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LIFE MERCURY-FREE

Complex Awareness Raising and Behaviour Change for the Mercury-Free City Environment

Deliverable D.3.1 - Roadmap: Advancing Citizens' Awareness and Behavior to Diminish Mercury Pollution in Cities

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Table 1. Terms & Abbreviations.

Abbreviation	Definition
CFLs	Compact Fluorescent Lamp
EU	European Union
LIFE MERCURY-FREE	Complex Awareness Raising and Behaviour Change for the Mercury-Free City Environment
NGO	Non-Governmental Organisation
e-HUB	Electronic Hub
LIFE	L'Instrument Financier pour l'Environnement

1. Introduction

1.1 Background

Mercury pollution poses a significant environmental challenge, affecting the health of our cities and citizens. Recognizing the urgent need to address this issue, the Roadmap emerges as a strategic initiative. The background of this endeavor lies in the collective awareness of the diverse approaches to handling mercury-containing goods across European states participating in the project. These goods, including compact fluorescent lamp (CFLs), batteries, and other items, contribute to environmental degradation if not disposed of responsibly.

As the participating states grapple with the complex task of managing mercury-containing waste, it becomes imperative to understand the existing mechanisms and analyze the disparities in their performance. The background research underscores the necessity of a cohesive and collaborative strategy to diminish mercury pollution effectively.

The activities of the project will take place at the level of the wide public – consumers of goods containing mercury. The project activities involve four European cities: Lodz (Poland), Cracow (Poland), Lviv (Ukraine), and Ivano-Frankivsk (Ukraine) and three control cities, in which there will be conducted the monitoring of the same indicators as in the piloting cities: Larissa (Greece), Camerino (Italy), and Évora (Portugal).

1.2 Purpose of the Roadmap

The overarching purpose of the Roadmap is to develop a holistic plan addressing the multifaceted challenges associated with mercury pollution in cities. The Roadmap aims to compare the performance of European states in collecting mercury-containing waste, emphasizing the need for a unified approach. The plan envisions the establishment of a common informational portal to streamline the recycling process, a virtual counseling center for households, and the initiation of diverse activities to engage and educate citizens.

Beyond the technical aspects, the Roadmap seeks to instill a sense of confidence among citizens regarding the commitment of all stakeholders. By actively involving citizens, the plan aims to create a collective consciousness that stakeholders are not passive observers but active participants in solving the environmental challenge of mercury pollution.

1.3 Scope and Target Audience

The scope of the Roadmap extends to European states participating in the project, recognizing the diverse approaches and experiences each brings to the table. The target audience is the citizens, whose active involvement is crucial for the success of the initiative. By encompassing all types of stakeholders, from governmental bodies to community organizations, the Roadmap envisions a collaborative effort that is inclusive and far-reaching.

1.4 Duration

The Roadmap is designed to be a dynamic and ongoing initiative, spanning from approximately the seventh month of project implementation until its conclusion. This extended timeframe ensures a comprehensive and sustained effort to address mercury pollution in cities, allowing for the implementation and refinement of strategies over time. This duration emphasizes the commitment to creating lasting change rather than offering short-term solutions. In essence, the introduction sets the stage for a comprehensive and collaborative effort, recognizing the urgency and complexity of addressing mercury pollution while emphasizing the need for a sustained commitment from all stakeholders involved in the project.

2. Mercury-Containing Waste Collection Across Europeam States

The proper management of mercury-containing waste has emerged as a critical environmental concern, prompting the Euroepan Union (EU) and non-EU states

to establish a comprehensive legislative and regulatory framework to address the challenges associated with its collection and disposal. Mercury, a potent neurotoxin, poses significant risks to human health and the environment, necessitating stringent measures to minimize its release into ecosystems. In response to international commitments and recognizing the transboundary nature of mercury pollution, the EU and non-EU states have formulated a robust regulatory framework aimed at ensuring the safe and environmentally responsible collection of mercury-containing waste across its member states. This legislative initiative not only aligns with global efforts to reduce mercury emissions but also underscores the European states commitment to sustainable waste management practices.

This section will provide an overview of the key elements within the European states legislative framework, shedding light on the objectives, mechanisms, and obligations imposed on member states to effectively manage mercury-containing waste. By exploring the regulatory landscape, we aim to gain insights into the collaborative efforts and harmonized approaches that European states have adopted to address the challenges posed by this hazardous waste stream.

2.1 Legislative and Regulatory Framework

In terms of EU law, these are directives and implementing decisions of the EU Commission:

- Directive 2008/98/WE;
- Amending Directive (UE) 2018/851;
- Commission Implementing Decision (EU) 2021/19 of 18 December 2020 establishing a common method and format for reporting on reuse in accordance with a Directive of the European Parliament and of the Council 2008/98/WE (Dz.U. L 10 of 12.1.2021, p. 1–7);
- Commission Implementing Decision (EU) 2019/1004 of 7 June 2019 laying down rules for the calculation, verification and reporting of waste data in accordance with Directive 2008/98/EC of the European Parliament and of

the Council and repealing the Commission Implementing Decision C(2012) 2384 (Dz.U. L 163 of 20.6.2019, p. 66–100);

- Commission Directive (EU) 2015/1127 of 10 July 2015 amending Annex II to Directive 2008/98/EC of the European Parliament and of the Council on waste and repealing certain directives (Dz.U. L 184 of 11.7.2015, p. 13–15);
- Commission Decision 2000/532/EC of 3 May 2000 replacing Decision 94/3/EC establishing the list of wastes pursuant to Article 1 letter (a) Council Directive 75/442/EEC on waste and Council Decision 94/904/EC establishing the list of hazardous waste in accordance with Article 1, section 4 of Council Directive 91/689/EEC on hazardous waste (Dz.U. L 226 of 6.9.2000, p. 3–24).

2.1.1 Poland - Legislative and Regulatory Framework

Hazardous waste is generated in various industries, and waste classifications occur within specific groups as indicated in the waste catalog. Within each group, there are codes for different types of hazardous waste [15]. The exact breakdown can be found in the Regulation of the Minister of Climate dated January 2, 2020, on the waste catalog [21].

Examples of hazardous waste generated by companies include:

- Waste engine, gear, and lubricating oils, along with oil packaging;
- Sorbents, filter materials, wiping cloths, and protective clothing;
- Waste or unusable vehicles (including off-highway machinery), waste from dismantling, inspection, and maintenance of vehicles;
- Batteries and accumulators;
- Waste electronic equipment;
- Air conditioners;
- Sprays;
- Chemical packaging;
- Batches of non-conforming products and expired or unusable products, in which hazardous waste is highlighted;

Examples of municipal hazardous waste encompass:

- Cans and containers of paints and varnishes;
- Cytotoxic and cytostatic drugs;
- Wooden pallets and wooden boxes soaked in protective preparations;
- Batteries and rechargeable batteries;
- Waste electronic equipment;
- Plant protection products and their packaging.

Certain types of waste are subject to specific disposal and treatment, including disposal. These obligations primarily apply to waste generated by residents, who are not free to dispose of it, regardless of whether it is hazardous waste according to the waste catalog. This waste cannot be disposed of with other municipal waste [15].

National legal documents defining waste management

- Journal of Laws of 2013, item 21, Act of December 14, 2012 on waste [15];
- OJ 1996 no. 132 item 622 Act of September 13, 1996 on maintaining cleanliness and order in municipalities [16];
- OJ 2021 item 906 Regulation of the Minister of Climate and Environment of May 10, 2021 on the method of selective collection of selected waste fractions [22];
- OJ 2001 No. 62 item 627 Act of April 27, 2001, Environmental Protection Law [17];
- OJ 2020 item 10 Regulation of the Minister of Climate of January 2, 2020 on the waste catalogue [21];
- OJ 2015 item 1688 Act of September 11, 2015 on waste electrical and electronic equipment [20];
- OJ 2009 No. 79 item 666 Act of April 24, 2009 on batteries and accumulators [18];
- OJ 2013 item 888 Act of 13 June 2013 on packaging and packaging waste management [19];

- OJ 1996 no. 132 item 622 Act of September 13, 1996 on maintaining cleanliness and order in municipalities [16].

Local legal documents defining waste management

- Journal Laws of 2013, item 21, Act of December 14, 2012 on waste [15];
- OJ 1996 no. 132 item 622 Act of September 13, 1996 on maintaining cleanliness and order in municipalities [16].

The wastes covered by special obligations are:

- Used lead-acid car batteries (not hazardous waste) - They should be handed over to a dealer when buying a new battery or handed over to a municipal waste collection point [18];
- Used portable batteries and rechargeable batteries, e.g., "sticks," button batteries (they are not hazardous waste) - Dispose of them in the container for used batteries available at the store, school, office, etc., or hand them over to a selective collection point for municipal waste [18];
- Waste electrical and electronic equipment (may be hazardous waste, e.g., refrigerator, air conditioner, or non-hazardous waste, e.g., toy, TV remote control) - Dispose of it in a container available at the store, or donate used equipment when buying new equipment, or take it to a separate collection point for municipal waste (including mobile) [20];
- Unused or expired medicines (only cytotoxic and cytostatic drugs are hazardous waste) - Dispose of them in a container at a pharmacy or take them to a separate collection point for municipal waste [15];
- Plant protection products and their packaging - Return them to the store [19];
- Packages of hazardous agents, such as paints - Should be handed over to the point of selective collection of municipal waste - if the rules of the point allow it [16].

2.1.1.1 Lodz - Legislative and Regulatory Framework

With reference to EU directives and the national legal system, the following

applies in the city of Lodz, among others: the following local legal acts:

- Resolution No xl/502/17 of the Łódź Voivodeship Assembly of June 20, 2017, on the adoption of the waste management plan for the Łódź Voivodeship for the years 2016-2020, taking into account the years 2023-2028;
- Waste management plan for the Łódź Voivodeship for 2019-2025, including 2026-2031;
- Resolution No xl/503/17 of the Łódź Voivodeship Assembly of June 20, 2017 on the implementation of the waste management plan for the Łódź Voivodeship for 2016-2020, including the years 2023-2028 (Journal of Laws of the Łódź Voivodeship, item 3160), as amended by resolutions of the Łódź Voivodeship Assembly : No. liv/676/18 of July 10, 2018 (Official Journal of the Łódź Voivodeship, item 3942), No. lvii/709/18 of October 30, 2018 (Official Journal of the Łódź Voivodeship, item 3393)) and no. iv/68/19 of February 26, 2019 (Journal of Laws of the Łódź Voivodeship, item 1505);
- Resolution No. xlv/844/12 of the city council in Łódź of July 4, 2012 on the division of the city of Łódź into municipal waste collection sectors (Journal of Laws of the Łódź Voivodeship, item 2333);
- Resolution No. xv/647/19 of the city council in Łódź of October 16, 2019 on the decision on the collection of municipal waste by the city of Łódź from owners of properties where no residents live and municipal waste is generated (Journal of Laws of the Province Łódź, item 5891);
- Resolution No. xxxii/1058/20 of the city council in Łódź of November 19, 2020 on the detailed method and scope of providing services in the field of collecting municipal waste from property owners and managing this waste (Journal of Laws of the Łódź Voivodeship, item 6298), amended by resolution No. lvii/1710/22 of March 16, 2022 (Journal of Laws of the Łódź Voivodeship, item 1844);
- Resolution No. xlix/1498/21 of the city council in Łódź of October 20, 2021 on the selection of the method for determining the fee for municipal waste management and determining the rate of such a fee in the city of

Łódź (Journal of Laws of the Łódź Voivodeship, item 5070);

- Resolution No. xxxii/1054/20 of the city council in Łódź of November 19, 2020 on determining the fee rate for municipal waste management on the property on which a summer house is located or other property used for recreational and leisure purposes (art. Office of the Łódź Voivodeship, item 6295), as amended by resolution no. 6295;
- Resolution No. xxxii/1057/20 of the city council in Łódź of November 19, 2020 on the introduction of regulations for maintaining cleanliness and order in the city of Łódź (Journal of Laws of the Łódź Voivodeship, item 6349), as amended by resolution No. lvii/1711 /22 of March 16, 2022 (Journal of Laws of the Łódź Voivodeship, item 1845).

2.1.1.2 Krakow - Legislative and Regulatory Framework

Waste-containing hazardous chemical compounds, including mercury, is stored and disposed of in accordance with the relevant EU directives, to which national and local law is adapted. Selected documents in the field of local law adopted by the local government of the City of Krakow:

- Resolution No. LII/697/12 of the Krakow City Council of July 11, 2012 on entrusting *MPO Sp. z o. o. in Krakow, the obligatory own task of the commune to maintain cleanliness and order in the territory of the Municipality of Krakow;*
- Resolution No. LII/699/12 of the Krakow City Council of July 11, 2012 on the decision *to collect municipal waste from owners of properties located in the Krakow Municipality, where no residents live and municipal waste is generated;*
- Resolution No. LXXI/1044/13 of the Krakow City Council of April 10, 2013 *on dividing the area of the Krakow Municipality into sectors in order to organize the collection of municipal waste from property owners and designating points for selective municipal waste collection*;

- Resolution No. V/34/19 of the Małopolska Voivodeship Assembly of January 28, 2019 amending Resolution No. XI/125/03 of the Małopolska Voivodeship Assembly of August 25, 2003 regarding *"Waste Management Plan of the Małopolska Voivodeship for 2016-2022";*
- Resolution No. XLV/1199/20 of the Krakow City Council of September 16 2020 on *determining the detailed method and scope of provision of services in the scope of collecting municipal waste from property owners in the Municipality of Krakow and managing this waste, in exchange for a fee paid by the property owner for municipal waste management;*
- Resolution No. XLV/1200/20 of the Krakow City Council of September 16 2020 regarding *the Regulations for maintaining cleanliness and order in the Municipality of Kraków;*
- Resolution No. LXXXIII/2356/22 of the Krakow City Council of April 27, 2022. *on determining the detailed method and scope of providing services in the field of collecting municipal waste from property owners in the Municipality of Krakow and managing this waste in exchange for a fee paid by the property owner for municipal waste management;*
- Resolution No. LXXXIII/2359/22 of the Krakow City Council of April 27, 2022. *regarding the Regulations for maintaining cleanliness and order in the Municipality of Kraków.*

2.1.2 Ukraine - Legislative and Regulatory Framework

The Ministry of Environmental Protection and Natural Resources of Ukraine is the national coordination center for the exchange of information in accordance with the provisions of the Minamata Convention on mercury. In Ukraine, a law on the handling of chemical substances was adopted. With the exception of certain provisions, the new law will enter into force on November 2, 2024. The Verkhovna Rada of Ukraine issued the Resolution dated October 18, 2022 "On adoption as a basis of the Law of Ukraine "On Chemical Safety and Management

of Chemical Substances". Products" (reg. No. 8037). This new law contains several important provisions. It: creates a regulatory framework for the management of chemical substances; gives authority to state bodies; determines the responsibility of business entities; introduces the international classification of hazardous chemicals into national legislation; mandatory registration of chemicals; meets the requirements of the following international treaties: Basel Convention (control of transboundary transportation of hazardous waste and its disposal), Rotterdam Convention (Prior Informed Consent (PIC) for Certain Hazardous Chemicals and Pesticides), Stockholm Convention (persistent organic pollutants (POPs)) and Minamata Convention (mercury). The Ministry of Environmental Protection and Natural Resources plays a key role in the formation and implementation of waste management policy. Local self-government bodies in the field of waste management ensure: fulfilling the requirements of the legislation on waste; implementation of control over rational use and safe handling of waste on its territory; liquidation of unauthorized and uncontrolled waste dumps; granting consent to place on the territory of a village, town, city places or objects for the storage and disposal of waste, monitoring compliance by legal entities and individuals with requirements in the field of industrial and household waste management in accordance with the law.

On September 1, 2017, the Association Agreement [6] between Ukraine and the EU entered into force. The agreement is the basis for cooperation between the EU and Ukraine and EU support for reforms in the country, including the ecological issues and hazardous waste management.

On June 23, 2022, the member states of the EU voted to grant Ukraine the status of a candidate country for joining the EU. Regulatory and legal acts of the EU, the implementation of which is mandatory for Ukraine according to the Association Agreement:

- European Parliament and Council Directive 2008/98/EC of 19 November

2008 on waste and repealing certain Directives [13]

- Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste [8]
- Directive 2006/21/EC of the European Parliament and of the Council of 15 March 2006 on the management of waste from extractive industries and amending [11]
- European Parliament and Council Directive 94/62/EC of 20 December 1994 on packaging and packaging waste [23]
- Directive 2012/19/EU of the European Parliament and of the Council of 4 July 2012 on waste electrical and electronic equipment (WEEE) [14]
- Directive 2006/66/EC of the European Parliament and of the Council of 6 September 2006 on batteries and accumulators and waste batteries and accumulators [12]

Ukrainian legislation regulating hazardous waste management

- Law of Ukraine "On Environmental Protection" [45]. Date of entry into force: July 1, 1991. The law establishes environmental rights and responsibilities of citizens of Ukraine;
- Law of Ukraine “On Waste” [47]. Date of entry into force: April 14, 1998. The law defines the legal, organizational and economic principles of activities related to the prevention or reduction of the volume of waste generation, its collection, transportation, storage, processing, utilization and removal, disposal and burial;
- Law of Ukraine “On Chemical Sources of Current” [44]. Date of entry into force: July 1, 2006. The law defines the legal, organizational and economic principles in the field of handling chemical current sources;
- Law of Ukraine “On waste management” [48]. Date of entry into force: July 9, 2023. The law implements the fundamental principles of European waste management legislation in Ukraine;
- Law of Ukraine “On Chemical Safety and Management of Chemical Products” [43]. Date of entry into force: November 2, 2024. The law defines the legal, organizational and economic principles for ensuring chemical

safety, aimed at preventing the negative impact of chemical products on the environment and public health;

- Law of Ukraine “On Ukraine’s accession to the Minamata Convention on Mercury” [46]. Date of entry into force: July 1, 2023;
- Resolution of the Cabinet of Ministers of Ukraine dated July 13, 2000 No. 1120 "On approval of the Regulation on control over cross-border transportation of hazardous waste and its utilization/removal and Yellow and Green lists of waste" [53];
- Resolution of the Cabinet of Ministers of Ukraine dated July 13, 2016 No. 446 "On approval of licensing conditions for conducting business activities related to the management of hazardous waste" [54];
- Decree of the Cabinet of Ministers of Ukraine dated February 20, 2019 No. 117-r "On the approval of the National Strategy for Waste Management in Ukraine until 2030" [10].

2.1.2.1 Lviv - Legislative and Regulatory Framework

According to the mentioned legislation, the authorized executive authorities in the field of mercury contained waste management in the Lviv region are defined as:

- The Main Department of the State Service of Ukraine for emergency situations in the Lviv region;
- Department of Ecology and Natural Resources of the Lviv Regional State Administration;
- State Ecological Inspection in Lviv region;
- Department of Emergency Situations, Civil Protection and Territorial Defense of the Lviv City Council;
- Department of Waste Management of Lviv City Council;
- Subsidiary enterprise "Bodnarivka" of Lviv municipal enterprise Green

Lviv;

- Department of Ecology and Natural Resources of the Lviv City Council;
- State Institution "Lviv Regional Center for Disease Control and Prevention of the Ministry of Health of Ukraine";
- The Main Directorate of the National Police of Ukraine in the Lviv region.

Normative legal acts, on the basis of which the Department for Emergency Situations, Civil Protection and Territorial Defense of the Lviv City Council organizes the collection and preparation for the disposal of metallic mercury and hazardous materials from the population, enterprises, institutions, and organizations regardless of the forms of ownership in the territory of the city. Lviv: Civil Protection Code of Ukraine, Laws of Ukraine "On Waste", "On Ensuring Sanitary and Epidemiological Welfare of the Population", Resolution of the Cabinet of Ministers of Ukraine dated January 9, 2014. No. 11 "On approval of the Regulation on the unified state system of civil protection", order of the Ministry of Emergency Situations of Ukraine dated July 8, 2009. No. 463 "On the approval of methodological recommendations on the organization and implementation of demercurization", the decision of the executive committee of the Lviv City Council dated 10.17.2003. "On the approval of the Rules for the collection, storage, transportation, utilization, and disposal of waste in the city of Lviv". Currently, Lviv has the following mercury-containing waste management (see Figure 1).

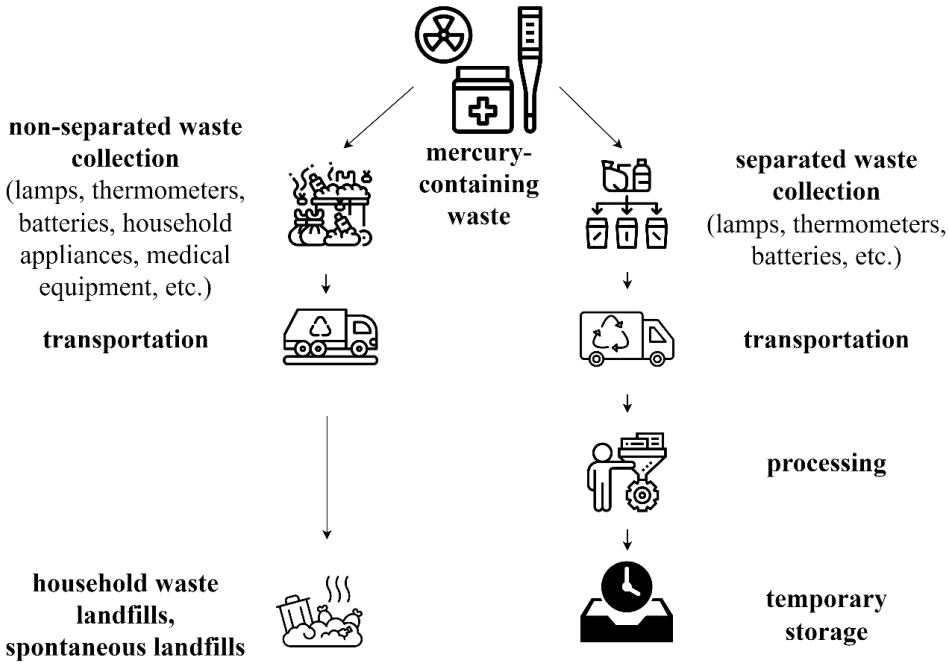

Figure 1. Mercury-containing waste management scheme in Lviv.

Part of the mercury-containing waste that ends up in regular waste cans is transported to unequipped waste landfills. The rest of the mercury-containing waste is collected by eco buses of "Bodnarivka" a subsidiary of the Lviv municipal company "Green Lviv", processed and then stored in temporary storage places. Also, one of the problems of the city of Lviv in the field of mercury-containing waste management is insufficient information and educational activities and cooperation in this matter of local and state municipalities, stakeholders, the public, educational and scientific institutions, businesses, and activists to raise public awareness [49, 57].

2.1.2.2 Ivano-Frankivsk - Legislative and Regulatory Framework

The city of Ivano-Frankivsk is part of the Ivano-Frankivsk region of Ukraine, which is governed by Ukrainian legislation.

The authorized executive authorities in the field of mercury contained waste management in the Ivano-Frankivsk region are:

- Department of Ecology and Natural Resources of Ivano-Frankivsk

Regional State Administration;

- Department of Civil Protection of Ivano-Frankivsk Regional State Administration;
- Department of Health Protection of Ivano-Frankivsk Regional State Administration;
- State ecological inspection in Ivano-Frankivsk region.

The authorized executive authorities in the field of mercury contained waste management in the Ivano-Frankivsk city are:

- Department of Emergency Situations of Ivano-Frankivsk City Council;
- Department of Health Protection of Ivano-Frankivsk City Council;
- Department of Economic Development, Ecology and Energy Saving of Ivano-Frankivsk City Council.

The Department of Emergency Situations of Ivano-Frankivsk City Council collects hazardous waste. The number of city residents and businesses that care about the environment and hand over used batteries, mercury bulbs, and thermometers for disposal is constantly increasing. There are special points at schools and univercities with a container where citizens put used batteries. The Department also cooperates with public organizations and eco-activists. In addition, batteries are collected in cafes, shops, gas stations, and utility companies (see the addresses in chapter 2.2.4 Ivano-Frankivsk - Current Practices). In the city of Ivano-Frankivsk, hazardous waste is collected at the Department of Emergency Situations of Ivano-Frankivsk City Council. Hazardous waste must be handed in only in packaging or wrapped in paper at the address: Dnistrovska St., 30.

2.1.3 Greece - Legislative and Regulatory Framework

Properly managing hazardous waste is not only a legal and regulatory requirement but also a crucial component of sustainable environmental superintendence. This introduction sets the stage for a comprehensive exploration of the regulations, practices, and considerations surrounding hazardous waste management. Hazardous waste is defined in Greece

according to the European Waste Catalogue (EWC) and Hazardous Waste List, which is consistent with EU regulations. These lists classify waste materials as hazardous based on their characteristics (e.g., toxicity, flammability, etc.) or specific substances they contain. The Ministry of Environment, Energy, and Climate Change, known as MEECC (YPEKA in Greek), is responsible to develop and implement the national environmental policies. The management of municipal waste, however, falls under the purview of various Ministries (MEECC, Ministry of Interior, Ministry of Development), leading to challenges in central administration's ability to effectively coordinate and lead this sector [55]. To address this issue, an "inter-ministerial committee for waste" has been operational for some time, although its impact remains uncertain. MEECC assumes responsibility for policy creation, national planning, technical aspects, and the licensing of major waste treatment and disposal facilities. It collaborates with other relevant Ministries and the Central Association of Municipalities in fulfilling these responsibilities. According to Law 4042/2012 (art. 29 par. 2) the Directive 2008/98/EC waste hierarchy applies as a priority order in waste prevention and management legislation and policy.

The management of waste should be conducted in accordance with the priority order of the waste hierarchy:

- prevention
- preparing for re-use
- recycling
- other recovery, e.g., energy recovery
- disposal

Article 14 provides: Waste management is carried out without endangering human health, without harming the environment and in particular:

- without risk to water, air, soil, plants or animals;
- without causing nuisance through noise of odours; and
- without adversely affecting the landscape or places of special interest.

Consequently, the abandonment, dumping or uncontrolled management of waste is forbidden. Article 15 of the Framework Law provides that, the costs of waste management are borne by the original waste producer or by the current or previous waste holders in accordance with the polluter-pays principle [5]. Finally, it has to be stressed that the principles of self-sufficiency and proximity, as defined in art. 16 of Directive 2008/98 are also applied in Greece (Law 4042/2012 art. 16). Mixing of waste with other waste or substances or materials is forbidden. The above-mentioned principles apply to all kinds of waste. The key laws and regulations related to waste management in Greece include:

National legal documents defining waste management

- Waste Framework Directive (2008/98/EC). This EU directive sets out the basic concepts and definitions related to waste management and establishes a hierarchy for waste management practices, including waste prevention, recycling, and disposal;
- National Waste Management Plan. Greece is required to develop and implement a National Waste Management Plan in accordance with EU directives. This plan outlines the national strategy for waste management and sets targets for waste reduction, recycling, and disposal;
- Legislative Decree 2930/2001. This decree, as amended, is a significant piece of national legislation in Greece that deals with waste management. It addresses issues such as waste classification, waste prevention, recycling, and the operation of waste facilities;
- Extended Producer Responsibility (EPR) Regulations. Greece, like other EU member states, has implemented EPR regulations, which require producers to take responsibility for the disposal and recycling of their products and packaging;
- Landfill Directive (1999/31/EC). This EU directive sets out specific

requirements for the management and disposal of waste in landfills. Greece, like other EU member states, must comply with these requirements;

- Hazardous Waste Regulations. Specific regulations govern the management of hazardous waste in Greece, including its collection, transportation, and disposal. Hazardous waste is subject to stricter controls due to its potential environmental and health risks;
- Waste Electrical and Electronic Equipment (WEEE) Regulations. Greece, in accordance with EU directives, has regulations governing the collection and recycling of electronic waste;
- Bans on Certain Waste Types. Greece has implemented bans on the disposal of certain types of waste in landfills, such as tires and specific hazardous waste streams.

2.1.3.1 Larissa - Legislative and Regulatory Framework

Depending on the region and local authorities within Thessaly, there may be additional regulations and policies related to waste management specific to that area. Municipalities often play a key role in waste collection and management.

The processing of hazardous waste is automatically regulated under the IPPC procedure, as outlined in Law 4042/2012 and Ministerial Decision 13588/2006 - published in Government.

Gazette B' 383/2006. These regulations dictate that hazardous waste treatment must occur at specific locations, adhering to strict guidelines. In Greece, there are only a limited number of facilities dedicated to the treatment of hazardous waste. Hazardous waste can be managed at designated sites or within specific areas of the facility itself, following precise technical specifications and appropriate treatment methods for each type of waste, as specified in Ministerial Decree 13588/2006.

The authorization for the collection, initial storage, and overall treatment of hazardous waste is integrated into the environmental permit. Only the transportation of hazardous waste requires a separate permit. Hazardous waste

must be correctly packaged and labeled in accordance with international and EU standards and must be accompanied by the appropriate identification documentation, as stipulated in Article 17 of Law 4042.

2.1.4 Portugal - Legislative and Regulatory Framework

Portuguese Environment Agency

The Portuguese Environment Agency (Agência Portuguesa do Ambiente -APA) is a public institute that is part of the state's indirect administration, under the supervision of the Ministry of the Environment and Climate Action and endowed with administrative and financial autonomy and its own assets.

Heavy Metals Protocol

In 2017, Portugal ratified the Heavy Metals Protocol and in 2021 approved the amendments to this Protocol. The Protocol on Heavy Metals in Aarhus (Denmark) in 1998 referred as Aarhus Protocol: covers three metals, cadmium, lead and mercury. The parties must reduce their emissions below their 1990 levels. The protocol aims to eliminate emissions from industrial sources, combustion processes and waste incineration and it sets limit values for emissions from stationary sources and recommends the use of best available techniques for these sources, such as special filters or scrubbers for combustion sources or processes without the use of mercury. The protocol requires parties to adopt measures to phase out leaded petrol. It also introduces measures to reduce emissions of heavy metals from other products, such as mercury in batteries, and proposes the adoption of management measures for other products containing mercury, such as electrical components, measuring devices, fluorescent lamps, dental amalgams, pesticides and paints. The protocol was amended in 2012 to introduce more stringent emission limit values (ELVs) for particulate emissions and for cadmium, lead and mercury applicable to certain combustion processes and other industrial emission sources that

release these components into the atmosphere [2].

Batteries and accumulators

The system for placing batteries and accumulators on the market and the system for collecting, treating, recycling and disposing of waste batteries and accumulators are regulated by Decree-Law (DL) n.152-D/2017, of 11 December, as amended by DL n.102-D/2020, of 10 December, as amended by n. Law 52/2021, of 10 August. This law repealed DL n. 6/2009, of 6 January, rectified by Declaration of Rectification n. 18-A/2009, of 6 March, amended by DL n. 266/2009, of 29 September, 73/2011, of 17 June, and 173/2015, of 25 August. It transposes into national law Directive 2006/66/EC of the European Parliament and of the Council of 6 September on batteries and accumulators and waste batteries and accumulators (repealing Council Directive 91/157/EEC of 18 March), as amended by Directives 2008/12/EC, 2008/103/EC and 2013/56/EU of the European Parliament and of the Council of 11 March 2008, 19 November 2008 and 20 November 2013, respectively. Specific EU legislation on the placing on the market of batteries and accumulators and the management of their waste can be found on the European Commission's website [28].

2.1.4.1. Évora - Legislative and Regulatory Framework

Portugal has established a legislative framework governing the use, production and disposal of products containing mercury. To the best of our knowledge, Évora Municipality today has no action to selectively collect mercury-containing goods, having delegated all responsibility to the inter-municipal company GESAMB.

2.1.5 Italy - Legislative and Regulatory Framework

Mercury is a highly toxic heavy metal that poses serious environmental and health risks when improperly managed. To address this issue, the Italian legislative and regulatory framework has implemented stringent laws and practices for collecting and recycling mercury-containing waste. This text will provide an overview of the Italian legislative framework, current practices for

collecting mercury-containing waste, and the establishment of an informational portal and virtual counseling center for households.

Legislation

Italy has a robust legal framework for the management of hazardous waste, including mercury-containing waste. The key legislative acts include the Legislative Decree No. 152/2006 [38], which transposed the European Waste Framework Directive (2008/98/EC) [32], and the Legislative Decree No. 209/1999 [39], which addresses the specific management of hazardous waste (2012/19/EU) [33]. These laws establish the regulatory foundation for waste management practices. Italy has taken a proactive stance against the use of mercury-containing products by implementing bans and restrictions. The EU Directive 2002/95/EC [31], commonly known as the RoHS Directive, restricts the use of certain hazardous substances, including mercury, in electrical and electronic equipment. Furthermore, mercury thermometers and other products-containing mercury have been banned in Italy to prevent their release into the environment.

Extended Producer Responsibility (EPR)

Italy has adopted an EPR model, which places the onus on manufacturers, importers, and distributors to finance the collection and recycling of their products at the end of their life cycle. This approach has been crucial in managing mercury-containing waste effectively, ensuring that producers are held accountable for their products. In particular, it provides for restrictions on the concentration level of lead, cadmium, mercury and hexavalent chromium, which cannot exceed 100mg/kg, and gives the Commission the power to adopt delegated acts that further reduce the level of this restriction or establish exemptions [30]. Compliance with this requirement must be demonstrated in

specific technical documentation.

2.1.5.1 Camerino - Legislative and Regulatory Framework

Camerino city, Macerata province and Marche region follow the rules provided by the Italian government as described above. In addition, Regulatory Regional Authorities play an essential role in order to harmonize the national regulations.

Regulatory Regional Authorities

The Italian Ministry of Environment, Land and Sea, along with regional environmental agencies, plays a pivotal role in enforcing and regulating waste management practices [40]. Regional authorities often have specific guidelines and regulations tailored to local needs. In case of Marche region, D.A.C.R. 14/04/2015 n. 128 [41] "Approval of the Regional Waste Management Plan (PRGR) drawn up in implementation of art. 199 Legislative Decree no. 152/2006 [38]" (Published in the Marche B.U. 30 April 2015, no. 37 - supplement 4). The Regional Waste Management Plan (PRGR) has a multi-year temporal validity and has been developed based on the following overarching objectives:

- Minimization of waste production through effective prevention actions;
- Increase in separate waste collection through the reorganization of collection services following the "door-to-door" model;
- Maximization of material recovery, also through the enhancement of undifferentiated waste;
- Improvement of the technical/environmental performance of facilities.
- Maximum reduction of landfill disposal.

Based on these objectives, the anticipated results of the Plan can be summarized as follows:

- Prevention: Contraction of per capita urban waste production by 10% compared to the average data for the period 2010-2012;
- Separate waste collection: separate collection for recovery will exceed 70% at the level of each ATO (Ambito Territoriale Ottimale - Territorial

Optimization Area);

- Disposal: Minimization of reliance on landfills through the evolution of the pre-treatment system to allow further material recovery, including from undifferentiated waste, with the possibility of indirect energy valorization.

2.2 Current Practices

As the EU and non-EU states continue thier commitment to environmental sustainability, the management of mercury-containing waste has become a focal point in Europe. This section delves into the current practices of mercury-containing waste collection across European states, highlighting the strategies and initiatives implemented to tackle the unique challenges associated with this hazardous material. This exploration aims to provide a snapshot of the prevailing methods and technologies employed, shedding light on the collaborative endeavors and advancements that characterize the current landscape of mercury-containing waste management in the European states. Through an examination of these practices, we seek to understand how European states are navigating the complexities of handling this hazardous waste stream while aligning with broader sustainability objectives.

2.2.1 Lodz - Current Practices

Currently, there are three municipal waste selective collection points (PSZOK) in Lodz. These are places where property owners can give away waste that causes problems in management free of charge.

At Selective Collection Points for municipal waste, the quantities accepted are limited:

- construction and demolition waste - up to 1,500 kg per month;
- furniture and other bulky waste - up to 1,500 kg per month;
- used car tires - up to 4 units per year.

Residents deliver waste that must be sorted by type to the points on their own (with their own transport). The points do not accept mixed municipal waste.

They are intended only for residents of Lodz, it may happen that their employees may ask for verification of this data. Selective collection points for municipal waste are an investment of the City of Lodz. A map of the PSZOKs can be found in Figure 2.

Addresses, contact and opening hours of PSZOKs:

- **PSZOK Graniczna.** Address: 2 Graniczna Street, phone: 603 500 505 . Opening hours: Monday, Wednesday, Thursday, Friday - from 8:00 am to 5:00 pm, Tuesday - from 8:00 am to 8:00 pm, Saturday - from 8:00 am to 12:00 pm;
- **PSZOK Kasprowicza**. Address: 10 Kasprowicza St., phone: 663 662 227 Opening hours: Monday, Wednesday, Thursday, Friday - from 8:00 a.m. to 5:00 p.m., Tuesday - from 8:00 a.m. to 8:00 p.m., Saturday - from 8:00 a.m. to 12:00 p.m;
- **PSZOK Zamiejska.** Address: 1 Zamiejska Street, phone: 663 662 227 Opening hours: Monday, Wednesday, Thursday, Friday - from 7:00 a.m. to 6:00 p.m., Tuesday – from 7:00 a.m. to 8:00 p.m., Saturday - from 7:00 a.m. to 1:00 p.m.

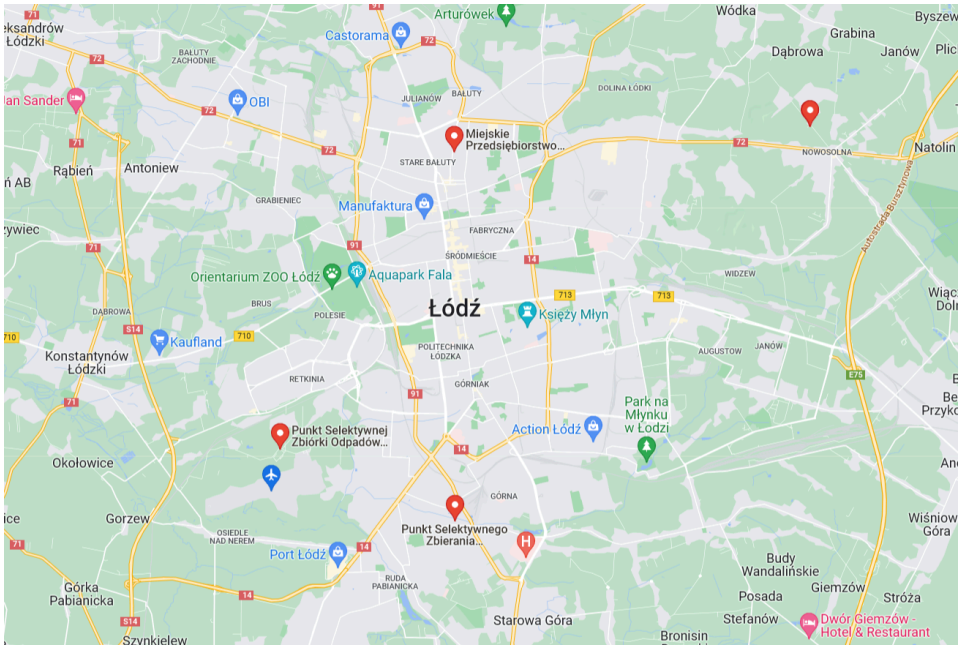

Figure 2. Map of Krakow municipal waste selective collection points.

Residents who have out-of-date medicines can deliver them free of charge to selected pharmacies in Lodz, where special containers for out-of-date medicines (red, metal ones with cardboard inserts and plastic film) have been set up. A map of pharmacies where you can donate expired medicines can be found in the Figure 3. Residents who have old-type thermometers containing mercury and its derivatives can return them free of charge at five pharmacies in Lodz (Lutomierska 1 Street, Zawiszy Czarnego 26 Street, Łaczna 28 Street, Piłsudskiego 31 Avenue, Czernika 10 Street).

Only medicines in the form of lozenges, irritants, ointments, as well as liquid medicines (tightly screwed packages) and aerosols can be thrown into the containers for medicines set in pharmacies. Throwing medicines without cardboard packaging is welcome.

It is absolutely forbidden to throw in needles, syringes and ampoules, as well as other medical and dressing materials.

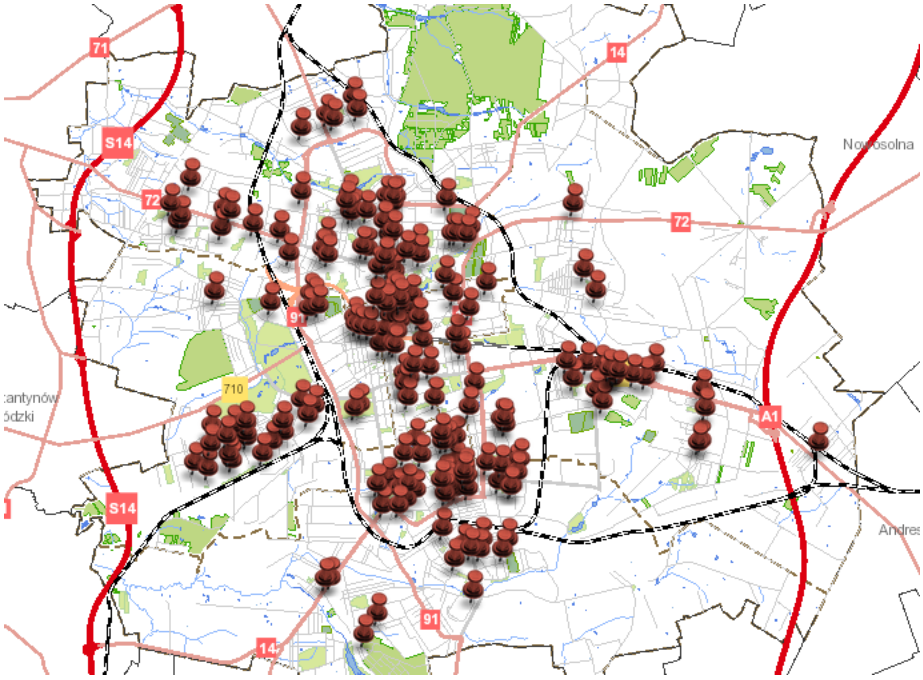

Figure 3. Map of Krakow pharmacies where you can donate expired medicines.

Syringes, needles and ampoule syringes from injections performed at home should be thrown into the container with residual waste after segregation.

However, due to the fact that this is hazardous waste, it is recommended that before throwing such waste into the container, it should be secured, for example, by putting a cap over the needle and placing the used syringes in a plastic bag or box and sealing the package tightly with adhesive tape, so that this waste does not pose a danger to employees of companies collecting and sorting waste [61].

2.2.2 Krakow - Current Practices

Based on the presented legal situation, the Municipality of Krakow is responsible for the collection of municipal waste from all properties located within the administrative boundaries of the city. For this purpose, in 2012, the Krakow City Council entrusted the Municipal Purification Company LLC in Krakow (MPO Sp. z o.o.) with the commune's own mandatory task of maintaining cleanliness and order in the territory of the Krakow Municipality.

In accordance with the provisions of Resolution No. LXXI/1044/13 of the Krakow City Council of April 10, 2013 on dividing the area of the Kraków Municipality into sectors In order to organize the collection of municipal waste from property owners and to designate selective municipal waste collection points, the Krakow Municipality was divided into 5 sectors (Figure 4): sector I covering Districts: I, II, III and XIV, sector II covering Districts: IV, V, VI and VII, sector III covering Districts: VIII, IX and X, sector IV covering Districts: XI, XII and XIII, sector V covering Districts: XV, XVI, XVII and XVIII [4].

Figure 4. Map of Krakow divided into municipal waste collection sectors. Source: https://mpo.krakow.pl/pl/mpo/odbiorodpadow/analiza, access: 02.11.2023

In accordance with the Regulation of the Minister of Climate and Environment of May 10, 2021. on the method of selective collection of selected waste fractions (Journal of Laws of 2021 pos. 906) the owner of the property is obliged to conduct selective waste collection directly on the property, the so-called "at source" in accordance with the established rules [35].

Moreover, in 2022, separately collected municipal waste was accepted from property owners in the Municipality of Kraków at two Selective Municipal Waste Collection Points (PSZOK – polish: Punkt Selektywnego Zbioru Odpadów Komunalnych).

Addresses and contact of PSZOKs

- LAMUSOWNIA, Adress: 1D Nowohucka St., 31-580 Krakow (Figure 5);
- BulkyWaste Collection Point BARYCZ, Adress: 40 Krzemieniecka St., 30-694 Krakow (Figure 5).

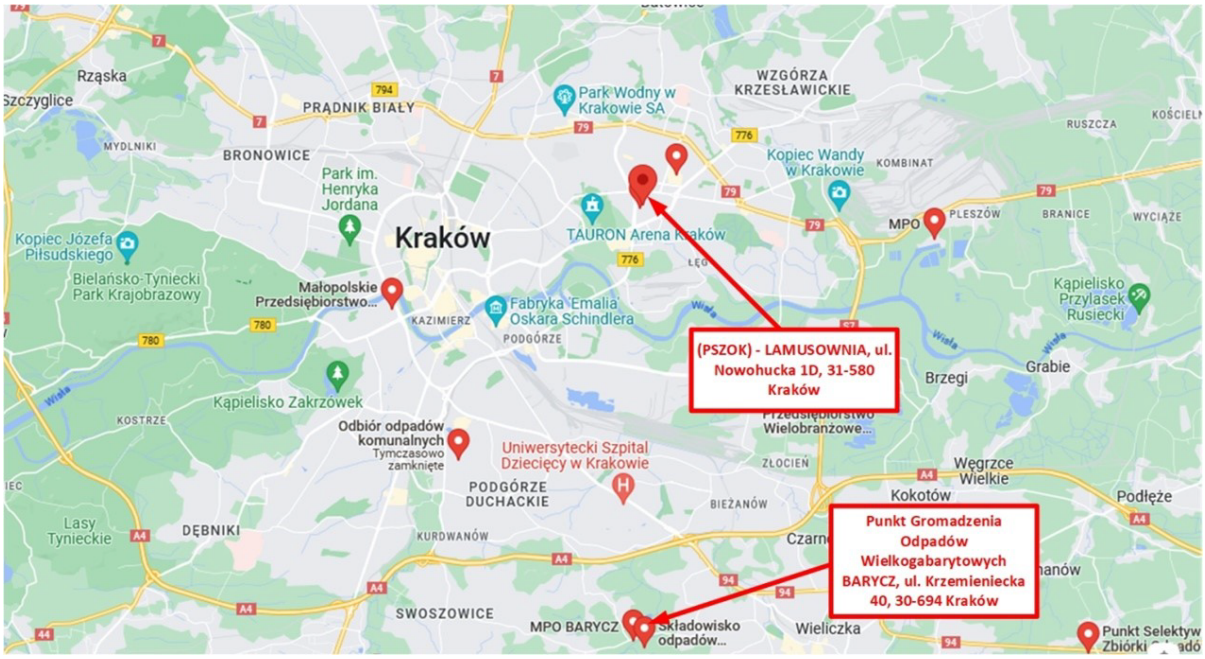

Figure 5. The map of Krakow with the location of PSZOK. (Source: https://www.google.com/maps/search/PSZOK+Krak%C3%B3w/@50.0397852,19.9057846,12z?entry=ttu, access: 02.11.2023)

Additionally, in the area of the Municipality of Krakow, in the field of hazardous waste:

- bulky waste collection system;
- collection program for waste electrical and electronic equipment entitled "ELECTROBRIGADE ON THE PHONE", under which each property owner from the Krakow Municipality can report the need to collect unnecessary electrical or electronic equipment within a telephone agreed time (mob.: +48 801 084 084);
- the "KRAKOWSKIE EKO - PUDEŁKO" (english: KRAKOW'S ECO-BOX) program, under which special devices were made available in the Krakow Municipality - containers with built-in separate containers for specific types of waste for collecting small electrical and electronic devices such as telephones, chargers, CDs, light bulbs, batteries, etc (Figure 6). Additionally, on specified days and hours, property owners from the Krakow Municipality may return waste generated as a result of the patient performing self-test strips at home to determine the blood sugar level to a container placed in a car (electrically driven) collecting waste, or waste needles or pre-filled syringes;
- collection of expired medicines in special containers placed in pharmacies.

Addresses of Krakow's eco-box

- UMK (ul. Powstania Warszawskiego 10)
- Galeria Krakowska (ul. Pawia 5)
- Galeria Kazimierz (ul. Podgórska 34)
- UMK (ul. Wielicka 28A)
- Galeria Bonarka (od ul. Kamie´nskiego)
- CH Nowe Czy˙zyny (ul. Medweckiego 2)
- Nowohuckie Centrum Kultury (al. Jana Pawła II 232)
- CH M1 (al. Pokoju 67) I punkt Media Markt
- CH M1 (al. Pokoju 67) II punkt OBI

- SM Czy ˙ zyny (os. Dywizjonu 303 1)
- Centrum Serenada (al. Gen. T. Bora-Komorowskiego 41)
- UEK (ul. Rakowicka 27)
- UR (al. Mickiewicza 21)
- osiedle Widok (przy ul. Na Błonie 13D)
- SM Grodzka (ul. Majora Łupaszki 13)
- Galeria Bronowice (ul. Stawowa)

Figure 6. Krakow's eco-box (Source: https://mpo.krakow.pl/pl/mieszkancy/uslugi/ekopudelko, access: 02.11.2023)

The Municipal Office in Krakow runs a number of educational programs and also produces educational films.

An online waste search engine is also available to residents: https://mpo.krakow.pl

Moreover, due to the poor air condition in the Municipality of Krak.w, a program was carried out to replace old heating boilers. Currently, the "Clean Air" program is being implemented throughout the country, run by the provincial branches of the National Fund for Environmental Protection and Water Management (polish: Narodowy Fundusz Ochrony ÅLSrodowiska i Gospodarki Wodnej – NFÅLSiGW), co-financing the replacement of old heating boilers and the insulation of buildings in order to eliminate low-emission sources of air pollution.

2.2.3 Lviv - Current Practices

All-Ukrainian initiative "Batteries, Surrender!"

The movement began on the initiative of three dedicated IT professionals in the city of Dnipro, who decided to fight against environmental pollution in Ukraine. One battery, carelessly thrown into the ground, can pollute 16 m^2 of soil with dangerous substances, and the answer to "where to put used batteries" has not been found. But they decided to create it! They started to open their own battery collection points and attract people to do the same - in entrances, offices, schools, and shops. In short, everywhere, so that 100% of all batteries in Ukraine begin to be recycled, and not landfilled. The map has 1212+ active battery collection points [3].

All-Ukrainian initiative "Batteries, Surrender!" is the only campaign in Ukraine that actually sends 100% of batteries and provides reports about it. All batteries collected as part of the initiative go to the GreenWEEE plant in Romania. Project "Creation of a municipal system for handling waste of household electronic and electrical equipment in Lviv using the experience of Lublin" [9], as part of the implementation of the project, the following was implemented:

- a comprehensive municipal program for handling household electronic and electrical equipment waste in the city of Lviv was developed and approved;
- purchased and placed 80 specialized containers for separate collection of spent power elements (batteries) in Lviv;
- purchased equipment based on minibusses of mobile points for collecting waste of household electronic and electrical equipment in Lviv;
- purchased and installed equipment for decontamination of mercury lamps and other equipment elements that contain mercury vapors in Lviv;
- an information and educational campaign was conducted for the population covering the issues of household electronic waste management.

"Bodnarivka" a subsidiary of the Lviv municipal company "Green Lviv" that is part of the Department of Ecology and Natural Resources of the Lviv City Council accepts used fluorescent lamps, thermometers, and batteries from the public. Reception is carried out by special eco buses that run along the route according to the specified schedule on the website [7].

Ecobuses schedule

Ecobuses usually run on Thursdays, Fridays, and Saturdays. The stops are located near shopping centers, supermarkets, railway stations, and administration buildings and there are about 30 stops every month. They stand for 3 hours at each stop. The updated Eco-Bus schedule for each month with additional stops is distributed through social media and on official partner sites [7].

"Bodnarivka" purchased and installed a mercury-containing waste processing line. The supplier of the equipment for this line is the Swedish company "MRTSystemAB", which is the world leader in the production of equipment for the processing of hazardous waste. The line was purchased with the funds of the EU as part of the Poland-Belarus-Ukraine Program 5.2. The system is equipped according to the European model and is the first and only one in the territory of Ukraine. The company accepts for processing from legal entities compact energy-saving and tubular used fluorescent lamps, and mercury medical thermometers that have failed and are unusable. The company works on the “zero waste” technology with a closed cycle (absolutely waste-free), which makes it the first and only plant of its kind operating in Ukraine. The line’s capacity is 200 kg per hour, about 500 tubular or 800 compact fluorescent lamps per hour (Figure 7). After processing, glass, cap, phosphor, and mercury are obtained, which can be used as raw materials for industrial needs. This makes it possible to almost completely provide appropriate services to all of the west of Ukraine.

Today, the company has stationary and mobile collection points for used lamps and thermometers containing mercury, batteries. The Department of

Emergency Situations and Civil Protection of the Population of the Lviv City Council is holding Mercury Acceptance Days for the citizens of Lviv.
This service is free and unlimited [58]. Responses to events related to the detection of mercury and mercury-containing waste are carried out by formations that are created in accordance with current legislation and have appropriate training and equipment. These formations can be created at the state, regional, and local levels, and they can also be state, communal, or private.

Figure 7. The decontamination equipment for mercury lamps and other items containing mercury vapor [7].

On the territory of the Lviv region, to date, the units of the Main Department of the State Service of Ukraine for emergency situations in the Lviv region [59] are involved in the response to the mentioned events, directly in the city of Lviv - the group of radiation chemical and biological protection of the Emergency and Rescue Unit of the Special Purpose Emergency and Rescue Squad of the Main

Department of the State Service of Ukraine for Emergency Situations in the Lviv region. When receiving information about the occurrence of a Hazardous Event related to the detection of mercury or mercury-containing waste, the management bodies and civil defense forces specified in the response plans for such events are mutually informed and go to the place of occurrence of the event. when the information is received by the Main Department of the State Emergency Service of Ukraine in the Lviv Region (MD SES of Ukraine in the Lviv Region). The dispatcher of the operational coordination center of the State Emergency Service of Ukraine in the Lviv region or the dispatcher of the communication point of the state fire and rescue unit in accordance with the action algorithm informs State Institution "Lviv Regional Center for Disease Control and Prevention of the Ministry of Health of Ukraine", the Main Directorate of the National Police of Ukraine in the Lviv region, local self-government bodies in the territory which the event occurred and send to the scene of the incident the mobile operational group of the Main Directorate (operational group of the district (city) administration) and the group of radiation, chemical and biological protection of the emergency and rescue squad of the special purpose of the Main Directorate of the State Emergency Service of Ukraine in the Lviv region or another guard. This mutual information procedure is carried out regardless of who received the information about the event.

2.2.4 Ivano-Frankivsk - Current Practices

All-Ukrainian initiative "Batteries, Surrender!"

The initiative "Batteries, Surrender!" [3] was established in 2013. This social initiative is aimed at introducing a culture of proper disposal of hazardous household waste in Ukraine, popularizing the collection of used energy elements, their processing and spreading the ideas of social entrepreneurship in this field. The founder is the public organization "EkoDnipro" in Dnipro city. Since 2013, branches and over 1,500 battery acceptance points have been established in all regions of Ukraine (Figure 8).

Figure 8. The map of a battery collection points in Ivano-Frankivsk city [24].

Social enterprise "Zero waste Ivano-Frankivsk"

In October 2021, the public sorting station "Re:space" was opened. It is located on the territory of the Innovation Center "Promprylad. Renovation" in Ivano-Frankivsk. This is an ecohub that combines: an educational platform for eco-events and workshops, a public recycling station and a recycling laboratory for the creative processing of secondary raw materials The organization "Zero waste Ivano-Frankivsk" [56] creates infrastructure for the separate collection of solid household and organic waste from legal entities and individuals in Ivano-Frankivsk. The received raw materials are transferred to partners for processing. They also process organic waste (coffee grounds) into heating pellets and sell them under the TM "Zigrivai". The 80% of the net profit is transferred to finance the activities of the NGO "Zero Waste Ivano-Frankivsk" for the implementation of environmental and educational projects.

NGO “SortSmart”

Since October 2018, the NGO “SortSmart” [50] has been sorting and submitting recyclable materials for processing in the city of Ivano-Frankivsk. Four enthusiastic entrepreneurs came together to bring the city closer to European standards for household waste management. They collect sorted garbage from residents and companies of Ivano-Frankivsk. Currently, 20 local companies are partners of SortSmart. Paper, glass, plastic, metal and tetra pak are taken from their offices.

Addresses of hazardous waste reception points in Ivano-Frankivsk city

The batteries

- Ivano-Frankivsk City Council (21 Hrushevskogo St.)
- Ivano-Frankivsk City Council Department of Education and Science (10 S. Bandery St.)
- Ivano-Frankivsk National Technical University of Oil and Gas (15 Karpatska St.)
- Ivano-Frankivsk National Medical University, dormitory 1, 2 (Troleybusna St., 10)
- Vasyl Stefanyk Precarpathian National University (57 Shevchenks St.)
- PNU, dormitory No. 4 (Chornovola St., 49a)
- PNU, dormitory No. 5 (2 Sukhomlynskogo St.)
- School No. 10 (196b Vovchynetska St.)
- School No. 11 (9 Lepkogo St.)
- School No. 15 (Nezalezhnosti St., 207)
- School No. 23 (90 Mazepy St.)
- School No. 25 (13, 24 Serpnya St.)
- Gymnasium No. 2 (35 Shukhevichiv St.)
- Kindergarten No. 10 (5 Mykolaichuka St.)
- Kindergarten No. 12 (4 Dovga St.)
- Kindergarten No. 15 (Nova St., 19)
- Kindergarten No. 17 (210 Vovchynetska St.)
- "Epicentr" hypermarket (17 Ivasyuka St.),
- Cosmetics stores “Watsons”
- "ATB-Market" stores
- Ivano-Frankivsk Regional Puppet Theater (27-A, Sichovyh Striltsiv St.)
- Dobrobut ECO of Ukraine LLC (Rebeta St.)

Mercury-containing lamps

- Dobrobut ECO of Ukraine LLC (Rebeta St.)

2.2.5 Larissa - Current Practices

Since 2004, there has been a slight decrease of 0.5% in hazardous waste, while the recycling of hazardous waste has seen a notable increase of 6.3%, and incineration has surged by 80%. More specifically, Greece generates approximately 330,000 metric tons of hazardous waste each year, primarily stemming from industrial processes, healthcare facilities, and transportation activities. Among the total hazardous waste production, 42% consists of oil and liquid fuel waste, with nearly all of it being recovered. End-of-life and out-of-specification products make up 14.5%, while waste from thermal processes, particularly steel and aluminium, constitutes 13.4%. Attica (48.5%), Central Macedonia (12.6%), Sterea Ellada (10.2%), Thessaly (6.9%), and Western Greece (5.2%) are the regions that create the most hazardous waste. In contrast to 3,262 tons in 2003 and 905 tons in 2001, 4,442 tons of the entire volume of hazardous waste generated were shipped in 2006.

Air Pollution

In terms of air pollution measurement systems in Larissa, it's important to highlight that the local authorities do not conduct consistent monitoring of air quality in the city. Such monitoring requires the implementation of modern technology, including online measurement systems. Although one monitoring system has been in place in the city center since 1986, it falls short in providing comprehensive data on key pollutants like CO, CO2, SO2, NO, NO2, and O3, making it insufficient for a comprehensive assessment of the city's air quality [27].

Water Pollution

Wastewater treatment facilities are present in Tirnabos, Giannouli, and Elassona cities. Additionally, it's noteworthy that Sarantaporo village utilizes a physical treatment system. In all other villages, wastewater is managed through the use of absorbent cesspools or septic reservoirs, potentially leading to the transfer of pollutants into underground water sources. In the broader Larissa city and

Farsala city regions, intensive agriculture, involving the cultivation of cereals and cotton, is practiced, often involving the use of fertilizers rich in nitrogen, phosphate, and sulfur. The decrease in nitrate concentration levels in groundwater is attributed to a program initiated by the Greek Ministry for Agriculture, which aimed to reduce fertilizer usage in the prefecture's agricultural lands. In general, an integrated system of environmental management in the area of Larissa prefecture has to be achieved through the commitment of responsibility both by local society and the responsible authorities. Only in this way, the desirable collaborative decision-making will be achieved in a process of environmental planning in any prefecture. A special agency, where municipalities, civilians and industries could participate, is an issue that has to be considered in a serious way by the qualified authorities [1].

Methods used for hazardous waste collection and disposal

Battery Disposal

Many supermarkets and electronic stores have collection bins for used batteries, which are considered hazardous waste. City residents can deposit old batteries in these bins.

Household Hazardous Waste Events

The municipality organise events or campaigns focused on the collection of hazardous waste from households. These events are often well-publicized, and residents are encouraged to participate by bringing their hazardous waste to designated locations during these times.

In general, an integrated system of environmental management in the area of Larissa prefecture has to be achieved through the commitment of responsibility both by local society and the responsible authorities. Only in this way, the desirable collaborative decision-making will be achieved in a process of environmental planning in any prefecture. A special agency, where

municipalities, civilians and industries could participate, is an issue that has to be considered in a serious way by the qualified authorities [26].

2.2.6 Évora - Current Practices

General obligations for producers of batteries and accumulators (B&A)

According to the "principle of extended producer responsibility", the producer of the product is responsible for the environmental impacts and waste arising from the production process and subsequent use of their products, as well as their management when they reach the end of their life.

As such, producers of B&A must, in particular:

- Provide financing for the management of B&A waste and, to this end, may opt for an individual system or transfer their responsibility to a licensed integrated system; Ecovalor (Ecovalue) is a compulsory financial payment levied on producers for each battery and/or accumulator placed on the national market, with a view to supporting the costs necessary for the selective collection and treatment of B&A waste under appropriate environmental conditions. Ecovalor is determined according to the typology/chemical system in which the B&A falls and corresponds to the contribution to the respective management entity;
- Register producers of products on SILIAMB (the Portuguese Environment Agency's producer registration platform);
- Ensure the B&A labelling obligations.

Since 2018, between 1 January and 31 March of each year, producers must submit the annual declaration (Registration System for Batteries and Accumulators producers in SILIAMB) regarding the products placed on the market in the previous year, as well as the estimate of products to be placed on the market in the same year.

Integrated systems licensed for the management of B&A waste

There are currently four licensed management entities responsible for integrated B&A waste management systems, with different scopes of action: I) Electrão - Waste Management Association It has been licensed since 20 January 2010, at the time under the name Amb3E – Associação Portuguesa de Gestão de Resíduos (Portuguese Waste Management Association), managing an integrated system for waste portable batteries and accumulators and industrial batteries and accumulators incorporated into electrical and electronic equipment, taking into account the option provided for in Article 9(6) of the Waste Management Act. This licence was extended in 2009, taking into account the option provided for in Article 9(6) of DL 6/2009, of 6 January, and the potential synergies arising from the shared management of waste portable batteries and accumulators and waste electrical and electronic equipment. This licence was extended on 18 January 2016 (with effect from 1 January 2016) for a period of twelve months, automatically renewable for equal periods until a new licence is issued. The current licence was approved by Order N.11275-D/2017 of 19 December and is valid from 01.01.2018 until 31.12.2021. II) ERP Portugal - Waste Management Association It has been licensed since 4 March 2010 to manage an integrated system for waste portable B&A and industrial batteries and accumulators that can be incorporated into electrical and electronic equipment, taking into account the option provided for in Article 9(6) of DL 6/2009 of 6 January and the potential synergies that arise from the shared management of waste portable B&A and waste electrical and electronic equipment. This licence was extended on 18 January 2016 (with effect from 1 January 2016) for a period of twelve months, automatically renewable for equal periods until a new licence is issued. The current licence was approved by Order no.11275-A/2017, of 19 December, and is valid from 01.01.2018 until 31.12.2021. Propose a correction or amendment: geral@apambiente.pt APA, August 2021 10 III) VALORCAR - End-of-Life Vehicle Management Company Lda It has been licensed since 23 July 2009 to manage an integrated system of waste batteries and accumulators for motor vehicles and waste industrial batteries and accumulators. This licence was

extended on 2 February 2015 (with effect from 1 January 2015) for a period of twelve months, automatically renewable for equal periods until a new licence is issued. The current licence was approved by Order N.11275-C/2017 of 19 December and is valid from 01.01.2018 until 31.12.2021. IV) GVB - Battery Management and Recovery Lda. It has been licensed since 24 March 2010 to manage an integrated system of waste batteries and accumulators for motor vehicles and some types of industrial batteries and accumulators. This licence was extended on 18 January 2016 (with effect from 1 January 2016) for a period of twelve months, automatically renewable for equal periods until a new licence is issued. The current licence was approved by Order N.11275-E/2017 of 19 December and is valid from 01.01.2018 until 31.12.2021.

Collection points to deliver waste portable B&A

- At the dealers, who ensure the collection of waste portable batteries and accumulators, by legal obligation, under the terms of paragraphs 8 and 9 of article 13 of DL N.152-D/2017, of 11 December;
- At other collection points for waste portable batteries and accumulators installed by the management entities of integrated waste battery systems (or by producers, in the case of individual systems), namely in health units, schools, fire stations, shopping centers, companies, parish councils, retail shops, town halls, among others;
- In the specific containers for portable batteries and accumulators, installed in the ecopoints of urban waste management systems, municipalities or associations of municipalities, or multi-municipal entities.

Collection points to private users deliver waste automotive batteries and accumulators

- Hand over the waste with the purchase of a new battery, the take-back being ensured free of charge by the dealer, and in the case of waste

batteries from non-commercial private motor vehicles the take-back does not depend on the purchase of a new battery;

- Deposit free of charge at the ecocenters of municipalities, associations of municipalities or multi-municipal entities.

In addition to operators licensed to treat P&A waste, the following are authorised to collect portable batteries and accumulators

- Municipalities, associations of municipalities and management companies of multi-municipal and inter-municipal systems (SGRU), with competence in the collection of municipal waste;
- Traders, who ensure the collection of waste portable batteries and accumulators, by legal obligation, under the terms of paragraphs 8 and 9 of article 13 of Decree-Law no. 152-D/2017, of 11 December;
- Other collection points for waste batteries and portable accumulators installed by the management entities of integrated systems, namely in health units and schools (Ponto Electrão, depositrão);
- Other organisations that collect waste as part of campaigns or actions.

Évora region

GESAMB is an authorised municipal entity that collects and concentrates household waste (hospital and industrial waste are outside the scope of GESAMB). It has a mobile unit that travels to various points in the Évora district to collect hazardous household waste (electrical equipment, screens, batteries, fluorescent lamps, etc). GESAMB sends the hazardous waste it concentrates to the above-mentioned national organisations, which process this waste. The equipment that was collected has already been on two trips, each lasting 88 days, for a total of 176 days. It spends at least 5 days on each trip in smaller municipalities, such as Alandroal, Mouro, Mora, Arraiolos, and up to 21 days in Évora. The “Special Collection Unit for Hazardous Waste” stops in a central place, every day, all types of waste is received (Figure 9). Collection Unit timetable: From

Monday to Friday: 12:30-16:00 or 17:00-20:30, Weekend: 10:00-17:00. The Collection Unit schedule is accorded in advance with the municipalities.
In the meantime, on October 24th, we're going to start the 3rd itinerary of 88 days in total, which will take place in the months of October-November 2023 and February-May 2024 - when we have the calendar worked out with the municipalities, we'll publish the dates and locations on our website.

Figure 9. Examples of collection points in Évora

Links to the websites of the national management organisations for WEEE, lamps and batteries:

- https://apambiente.pt/residuos/entidades-gestoras-do-sigreee
- https://www.electrao.pt/
- https://erp-recycling.org/pt-pt/
- https://apambiente.pt/residuos/residuos-perigosos-0 - the final destination of the waste sent by Gesamb
- https://www.egeo.pt/servicos/area/113
- https://www.ecodeal.pt/pt

2.2.7 Camerino - Current Practices

The collection and disposal of mercury-containing waste primarily focus on products such as fluorescent lamps, batteries, thermometers, and electrical equipment. These products are frequently found in households and industrial settings.

Collection Points

Italy has established a network of collection points for hazardous waste, including mercury-containing products. These collection points are strategically located to make it convenient for households and businesses to dispose of such items. The responsibility for managing these collection points often falls on local authorities, who work in collaboration with the private sector to ensure the proper collection and transportation of waste to specialized treatment facilities. Macerata province, including Camerino site, has its own collecting points (few examples in Figure 10):

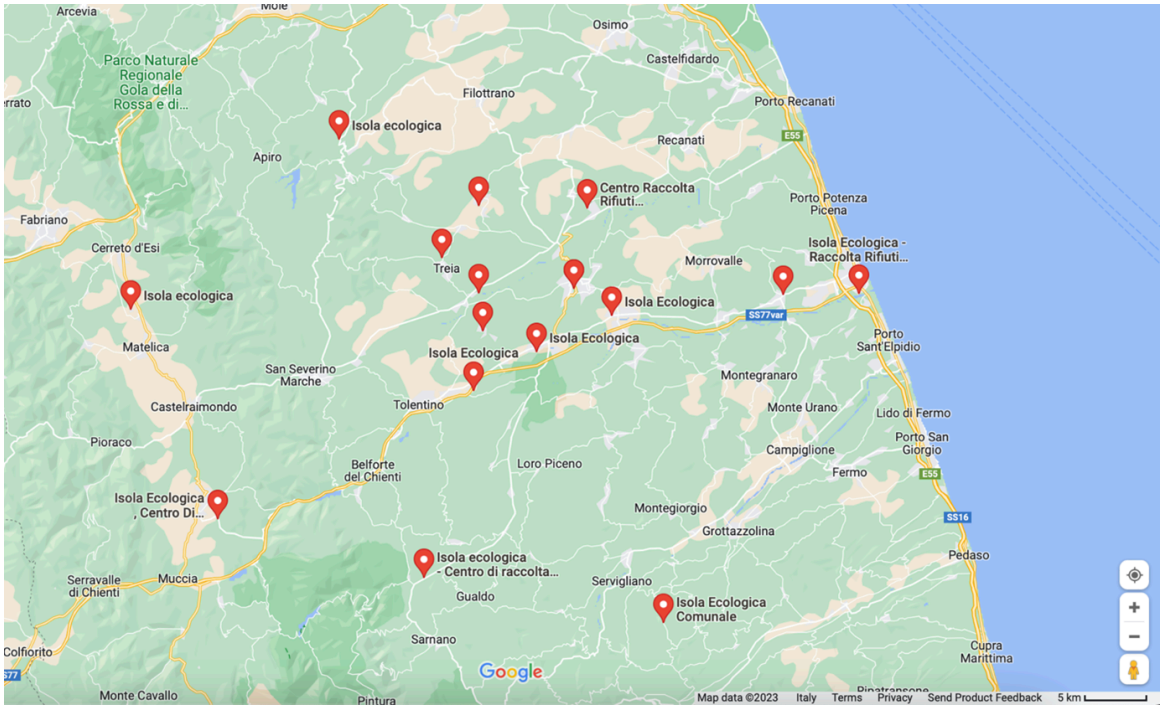

Figure 10. Examples of collecting points location in Macerata province. Addresses, contact and opening hours: http://www.cartacanta.org/isole-ecologiche/index.htm

Specialized Treatment Facilities

Once collected, mercury-containing waste is transported to specialized treatment facilities where the hazardous materials are safely extracted and disposed of. The facilities employ advanced technologies to minimize the release of mercury into the environment. Italy adheres to stringent European and national standards for the treatment and disposal of hazardous waste.

Public Awareness

Italy places a strong emphasis on public awareness and education regarding the proper disposal of mercury-containing waste. The Ministry of Environment and Protection of Land and Sea conducts awareness campaigns and provides resources to educate the public about the dangers of mercury and the importance of responsible disposal. This includes guidance on where and how to dispose of mercury-containing items (Figure 11).

Figure 11. Example of manual on how to discard waste close to sea sites [29]

Webpages (few examples):

- https://www.mase.gov.it/pagina/inquinamento-da-mercurio
- https://www.governo.it/sites/governo.it/files/air_32.pdf
- https://www.governo.it/sites/governo.it/files/relazione_illustrativa_115.pdf
- https://www.arpa.marche.it/images/pdf/rifiuti/00_RELAZIONE_RIFIUTI_2017_COMPLETA_NEW_LOGO.pdf

Italy has adopted a comprehensive legislative and regulatory framework to manage mercury-containing waste responsibly. Through bans, extended producer responsibility, and the establishment of collection points, the country has taken significant steps to protect the environment and public health. The creation of an informational portal and a virtual counseling center further enhances accessibility and education regarding mercury waste management. These initiatives demonstrate Italy's commitment to sustainable waste management and environmental protection. In conclusion, Italy has made significant strides in managing mercury-containing waste through its comprehensive legislative framework and current practices. By enforcing strict regulations, establishing collection points, and promoting recycling, Italy is contributing to a safer and more sustainable approach to waste management. Informational portals and virtual counseling centers play a crucial role in educating the public and ensuring that households have easy access to the resources needed to dispose of mercury-containing waste responsibly. Through these combined efforts, Italy is reducing the environmental and health risks associated with mercury and promoting a cleaner, safer environment for its citizens.

3. Phase 1 of the Roadmap: Stakeholder Identification and Engagement

The preparation of a Roadmap to address and diminish mercury pollution in urban areas involves a diverse range of stakeholders committed to environmental sustainability, public health, and community well-being. In this

comprehensive endeavor, various entities play pivotal roles, contributing their expertise, resources, and local knowledge to formulate effective strategies and initiatives. Below is an overview of the stakeholders engaged in the Roadmap preparation process in the selected cities of Lodz, Krakow, Lviv, Ivano-Frankivsk, Larissa, Évora and Camerino.

3.1 Lodz

Table 2 summarizes the stakeholder involved in Lodz region and their level of engagement.

Table 2. Lodz stakeholders list.

Stakeholder	Engagement
High Education Institutions in Lodz	Engaged in research, education, and expertise, these institutions provide valuable insights into the scientific aspects of mercury pollution and its mitigation
Municipality of Lodz	As a key administrative body, the municipality takes a lead role in policy formulation, regulation, and coordination of efforts to address mercury pollution within the city
Selected Secondary Schools in Lodz region	Educational institutions are essential in raising awareness among the younger generation, fostering a sense of environmental responsibility
Citizens of Lodz region	The involvement of the general public is crucial for garnering support, raising awareness, and ensuring the implementation of pollution reduction measures is in line with community needs
Local Authorities of Lodz region	These authorities contribute to regulatory frameworks and ensure that regional policies align with broader environmental goals

3.2 Krakow

Table 3 summarizes the stakeholder involved in Krakow region and their level of engagement.

Table 3. Krakow stakeholders list.

Stakeholder	Engagement
Local authorities of Krakow	Responsible for local governance, these authorities collaborate to implement policies addressing mercury pollution and promoting sustainable practices
Local NGOs of Krakow	Non-governmental organizations play a vital role in advocacy, community engagement, and implementation of local initiatives to combat mercury pollution
Primary and secondary schools of Krakow	Educational institutions at various levels contribute to awareness-building and education on the environmental impact of mercury pollution
Residents of Kraków with the possibility of extension to the Małopolskie and Podkarpackie voivodeships	Extending the reach to nearby regions ensures a comprehensive and coordinated approach to address pollution that may transcend administrative boundaries

3.3 Lviv

Table 4 summarizes the stakeholder involved in Lviv region and their level of engagement.

Table 4. Lviv stakeholders list.

Stakeholder	Engagement
Department of Ecology and Natural Resources, Department of Waste Management, Department of Emergency Situations, Civil Protection and Territorial Defense of the Lviv City Council	Local government departments collaborate to formulate and enforce policies to reduce mercury pollution

"Bodnarivka" a subsidiary of the Lviv municipal company "Green Lviv"	Active in waste management, this enterprise contributes to proper disposal and treatment of mercury-containing waste.
The main department of the State Emergency Service of Ukraine in the Lviv region	Ensures preparedness and effective response to emergencies related to mercury pollution
State Ecological Inspection in Lviv region	Engaged in monitoring and enforcement, the inspection plays a crucial role in ensuring compliance with environmental regulations
State Institution "Lviv Regional Center for Disease Control and Prevention of the Ministry of Health of Ukraine"	Monitors and addresses health-related aspects of mercury pollution, contributing to public health initiatives and interventions in response to potential health risks associated with exposure to mercury
Department of Social Protection of Population of Lviv Regional State Administration	Focuses on safeguarding the well-being of the population in the context of environmental issues
Educational institutes (students and teachers at universities, colleges, and schools)	Contribute to research, awareness, and education on mercury pollution
Ecological NGOs	Play a crucial role in addressing and advocating for mercury-free initiatives in various aspects of life
Lviv citizens and other stakeholders	Involvement of the broader community ensures a collective and inclusive approach to pollution reduction

3.4 Ivano-Frankivsk

Table 5 summarizes the stakeholder involved in Ivano-Frankivsk region and their level of engagement.

Table 5. Ivano-Frankivsk stakeholders list.

Stakeholder	Engagement
Ivano-Frankivsk City Council	Plays a central role in local governance and policy formulation
Department of Safety and Emergency of the Ivano-Frankivsk City Council, Department of Ecology of the Ivano-Frankivsk City Council	Departments collaborate to address safety and environmental concerns related to mercury pollution
Scientific and Analytical Centre of Ivano-Frankivsk United Territorial Community	Contributes scientific expertise to the Roadmap preparation process
Universities and schools in Ivano-Frankivsk	Educational institutions participate in research, awareness, and education initiatives
Ecological NGOs	Non-governmental organizations bring advocacy, expertise, and community engagement to the forefront

3.5 Larissa

Table 6 summarizes the stakeholder involved in Larissa region and their level of engagement.

Table 6. Larissa stakeholders list.

Stakeholder	Engagement
University of Thessaly	Academic institutions contribute research and expertise to the Roadmap
Municipality of Larissa	Local governance plays a central role in policy formulation and implementation
1st Experimental High School of Larissa	Educational institutions contribute to awareness and education initiatives
Citizens of our region-Larissa	Community engagement ensures a collective approach to pollution reduction

3.6 Évora

Table 7 summarizes the stakeholder involved in Évora region and their level of engagement.

Table 7. Évora stakeholders list.

Stakeholder	Engagement
University of Évora	Academic institutions provide research and expertise on mercury pollution

Preschool and basic school students and teachers, High school students and teachers	Educational institutions contribute to awareness and education initiatives targeting different age groups
Municipalities	Local government bodies play a crucial role in policy formulation and implementation
Merchants of goods containing mercury	Involvement of merchants ensures responsible business practices and supply chain considerations
Évora citizens	Community engagement is vital for successful implementation and acceptance of pollution reduction measures

3.7 Camerino

Table 8 summarizes the stakeholder involved in Camerino region and their level of engagement.

Table 8. Camerino stakeholders list.

Stakeholder	Engagement
High school students (Macerata province, where also Camerino region is included)	The involvement of students ensures a focus on the younger generation and their role in shaping a sustainable future
Universities and scientific communities (University of Camerino involved)	Academic institutions contribute research, expertise, and guidance to the Roadmap

Relatives of the aforementioned target groups	The inclusion of relatives expands the reach of awareness and community involvement
Municipalities and citizens in Camerino region (Camerino, Castelraimondo, Sefro, and Pioraco)	Local governance and community engagement are essential for effective pollution reduction measures

The collaboration of diverse stakeholders, including educational institutions, local authorities, NGOs, and citizens, is integral to the success of the Roadmap for diminishing mercury pollution in these cities. Their combined efforts reflect a holistic and inclusive approach to addressing environmental challenges and ensuring a sustainable future.

4. Phase 2 of the Roadmap: Virtual Counseling Centers for Households

As cities strive for environmental sustainability and the well-being of their inhabitants, the Roadmap for diminishing mercury pollution emerges as a comprehensive strategy. Nestled within this strategic framework is the innovative concept of Virtual Counseling Centers tailored specifically for households. Mercury pollution, stemming from various sources like waste disposal, industrial emissions, and product usage, poses significant threats to public health and the environment. Recognizing the need for proactive and accessible solutions, the integration of Virtual Counseling Centers emerges as a crucial initiative in the ongoing battle against mercury pollution in urban areas.

Understanding the Mercury Challenge

Mercury, a potent neurotoxin, infiltrates ecosystems through diverse pathways, creating complex challenges for cities. The Roadmap acknowledges the

multifaceted nature of mercury pollution, addressing not only its environmental impact but also its potential health repercussions for residents. With this understanding, Virtual Counseling Centers are strategically positioned to provide targeted guidance to households on minimizing mercury exposure, recognizing its sources, and adopting eco-friendly practices.

The Role of Virtual Counseling Centers

Table 9 summarizes the Role of Virtual Counseling Centers

Table 9. Role of Virtual Counseling Centers.

Awareness and Education	Virtual Counseling Centers serve as hubs of information dissemination, offering households comprehensive knowledge about the sources and effects of mercury pollution. Through webinars, online resources, and interactive sessions, residents gain a nuanced understanding of how their daily activities may contribute to mercury emissions
Guidance on Waste Management	Household waste, often containing mercury-containing items such as batteries and electronic devices, becomes a focal point for intervention. Virtual Counseling Centers equip households with practical strategies for proper waste disposal, recycling, and the safe handling of mercury-containing products, thereby reducing the risk of pollution
Product Selection and Alternatives	Through personalized consultations, households receive guidance on selecting mercury-free alternatives for common products. This proactive approach not only contributes to pollution reduction but also encourages a market shift towards environmentally friendly and sustainable choices
Health and Safety Measures	Virtual Counseling Centers offer expert advice on adopting health and safety measures within households to minimize exposure to mercury. This includes recommendations on ventilation, proper storage of products, and guidelines for handling potentially hazardous materials

Accessibility and Inclusivity

One of the key strengths of Virtual Counseling Centers lies in their accessibility. By leveraging digital platforms, these centers ensure that information and support are readily available to a diverse audience, irrespective of geographical location or socio-economic status. This inclusivity fosters a sense of community engagement, empowering households to actively participate in the collective effort to diminish mercury pollution.

Collaborative Approach

The success of Virtual Counseling Centers is intricately linked to collaboration with local authorities, educational institutions, and environmental organizations. By forging partnerships, these centers can tap into a wealth of resources, expertise, and community networks, creating a synergistic impact on mercury pollution diminishment.

In this Roadmap, Virtual Counseling Centers for households emerge as catalysts for change. By imparting knowledge, fostering awareness, and providing practical guidance, these centers empower individuals to be proactive stewards of their environment. As cities embrace a future marked by sustainability and reduced mercury pollution, the integration of Virtual Counseling Centers represents a transformative step towards a cleaner, healthier, and more environmentally conscious urban landscape.

5. Phase 3 of the Roadmap: Sustainable Mercury Reduction Marathons & Public Awareness Campaign

As an integral component of overarching Roadmap to diminish mercury pollution in cities, the Sustainable Mercury Reduction Marathons will serve as dynamic and engaging initiatives, leaving a lasting impact on communities. These marathons are not just standalone events but will incorporate activities

with enduring effects beyond their duration, fostering a sustained commitment to mercury reduction.

5.1 Key Marathon Activities

5.1.1 Active Promotion through Multiple Channels

Objective: Increase awareness and participation in marathon activities.

Implementation: Leverage project social network accounts, connect with LIFE e-HUB, and collaborate with local TV and radio for widespread coverage.

Long-term Impact: Establish a continuous and pervasive presence in the public consciousness, driving ongoing engagement.

5.1.2 Mercury Declaration Campaign

Objective: Encourage individuals to declare their possession of mercury-containing goods.

Implementation: Utilize the LIFE e-HUB platform for declarations, prompting participants to share reasons, disposal plans, and commitment to adopting mercury-free alternatives.

Long-term Impact: Foster a culture of transparency and responsibility; repeated in each marathon with a competition element to incentivize active participation.

5.1.3 Active Disposal Incentive Program

Objective: Encourage proper disposal of mercury-containing goods.

Implementation: Participants delivering mercury-containing goods to collection points receive special notes; notes uploaded to LIFE e-HUB enter participants into a lottery for small prizes, promoting responsible disposal practices.

Long-term Impact: Establish a continuous cycle of responsible waste disposal, reinforcing the importance of proper mercury-containing goods disposal.

5.1.4 “Labelling and Alternatives School" Webinars

Objective: Enhance public understanding of goods labeling, storage, use, and

disposal of mercury-containing products.

Implementation: Conduct webinars with visualized computer scenarios for interactive learning. Participants take tests within scenarios to reinforce knowledge.

Long-term Impact: Equip households with the knowledge to make informed choices regarding mercury-containing products, creating a knowledgeable and empowered community.

5.1.5 Mercury-Free District Parties

Objective: Celebrate and showcase the achievements of the marathon, presenting LIFE e-HUB opportunities.

Implementation: Organize parties in city districts, featuring results of the goods declaring competition, waste lottery, and certificates for "Labelling and Alternatives School" graduates.

Long-term Impact: Strengthen community bonds, establish LIFE e-HUB as a go-to resource, and address accessibility concerns through volunteer helpers, creating an inclusive and supportive environment.

5.2 Purpose

The overarching purpose of the Mercury Pollution Awareness Marathons is to actively intervene and engage individuals who may be passive in ecological activities. Specific objectives include:

- Attracting attention and awareness among individuals unaware of the rules of mercury-containing goods disposal.
- Actively involving citizens in the responsible disposal of hazardous goods, utilizing the correct collection points, and adopting mercury-free alternatives.
- Creating additional indicators for the project's environmental impact by comparing the numbers of devices declared, devices handed over to collection points, participants in educational activities, and the ratio of

involved citizens to the total city population.

The Sustainable Mercury Reduction Marathons, with their multifaceted activities, are not just events but integral components of a continuous Roadmap. By combining awareness-building, community engagement, education, and celebration, these marathons aim to instill lasting changes in behaviors and attitudes, driving the reduction of mercury pollution while fostering a sense of community and responsibility. Through strategic planning and integration, these marathons will leave a legacy of sustainable practices and a mercury-aware society.

6. Innovative Approaches to Consumer Participation in Hazardous Waste Disposal: A Three-Tiered Strategy for Mercury-Free Cities

As cities worldwide strive for environmental sustainability and the reduction of hazardous waste, an integral aspect of the Roadmap towards becoming mercury-free zones involves developing efficient and user-friendly systems for residents to dispose of toxic materials. This section delves into three distinct strategies within the comprehensive Roadmap for mercury-free cities, each catering to different preferences and lifestyles (summarized in Figure 12). From the convenience of returning goods to their place of purchase, utilizing municipal collection points in residential areas, to the innovative concept of mobile reception points through ecobuses, these solutions aim to not only streamline the disposal process but also encourage active participation from residents. By examining the advantages and challenges associated with each method, we aim to provide city planners and policymakers with valuable insights to create effective waste management systems that align with the

diverse needs and lifestyles of urban populations.

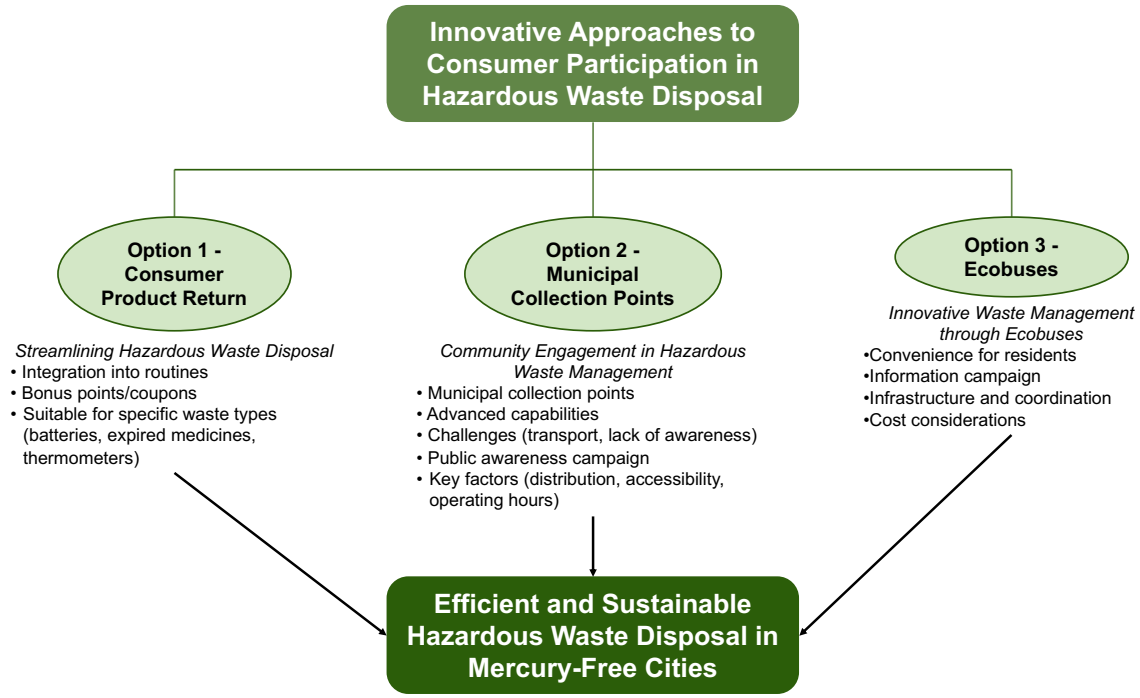

Figure 12. Overview of the three options for consumers on how to dispose mercury-containing products safely and responsibly.

6.1 Option 1: Streamlining Hazardous Waste Disposal: A Convenient Approach Through Consumer Product Return

Facilitating the disposal of hazardous waste by encouraging residents to return it to the points of purchase presents a remarkably convenient solution. This method seamlessly integrates into individuals' routines, as it aligns with the timing of their next purchase, eliminating the need for additional effort. To incentivize participation, a system of bonus points or coupons redeemable at the store can be implemented, fostering a sense of environmental responsibility. Particularly suited for items unsuitable for segregated trash bins yet not highly hazardous, this approach avoids the potential dangers of storing such waste in homes or businesses. This method, commonly employed for the proper disposal of batteries, expired medicines, or mercury thermometers, exemplifies a practical and accessible avenue for waste management within various retail

outlets, malls, and stores.

6.2 Option 2: Community Engagement in Hazardous Waste Management: Navigating Challenges in Delivering Toxic Waste to Municipal Collection Points

Embracing the practice of delivering waste to special municipal collection points stands as a widespread solution for effective hazardous waste disposal. These designated points boast advanced capabilities for waste segregation and immediate processing, contributing to a more sustainable environment. However, the convenience for users is a critical consideration, given the challenges associated with transporting hazardous waste to these collection points. In our fast-paced world, where time is a precious commodity, individuals may find it less feasible to allocate time for such tasks. Moreover, the lack of awareness about the existence of these collection points among certain residents adds another layer of complexity. To enhance the effectiveness of this solution, a robust public awareness campaign becomes imperative, emphasizing the significance of proper waste disposal and informing residents about accessible collection points. Key factors such as the distribution, accessibility, and operating hours of these points also play pivotal roles in ensuring the success of this waste management strategy. Striking a balance between user convenience and environmental responsibility is essential to encourage widespread participation in this crucial aspect of community waste management.

6.3 Option 3: Innovative Waste Management: Harnessing Convenience through Ecobuses for Toxic Waste Disposal

The utilization of ecobuses emerges as a notably more convenient solution for residents compared to traditional selective waste collection points, demanding significantly less effort from individuals. However, to optimize the effectiveness of this waste disposal option, an informative campaign is essential to educate residents about the ecobus service. Familiarity with the predetermined locations and schedules of these mobile reception points is paramount for residents to

seamlessly integrate hazardous waste collection into their routines.

While acknowledging that implementing this solution involves considerable costs and necessitates meticulous coordination between city authorities and waste transport service providers, the significance of the issue underscores the importance of such endeavors. The efficient and mobile nature of ecobuses offers a compelling response to the challenge of toxic waste disposal, justifying the investment in infrastructure and collaborative efforts required. As we strive for more sustainable urban living, the advantages of ecobuses in facilitating the convenient and timely handover of hazardous waste underscore the necessity of pursuing innovative solutions to address pressing environmental concerns.

7. Summary & Conclusions

The Roadmap presents the current legal status of hazardous waste disposal in the countries and regions participating in the life-mercury-free project, as well as currently implemented practices. Various solutions for the proper disposal of hazardous waste, such as those containing mercury, are discussed. Three options for consumers to dispose of these products safely and responsibly were presented. The presented solutions, encapsulated in Options 1, 2, and 3, offer viable approaches for consumers to responsibly dispose of such products. By advocating for collaboration between retailers, manufacturers, and consumers, as well as the establishment of accessible collection points and innovative mobile collection methods, this paper provides a comprehensive framework to address the challenges associated with hazardous waste disposal. The proposed options not only contribute to environmental preservation but also emphasize the importance of public awareness and education in fostering a culture of responsible waste management. Implementing these strategies holds the potential to make significant strides towards a mercury-free and environmentally sustainable future.

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