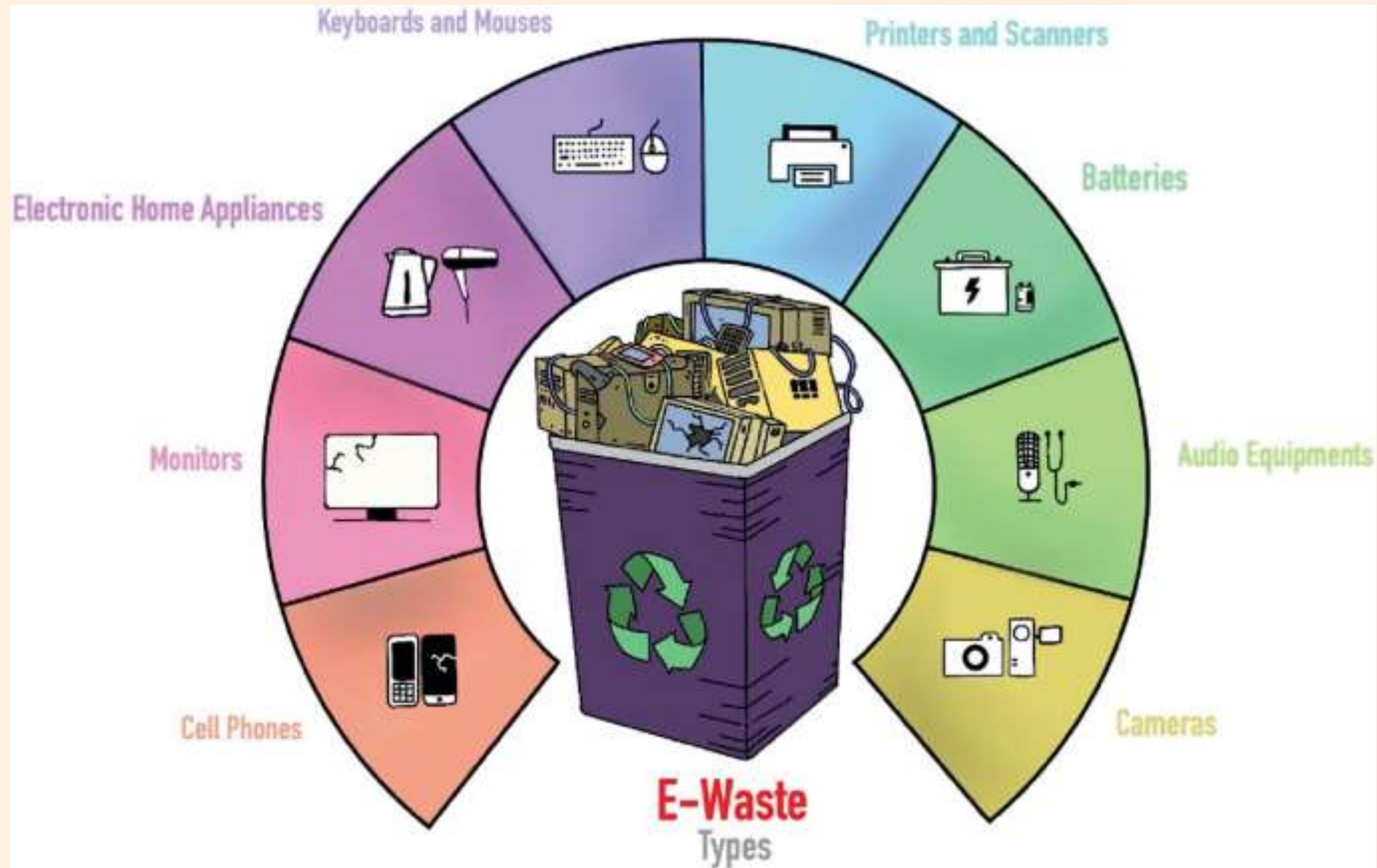


# Disposal methods for hazardous waste

- **Underground Disposal:** Waste placed in inactive mines
- **Landfill Disposal:** Engineered landfills prevent contamination
- **Ocean Dumping:** Treated waste disposed of in deep-sea areas
- **Deep-Well Injection:** Liquid waste injected into deep formations
- **Surface Impoundments:** Man-made depressions store liquid waste
- **Incineration:** High-temperature burning reduces volume and toxins
- **Encapsulation:** Waste enclosed in solid materials to prevent leaks

# E-waste

- discarded electrical appliances such as mobile phones, computers and televisions



# E-waste - facts

- The amount of electrical and electronic equipment in the EU rose from 7.6 million tonnes in 2012 to 13.5 million tonnes in 2021
  - Collected e-waste increased from 3.0 million tonnes in 2012 to 4.9 million tonnes in 2021
  - Average collection was ? kilos per inhabitant
-

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**What was the average collection of e-waste in EU  
in 2021 per capita?**

① Start presenting to display the poll results on this slide.



Average collection was 11kgs per inhabitant, with the leading country being Austria with 15,7kgs (in 2021)

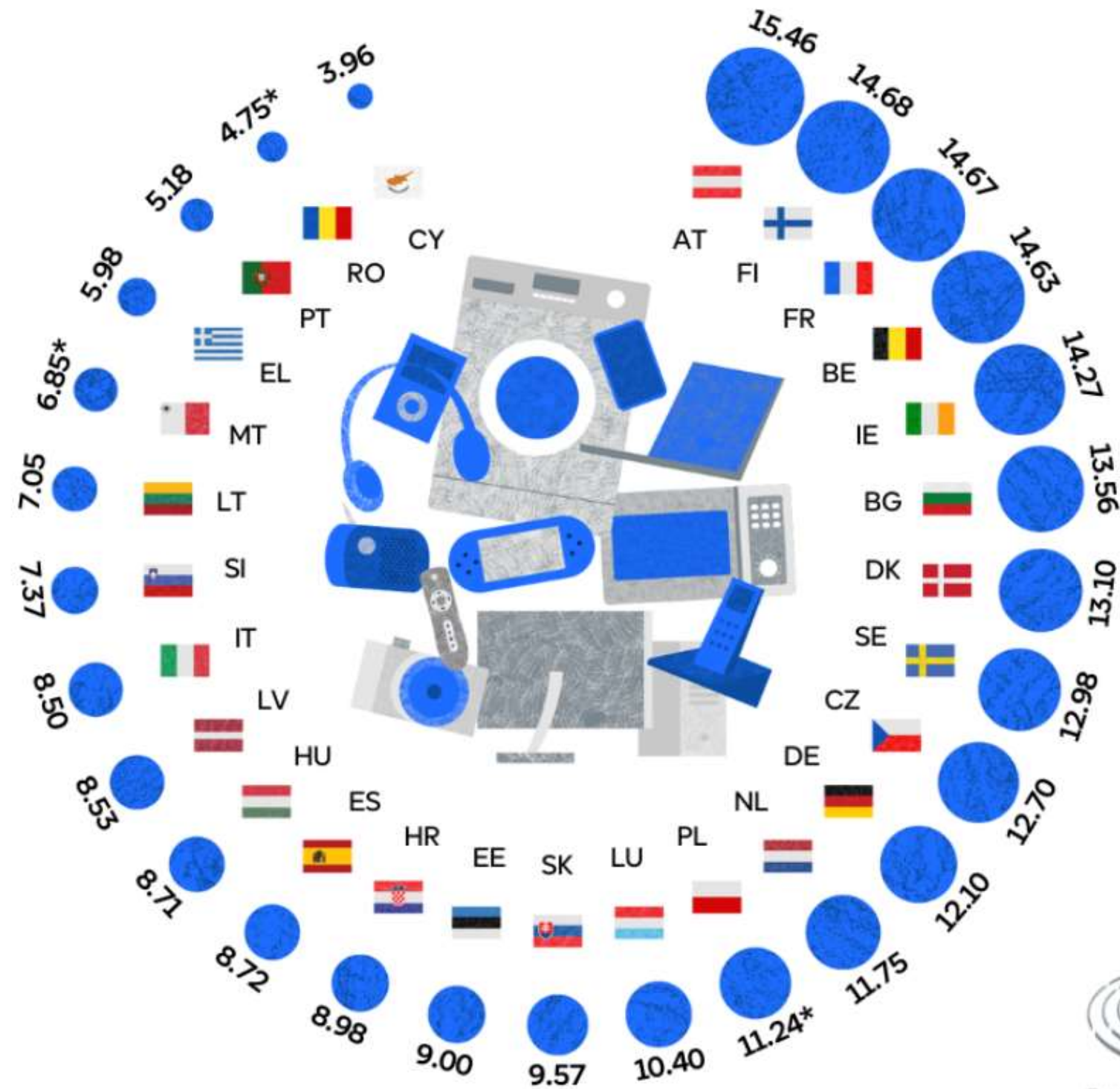






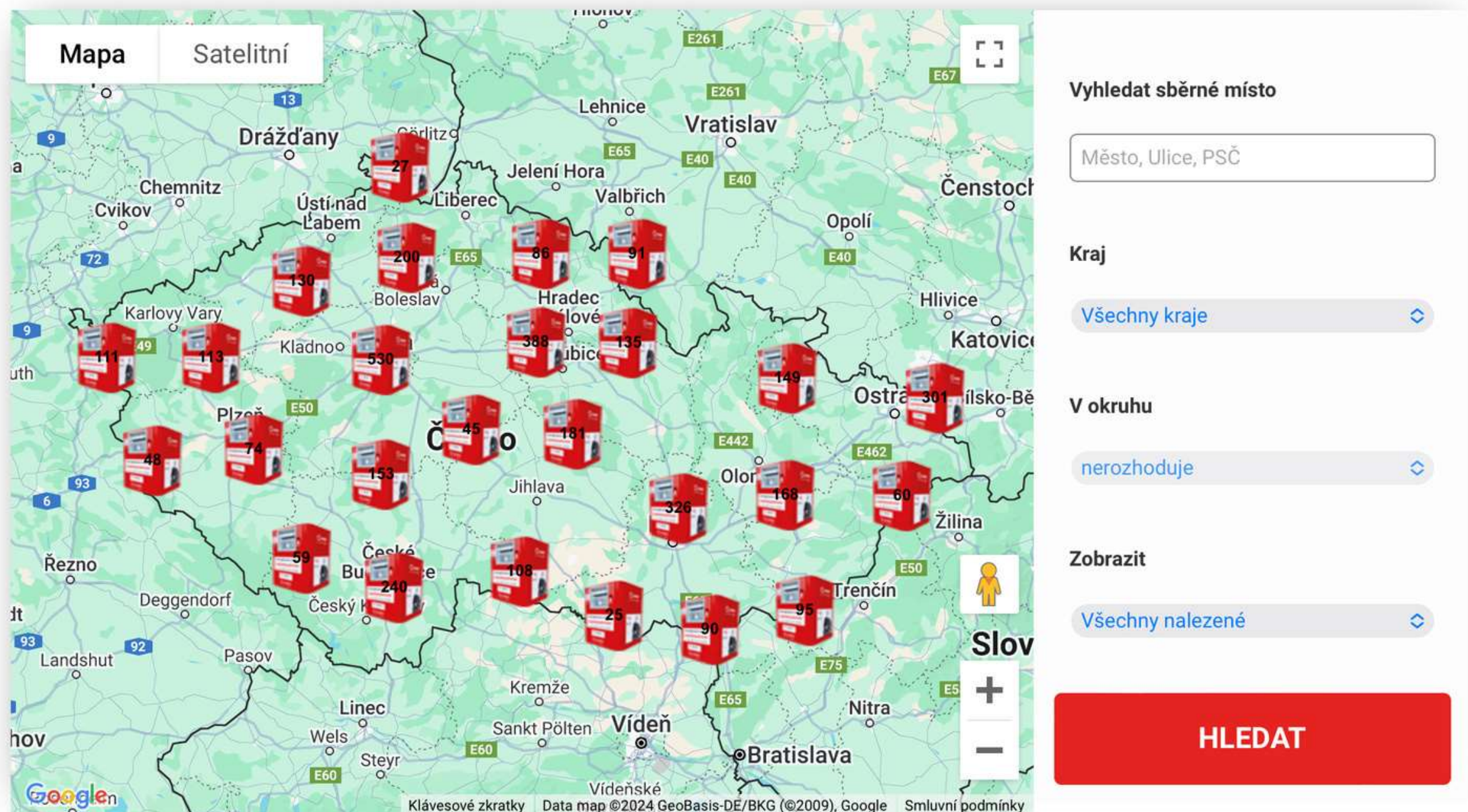
# How much e-waste do EU countries collect?

Electric and electronic equipment waste, in kg per inhabitant



# E-waste home disposal - Czechia

## Vyhledávání

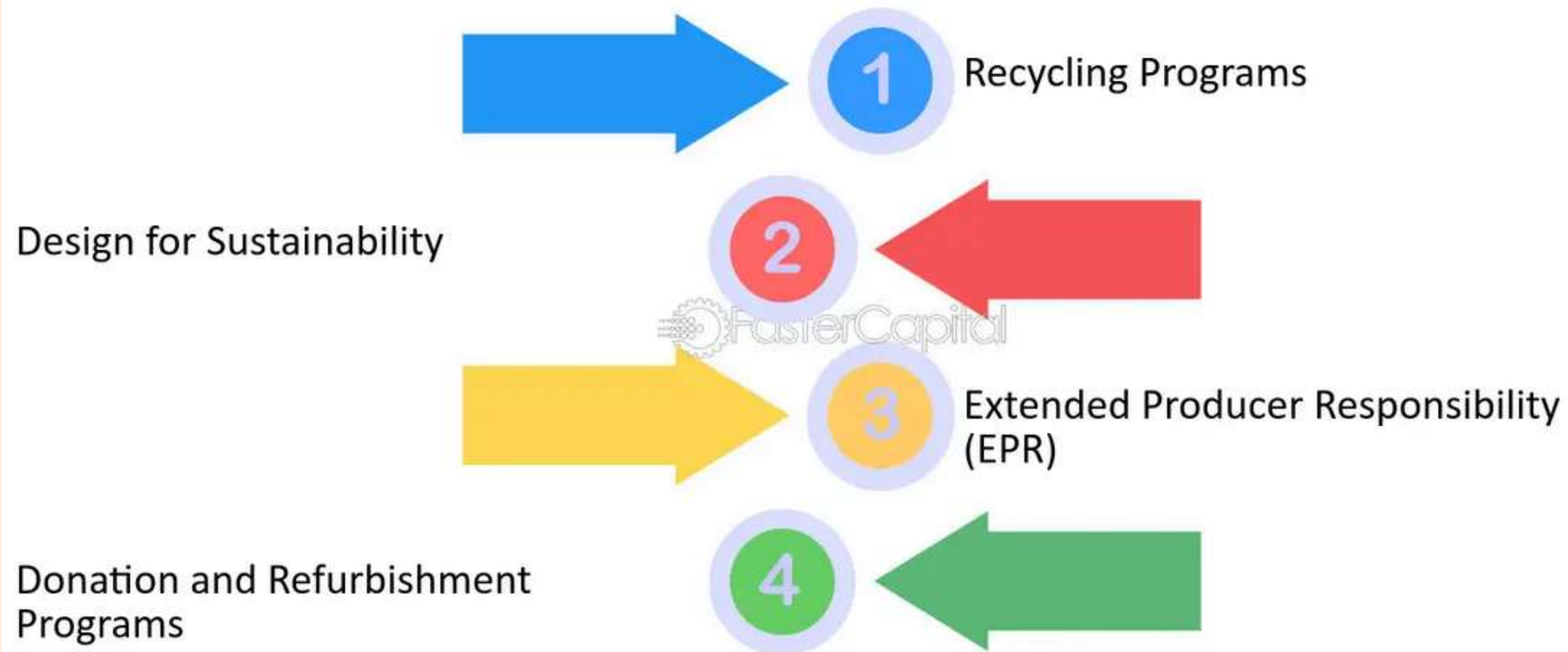


The screenshot shows a web application interface for finding e-waste collection points in the Czech Republic. The main component is a map of the Czech Republic, overlaid with numerous red icons representing collection points. Each icon is labeled with a number, such as 27, 130, 200, 86, 91, 111, 49, 113, 130, 530, 388, 135, 149, 48, 74, 153, 45, 181, 326, 168, 60, 59, 240, 108, 25, 90, 95, 108, 25, 90, 95. The map includes a search bar at the top left with the text "Město, Ulice, PSČ" and a "Vyhledat sběrné místo" button. Below the search bar are filter options for "Kraj" (Region) and "V okruhu" (District), both set to "Všechny kraje" and "nerozhoduje" respectively. A "Zobrazit" (Show) button is set to "Všechny nalezené" (All found). A large red "HLEDAT" (SEARCH) button is at the bottom right. The map also features a "Mapa" and "Satelitní" (Satellite) toggle, a "Slov" (Text) button, and a "Google" logo at the bottom left. The footer contains the text "Klávesové zkratky Data map ©2024 GeoBasis-DE/BKG (©2009), Google Smluvní podmínky".



# Possible solutions for e-waste

## Possible Solutions to the E-Waste Crisis



# **Risks of hazardous and e-waste on the environment and humans**

## **Health and Environmental Implications of Hazardous Waste**

**1. Respiratory and Cardiovascular Issues**

**2. Cancer Risks**

**3. Neurological Effects**

**4. Reproductive Health Issues**

**5. Acute Symptoms**

**6. Contamination of environment - water sources, soil**

**7. Danger to animals**

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# **Risks of hazardous and e-waste on the environment and humans**

## **Implications of E-Waste**

- 1. Toxic Chemical Exposure**
  - 2. Environmental Contamination**
  - 3. Occupational Hazards**
  - 4. Global Health Disparities**
-

# Waste management practices

- **Ordinance No. 273/2021 Coll.** (Vyhláška č. 273/2021 Sb.) is an ordinance issued on July 12, 2021, concerning the details of waste management. It incorporates relevant European Union regulations and establishes requirements for various aspects of waste management, including:
    - **Waste Management Facilities**
    - **Data Submission**
    - **Technical Conditions**
    - **Energy Recovery**
    - **Landfilling and Shipment**
    - **Hazardous Waste Management**
-

# Waste management practices - international

- [Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal](#)
  - controls the international trade in hazardous wastes and certain other wastes
  - The Convention, adopted in 1989, entered into force in 1992, establishes a “notice and consent” regime — also known as prior informed consent (PIC) — for the export of hazardous and certain other waste to importing countries.
-

# Resources

<https://cvrlabs.com/hazardous-waste-solid-waste-testing/>

<http://www.hazardouswasteeurope.eu/>

<http://www.hazardouswasteeurope.eu/what-is-hazardous-waste/>

[https://www.era-comm.eu/EU\\_waste\\_law/part\\_2/part\\_2\\_12\\_hazardous.html](https://www.era-comm.eu/EU_waste_law/part_2/part_2_12_hazardous.html)

<https://eupolitical>

<https://a-otc.com/hazardous-waste-disposal-methods/report.com/dealing-with-hazardous-waste>

<https://www.eurits.org/reliable-treatment-techniques/>

[https://www.mzp.cz/cz/articles\\_blaha\\_likvidace\\_nebezpecneho\\_odpadu](https://www.mzp.cz/cz/articles_blaha_likvidace_nebezpecneho_odpadu)

<https://www.umweltbundesamt>

<https://www.zakonyprolidi.cz/cs/2021-273de/en/topics/waste-resources/waste-management/waste-types/hazardous-waste>

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Thank you for your  
attention!

Do you have any questions?

