Based on the Article 38 Paragraph 1 of the Law on the Planning System of the Republic of Serbia (“Official Gazette of the RS”, number 30/18),

The Government adopts the following

WASTE MANAGEMENT PROGRAM OF THE REPUBLIC OF SERBIA FOR THE PERIOD 2022-2031

1. INTRODUCTION

As part of the negotiations for accession to the EU, the Republic of Serbia, through Chapter 27, has begun the process of establishing a waste management system and adapting it to the EU goals and *Acquis Communautaire*.

The Waste Management Program in the Republic of Serbia for the period 2022 - 2031 (hereinafter: the Program) was preceded by the Waste Management Strategy for the period 2010-2019 ("Official Gazette of the RS", No. 29/10) (hereinafter: the Strategy), which set the conditions for the establishment and development of an integrated waste management system in the Republic of Serbia. During the previous period, the progress has been made in harmonizing waste management regulations with the EU regulations, in institutional strengthening and reaching regional agreements for the establishment of joint waste management, as well as in the construction of a number of sanitary landfills. The goals set by the Strategy have not been fully achieved, primarily in the scope of organized waste collection, the degree of primary waste separation and recycling, infrastructure construction and cessation of waste disposal at unsanitary landfills and dumps, application of economic instruments and establishment of sustainable waste management financing system. As the planned goals from the previous document were not fully achieved and as in the meantime new EU goals have been set in the field of waste management within the "green transition" for the transition to a circular economy in the EU, it is necessary to establish new goals in the field of waste management in the Republic of Serbia.

Accordingly, the Ministry of Environmental Protection (hereinafter: the Ministry) coordinated the development of the Program in order to achieve continuity in the implementation of waste management policy and its harmonization with EU regulations and standards.

The work group for drafting this planning document consisted of representatives of the Ministry, the Provincial Secretariat for Urbanism and Environmental Protection, the City of Belgrade-Secretariat for Environmental Protection, the Environmental Protection Agency, the Standing Conference of Towns and Municipalities and the Chamber of Commerce of Serbia. The Program development support was provided through the twinning project "EU Support to the Development of a Strategic Framework in the Field of Waste Management", funded by the European Commission, EU Instrument for Pre-Accession Assistance (SR13/IPA/EN/0416), implemented by the Ministry, the Austrian Environmental Agency, the Swedish Environmental Protection Agency and the Environmental Project Management Agency of Lithuania. The program was finalized with the support of the project "Local Development Resilient to Climate Change", implemented by the Ministry and UNDP.

The program was prepared in accordance with the Law on the Planning System of the Republic of Serbia, the Law on Waste Management, "Official Gazette of the RS", No. 36/09, 88/10 , 14/16 and 95/18-other law) and accompanying bylaws. The Law on Waste Management (Articles 9-11) prescribes the types of planning documents adopted for the purpose of waste management planning, the content of the strategy and the content of the national waste

management plan. In order to establish an optimal planning framework for the field of environmental protection and harmonization with the provisions of the Law on the Planning System, the Program has been prepared in accordance with Articles 10-15 of the Law on Planning System, and taking into account the provisions of the Law on Waste Management. In accordance with the process of optimizing the planning framework in the Republic of Serbia, the area of waste management as a narrower area within the planning and implementation of public policies "environmental protection" will be covered by the sectoral strategy for environmental protection

The program determines the strategic goals for the improvement of the waste management system and the basic principles that should guide all actors in waste management to achieve these goals in the Republic of Serbia for the period 2022 - 2031. The implementation of this program, in addition to reducing the harmful impact on the environment and climate change, should enable the realization of preconditions for the use of waste in the circular economy, for the development of which the goals and measures are determined in a special program. Also, special documents are being developed for the establishment of a waste sludge management system from wastewater treatment plants and for the treatment of animal by-products. Management of agricultural, mining and medical and pharmaceutical waste is planned through sectoral planning documents.

ABBREVIATIONS

APV	Autonomous Province of Vojvodina
EPA	Environmental Protection Agency
DDT	Dichlorodiphenyltrichloroethane
EU	European Union
EU IPA	Instrument for EU Pre-Accession Assistance
LSU	Local Self-government Unit
PPP	Public Private Partnership
MEP	Ministry of Environmental Protection
OECD	Organization for Economic Co-operation and Development
PET	Polyethylene terephthalate
PCB	Polychlorinated biphenyl
POPs	Persistent Organic Pollutants
PVC	Polyvinyl chloride
SDA	Serbian Development Agency
RDF	Refuse-derived Fuel
UNDP	United Nations Development Program

2. PLANNING AND REGULATORY FRAMEWORK

2.1 Public Policy Framework in the EU and on the International Level

During the last decade, several documents have been adopted at the EU level defining common policies for further development into a just and prosperous society, with a modern, resource efficient and competitive economy, which protects natural resources and public health and protects and enhances the environment.

The strategic framework for further development of environmental policy was set by the EU in 2013 with the adoption of the 7th EU Environment Action Program until 2020 (Decision 1386/2013 / EU). This program has set the following priority objectives for Member States in the field of waste management: turning waste into a resource based on strict application of the principle of waste management hierarchy; reduction of waste generation per capita and total waste generation; gradually reducing the disposal of recyclable and reusable waste; ensuring high quality recycling including extended producer responsibility and developing secondary raw material markets. In this sense, the program defines the need to review existing goals in order to encourage a circular economy model based on the product life cycle.

First Circular Economy Action Plan Closing the Loop – An EU Action Plan for Circular Economy (COM (2015) 614) The European Commission has adopted measures to improve waste management: reduce landfill waste and increase preparation for reuse and recycling of key waste streams, such as municipal waste and packaging waste, encouraging the necessary investments in waste management, promoting economic incentives and improving the extended producer responsibility scheme. Based on this plan, a package of directives for the circular economy in the field of waste management was adopted, which, in addition to certain changes, also prescribed new goals for member states until 2035.

The European Strategy for Plastics in a Circular Economy (COM/2018/028), according to this program until 2030, aims to recycle all plastic packaging. The directive encourages a circular approach that favours the use of sustainable and non-toxic reusable products compared to disposable plastic products. This Strategy also imposes special requirements in terms of a total ban on the production and placing on the market of certain products; reducing the generation of this waste, developing a plastic waste management system and preventing pollution and solving the problem of marine pollution.

A New Circular Economy Action Plan for a Cleaner and More Competitive Europe (COM/2020/98) from 2020 sets out ambitious measures to stimulate the transition to a circular economy, i.e., to develop an efficient and competitive economy that would ensure fulfilment of that objective by 2050. At the community level, there are no greenhouse gas emissions. Special attention is paid to the sectors of textiles, construction, electronics, batteries and vehicles, packaging, food waste and plastics. The focus of measures in waste management is aimed at completely avoiding waste generation, i.e., its transformation into high-quality secondary raw materials and the good functioning of the secondary raw materials market. The action plan also proposes a series of actions to reduce EU waste exports and combat illegal shipments. In general, the proposed activities should contribute to closing the product life cycle through increased recycling and reuse, achieving economic benefits and environmental protection.

With the Sofia Declaration on the Green Agenda for the Western Balkans from 2020, the countries of the Western Balkans pledged to implement measures in the field of climate change and pollution prevention, energy development, transport and circular economy, as well as biodiversity, sustainable agriculture and food production. The countries of the Western

Balkans should develop national strategic documents for the circular economy, taking into account waste prevention, the entire product life cycle, modern waste management and waste recycling, reuse, repair and re-production; make further progress in building and maintaining waste management infrastructure for cities and regions, devise and implement programs to raise citizens' awareness of waste, separate collection and sustainable consumption, and conclude and implement a regional agreement on plastic pollution prevention.

In accordance with the mentioned strategic documents, the existing EU legislative framework in the field of waste management has been amended, which is covered by the description of the key requirements of the relevant directives.

Directive 2008/98 / EC of the European Parliament and of the Council on Waste - The Waste Framework Directive annulled certain previously adopted directives and laid down the following provisions relevant to further developments in waste management:

1) waste management hierarchy;
2) defining the status of by-products;
3) defining the cessation of waste status
4) extended producer responsibility;
5) waste prevention
6) targets to be achieved at EU level by 2020 in terms of reuse and recycling;
7) management of hazardous waste, waste oils and biowaste;
8) the obligation to obtain a waste management permit and keep a register of issued permits with possible exceptions for the disposal of own non-hazardous waste at the place of production and for the recovery of waste;
9) minimum technical requirements for waste treatment;
10) obligation to develop waste management plans and waste prevention programs at the national level.

In addition to these provisions, it is necessary to point out other provisions which regulate public participation, inspection supervision, the obligation to keep and keep records of waste, as well as the manner of reporting and implementation of penal policy.

The key provisions introduced by this Directive regulate "by-products" which enable a substance or object produced during the production process and whose main purpose is not the production of that particular product to be considered a substance or object other than waste under defined conditions.

In addition, the requirements for "cessation of waste status" are considered key provisions, defining the conditions under which certain waste ceases to be waste.

Producer liability has been defined and extended, so that Member States may take measures to ensure that any natural or legal person who professionally develops, manufactures, processes, treats, sells or imports products (producer) assumes responsibility for waste management.

In accordance with the polluter pays principle, the costs of waste management are borne by the waste producer or the current or previous owner of the waste.

The prescribed goals by 2020 have been revised by a "new" directive.

EU Directive 2018/851 amending Directive 2008/98 / EC on Waste is an amendment to the Waste Framework Directive in accordance with the previously prescribed waste management hierarchy. The key requirements laid down in this directive are with regard to the setting of specific objectives to be achieved at EU level:

1) Establishing separate collection at least for paper, metal, plastic and glass, and no later than 1 January 2025 for textiles;
2) The EU's common goal for preparing for the reuse and recycling of municipal waste is 65% of the waste mass by 2035;
3) Establishment of a construction waste sorting system for at least wood, mineral fractions (concrete, brick, tiles and ceramics, stone), metal, glass, plastics and gypsum. Directive 2008/98 / EC laid down targets for preparation for reuse and recycling of non-hazardous construction waste of at least 70% of the waste mass to be reached by 2020. These targets are still in force and will be considered by the end of 2024 and it is possible that a new proposal will be made regarding the targets for non-hazardous construction waste;
4) By the end of 2023, biowaste must either be separated and recycled at source, or collected separately and not mixed with other types of waste;
5) By the end of 2024, Member States have an obligation to establish separate collection of hazardous waste fractions produced by households;
6) Changes have been introduced regarding the rules for calculating the achieved goals. In their reporting, Member States must adhere to the rules for calculating targets, and in particular, establish an effective system for controlling the quality and traceability of municipal waste. In this regard, a new Commission Implementing Decision (EU) 2019/1004 was adopted, which lays down rules for the calculation, verification and reporting of waste data in accordance with the Directive 2008/98/EC.

It is especially important to emphasize that this Directive lays down general minimum requirements for extended producer responsibility schemes, which require that the roles and responsibilities of all entities in waste management be clearly defined. The preamble to the directive also states that Member States should take measures to promote the prevention and reduction of food waste in accordance with the 2030 Agenda for Sustainable Development, adopted by the United Nations General Assembly in 2015 and in particular its goal of reducing food waste per capita by half by 2030.

The Landfill Directive 1999/31/EC has established a legal basis for the control and prevention of environmental impacts arising from the disposal of waste. This directive defines the requirements for the appropriate landfill class, i.e., landfills for inert, non-hazardous and hazardous waste. The directive also laid down detailed requirements in terms of criteria for determining the location as well as technical requirements in terms of design, construction and operation of landfills. In addition, this directive prescribes criteria relating to the acceptance, non-acceptance and disposal of waste, procedures during active operation, procedures to be followed when closing a landfill as well as mandatory monitoring during the active and passive phase of landfill operation. Dates are also prescribed for the reduction of biodegradable municipal waste disposed on landfills/dumps to 35% of the total amount (by weight) of biodegradable municipal waste produced in 1995.

Certain directives and decisions have partially developed the legal framework important for waste disposal, but it was only in 2018 that the EU Directive 2018/850 on amendments to the Landfill Directive was passed through a package of directives from the circular economy. The main elements of the amendments to this directive include:

1) Obligations for Member States to take measures to ensure that waste collected separately for preparation for reuse and recycling, in particular municipal waste, is not disposed of in landfills as of 2030;
2) Member States have an obligation to reduce the amount of municipal waste landfilled to 10% or less of the total amount of municipal waste generated by 2035.

It is important to note that the amendments to the directive prescribe a new way of calculating the achieved goals. During 2019, a "new" Implementing Decision of the Commission (EU) 2019/1885 was adopted, which determines the rules for the calculation, verification and reporting of data on municipal waste landfills.

Directive 94/62 / EC on Packaging and Packaging Waste had two main objectives: to protect the environment and to ensure the functioning of the internal EU market. In that sense, the directive prescribed measures that are primarily aimed at preventing the production of packaging waste, reuse of packaging, recycling and other forms of reuse of packaging waste, which directly leads to a reduction in the disposal of this type of waste. The key requirements for Member States relate to measures to encourage an increase in the share of reusable packaging and reusable packaging systems. Measures that Member States may use include: the use of a refund system, the setting of qualitative or quantitative targets, the use of economic incentives and the setting of a minimum percentage of reusable packaging placed on the market each year for each packaging stream.

Directive 94/62 / EC on Packaging and Packaging Waste amended by EU Directive 2018/852 on the circular economy package requires Member States to ensure that collective operators are established by 31 December 2024 to fulfill extended producer responsibility obligations for all types of packaging. The goals to be achieved have been increased:

1) the EU's common target for packaging waste recycling is at least 70% of weight by weight of total packaging waste by the end of 2030;

2) The minimum targets according to weight-by-weight for recycling for the following materials contained in packaging waste by the end of 2030 are 55% plastic, 30% wood, 80% ferrous metals, 75% glass, 85% paper and cardboard.

As of 2019, the rules and criteria for calculating achieved objectives based on the Implementing Decision of the EU Commission 2019/665 are applied.

Directive 2000/53 / EC on Waste Vehicles has set as main objectives: prevention of waste from vehicles, separation of hazardous substances from waste vehicles, reuse, recycling and reuse of waste vehicles, reduction of waste disposal of this type of waste and improvement of environmental standards environments by manufacturers, importers, distributors, sellers and end-users during the life cycle of vehicles, and especially in the treatment of waste vehicles.

Directive 2006/66/EC on Batteries and Accumulators and Waste batteries and Accumulators sets maximum levels for certain chemicals and metals in certain batteries; it obliges Member States to encourage improvements in the environmental battery performances; requires proper management of these batteries, including recycling, collection, recovery and disposal programs.

Waste battery collection rates of at least 45% of the battery and accumulator collection rate have been set by the end of 2016. Recycling of batteries and accumulators for the production of similar products or for other purposes was to reach the following levels within five years:

1) at least 65% of the average weight of lead batteries and accumulators, including recycling of lead content to the highest technically feasible level;

2) 75% of the average weight of nickel-cadmium batteries and accumulators, including recycling of cadmium content to the highest technically feasible level;
3) at least 50% of the average weight of other waste from batteries and accumulators. This recycling efficiency also applies to lithium-based batteries and accumulators. In addition, the directive provides for financial responsibility for programs and adopts rules covering most phases of this legislation, including marking, marking of documents, reviews and other administrative and procedural issues.

Directive 2012/19 / EU on Waste Electrical and Electronic Equipment prioritizes the prevention of this type of waste. In addition, reuse, recycling and other forms of reuse encourage the efficient use of resources and valuable secondary raw materials. As defined by the directive, manufacturers of electrical and electronic equipment should be registered and finance the costs of collection, treatment and recycling of collected waste.

Directive (EU) 2018/849 of the European Parliament and of the Council amending Directive 2000/53/EC on Waste Vehicles, Directive 2006/6/EC on Batteries and Accumulators and Waste Batteries and Accumulators and Directive 2012/19/EU on waste from electrical and electronic equipment have prescribed certain changes for:

1) waste vehicles - measures to ensure that all end-of-life vehicles are stored (even temporarily) and treated in accordance with the waste hierarchy. Member States are also required to report electronically to the European Commission on reuse and treatment targets for each calendar year;

2) batteries and accumulators and waste batteries and accumulators - requires the Member States to submit electronically to the European Commission reports on the levels of recycling achieved in each calendar year. It also empowers Member States to use economic instruments and other measures to provide incentives for the application of the waste hierarchy;

3) waste electrical and electronic equipment – requires the Member States to electronically submit to the European Commission reports on the quantities and categories of electrical and electronic equipment placed on their market. It also empowers Member States to use economic instruments and other measures to encourage the application of the waste hierarchy.

Directive (EU) 2019/904 on the Reduction of Impact of Certain Plastic Products on the Environment applies to single-use plastic products listed in the Annex to this Directive, to products made of oxo-degradable plastic and to fishing gear containing plastic. Oxo-degradable plastics are plastic materials that include additives that, by oxidation, lead to the fragmentation of the plastic material into micro-fragments or to chemical decomposition. Member States shall prohibit the placing on the market of plastics products made of oxo-degradable plastics.

Directive 96/59 / EC on PCBs/PCTs was replaced in 2009 by Regulation (EC) no. 596/2009 - Adaptation to the regulatory procedure with scrutiny. The regulation includes a list of product names of capacitors, resistors and inductors containing PCBs, establishing a reference measurement method for determining the PCB content in contaminated materials.

The EU Regulation on Persistent Organic Pollutants 2019/1021 aims to protect human health and the environment from POP substances through prohibition measures and restrictions as soon as possible, adopting provisions that also apply to waste containing these substances.

Directive 87/217/EEC on the Prevention and Reduction of Asbestos Pollution aims to lay down measures and supplement the provisions already in force with a view to preventing and reducing asbestos pollution in the interests of human health and the environment.

Directive 2010/75/EU on Industrial Emissions entered into force in 2011. It includes seven previous directives - Integrated Pollution Prevention and Control Directive 1996/61 / EC, Large Combustion Plants Directive 2001/80 / EC, Waste Incineration Directive 200/76 / EC, Directive 1999/13 / EC on Installations Using Volatile Organic Compounds , Directive on waste from the titanium dioxide industry78 / 176 / EEC, SEVESO Directive 2012/18 / EU, Directive on volatile organic compounds in paints 2004/42 / EC and 2010/79 / EU. The application of the best available techniques is also mandatory in waste management. What needs to be pointed out in relation to this directive, and it refers to the field of waste management, is that the list of activities and facilities in waste management that are subject to the obligation to obtain an integrated permit has been expanded. In addition, waste incineration is fully defined in Annex 6 of this Directive.

Directive 2009/125 / EC establishing a general framework for the setting of ecodesign requirements for products affecting energy consumption, with a view to ensuring the free movement of those products in the internal market. This directive abolishes on the EU market products that do not meet the prescribed requirements related to the environmental characteristics of product design, which has an impact on subsequent reuse or treatment when the product becomes waste.

2.2 National Public Policy Framework

2.2.2 Legislative and Strategic Framework of the Republic of Serbia

The adoption of the Law on Waste Management and the Law on Packaging and Packaging Waste ("Official Gazette of the RS", No. 36/09 and 95/18-other law) set the conditions for the establishment and development of an integrated waste management system in the Republic of Serbia, in accordance with the standards of relevant EU legislation in this area. In addition, waste management is directly or indirectly regulated by other regulations that provide the legal framework for environmental protection and sustainable development in the Republic of Serbia

The Law on Waste Management sets the types of waste and its classification, waste management planning, stakeholders, obligations and responsibilities regarding waste management, management of special waste streams, permission requirements and procedures, cross-border movement of waste, reporting, financing of waste management, supervision and other relevant aspects of waste management. Waste management consists of a set of activities of common interest that include the implementation of prescribed action plans implemented in the processes of collection, transport, storage, treatment and disposal of waste, including supervision of these activities and responsibility for waste management facilities after their closure. Based on this law, a number of bylaws have been adopted that define in detail the framework of waste management, including the management of special waste streams. In addition, these bylaws further align national legislation with EU regulations in this area. Amendments to this Law are being prepared in order to further harmonize with the EU Directives and the package related to the circular economy.

- Decree on products that after use become special waste streams, form of daily records on the quantity and type of produced and imported products and annual report, manner and deadlines for submission of annual report, taxpayers, criteria for calculation, amount and manner of calculation and payment of compensation (" Official Gazette of RS ", No. 54/10, 86/11, 15/12, 3/14 and 77/21).

The Law on Packaging and Packaging Waste sets the requirements in the field of environmental protection that relate to packaging and that it must be met in order to place packaging on the market; packaging and packaging waste management, reporting on packaging and packaging waste, economic instruments, as well as other relevant issues related to packaging and packaging waste management. The law also regulates imported and manufactured packaging, i.e., packaging placed on the market, as well as packaging waste generated in business activities on the territory of the Republic of Serbia, regardless of its origin and purpose, and used packaging material. Amendments to the law are being prepared for further harmonization with the EU directive. Based on these laws, appropriate bylaws have been adopted in order to additionally regulate certain issues in the field of waste management established by law. Amendments to this Law are being prepared in order to further harmonize with EU Directives.

The Law on Fees for the Use of Public Goods ("Official Gazette of the RS", No. 95/18 and 49/19) prescribes a fee for products that after use become special waste streams, and which are the subject of this program.

The Law on Environmental Protection ("Official Gazette of the RS", No. 135/04, 36/09-other law, 72/09-other law, 43/11 (CC), 14/16, 76/18 and 95/18-other law) provides for an integrated environment protection system, including action plans, conditions and instruments for sustainable management and preservation of natural balance, integrity, diversity and quality of natural values and conditions for the survival of living beings, prevention, control, reduction and remediation of all forms of pollution, promotion and use of products, processes, technologies and practices that have a less harmful impact on the environment, application of special rules of conduct in waste management from waste generation to disposal, i.e. prevention or reduction of waste generation, reuse and recycling, separation of secondary raw materials and use of waste as fuel, import, export and transit of waste, competencies of the Environmental Protection Agency, training of staff to improve knowledge and raise awareness, access to information and public participation in decision-making process. In addition, the law provides for a rule of hierarchy in waste management, from generation to final disposal, including prevention, reuse and recycling, transboundary movements of waste. Based on this law, bylaws were adopted.

The Law on Strategic Environmental Assessment ("Official Gazette of the RS", No. 135/04 and 88/10) determines the relations between environmental policy and other sectoral policies currently being developed, as well as the development of new plans and programs in areas of spatial and urban planning or land use, agriculture, forestry, fisheries, hunting, energy, industry, transport, waste management, water management, telecommunications, tourism, conservation of natural habitats and wild flora and fauna and establishing a framework for the adoption of future development projects. In addition, this law regulates the conditions, manner and procedures of conducting strategic assessment of the impact of certain plans and programs on the environment in the phases of their preparation and adoption, as well as the content of reports on strategic assessment, its verification and public involvement and participation in the report evaluation process.

The Law on Environmental Impact Assessment ("Official Gazette of the RS", No. 135/04 and 36/09) prescribes the procedure for assessing the potentially significant impacts of certain projects conducted by public or private companies on the environment, the content of the study on environmental impact assessment environment, liability of applicants for permits or approvals for construction or reconstruction of buildings, change of technology, capacity expansion, closure and cancellation of projects that may have significant effects on the environment, as well as other interventions taking place in nature and the natural environment, public participation in project development or approval. Impact assessment is performed in the

case of projects in the field of industry, mining, energy, transport, tourism, agriculture, forestry, water management, waste management and utilities, as well as in the case of projects planned in protected areas or protected environment of immovable cultural property.

The Law on Integrated Prevention and Pollution Control ("Official Gazette of the RS", No. 135/04, 25/15 and 109/21) determines the conditions and procedure for issuing integrated permits for the operation of facilities and activities that may adversely affect human health, environment or material goods, types of activities and facilities, supervision and other relevant aspects of prevention or control of environmental pollution. Based on this law, several bylaws have been adopted to define the obligations of the operator and the time schedule of the application for the integrated permit.

The Law on Mining and Geological Research ("Official Gazette of the RS", No. 101/15, 95/18-other law and 40/21), among other issues, defines the management of mining waste, that is, the waste from the extraction industry. The law prescribes the obligation to develop a mining waste management plan and issue a permit for the disposal and management of mining waste. The Ministry of Mining and Energy is in charge of implementing this law. A bylaw is adopted on the basis of the Law on Mining and Geological Research:

- Decree on the conditions and procedure for issuing waste management permits, as well as criteria, characterization, classification and reporting on mining waste ("Official Gazette of the RS", No. 53/17).

The Law on Planning and Construction ("Official Gazette of the RS", No. 72/09, 81/09-correction, 64/10 - CC decision, 24/11, 121/12, 42/13 - CC decision and 50/13 – CC decision, 98/13 – CC decision, 132/14, 145/14, 83/18, 31/19, 37/19-other law, 09/20 and 52/21) prescribes the procedure for construction of waste management infrastructure. It also determines the conditions and manner of spatial planning, arrangement and purpose of construction land and construction and use of facilities.

The Law on Communal Activities ("Official Gazette of the RS", No. 88/11, 104/16, 95/18) determines communal services and regulates general conditions and manner of their provision, enables organization and provision of communal services for two or more municipalities and/or cities, under the conditions provided by law and agreements between municipal assemblies.

The Law on Chemicals ("Official Gazette of the RS", No. 36/09, 88/10, 92/11, 93/12 and 25/15) regulates integrated management of chemicals, classification, packaging and labeling of chemicals, integrated register of chemicals placing on the market, restrictions and prohibitions on production, placing on the market and use of chemicals, import and export of certain dangerous chemicals, marketing authorizations and permits for the use of highly hazardous chemicals, the placing on the market of detergents, systematic monitoring of chemicals, availability of data, supervision and other issues relevant to the management of chemicals.

The Law on Biocidal Products ("Official Gazette of the RS", No. 109/21) determines the list of active substances, procedures for the adoption of acts regulating the placing of biocidal products on the market, restrictions and prohibitions on the exploitation and placing on the market of biocidal products, research and development of biocidal products, classification, packaging, labeling, advertising and safety data sheet of biocidal product, register of biocidal products, safe use of biocidal products, surveillance and other areas of importance for safe use and placing of biocidal products on the market.

The Law on Air Protection ("Official Gazette of the RS", No. 36/09, 10/13 ad 26/21-other law) regulates air quality management and determines measures, manner of organization and control of the implementation of protection and improvement of air quality as a natural

value of common interests under special protection. The provisions of this law do not apply to pollution caused by radioactive materials, industrial accidents and natural disasters.

The Law on Plant Health ("Official Gazette of the RS", No. 41/09 and 17/19) regulates the manner of handling the organisms harmful for plants, reduction of delivery of pesticides and fertilizers, including their destruction.

The Law on Veterinary Medicine ("Official Gazette of the RS", No. 91/05, 30/10, 93/12 and 17/19-other law) regulates the protection and improvement of animal health and welfare, determines infectious animal diseases and measures to prevent the occurrence, detection, prevention of the spread, control and elimination of contagious animal diseases and diseases that can be transmitted from animals to humans, veterinary and sanitary control and requirements for breeding and trade in animals, production and trade of products of animal origin, food of animal origin, animal feed, requirements for performing veterinary practice, as well as the manner of safe disposal of dead animals and by-products of animal origin. The bylaw passed on the basis of this law is:

- Rulebook on the manner of classification and handling of animal by-products, veterinary-sanitary conditions for construction of facilities for collection, processing and destruction of animal by-products, manner of official control and self-control, as well as conditions for cattle cemeteries and gravel pits ("Official Gazette of the RS", No. 31/11, 97/13, 15/15 and 61/17).

The Law on Health Care ("Official Gazette of the RS", No. 25/19) regulates the health system, the organization of the health service, social care in order to achieve the health of the population, the general health interest, rights and obligations of patients, health care of foreign nationals, the establishment of the Agency for Accreditation of Health Institutions in the Republic of Serbia, supervision and other issues relevant to the organization and implementation of health care. The scope of public care for the health of the population includes, among other things, responsibility for adopting a state program in the field of health care related to polluted environment which is the result of the presence of harmful and dangerous substances in air, water and soil, disposal of waste materials, hazardous chemicals, etc. The responsibility of health institutions and private practice for organizing, i.e., providing measures for disposal and/or destruction of medical waste in accordance with the law has also been determined.

The Law on Waters ("Official Gazette of the RS", No. 30/10, 93/12, 101/16 and 95/18-other law) regulates the conditions for water management and the permits for water management for certain industrial facilities that discharge wastewater; regulates the obligation to build wastewater treatment plants and wastewater disposal and discharge plants, including industrial and municipal landfills. Bylaws adopted before the adoption of this Law, which are based on the previous Law on Waters, shall be applied until the adoption of bylaws based on this Law, except for provisions that are in conflict with this Law.

The Law on Agricultural Land ("Official Gazette of the RS", No. 62/06, 65/08-other law, 41/09, 112/15, 80/17 and 95/18-other law) regulates the protection of land, as well as the conditions of use of land for exploitation mineral resources and disposal of tailings, ash and slag and other waste and hazardous substances on agricultural land and the prescribed obligation to re-cultivate agricultural land used for the disposal of tailings, ash and slag or other waste material.

The Law on Energy ("Official Gazette of the RS", No. 145/14, 95/18-other law and 40/21) regulates the goals of energy policy and manner of its realization, conditions for reliable, safe and quality delivery of energy and energy products and conditions for safe supply of

customers, protection of energy customers and energy sources, conditions and manner of performing energy activities, etc.

The Law on Energy Efficiency and Rational Use of Energy ("Official Gazette of RS", No. 40/21) regulates, *inter alia*, energy labeling and eco-design requirements. Eco-design incorporates environmental aspects into the design and construction of products that affect energy consumption, in order to improve the product's impact on the environment throughout its entire life cycle. After the adoption of regulations on eco-design for individual products, based on the legal framework contained in the law and the Regulation on eco-design of products that affect energy consumption, only products that meet the prescribed eco-design requirements will be able to be placed on the Serbian market, which means, among other things, that they do not have a detrimental impact on the environment. In this way, the adverse impact on the environment will be significantly reduced.

– Decree on eco-design of products that affect energy consumption ("Official Gazette of RS", No. 132/21).

The Law on Public-Private Partnerships and Concessions ("Official Gazette of the RS", No. 88/11, 15/16 and 104/16) regulates the conditions and manner of drafting, proposing and approving public-private partnership projects; rights and obligations of public and private partners; the form and content of the public-private partnership agreement with or without elements of the concession; conditions and manner of granting the concession, as well as other issues of importance for public-private partnership, with or without elements of the concession, that is, for the concession.

The Law on Ministries ("Official Gazette of the RS", No. 128/20) regulates the number of ministries and special organizations and their scope.

The Law on Cessation of the Law on the Environmental Protection Fund ("Official Gazette of the RS", No. 93/12) regulates the termination of the Environmental Protection Fund.

The Law on Determining the Competences of the Autonomous Province of Vojvodina (Official Gazette of the RS, No. 99/09, 67/12 – CC decision, 18/20-other law and 111/21-other law) determines the competencies of the Autonomous Province, especially in areas where the Republic regulates the system, such as the following: culture, education, health care, sanitary inspection, environmental protection and improvement, urbanism, construction, economy and privatization, mining and energy, agriculture, forestry and the like.

The Law on Local Self-Government ("Official Gazette of the RS", No. 129/07, 83/14, 101/16, 47/18 prescribes the rights and responsibilities of local self-government units determined by the Constitution of the Republic of Serbia, law, other regulations and statute (key and delegated affairs), the possibility of cooperation and association of local self-government units in order to achieve common goals, plans and development programs, as well as other activities of common interest.

The Law on Financing of Local Self-Government "Official Gazette of the RS", No. 62/06, 47/11, 93/12, 83/16, 104/16, 96/17, 89/18, 95/18, and 111/21-other law) regulates the manner of financing the unit of local self-government from the source revenues and allocated public revenues of the Republic.

The Law on the Capital ("Official Gazette of the RS", No. 129/07, 83/14-other law, 101/16-other law, 37/19 and 111/21-other law) regulates the position, competencies and powers of the City of Belgrade, the capital of the Republic of Serbia.

The Law on Public Enterprises ("Official Gazette of the RS", No. 15/16, 88/19) regulates the establishment and operation of enterprises performing activities of general

interest, the form and share of state capital in public enterprises and defines activities of general importance as activities which are prescribed by law as such, inter alia, in the field of use, management, protection and promotion of property of general interest, as well as communal services.

The Law on Companies ("Official Gazette of the RS", No. 36/11, 99/11, 83/14-other law, 05/15, 44/18, 95/18, 91/19 and 109/21) regulates the legal status of companies and other forms of organization in accordance with this law, and especially their establishment, management, status changes, changes in legal form, termination and other issues relevant to their position, as well as the legal position of entrepreneurs.

The Criminal Code "Official Gazette of the RS", No. 85/05, 88/05 -correction, 107/05 -correction, 72/09, 111/09, 121/12, 104/13, 108/14, 94/16 and 35/19) prescribes sanctions for: transfer of goods across the customs border, avoiding customs control measures; selling, distributing or concealing undeclared goods; illegal production or processing of goods without the approval of the competent authority; illegal trade, production, sale or placing on the market of harmful food products, food or beverages or other harmful products; contamination of drinking water or foodstuffs; violation of regulations related to the protection, preservation and improvement of the environment by air, water and soil pollution; failure to take certain environmental protection measures; illegal construction, in the case when an authorized or competent person approves the construction, operation or operation of a facility or the application of technology that pollutes the environment, acting contrary to regulations on environmental protection.

The application of a sustainable waste management system is an essential part of the strategic sustainable development of the environmental protection system.

The lack of an adequate waste management system has been identified as one of the main risk factors for sustainable development of the Republic of Serbia in the National Sustainable Development Strategy (Official Gazette of the RS, No. 57/08), which was ceased, but whose principles and goals in these areas are still relevant. Establishment and implementation of an adequate and sustainable waste management system is listed as a priority measure and in accordance with the holistic approach applied in this strategy, such a waste management system takes into account not only technical requirements for savings and environmentally friendly waste management, but also combined socio-economic effects.

The Law on Spatial Plan of the Republic of Serbia from 2010 to 2020 ("Official Gazette of the RS", No. 88/10) defines, as a general instrument of spatial planning, locations for 26 centers for regional municipal waste management, locations for five centers for hazardous waste storage, and one location for centralized hazardous waste management. The Draft Spatial Plan of the Republic of Serbia for the period 2021-2035 has also been prepared. and the Report on the Strategic Assessment of the Environmental Impact of the Spatial Plan of the Republic of Serbia from 2021 to 2035, which were available to the public in the period May-July 2021. The Draft Spatial Plan of the Republic of Serbia for the period 2021-2035 follows the objectives of waste management set in the Spatial Plan of the Republic of Serbia from 2010 to 2020.

The Sustainable Urban Development Strategy of the Republic of Serbia until 2030 ("Official Gazette of the RS", No. 47/19) represents a framework for sustainable urban development using an integrated approach, in accordance with the needs of urban planning, urban development and the potential of urban settlements as generators of development activities. The complexity of urban space requires a special approach to directing development trends and activities in urban areas. The strategy also recognizes waste management as a factor in urban development.

The Strategy of industrial policy of the Republic of Serbia for the period from 2021 to 2030 ("Official Gazette of the RS", No. 35/20) aims to raise the competitiveness of industry and points to problems when it comes to industries that generate large amounts of waste and use raw materials inefficiently. This strategy recognizes the lack of infrastructure for the treatment of industrial and other types of waste. One of the planned activities includes adjusting the criteria for the procurement of equipment in a way that includes investments in equipment that uses recycled resources. One of the special goals of the Strategy is the transformation of the industry from a linear to a circular model.

Energy Development Strategy of the Republic of Serbia until 2025 with projections until 2030 ("Official Gazette of the RS", No. 101/15) which defines the strategic priorities for the development of the energy sector. The Strategy defines energy resources and potentials, and among them is the potential of using waste for energy purposes. A new Energy Development Strategy of the Republic of Serbia until 2040 is being drafted, with projections until 2050, which will, among other things, look at new potentials and possibilities of using waste for energy purposes. It is planned that the new Energy Development Strategy of the Republic of Serbia until 2040 with projections until 2050 will be adopted in 2022.

2.2.3 Institutional Framework

The Ministry has the key institutional responsibility in the field of waste management. The Ministry, in accordance with the Law on Ministries performs state administration tasks which, among other things, relate to: waste management, including hazardous waste, except radioactive waste; approval of cross-border movement of waste, as well as other activities determined by law. The Ministry proposes to the Government a strategy and national waste management plans, coordinates and performs waste management activities of importance to the Republic, approves regional waste management plans, except for plans in the territory of the Autonomous Province, issues permits prescribed by law, supervises and controls the application of waste management measures and undertakes other measures and activities, in accordance with international treaties and agreements.

The Environmental Protection Agency, as an administrative body within the Ministry in the capacity of a legal entity, performs state administration tasks related to maintaining and updating the database on waste management in the environmental protection information system, in accordance with the law governing environmental protection.

Other ministries are in charge for certain waste streams:

1) Agricultural waste and animal by-products – Ministry of Agriculture, Forestry and Water Management;
2) Mining waste – Ministry of Mining and Energy;
3) Medical waste and pharmaceutical waste – Ministry of Health.
4) The Ministry of Labor, Employment, Veterans and Social Affairs inspects occupational safety on the entire territory of the Republic of Serbia, including the Autonomous Province. The companies subject to inspection operate in all sectors, including the waste management sector. The Ministry of Construction, Transport and Infrastructure inspects trucks, trains and ships. There are already joint inspections of these ministries and the Ministry in place, and they need to be further improved.

At the provincial level, the key responsibility in the field of environmental protection lies with the Provincial Secretariat for Urbanism and Environmental Protection, based on the competencies transferred to AP Vojvodina by The Law Determining the Competences of the Autonomous Province of Vojvodina. The Provincial Secretariat participates in the development of

the Strategy and national waste management plans, performs waste management activities of importance for the province, approves regional waste management plans on its territory, issues permits, consents and other acts in accordance with the law, supervises and controls the measures of waste management on its territory and other activities determined by law.

Local self-government units have competencies in the field of communal activities and are responsible for the strategic assessment of plans and programs, the assessment of the impact of projects on the environment and the issuance of integrated permits within their competence. Municipal waste management is the concern of local self-governments. According to the Law on Waste Management, the local self-government unit adopts a local management plan waste and takes care of its implementation, conducts management of non-hazardous (including municipal) and inert waste on its territory, regulates the procedure for charging for services, issues permits and other acts; supervises and controls waste management measures, as well as other tasks determined by law.

Professional organizations for waste testing perform waste testing for the purposes of classification in cross-border movement of waste, treatment and disposal of waste, as well as for the purpose of declaring the cessation of waste status, in accordance with the scope of activities for which they are accredited. By 2021, nine institutions with the status of a professional organization for waste testing have been accredited.

Other participants with a certain role in waste management according to the Law on Waste Management are producers or importers of products, waste producers, waste owners and holders, waste carriers, intermediaries/traders and operators of waste management facilities. These actors come from the public and private sectors.

In addition to institutions with a role in waste management, the involvement of the public sector (including consumer organizations and individual waste producers) is very important for the success of waste management policy. Changing consumer behavior is a crucial factor in encouraging initiatives in the waste management sector, such as waste prevention or household segregation. Furthermore, associations (civil society organizations) registered in accordance with the Law on Associations ("Official Gazette of RS", No. 51/09, 99/11 - other laws and 44/18 - other law) dealing with issues of environmental protection and media, have a significant role in supporting the implementation of waste management goals, citizen information campaigns, as well as direct communication with citizens.

3. DESCRIPTION OF THE EXISTING STATUS OF THE WASTE MANAGEMENT FIELD

Assessment of the implementation of the Strategy was performed on the basis of an analysis of planned priority activities and the current situation in waste management. The results of the assessment show that the implementation of the Strategy did not proceed as planned. In the previous period, results were achieved in the harmonization of regulations in the field of waste management. Results have also been achieved in institutional strengthening and development, by merging municipalities into waste management regions and signing inter-municipal agreements, but regional enterprises have not yet been established. Since 2010, 8 regional landfills have been built within the regional waste management centres, and a total of 12 sanitary landfills, which is insufficient. Due to the lack of space for further waste disposal due to filled landfills, some municipalities are redirecting their municipal waste to neighbouring regional landfills. For the period from 2010, 32 projects of remediation, closure and reclamation of landfills were done. 18 regional waste management plans from 26 districts have been developed. The percentage of the population covered by organized waste collection shows an increasing trend. The recycling rate is still insufficient. Not much has been achieved in developing waste management financing systems and implementing economic instruments. Landfills in some municipalities that posed a risk to the

environment have been rehabilitated. There are insufficient results in the field of hazardous waste management. Hazardous waste management infrastructure is not in place.

3.1 Basic Data

The Republic of Serbia is located in Southeast Europe on the Balkan Peninsula and covers an area of 88,499 km2. There are two autonomous provinces in the Republic of Serbia, Vojvodina (21,614 km2) in the north and Kosovo and Metohija (10,910 km2) in the south (Municipalities and Regions in the Republic of Serbia, 2020). Kosovo and Metohija is under temporary international administration, according to United Nations Security Council Resolution 1244, and is not considered in this Program.

According to the 2011 Census, the Republic of Serbia has close to 7.2 million inhabitants, and 59.4% of the population lives in urban areas. The largest cities are Belgrade, Novi Sad, Nis and Kragujevac. The most important agricultural areas are located in the AP of Vojvodina. Livestock is also developed. Heavy industry in the Republic of Serbia is mainly related to mining, including processing, metallurgy, chemical industry and others. Other industrial production includes the production of cement and other construction materials, electrical equipment, wood processing, rubber, textiles, food products, etc. Investments in infrastructure are constantly growing. It is estimated that the total economic activity in the Republic of Serbia in 2020, measured by the real movement of gross domestic product (GDP), achieved a growth of 1.1% compared to 2019. In 2020, the share of environmental costs in gross domestic product was 0.8% (SBS, Environmental Expenditures, 2020).

The following table presents the division of total costs according to environmental protection activities.

Table 3.1. *Costs according to environmental protection activities in the Republic of Serbia (in RSD million)*

Activities	Total, mil RSD		Share, %	Changes compared to previous year	
	2019	2020	2020	Difference Mil RSD	Growth rate, %
Environmental protection Costs (a+b)	**42.367,8**	**46.698,1**	**100**	**4.330,3**	**10,2**
Air protection	4.584,2	10.643,5	22,8	6.059,3	132,2
Waste water management	5.817,1	5.741,8	12,3	-7,3	-1,3
Waste management	26.307,4	23.991,4	51,4	-2.316,0	-8,8
Other*)	5.659,2	6.321,2	13,5	662,0	11,7
a) Environmental protection investments	**11.606,4**	**18.470,6**	**100**	**6.864,2**	**59,1**
Air protection	4.199,2	10.134,3	54,9	5.935,1	141,3
Waste water management	1.381,7	2.670,9	14,5	1.289,2	93,3
Waste management	4.292,2	3.124,0	16,9	-1.168,2	-27,2
Other*)	1.733,3	2.541,3	13,8	808,0	46,6
b) Environmental protection current costs	**30.761,5**	**28.227,5**	**100**	**-2.534,0**	**-8,2**
Air protection	385,0	509,2	1,8	124,2	32,3
Waste water management	4.435,4	3.070,9	10,9	-1 364,5	-30,8
Waste management	22.015,2	20.867,5	73,9	-1 147,7	-5,2
Other*)	3.925,9	3.779,9	13,4	-146,0	-3,7

*) Protection and remediation of land, groundwater and surface water, Protection against noise and vibration; Protection of nature; Other activities related to environmental protection.

3.2 Municipal Waste

3.2.1 Types and Quantities of Municipal Waste

Data on the quantities, types and composition of waste are the starting point in the waste management planning process. The waste management planning process must be based on a reliable database of existing waste quantities, sources and types, as well as on the existing method of waste management (collection, transport, recycling, treatment and disposal). The latest available official data from the Environmental Protection Agency were used to make an analysis of the current situation and make projections of the amount of waste for the next period.

In line with the amendments to the EU Waste Framework Directive and the proposed amendments and amendments to the Law on Waste Management, the definition of municipal waste is:

Municipal waste is separately collected household waste, including paper and cardboard, glass, metal, plastic, biowaste, wood, textiles, packaging, waste electrical and electronic equipment, waste batteries and accumulators, bulky waste and mixed municipal waste and/or separately collected waste from other sources, if such waste is similar in nature and composition to household waste, but does not include waste from production, agriculture, forestry, fisheries and aquaculture, waste vehicles and construction waste."

This Program uses the methodology for calculating the total amount of municipal waste and the degree of recycling of waste in the Republic of Serbia, based on field measurements which was adopted by the Environmental Protection Agency. This methodology is in line with the EU Waste Framework Directive 2008/98/EU and Implementing Decision (EU) 2019/1004. The method of calculation of certain types packaging and packaging waste is in accordance with the Implementing Decision (EU) 2019/665 and will be applicable from 1 January 2023. The level of municipal waste disposal is calculated in accordance with the EU Landfill Directive and the Implementing Decision (EU) 2019/1885 dated 1 January 2023.

In 2020, 2.95 million tons of municipal waste were generated in the Republic of Serbia. A total of 2.34 million tons was collected and disposed of, while 558,568 tons of waste, that is, 19% of the generated municipal waste, were disposed of at the regional sanitary landfills in 2020, according to the data of the Environmental Protection Agency. A total of 79.45% of municipal waste was disposed of in landfills. There is no waste treatment before landfilling. In the Republic of Serbia, the average coverage of municipal waste collection is 86.4%. 455,457t of municipal waste was recycled, at the recycling rate of 15.45%. As mentioned above, the reason for the change in the level of recycling compared to previous reporting is the new calculation methodology applied in the EU.

The average daily amount of municipal waste is 1.17 kg/inhabitant, or 0.43 t/year.

Table 3.2. *Quantities of municipal waste (Source: Waste Management in the Republic of Serbia in the period 2011-2020; Environmental Protection Agency, 2021)*

	2011.	**2012.**	**2013.**	**2014.**	**2015.**	**2016.**	**2017.**	**2018.**	**2019.**	**2020.**
Total amount of generated waste (Million tons)	2,71	2,62	2,41	2,13	1,84	1,89	2,71	2,79	2,83	2,95
The amount of waste collected and disposed of by municipal PUC (Million tons)	2,09	1,83	1,92	1,67	1,36	1,49	2,33	2,22	2,24	2,34

Average volume of waste collection (%)	77	~ 70	80	~80	82	~82	83,7	87,2	86,2	86,4
Average daily amount of municipal waste per inhabitant (kg)	1,01	0,99	0,92	0,81	0,71	0,73	1,06	1,10	1,12	1,17
Average annual quantity per inhabitant (t)	0,37	0,36	0,34	0,30	0,26	0,27	0,39	0,40	0,41	0,43

Table 3.3. *Quantities of generated and treated municipal waste in 2020 (according to Eurostat and OECD questionnaire)*

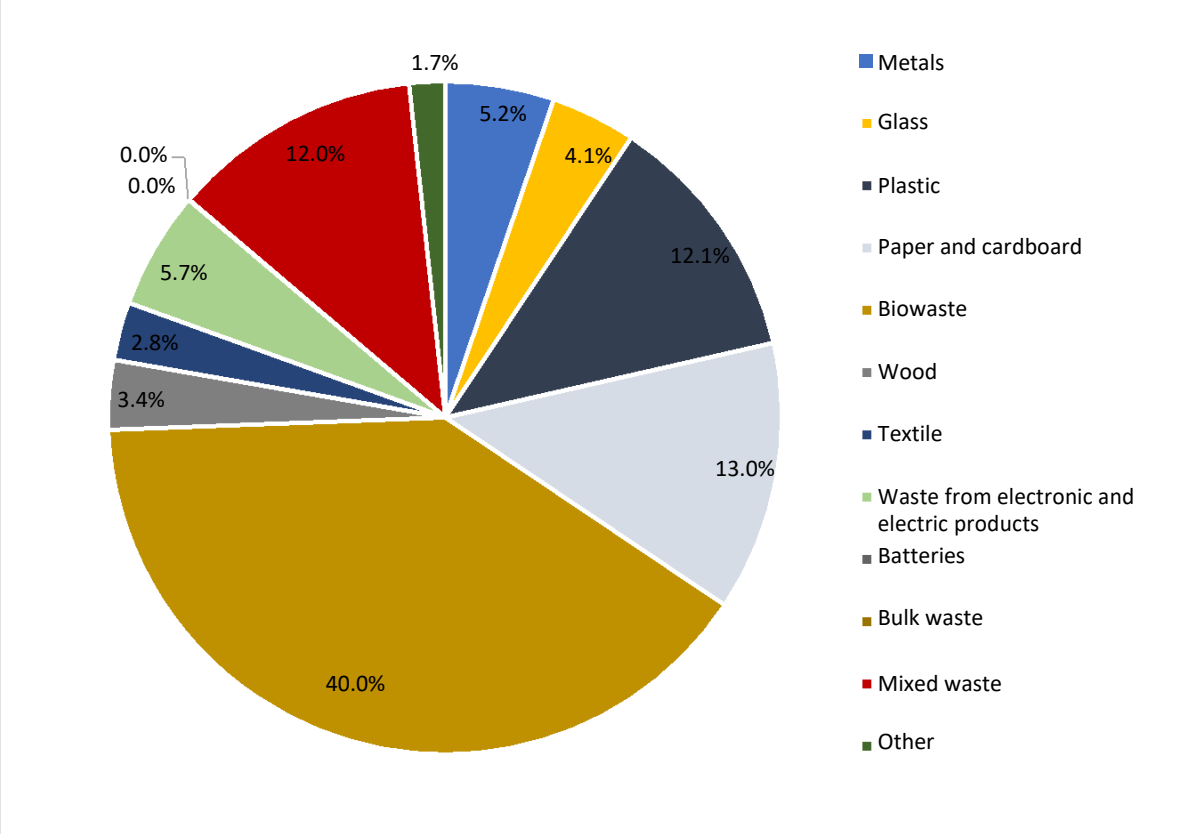
Municipal waste	**2020.**
Total generated municipal waste* (t)	2.947.496
Waste generated in household (OECD) (t)	2.063.247
Waste generated in other sources (OECD) (t)	884.249
Separate collection (from total generated municipal waste) (t)	482.515
Waste disposed of or reused (of total generated) * (t)	2.819.629
Utilization (t)	477.897
Preparation for re-use (t)	-
Recycling - material (t)	444.274
of which Metals recycled from slag after incineration (t)	-
Recycling - composting and digestion (t)	11.183
of which Separate source collection and recycling of biowaste - example, home composting (t)	-
Utilization – energy utilization (R1)* (t)	5.860
Utilization - other* (t)	16.580
Disposal (t)	2.341.732
Disposal - incineration (D10)* (t)	-
Disposal - landfill (D1, D5, D12)* (t)	2.341.732
Disposal - other (D2-D4, D6-D7); (OECD) (t)	
Coverage by collection system (%)	86,40

Table 3.4. *Quantities of materials from municipal waste by groups 15 and 20 from the Waste Catalog for 2020*

Municipal waste	Index number from the Waste Catalog	Generated municipal waste (t)	Separate collection (t)	Preparation for reuse (t)	Recycling (t)	Energy utilization (t)	Other utilization (t)
Total		2.947.496	482.515	-	455.457	5.860	16.580
Metals	20 01 40, 15 01 04, 15 01 11*	153.848	47.853	-	47.288	66	22
Metals separated after waste incineration	20 01 40, 15 01 04, 15 01 11*	0	0	-	0	0	0
Glass	20 01 02, 15 01 07	120.838	22.238	-	21.998	0	0
Plastic	20 01 39, 15 01 02	356.021	55.293	-	45.219	3.606	6.012
Paper and cardboard	20 01 01, 15 01 01	382.802	229.973	-	225.049	2.025	626
Biowaste	20 01 08, 20 01 25, 20 02 01	1.179.870	11.469	-	11.183	71	102
Source separated and recycled biowaste	20 01 08, 20 01 25, 20 02 01						
Wood	20 01 37*, 20 01 38, 15 01 03	99.429	27.945	-	17.867	89	9.808
Textile	20 01 10, 20 01 11, 15 01 09	81.405	61	-	60	0	0
Electric and electronic equipment	20 01 21*, 20 01 23*,						
Batteries	20 01 33*, 20 01 34	70	21	-	20	0	0
Bulk waste	20 03 07	1.359	422	-	418	0	0
Mixed waste	20 03 01, 15 01 06	354.957	0	-		0	0
Other		50.199	26.536	-	26.261	0	10

Based on the data of the Environmental Protection Agency, it can be concluded that 40% of municipal waste is biowaste, which consists of garden waste and food waste. The share of biowaste does not include other potentially biodegradable waste such as paper and cardboard or textiles. Food waste accounts for a significant percentage of biowaste in municipal waste. Food waste (20 01 08 - biodegradable kitchen and restaurant waste), when disposed on a landfill, has negative impact on the climate due to methane production during decomposition, i.e., greenhouse gas emissions, but also pollution of surface and groundwater with nutrients excreted in leachate.

Recyclable waste components from the dry fraction are plastic (12.1%), paper and cardboard (13%), glass (4.1%) and metals (5.2%). Less represented types of waste are: wood, textiles, bulky waste, batteries and other waste. The morphological composition of municipal waste is as follows:



Graph 3.1. *Average morphological composition of mixed municipal waste in the Republic of Serbia in 2020, 2021*

Table 3.5. *Average morphological composition of mixed municipal waste in the Republic of Serbia in 2020*

Municipal waste fractions	Quantity of mixed Municipal Waste	Quantity of separately collected waste	Total quantity of municipal waste (t)	Share in total municipal waste (%)
Metals	105.994	47.853	153.848	5,2
Glass	98.599	22.238	120.838	4,1
Plastics	300.728	55.293	356.021	12,1
Paper and cardboard	152.829	229.973	382.802	13,0
Biowaste	1.168.401	11.469	1.179.870	40,0
Wood	71.484	27.945	99.429	3,4
Textile	81.344	61	81.405	2,8
Waste from electronic and electrical product	105.994	60.704	166.698	5,7
Batteries	49	21	70	0,002
Bulk waste	937	422	1.359	0,0
Mixed waste	354.957	0	354.957	12,0
Other	23.664	26.536	50.199	1,7
TOTAL	**2.464.981**	**482.515**	**2.947.496**	**100**

Paper and cardboard play an important role in biodegradable municipal waste. Most of this flow consists of packaging waste, but also newspapers, magazines and the like. This particular waste stream has great potential for recycling.

Textile waste (20 01 10 - clothing and 20 01 11 - textile), as part of biodegradable waste, also has a negative impact on the environment when disposed on a landfill. The total amount of textile waste cannot be considered biodegradable waste, because only natural textiles are biodegradable, but textile clothing can be reused. Textile waste is thus one of the biggest and growing problems in the Republic of Serbia. There is no special infrastructure for separate collection of this waste.

Wood waste is mainly generated in commercial and industrial activities (packaging), but, to a lesser extent, also in household activities (packaging of some devices, reconstruction and repair works).

3.2.2 Existing Municipal Waste Collection System

Public services and utilities in the Republic of Serbia are mainly under the jurisdiction of public utility companies established by municipalities. In some municipalities there are agreements with strategic partners on waste collection or disposal. Collection is organized in urban areas, while rural areas are less covered. Certain problems in rural areas arise due to inadequate infrastructure, accessibility and organization. Most local governments have mechanization and vehicles for waste collection, however, there is a lack of adequate equipment for separate waste collection.

Currently, the main problems with the municipal waste collection system include:

1) Insufficient number and structure of waste collection containers;
2) Inadequate distribution of containers;
3) Lack of appropriate vehicles for waste transport;

4) Inadequate frequency of waste transport;
5) Inadequate vehicle routes.

In the Republic of Serbia, there is no systematically organized separate collection, sorting and recycling of municipal waste. Although the source separation in the Republic of Serbia is determined by law and envisages the separation of plastic, paper, glass and metal in specially marked containers, separate collection does not work in practice, except sporadically in some local governments.

Separate collection of recyclable materials, except for packaging waste from households, has not yet been properly implemented. In 2013, public utility companies responsible for collection reported about separate collection of recyclable materials for the first time.

Various types of special vehicles are used for waste collection, such as: waste collection vehicles with pressure plate, Rotopress, forklifts for open type containers, ordinary trucks and tractors with trailers. The frequency of collection varies from municipality to municipality.

In urban areas of other cities and municipalities, collection is usually carried out once a day or twice a week. In rural areas and in areas where each household has its own waste bin, the most common collection frequency is once a week. In urban areas, a 1.1 m^3 container is most commonly used for municipal waste, while in some urban areas there are 3 m^3 and 5 m^3 underground containers. In semi-urban areas, 120l and 240l bins are most commonly used (each household has its own waste bin). In rural areas, where there are no residential buildings, waste is collected from households in plastic bags or 240/140/80 l bins.

Only a few local governments have waste collection centers ("recycling yards").

Lines for secondary waste separation exist in some local self-governments: Belgrade, Novi Sad, Subotica, Sremska Mitrovica, Pirot, Uzice, Jagodina and Leskovac, and others with smaller capacities and functionalities.

Hazardous household waste is not collected separately from the mixed municipal waste stream.

The following permits were issued to operators until October 2021: 137 permits for collection; 178 transport permits, and 98 storage permits for the collection of municipal waste (household waste and similar commercial, industrial and institutional waste), including separate collection of fractions (waste category 20) (Agency register on issued waste management permits).

3.2.3 Existing Infrastructure for Municipal Waste Treatment and Disposal

Waste management is considered an activity of general interest and can be carried out either by a public company according to the Law on Public Enterprises, or by private companies by delegating activities in accordance with the Law on Public-Private Partnerships and Concessions.

The recycling infrastructure system is not balanced to maximize overall efficiency; the network for separate waste collection is not sufficiently developed in relation to the existing recycling capacities. There are several registered plants for recycling PET and other types of plastic, metal, paper, etc.

Although municipal waste contains a high degree of biodegradable content, there is no network of plants for biological treatment of municipal waste, except in the regional center for waste management in Subotica. The Republic of Serbia does not have the necessary infrastructure to reduce the disposal of biodegradable waste in landfills.

Construction of three plants for controlled incineration of municipal waste is planned in the Republic of Serbia. The costruction of one plant is underway in Belgrade and it is planned to become operational in 2022, while the design of plants for controlled incineration of

municipal waste and production of electricity and heat from non-recyclable waste in Nis and Kragujevac is in progress Cement plants in Beocin and Novi Popovac have permits for heat treatment (co-incineration) of certain high-calorie fractions of municipal waste and other special waste streams in cement kilns.

Regional sanitary landfills are used for the disposal of non-hazardous waste and they are sanitary-technically arranged locations where waste generated in public areas, in households, in production and service activities, in turnover or use, which does not have the properties of hazardous substances and cannot be processed or rationally used as an industrial raw material or energy fuel is being disposed. There is no waste treatment before landfilling. In addition to these landfills, a large number of unsanitary, municipal landfills and dumps are in use.

On the territory of the Republic of Serbia, there are a number of built and operational transfer stations where waste is being reloaded for transport to regional sanitary landfills.

Waste management regions are formed through the cooperation of local self-government units. Out of 26 regions for waste management as envisaged by the measures from the Strategy, regional waste management companies have been established in 13 regions, and another 12 regions have signed inter-municipal agreements, but regional companies have not been established yet. Some of the municipalities have joined other regions, different from those envisaged in the Strategy, while some regions have been merging. The level of changes required in institutions in the Republic of Serbia, during a relatively short period of time, has been recognized as one of the main challenges for the successful implementation of the Landfill Directive.

Table 3.6. *Waste management regions in the Republic of Serbia (Source: Specific plan for the implementation of the EU Directive 1999/31/EC on landfills)*

Region	**Municipalities**
Sremska Mitrovica	Bogatic, Ruma, Sremska Mitrovica, Sabac, Sid
Pancevo	Kovin, Kovacica, Opovo, Pancevo.
Indjija	Indjija, Irig, Pecinci, Sremski Karlovci, Stara Pazova.
Uzice	Arilje, Bajina Basta, Cacak, Cajetina, Ivanjica, Kosjeric, Lucani, Pozega, Uzice.
Pirot	Babusnica, Bela Palanka, Dimitrovgrad, Pirot.
Kikinda	Ada, Becej, Kikinda, Nova Crnja, Novi Becej.

Region	Municipalities
Lapovo	, Despotovac, Lapovo, Raca, Svilajnac.
Jagodina	Cuprija, Jagodina, Paraćin, Smederevska Palanka, Velika Plana.
Leskovac	Bojnik, Crna Trava, Lebane, Leskovac, Medvedja, Vladicin Han, Vlasotince
Subotica	Bačka Topola, Čoka, Kanjiža, Mali Iđoš, Novi Kneževac, Senta, Subotica
Valjevo	Barajevo, Koceljeva, Lajkovac, Lazarevac, Ljig, Mionica, Obrenovac, Osecina, Ub, Valjevo, Vladimirci, Krupanj, Loznica, Mai Zvornik, Ljubovija.
Zrenjanin	Secanj, Titel, Zitiste, Zrenjanin.
Nova Varos	Nova Varos, Priboj, Prijepolje, Sjenica.
Vranje	Bosilegrad, Bujanovac, Presevo, Surdulica, Trgoviste, Vranje
Belgrade	Cukarica, Grocka, Mladenovac, New Belgrade, Palilula, Rakovica, Savski venac, Sopot, Stari Grad, Surcin, Vozdovac, Vracar, Zemun, Zvezdara.
Novi Sad	Backa Palanka, Backi Petrovac, Beocin, Novi Sad, Srbobran, Temerin, Vrbas, Zabalj
Nis	Aleksinac, Gadzin Han, Kursumlija, Doljevac, Zitoradja, Merosina, Nis, Prokuplje, Razanj, Sokobanja, Svrljig
Sombor	Apatin, Bac, Kula, Odzaci, Sombor.
Vrsac	Alibunar, Bela Crkva, Plandiste, Vrsac.
Zajecar	Boljevac, Bor, Kladovo, Knjaževac, Majdanpek, Negotin, Zaječar.
Smederevo	Golubac, Smederevo, Veliko Gradiste.
Kragujevac	Arandjelovac, Batocna, Gornji Milanovac, Knić, Kragujevac, Topola, Rekovac
Kraljevo	Kraljevo, Vrnjacka Banja, Trstenik
Raska	Novi Pazar, Raska, Tutin
Krusevac	Aleksandrovac, Brus, Ćićevac, Kruševac, Varvarin, Blace
Pozarevac	Kucevo, Malo Crniće, Petrovac, Požarevac, Žabari, Žagubica

A total of ten regional sanitary landfills and two more that are not of the regional type have been built in accordance with the EU standards, by the end of 2021. Operational sanitary landfills are as follows:

1) Regional sanitary landfill "Duboko" Uzice;
2) Regional sanitary landfill "Vrbak" Lapovo;
3) Kikinda regional sanitary landfill;
4) Regional sanitary landfill "Gigos" Jagodina;
5) Regional sanitary landfill “Željkovac - Landfill Two” Leskovac;
6) Regional sanitary landfill "Muntina padina" Pirot;
7) Regional sanitary landfill "Jarak" Sremska Mitrovica;
8) Pancevo regional sanitary landfill;
9) Regional sanitary landfill Subotica;
10) Regional sanitary landfill "Vinca" Belgrade;
11) Sanitary landfill "Meteris" Vranje;
12) Sanitary landfill "Vujan" Gornji Milanovac.

Regions that will use the existing regional sanitary landfills in the neighboring regions for waste disposal in the coming period have been identified. The Decision on Joint Provision and Implementation of Waste Management ("Official Gazette of the RS", No. 45/18) supports this approach.

Table 3.7. *Amount of waste disposed of in sanitary landfills in tons per year (Source: Waste Management in the Republic of Serbia in the period 2011-2020; Environmental Protection Agency, 2021)*

Sanitary landfill	**2017.**	**2018.**	**2019.**	**2020.**
RSL “Duboko” Uzice	75.295	79.764	82.214	83.541
RSL “Vrbak” Lapovo	41.266	35.264	68.166	57.396
RSL Kikinda	50.411	55.056	50.231	37.478
RSL “Gigos” Jagodina	62.893	61.660	75.360	69.042
RSL “Zeljkovac– D2” Leskovac	69.255	71.102	71.369	82.953
RSL “Muntina padina” Pirot	29.987	28.456	30.903	30.654
RSL “Jarak” Sremska Mitrovica	50.912	51.080	55.369	56.680
RSL Pancevo	25.815	25.358	28.562	76.225
RSL Subotica	-	-	4.056	27.382
SL “Meteris” Vranje	16.841	17.247	20.087	21.946
SL “Vujan” Gornji Milanovac	15.203	14.655	14.580	15.361
RSL “Vinca” Beograd	-	-	-	-
Total	**437.878**	**439.642**	**500.897**	**558.568**

A total of 19% of the generated municipal waste, that is 558,568t was disposed of in 2020 at these sanitary landfills (waste disposal only at adequate landfills that are designed and operated in accordance with the provisions of the Directive), in accordance with Article 14 of the EU Directive on Landfills, while other quantities of municipal waste are still disposed of in unsanitary landfills.

Regional waste management centers are organized through public-private partnerships, public utility companies and publicly owned limited liability companies.

In addition to regional sanitary landfills, there are more than 120 municipal landfills that do not comply with environmental standards and that accept municipal waste that is collected in an organized manner. Once the complete waste management infrastructure is built, these landfills will be closed and recultivated. There are still a large number of illegal dumps, over 3,500, which are beyond the control of municipal utility companies, with a completely different dimension and risk factors. About 20% of the generated municipal waste in the Republic of Serbia is dumped in illegal dumps, outside the control of municipal public utility companies. In most cases, illegal dumps are located in rural areas and are a consequence of the lack of funds for the expansion of the waste collection system, but also insufficient organization of waste management at the local level.

3.3 Industrial and Hazardous Waste

3.3.1 Types and Quantities of Industrial and Hazardous Waste

Industrial waste is waste from any industry or from a location where industry is situated, except for tailings and accompanying mineral raw materials from mines and quarries, while hazardous waste is waste that by its origin, composition or concentration of hazardous substances may cause danger to the environment and human health and has at least one of the hazardous characteristics determined by special regulations, including the packaging in which the hazardous waste was or is packed.

Business entities report to the Environmental Protection Agency on the waste they produce during their activities and the manner of handling the generated waste.

According to the data of the Environmental Protection Agency, a total of 9.57 million tons of waste was generated in the Republic of Serbia in 2020, of which approximately 68,000 tons of hazardous waste. Thermal energy facilities are the largest producers of waste. Ash, slag and dust from the boiler together with fly ash from coal combustion, marked 10 01 in the Waste Catalog were generated in the amount of 7.78 million tons, or 81% of the total amount of waste produced. Other types of waste originating from thermal processes are also present in significant quantities: unprocessed slag, waste from slag processing, solid waste based on calcium, generated in the process of desulphurization of gases (Environmental Report 2020, 2021). Currently, the fly ash is handed over for the needs of cement production. Certain quantities of gypsum from the desulphurisation process are exported, which has the status of a by-product.

This is followed by excavation and land generated during construction activities, solidified and other waste from waste treatment plants, packaging waste and scrap metals.

Out of the total amount of waste produced, 1,763,052 t (18%) were reported, while 7,812,437 t (82%), which is mainly fly ash from coal combustion, remained at the locations where the waste was produced. Waste from slag processing from the iron and steel industry 10 02 also represents the largest amounts of disposed waste and waste recycled. Of the exported quantities of non-hazardous waste, metals containing iron are the most represented.

Table 3.8. *Quantities of waste generated in the Republic of Serbia in 2020 (in tons), according to categories from the Waste Catalog (Source: Report on the state of the environment in the Republic of Serbia for 2020, 2021. Environmental Protection Agency)*

Group	Waste	Quantity (t)
01	Mining	-
02	Agriculture, food preparation and processing	117.767
03	Wood industry, paper, cardboard	46.090
04	Leather, fur and textile industry	8.617
05	Processing of oil, natural gas and coal treatment	1.884
06	Non-organic chemical industry	779
07	Organic chemical industry	7.590
08	Coatings, glues, sealants and printing colors	3.776
09	Photographic industry	803
10	Waste from thermal processes	8.379.777
11	Protection of metal and other materials	2.726
12	Moulding and surface processing of metal and plastics	44.155
13	Waste oils and liquid fuel residues	8.098
14	Waste organic solvents, coolants	133
15	Packaging waste, absorbents, cleaning cloths	135.110
16	Waste not specified in the catalogue	70.039
17	Construction and demolition wastes	320.879
18	Waste from health protection of people and animals	3.452
19	Waste processing plant wastes	337.457
20	Municipal and similar waste	86.260
TOTAL		**9.575.392**

The generated hazardous waste mainly consists of: sludges and filter cakes from gas treatment that contain hazardous substances. Significant amounts of hazardous waste submitted for reuse are waste containing oils and specially collected electrolyte from batteries and accumulators. Hazardous components removed from discarded equipment, cleaning acids and slags from lead thermal metallurgy represent the largest amounts of hazardous waste exported.

Table 3.9. *Hazardous industrial waste and commercial waste in the Republic of Serbia, 2020. The most significant waste flows by quantity (Environmental Protection Agency, 2021)*

Index number	Waste	Quantity (t)
10 02 13*	Sludges and filter cakes from the treatment process gases containing dangerous substances	10.728
16 07 08*	Waste containing oil	7.454
18 01 03*	Waste the collection and disposal of which is under specific requirements due to infection	3.134
16 02 15*	Hazardous components removed from disposed equipment	2.778
15 01 10*	Packaging which contains remnants of hazardous matters or which is contaminated by hazardous substances	2.531
13 02 08*	Other motor oils, gearbox oils and lubricants	2.463
16 06 06*	Separately collected electrolytes from batteries and car batteries	2.330
16 06 01*	Lead batteries	2.329
10 02 07*	Solid waste from treatment of gas containing hazardous substances	2.256
17 02 04*	Glass, plastics, wood containing hazardous substances or contaminated by hazardous substances	2.114
10 04 01*	Slag from primary and secondary production	1.962
17 05 03*	Soil and stone containing hazardous substances	1.822
10 10 11*	Other solid particles containing hazardous substances	1.776
20 01 35*	Disposed electrical and electronic equipment not listed under 20 01 21 and 20 01 23 containing hazardous components	1.673
05 01 03*	Sludge from tank bottom	1.621
15 02 02*	Absorbents, filter materials (including oil filters not specified in other manner), wiping cloths, protective clothing contaminated by hazardous substances	1.430
13 05 06*	Oils from oil/water separators	1.208
19 12 11*	Other waste (including mixed materials) from mechanical treatment of hazardous waste	1.166
11 01 05*	Cleaning acids	1.137
	Other types of waste	15.960
TOTAL		**67.872**

The share of hazardous waste during the period 2011 - 2019 ranged from 0.6% to 1.3% of total waste generated. In 2020, the share of hazardous waste in the total amount of waste was 0.6%.

However, there are also backlogs inherited due to lack of waste care in the previous period. The level of industrial waste generation per unit of product is disproportionately high, the use of raw materials is irrational and the energy efficiency of industry is low. In the Republic of Serbia, the amount of waste produced in relation to GDP is 260.8 t/mil $.

The Cadaster of Contaminated Sites in the Republic of Serbia has been prepared. The Cadaster of Contaminated Sites is a collection of data on endangered, polluted and degraded land and it is an integral part of the Land Information System maintained by the Environmental Protection Agency. The condition and quality of land at contaminated sites are monitored annually.

According to the statistical data of the Environmental Protection Agency, in 2020, 11,658 tons of hazardous waste were dumped at landfills (Operation D5). The most common type of hazardous waste was 10 02 13* - Sludges and filter cakes from the gas treatment process containing hazardous substances (10,800 t).

About 9,000 tons of hazardous waste were used for the production of energy (operation R1) in 2020, according to data submitted to the Environmental Protection Agency.

The most common types of hazardous waste used for energy production were 16 07 08* - Waste containing oil (4,965 t), 17 05 03* - Soil and stone containing hazardous substances (1,500 t), waste from group 13 - Waste from oils and residues of liquid fuels (1,170 t) and 19 12 11* - other wastes (including mixtures of materials) from mechanical treatment of wastes containing dangerous substances (533 t).

In addition, in the Republic of Serbia in 2020, about 80,000 tons of hazardous waste were treated in recycling/reuse operations (operations *R2-R11*). Waste/recycling operations used the most waste types under the following index numbers 20 01 35* - Discarded electrical and electronic equipment other than those mentioned in 20 01 21 and 20 01 23 containing hazardous components (37.137 t) and 16 06 01* - Lead batteries (15,838 t).

Table 3.10. *Quantities of hazardous waste treated in the Republic of Serbia in 2020 by reuse/disposal operations (Source: Environmental Protection Agency, 2021)*

Operation	Type of disposal/reuse operation	Quantity (t)
D5	Disposal of waste to specially designed landfills	11.658
R1	Primary utilization of waste as fuel or other energy-producing source	9.164
R2	Regeneration/processing of solvents	13
R3	Recycling/processing of organic matters not used as solvents	3.732
R4	Recycling/processing of metals and metal compounds	57.507
R5	Recycling/processing of other non-organic materials	265
R7	Renewing components used for pollution reduction	8.563
R9	Re-refining or other method of re-use of waste oil	1.264

R10	Disposal of waste to processes in soil which are beneficial to agriculture or environmental progress	718
R11	Utilization of waste obtained by any of the operations from P1 to P10	8.898
TOTAL		**101.782**

There is no organized collection of hazardous waste from households. For this reason, there are no relevant data.

3.3.2 Existing System for Collection of Industrial and Hazardous Waste

At the moment, there is no regular hazardous waste collection system on the territory of the Republic of Serbia. The hazardous waste collection system is primarily based on the economic value of waste. For example, waste oil of a certain quality (high calorific value) or lead batteries are collected in any case, can be sold to users in the formal or informal waste management sector. There is insufficient information on the collection of some hazardous waste streams without positive economic value (acids, chemical waste, oil contaminated waste, sludge, etc.). There is no special legislation on separate collection and management of hazardous waste from households in the Republic of Serbia. Certain hazardous household waste, such as waste electrical and electronic equipment and batteries, is collected under municipal supervision and in the context of special waste streams. For other hazardous household waste, e.g., waste oil, pharmaceutical waste (expired drugs) and chemical waste or varnishes, no regular collection system has been established in the Republic of Serbia so far.

Table 3.11. shows the number of valid waste management licenses issued for the collection, transport, storage and treatment of hazardous waste in the Republic of Serbia according to the register of the Agency on waste management licenses issued in the territory of the Republic of Serbia.

Table 3.11. *Number of valid licenses for collection, transport, storage, treatment and disposal of hazardous waste by May 2021 (Source: Environmental Protection Agency)*

Waste management activity	Number of valid licenses (Ministry of Environmental Protection	Number of valid licenses (AP of Vojvodina)
Collection	246	14
Transport	190	13
Warehousing	116	42
Treatment	103	28
Disposal	3	2
TOTAL	**658**	**99**

3.3.3 The Existing Infrastructure for Disposal and Treatment of Industrial and Hazardous Waste

The lack of infrastructure for the treatment and disposal of hazardous waste is a particular problem. The capacity for treatment of a wide range of hazardous industrial waste on the territory of the Republic of Serbia is insufficient.

There is a limited capacity for physical and chemical treatment of hazardous waste and only limited capacity for hazardous waste disposal.

There is not enough capacity to store hazardous waste. In such circumstances, hazardous waste producers, temporarily store the hazardous waste at their locations in temporary warehouses.

On the territory of the Republic of Serbia, there is still no national facility for the treatment of hazardous industrial waste, as well as central regional warehouses for hazardous waste, although the design is provided in the Spatial Plan of the Republic of Serbia from 2010. In the private sector, there are several facilities that treat hazardous waste and facilities that are planned for construction. Capacities for incineration of organic industrial and medical waste are lacking. Finally, a system for collecting hazardous waste from households has not been established so far.

Three regional sanitary landfills are licensed to receive certain types of hazardous waste, which primarily operate as regional sanitary landfills for non-hazardous waste. These landfills have separate cells for receiving waste containing asbestos, other hazardous construction and demolition waste and solidified hazardous waste. Only one other landfill has a permit for the disposal of hazardous waste. It exists within the Steelworks "HBIS Serbia" and is used for internal purposes.

Table 3.12. *Landfills in the Republic of Serbia that have cassettes for hazardous waste disposal*

Operator	**Location**	**Capacity (m^3)**
FCC Eko Ltd. Regional Landfill Vrbak Lapovo	Lapovo	12.876
FCC Kikinda Ltd.Kikinda	Kikinda	38.285
PWW Landfill Two Ltd. Leskovac	Leskovac	1.600
HBIS Serbia	Smederevo	240.000

There are three cement factories in the Republic of Serbia:

1) Lafarge Serbia, Beocin;
2) CRH Serbia, Popovac, Paracin;
3) Titan Cement Factory Kosjeric, Kosjeric.

Both Lafarge and CRH in Serbia have a permit for thermal treatment of hazardous and non-hazardous waste as an alternative fuel, while Titan is in the process of obtaining this permit. Not dangerous and hazardous waste was used as an alternative fuel in cement factories in the previous period. In addition, this industry in the Republic of Serbia, as an alternative raw material, uses more than 300,000 tons of non-hazardous and hazardous waste per year (mostly fly ash and granulated blast furnace slag).

In 2020, 11,658 tons of hazardous waste were disposed of. Hazardous waste is mostly disposed of in the landfill for industrial hazardous waste, and 240 t is disposed of in regional landfills that have a permit for the disposal of hazardous waste. Hazardous waste that is disposed of in regional landfills consists of construction and insulation materials that contain asbestos, and the landfill of industrial waste is mostly disposed of sludge and filter cakes that contain hazardous substances.

The lack of infrastructure for waste treatment in the Republic of Serbia has opened, as the only possibility for the final disposal of waste, export for treatment to authorized and registered plants in the EU (incinerators, physical and chemical treatment plants, salt mines, etc.). The companies that export waste are from the domain of the pharmaceutical industry, electric power industry, and laboratory waste is also exported from some medical institutions. Majority of PCB waste is exported.

3.4 Special Waste Flows

3.4.1 Types and Quantities of Special Waste Flows

The principle of extended producer responsibility applies to special waste streams, i.e. the producer or importer pays a fee when placing these products on the market for the purpose of their efficient collection and treatment, and based on the Regulation on products on the quantity and type of manufactured and imported products and the annual report, the manner and deadlines for submitting the annual report, the persons liable to pay the fee, the criteria for calculation, the amount and manner of calculating and paying the fee.

Waste tires

Waste tires are defined as non-hazardous waste (waste code 16 01 03). Tires for passenger cars and trucks represent about 85% of the total number of tires produced. The Republic of Serbia has a significant production of car tires, of which a significant share is exported. In 2020, 39,882.3 t of tires were put on the market (e.g., tires from tractors, trucks, buses and forklifts). 49,512 t of waste tires were reused, and 72 t were disposed of. About 27,000 t of waste tires were recycled (R5). 6,186 t of waste tires were imported. Waste tires are also used as waste fuel (RDF) in the cement industry in Serbia. The amount used for combustion (R1) in cement plants was about 6,123 t (Products that after use become special waste streams in the Republic of Serbia in 2020, 2021). Waste tire treatment options include the recycling of waste tires and their use for energy purposes. At least 80% of the total amount of waste tires collected in the previous year should be recycled, and not more than 20% used for energy purposes. There is no special scheme for collecting waste tires.

Used batteries and car batteries

An accumulator and battery represent any source of electricity produced by the conversion of chemical energy, which may consist of one or more primary battery cells (non-rechargeable) or one or more secondary battery cells (rechargeable). The Republic of Serbia has the production of lead-acid batteries, nickel-cadmium batteries and silver-zinc batteries. According to the data of the Environmental Protection Agency, in the Republic of Serbia, in 2020, 17,950.7 t of accumulators and batteries were placed on the market. Of that, 13,599.8 t are starters, that is, car batteries, 461 t are portable batteries and accumulators, and 3,889.9t are industrial batteries and accumulators. During 2020, 15,839 tons of batteries and accumulators were recycled for reuse, of which 4,782 tons were imported from abroad. During 2020, 4,280 tons of batteries and accumulators were exported from the Republic of Serbia (Products that after use become special waste streams in the Republic of Serbia in 2020, 2021).

However, so far there is no integrated collection system for portable batteries or for industrial batteries and accumulators.

Waste oils

In 2020, 36,792.9 tons of oil were placed on the market in the Republic of Serbia, and only 2,178 tons were treated and 730 tons of waste oil were exported, according to the

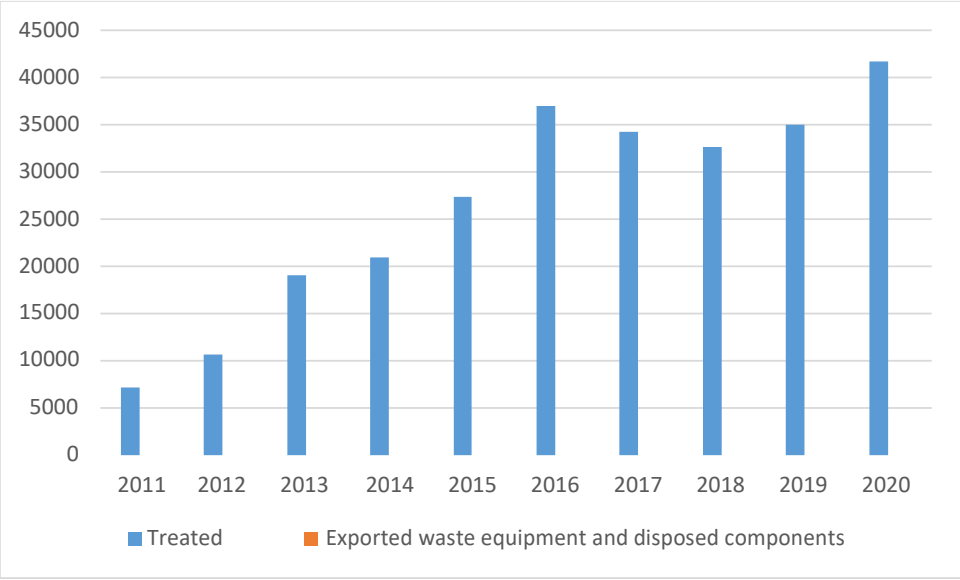
Environmental Protection Agency. All types of waste mineral oils are classified as hazardous waste. In 2020, 25 companies had a permit for the treatment of certain types of waste oils. It is assumed that much larger amounts of waste oil are collected in informal sector. Improving the separate collection of different types of waste mineral oils and improving treatment are a priority in order to achieve a high rate of waste oil recycling.

Waste electrical and electronic equipment

Waste electrical and electronic equipment includes equipment and devices, as well as assemblies and components generated in industry. According to the Waste Catalog, waste from electrical and electronic equipment is classified in the group with waste index numbers 16 02 and 20 01. Waste from electrical and electronic products consists of household waste (televisions, radios, refrigerators, freezers, etc.), computers, telephones, cassette players, etc. Most of this waste is hazardous waste due to the components it contains.

There is little data on the amount of waste generated and collected from electrical and electronic equipment. In addition, there is no data on the treatment of hazardous electronic waste and a small number of operators are involved in the recycling of this type of waste. Estimates of the amount of electrical and electronic equipment placed on the market show that in recent years about 60,000 tons of electrical and electronic equipment have been placed on the market in the Republic of Serbia. According to the Environmental Protection Agency, during 2020, operators reported that they recycled 41,716 tons of waste from electrical and electronic equipment.

In the same period, 5 tons of waste electrical and electronic equipment were exported. 3,831 t of components removed from discarded equipment, i.e., created by dismantling of waste electrical and electronic equipment, which the operators reported to have undergone treatment by re-use operations, was exported. Based on the reported data on treated quantities, it is estimated that the collected quantity is 6.3 kg/inhabitant/year. Collection of waste electrical and electronic equipment from households is still insufficient. The establishment of a system for collecting waste electrical and electronic equipment from households has been initiated.



Graph 3.2. *Amount of waste from electrical and electronic equipment treated in the period 2011 - 2020 in the Republic of Serbia, in tons (Source: Environmental Protection Agency, annual report, 2021)*

Mercury-containing waste fluorescent tubes

Waste fluorescent tubes containing mercury are collected separately from other waste, in accordance with the Rulebook on the manner and procedure for the management of mercury-containing waste fluorescent tubes ("Official Gazette of the RS", No. 97/10). According to the Waste Catalog, waste fluorescent tubes are classified in the group with waste index number 20 01 21 *. According to the data of the Environmental Protection Agency, about 300 tons of waste marked 20 01 21 * - fluorescent tubes and other mercury-containing waste, were collected in 2020 (Report on the state of the environment 2020, 2021). Data from EU member states show that an amount of 2,100 t can be expected per year.

Waste vehicles

Waste vehicles are heterogeneous, and consist of approximately 55-70% iron/steel, 3-8% non-ferrous metals, 8-18% plastics and textiles, 2-4% rubber, 2-5% glass, 2-5% working fluids and 5-10% of other materials. The car consists of more than 10,000 individual parts and approximately 40 different materials. Waste vehicles contain hazardous substances such as fuel, motor oil, oil filter, brake fluid, coolants, batteries, explosives (airbags), hazardous electronic parts, and the like. As with old cars, there is an inherited problem of asbestos (e.g., brake pads) and polychlorinated biphenyls (e.g., in condensers). The recycler ensures safe disassembly (i.e., removal of hazardous components, reuse of spare parts, etc.).

In recent years, an average of 160,000 tons of vehicles have been placed on the market annually in the Republic of Serbia (in 2020 - 157,955.3 tons). It is estimated that about 40,000 tons of waste vehicles are generated annually. According to the Environmental Protection Agency, the reported amount of generated waste vehicles in 2020 was 22,000 t, including waste from dismantling and maintenance of vehicles, while the treated quantities include only 2,391t of treated waste vehicles (16 01 04 * and 16 01 06). For now, there are no completely reliable data in Serbia on the preparation for reuse and treatment of waste vehicles. 302 companies have a permit for the management of waste vehicles as non-hazardous waste, while 43 companies have a permit for the management of waste vehicles as hazardous waste.

Asbestos-containing waste

The use of asbestos (17 06 01 * and 17 06 05 *) has been banned in the EU since 2005. As a result of that ban, asbestos is neither produced nor used in the EU today. However, due to its widespread use in the past, waste containing asbestos can be found in construction waste, and in various products, such as asbestos-cement roofing, or the so-called Salonite slabs, walls plastered with cement-asbestos mixture, flooring made of PVC and asbestos – vinyl flooring, some types of water pipes, fire insulation, linings for car brakes, etc.

Waste containing asbestos, waste under index numbers 17 06 01 * and 17 06 05 *, must be separated at the place of origin and transported directly in appropriate packaging (for example, in jumbo bags) for disposal in landfills that have the appropriate permit to accept this waste. Recycling or reuse of asbestos is not allowed, as the use of asbestos is prohibited in accordance with the regulations on the management of chemicals.

According to the submitted data of operators with a permit for the disposal of this type of waste, 240 t of waste consisting of construction and insulation materials containing asbestos and belonging to group 17 according to the Waste Catalog were disposed of and only 2.1 t were treated. Compared to the previous year, the quantities of disposed and treated waste containing asbestos were reduced (Products that after use become special waste streams in the Republic of Serbia in 2020, 2021).

Packaging waste

The management of packaging and packaging waste is regulated by the Law on Packaging and Packaging Waste. Packaging waste includes a number of types of waste given in the Waste Catalog in Chapter 15 01.

Packaging waste averages 14% glass, 25% plastic, 34% paper and cardboard, 5% metal, 21% wood and less than 1% of the rest.

In the Republic of Serbia, the recycling of packaging waste in accordance with the principle of producer responsibility is supported by seven operators in the packaging waste management systems ("collective schemes"). 'Collective schemes' provide a service of taking on all obligations of manufacturers/importers. Compared to the option of individual fulfillment of obligations, the advantage of these schemes is that they have the possibility of negotiating all services and prices for larger quantities of waste. These packaging waste management operators organize the collection and recycling of packaging waste generated by the public sector and industry. The number of companies participating in the packaging collection system increased from 2010 to 2020. Seven operators have a permit for packaging waste management in Serbia. In 2020, 360,942 tons of packaging were placed on the Serbian market. The amount of taken over packaging waste in 2020 of 215,988t were handed over for reuse, of which 195,658t of packaging waste was recycled.

Table 3.13. *Quantities of packaging placed on the market by manufacturers/importers/bottling plants (Source: Environmental Protection Agency, annual reports)*

Type	**2017.**	**2018.**	**2019.**	**2020.**
Plastic	94.098	92.765	92.807	91.265
Glass	56.766	55.430	62.009	52.324
Metal	14.599	15.682	16.956	17.948
Paper and cardboard	113.889	117.298	122.034	122.660
Wood	77.805	77.092	76.971	77.366
Other	762	688	752	673
TOTAL (t)	**357.919**	**358.955**	**371.529**	**362.236**

Table 3.14. *Packaging waste reported **as recycled** by collective schemes, in tons (Source: Environmental Protection Agency, annual report)*

Type	**2017.**	**2018.**	**2019.**	**2020.**
Plastic	25.577,9	29.820,81	34.747,9	30.738,6
Glass	17.874,5	20.705,25	27.743,7	25.155,9
Metal	6.515,4	7.103,25	12.181,7	13.980,5
Paper and cardboard	103.900,3	110.859,07	118.253,9	115.975,6
Wood	17.966,3	20.462,14	25.608,8	30.723,1
Other	12,5	5,28	126,6	137,5
TOTAL (t)	**171.846,8**	**188.955,8**	**218.662,6**	**216.711,2**

Table 3.15. *Packaging waste reported **as reused** by collective schemes, in tons (Source: Environmental Protection Agency, annual report)*

Type	2017.	2018.	2019.	2020.
Plastic	35.855,74	41.722,07	44.631,7	39.974,8
Glass	17.874,46	20.705,25	27.743,7	25.155,9
Metal	6.515,39	7.103,25	12.181,7	13.980,5
Paper and cardboard	104.156,50	110.859,07	118.253,9	116.049,1
Wood	17.966,28	20.462,14	25.608,8	30.723,1
Other	24,91	5,28	126,6	137,5
TOTAL (t)	**182.393,28**	**200.857,1**	**228.546,4**	**226.020,8**

The most commonly used method of treatment of packaging waste, reported by the operator, is Recycling/processing of organic substances that are not used as solvents (R3). This type of treatment has been reported for the treatment of packaging waste plastics and paper. Operation (R4) Recycling/processing of metals and metal compounds, applied to the treatment of packaging metal scrap (iron and aluminum). Operation (R5) Recycling/processing of other inorganic materials has been applied to the treatment of packaging glass waste, while Operation (R1) Use of waste primarily as fuel or other means of energy production has been applied to the treatment of waste plastics.

Based on the above data, the general and specific national targets for the Republic of Serbia in 2020 have been met, namely for the reuse of waste in the amount of 62.6% and for the recycling of waste in the amount of 60%.

Since the system for separate collection of packaging waste from households is currently not adequately established, most of the packaging waste from households is included in mixed municipal waste. According to the Environmental Protection Agency, the quantities of municipal packaging waste reported as collected through collective schemes increased from about 3,000 tons in 2010 to approximately 54,151 tons in 2020.

Based on the Specific Implementation Plan of the Packaging and Packaging Waste Directive, it was concluded that the total mass of packaging waste within the municipal waste stream is about 240,000 tons of dry fraction, of which only a few tens of thousands are collected separately. Since packaging waste from commercial and industrial flows is easier to collect (it is not contaminated, large quantities are in one place), it currently makes up the largest part of the reported quantities. However, in the coming period, the ever-increasing goals of recycling and reuse will focus the activities of collective operators on packaging waste from households, assuming that the share of these two flows is 60% in the household and 40% in the commercial flow.

Waste containing, consisting of or contaminated with Persistent Organic Pollutants (POPs waste)

POPs waste is waste that consists of, contains or is contaminated with long-term organic pollutants (POPs), which include PCB waste and waste POPs pesticides (for example DDT). According to the Waste Catalog, PCB waste is in groups 13 01 01, 13 03 01, 16 01 09, 16 02 09, 16 02 10 and 17 09 02. National Plan for the Implementation of the Stockholm Convention within which PCB action plans have been prepared waste, waste pesticides and unintentionally produced chemicals (dioxins and furans) was improved in 2015. POPs substances are prohibited for use and must be removed. In some substations, PCB (pyralene oil) is still used as a cooling medium, which, in accordance with the law, must be excluded from use and permanently disposed of. In the previous period, this waste was mainly exported for treatment. There are several authorized companies from the private sector that take over and export PCB waste for treatment in accordance with the Law on Ratification of the Basel Convention. However, one mobile plant for decontamination of PCB contaminated equipment has been built in the Republic of Serbia, and this process has been selected for future PCB waste treatment.

According to the data of the Environmental Protection Agency, in 2020, 165.42 t of waste containing PCBs were generated (Report on the State of the Environment 2020, 2021). From the presented quantities of oils for insulation and heat transfer, hydraulic oils containing PCBs are represented with the amount of 57.53 t, and transformers and capacitors containing PCBs waste components and construction and demolition waste containing PCBs with 107.88 t. 80.82t of this type of waste was treated. Of this, waste oils for insulation and heat transfer containing PCBs in the amount of 47.66 t were treated by procedure R9, which means the operation of refining or other method of reuse of waste oil. 33.16 t of waste transformers and capacitors containing PCBs were subjected to process R7. The quantities of treated waste containing PCBs increased compared to the previous year. In the mentioned period, 179.17t of this type of waste was exported. Out of that, 55.94 t of waste oils for insulation and heat transfer containing PCBs were exported to the Swiss Confederation, and 123.23t of transformers and capacitors containing PCBs were exported to the Republic of Romania.

Medical and pharmaceutical waste

Institutions that generate waste from human and animal health care during their operation, 1,066 of them, reported that during 2020 they produced 3,510 tons of waste generated in health care institutions that provide human health care and another 33.61 tons of waste from institutions that perform diagnostics and prevention of animal diseases, a total of 3,543.06 tons of waste from group 18. The trend of increasing the number of reports continues, but the amount of waste is slightly increased compared to the previous year.

Table 3.16. *Medical waste of category 18 01, generated in the period 2017-2020. year, in tons (Source: Environmental Protection Agency, 2021)*

Index number	Description of waste	2017.	2018.	2019.	2020.
18 01 01	sharp instruments (excl. 18 01 03)	154,98	150,82	152,69	160,29
18 01 02	Body parts and organs including blood bags and blood products (excl. 18 01 03)	44,17	42,49	49,5	42,42
18 01 03*	Waste whose collection and disposal is subject to	2.641,11	2.993,23	2.868,35	3.181,30

	special requirements to prevent infection				
18 01 04	Waste whose collection and disposal is not subject to special requirements to prevent infection	38,69	39,16	68,02	59,26
18 01 06*	Chemicals consisting of or containing hazardous substances	19,03	19,98	20,5	14,94
18 01 08*	Cytotoxic and cytostatic drugs	31,44	40,27	57,3	43,36
18 01 09	Medicines other than those mentioned in 18 01 08	9,15	7,3	9,36	7,38
18 01 10*	Waste amalgam from dentistry	0,03	0,07	0	0
	TOTAL 18 01	**2.938,58**	**3.293,32**	**3.225,73**	**3.509,45**

In the same period, 66 health institutions that have a plant for the treatment of this type of waste reported that they processed 3,510 tons of waste generated in health institutions, of which 18 tons were generated in institutions that diagnose and prevent animal diseases, and 3,492 tons in institutions which provide human health care (Environmental Report 2020, 2021). There are 35 public health institutions in the Republic of Serbia with about 950 individual pharmacies (according to the data of the Serbian Chamber of Commerce). As for privately owned pharmacies, there are 2,391 private pharmacies. The largest percentage of reported waste is the collection and disposal of which is subject to special requirements to prevent infection. Pharmacies also reported that they generated waste drugs from group 20 in the amount of 0.37 tons. 68.33 t of pharmaceutical waste and 39.36 t of chemicals containing hazardous substances generated during the provision of health care to the Republic of Austria were exported.

Table 3.17. *Medical waste treated in 2020 (Source: Environmental Protection Agency, 2021)*

Index number	Waste description	Quantity of waste treated (t)
18 01 01	Sharp instruments (excl. 18 01 03)	64,95
18 01 02	Body parts and organs including blood bags and blood products (excl. 18 01 03)	2,82
18 01 03*	Waste whose collection and disposal is subject to special requirements to prevent infection	3377,69
18 01 04	Waste whose collection and disposal is not subject to special requirements to prevent infection	21,9
18 01 08*	Cytotoxic and cytostatic drugs	0,63
18 01 09	Medicines other than those mentioned in 18 01 08	23,78
18 02 02*	Waste the collection and disposal of which is subject to special requirements to prevent infection	17,9
	TOTAL	**3.509,67**

Pathoanatomical waste is cremated or buried, and stored in refrigeration chambers at standard freezing temperatures.

Pharmaceutical waste is collected by companies that have permits for the collection of pharmaceutical waste and exported for treatment. The Republic of Serbia still does not have the capacity to manage pharmaceutical, cytostatic and chemical waste from health care institutions. Pharmaceutical waste, which consists of unused or expired medicines, is often disposed of in municipal waste containers. Some public pharmacies accept pharmaceutical waste from households, but only a few pharmacies actively promote this service. The annual rate of generation of cytostatic and cytotoxic waste (18 01 08 *) can be estimated at 70 to 75 t, of which 15t of bottles are contaminated with undiluted cytotoxic and cytostatic substances. The remaining 55 to 60 t are sharp objects, plastic tubes and glass and plastic bottles contaminated with diluted cytotoxic and cytostatic substances. Other pharmaceutical wastes (18 01 09 non-hazardous) are generated in health care institutions, pharmacies and households. It is estimated that the total amount of generated pharmaceutical waste in all public health institutions and public pharmacies in Serbia will be around 7 tons per year. The amount of waste in the private sector is expected to be 1 to 3 t per year. Basic data on the amount of pharmaceutical waste from households are missing. For planning purposes, the amount of waste is assumed to be 50 t per year, which estimates the total rate of pharmaceutical waste generation at 60 t per year.

Chemical waste from facilities operated by the health care is partly temporarily stored, and mostly discharged untreated into the sewer. The quantities generated are not known.

Animal waste

Treatment of animal by-products includes collection, classification according to the degree of risk (categories), storage and treatment in accordance with the Regulation on the manner of classification and treatment of animal by-products, veterinary and sanitary conditions for construction of facilities for collection, processing and destruction of animal by-products origin, manner of conducting official control and self-control, as well as conditions for livestock cemeteries and pit tombs. The largest quantities of animal by-products produced in the Republic of Serbia are processed in facilities that apply basic processing methods, such as facilities that produce meat and bone meal and rendered fats, facilities for technical products, compost and biogas, facilities for the production of processed animal protein origin, facilities for the production of pet food, etc.

In 2018, there were about 0.89 million cattle, 3.3 million pigs and 1.8 million sheep in the Republic of Serbia (Municipalities and Regions in the Republic of Serbia 2020, 2020). Based on these data, it can be estimated that the amount of manure produced is about 1 million tons per year. Meat production is an important part of the agricultural sector. The total meat production in 2020 is estimated at about 440,000 tons. New veterinary regulations will increase the amount of animal by-products treated in rendering plants. However, a small amount of Category 1 material (according to Regulation (EC) 1069/2009) can be disposed of with other waste treated in co-incineration plants.

Agricultural waste

The agricultural sector accounts for about 10% of GDP in the Republic of Serbia. Agricultural residues originate from agriculture, forestry, food and wood industries. Residues from agriculture can be classified into three main groups: residues produced in the process of growing field crops, residues originating from fruit and residues resulting from livestock farming. These residues have multiple and significant applications in agricultural holdings, and thus a certain economic value. Farming in Serbia covers about 1.7 million ha, with corn occupying about 0.9 million ha, wheat about 0.64 million ha and barley about 0.1 million ha. Cereal production was about 2.9 million tons of wheat and 1 million tons of corn (excluding silage corn), generating about 3.7 million tons of straw

Sludge from municipal wastewater treatment plants

Sludge from municipal wastewater treatment plant is classified in waste group 19 08 05 according to the Waste Catalog.

Only about 55% of the population (60% of households) in the Republic of Serbia is connected to the sewage system, and the rest of the households use septic tanks. Of the 75% of the population living in settlements with more than 2,000 inhabitants, 72% are connected to the sewage system, while 27% use septic tanks. In settlements with less than 2,000 inhabitants, the rate of connection to the sewage system is on average less than 5%. In Serbia, 15% of the population is covered by wastewater treatment (Statistical Yearbook of the Republic of Serbia 2021, 2021). About 350 wastewater treatment plants are missing. Operational wastewater treatment plants provide services to about 600,000 residents.

The total production of sludge from existing wastewater treatment plants is estimated at 11,000 - 15,000 t of dry matter/year, according to the Specific Plan for the Implementation of the EU Directive 91/271/EEC on Municipal Wastewater. Wastewater treatment plants in Serbia are managed mainly by local (municipal) utility companies. Therefore, these utility companies are also responsible for sludge management. The total reported amount of sludge generated by wastewater treatment is 4,000 tons of dry matter per year, which is not a significant burden. It is estimated that sludge production will reach an annual amount of 135,190 t of dry matter after the Municipal Wastewater Treatment Directive is fully implemented by 2041.

Construction and demolition waste

Construction waste includes waste generated during the construction of facilities or public infrastructure, reconstruction, maintenance or demolition of existing buildings, as well as waste generated from excavated material, which cannot be used without prior treatment. According to the Waste Catalogue, construction waste is classified in the group with the waste index number 17. Non-hazardous waste from construction and demolition is: concrete, earth, brick, glass, stone, plastic, tile and ceramics, copper, bronze, brass, iron, steel, insulation materials, gypsum, wood, mixed waste, etc. Hazardous waste from construction and demolition includes: construction and insulation materials containing asbestos, sealants containing PCBs, glazes containing PCBs, construction and demolition wastes containing mercury, other construction and demolition wastes containing hazardous substances, etc.

Most of the waste from construction and demolition is disposed of or more often disposed of together with municipal waste in municipal unsanitary landfills. The estimated composition of construction and demolition waste is as follows:

1) excavation soil, 75%;
2) construction and demolition waste (ceramics, concrete, iron, steel, plastic waste), 15-25%;
3) waste asphalt and concrete, 5-10%.

Recycling of construction and demolition waste depends on the separation at the source. Each mixed collection increases the level of pollution and reduces the possibility of recycling. Available statistics do not provide real potential quantities of construction and demolition waste in the Republic of Serbia. According to the data of the Statistical Office of the Republic of Serbia, in 2020, 729,000 tons of construction and demolition waste were generated in Serbia (Statistical Yearbook of the Republic of Serbia, 2021). However, if the comparison with the quantities of construction and demolition waste generated in EU countries is applied, the quantities are many times higher.

Taking into consideration the gross domestic product of Serbia, the potential of 1.6 million tons (upper limit of 3.6 million tons) seems to be the most probable. These amounts are calculated based on the assumption taking into account the total turnover in construction, total investment in building construction, GDP of the construction sector, construction activity of contractors in Serbia and the area of demolished dwellings (Municipalities and regions in Serbia in 2020, 2021):

1) share of construction in GDP – 5.7 %;
2) number of employees in the construction sector in the Republic of Serbia – 105,671;
3) issued building permits in the Republic of Serbia – 22,625;
4) total investments in facilities – RSD 471,639,883;
5) completed buildings and areas – 1,961,112 m^2;
6) demolished buildings and areas (m^2) – 129,599 m^2.

In the Republic of Serbia, there is currently no practice of separate collection of waste from construction and demolition, and there is no scheme for recycling this type of waste. Only small amounts of construction and demolition waste are recycled, asphalt is recycled in small quantities (less than 1,000 tons were recycled in 2018). Although there is a general legal obligation for the waste producer to collect the generated waste separately and sort it in accordance with future treatment, this provision is not in force due to the absence of a bylaw. Thus, waste of high economic value, such as metals, is mostly recycled, while other potentially recyclable materials are disposed of in landfills or more often end up in illegal locations. Quality standards for treated construction and demolition waste are lacking.

Mining waste

Waste from the exploitation of mineral raw materials is classified as waste group 01 in the Waste Catalog. During 2020, the mining and quarrying sector generated 45,709,000 tons of waste, most of which was disposed of in landfills (Statistical Yearbook of the Republic of Serbia, 2021). This waste is regulated by the Law on Mining and Geological Explorations. Mining waste includes all residues resulting from the processing of ores in order to obtain metal raw materials. The largest waste generator is RTB Bor, and in addition, there are about 200 active mines and about 250 closed mines (which have smaller or larger quantities of unrehabilitated waste). Problems with mining waste are primarily related to the disposal of large amounts of tailings. About 40 million tons of mining waste are produced in the Republic of Serbia annually.

Titanium dioxide production waste

Titanium dioxide is not produced in the Republic of Serbia, but it is used in the production of paints to achieve whiteness.

Secondary waste from waste treatment

Secondary waste is defined as waste generated during waste management operations, either from reuse (in this case secondary waste is usually separated materials that may or may not be reused, or e.g., residues (ash) from energy processes), or disposal. (e.g., stabilization, physical and chemical treatment, etc.).

In the Waste Catalogue, secondary waste can be identified under special index numbers from:

- Group 19 Waste from waste treatment plants, off-site wastewater treatment plants and water treatment for human consumption and industrial use. From this group, the following stand out the most:
  - subgroup 19 01 wastes from the incineration or pyrolysis of waste (it should be borne in mind that residues from co-incineration are partly covered by subgroup 10 01);
  - subgroup 19 02 wastes from physical/chemical treatment of waste (including dechromation, decyanisation and neutralization);
  - subgroup 19 03 stabilized/solidified wastes;
  - subgroup 19 05 wastes from aerobic waste treatment (biological treatment, composting);
  - subgroup 19 06 wastes not otherwise specified (biogas production);
  - subgroup 19 08 wastes from waste water treatment plants not otherwise specified (it should be noted that industrial treatment at the place of origin is listed in the appropriate group, e.g., Group 07);
  - subgroup 19 10 wastes from shredding wastes containing metal;
  - subgroup 19 11 wastes from oil regeneration;
  - subgroup 19 12 wastes from mechanical treatment of waste (e.g., sorting, crushing, compacting and palletizing) not otherwise specified;
  - subgroup 19 13 wastes from land and groundwater remediation.
- Group 16 01 waste vehicles from various modes of transport (including machinery) and waste from the dismantling of waste vehicles and from vehicle maintenance (except 13, 14, 16 06 and 16 08);
- Group 16 02 wastes from electrical and electronic equipment;
- Group 13 05 oil/water separator content.

The amount of waste generated in waste treatment activities depends on the level of waste treatment infrastructure, e.g., secondary waste is also generated in waste incineration and treatment preparation procedures.

Secondary waste can be either secondary raw materials (e.g., sorted metal waste, plastics, etc.) that can be reintroduced into the economic cycle, or these are unusable fractions or hazardous and polluting substances. In order to promote the use of reused material, waste cessation regulations, technical standards and economic incentives should be applied. Currently in the Republic of Serbia, most of the secondary waste is disposed of in landfills, and part is handed over to cement plants, especially waste from group 19 12.

3.4.2 Existing System for Collecting Special Waste Streams

Waste tires

The collection of waste tires is regulated by the Rulebook on the manner and procedure of waste tire management ("Official Gazette of the RS", No. 104/09 and 81/10). In accordance with Articles 5 and 6 of this Rulebook, the owner of waste tires shall hand them over to an authorized collector free of charge. By October 2021, 360 companies had a permit for the collection of worn tires, and 172 companies had a permit for the treatment of worn tires. For 2020, one company reported using tires as a secondary fuel (Operation R1). The collection of waste tires is regulated in such a way that the owner of waste tires hands them over to an

authorized collector free of charge. The system of collecting waste tires from households has not been established by local governments.

Waste batteries and accumulators

The importer, manufacturer and seller of batteries and accumulators are responsible for the collection. Importers and manufacturers are obliged to provide the consumer with information on the obligation of separate collection. The system of separate collection of waste batteries and accumulators from households has not been established by local governments.

Waste oils

The producer and/or importer of mineral oils is obliged to inform the seller in writing about the locations for waste oil collection in the Republic of Serbia. Legal entities that produce less than 500 l of waste oil per year are obliged to hand over their waste oil to an authorized person (collector), while waste producers who produce more than 500 l per year are required to provide a transfer station or hand over waste oil directly to the collector . The system of separate collection of waste motor oil has not been established by local governments.

97 companies have a permit for the collection of at least one type of waste mineral oil (without PCB oil) in accordance with the Waste Catalogue (Group 13, subgroup 13 01, Group 20, subgroup 20 01). In addition, 62 companies are licensed to collect oil mixtures and water, content from oil and water separators and oil concentrates from physical and chemical treatment.

Waste electrical and electronic equipment

Separate collection of waste from electrical and electronic equipment is mainly carried out by the operators of the waste treatment plant for electrical and electronic equipment or the collection company. The system for organized collection of waste electrical and electronic equipment from households has not been established by local governments, except sporadically. About 500 companies have a permit for the collection of waste electrical and electronic equipment (index number 16 02 and 20 01).

Waste fluorescent tubes containing mercury

Currently in the Republic of Serbia there is no organized separate collection of fluorescent tubes containing mercury. In October 2021, 105 companies have a license to collect fluorescent tubes containing mercury (index number 20 01 21*).

Waste vehicles

Collection and handling of vehicles declared as waste vehicles usually involves transporting the vehicle to a specific treatment plant where decontamination, dismantling and recycling processes take place.

According to the database of the Environmental Protection Agency, there are 63 legal entities/entrepreneurs who by October 2021 received permits for the collection of waste vehicles that are categorized as hazardous waste (index number 16 01 04*). Besides that, 132 legal entities/entrepreneurs have permits for the collection of waste vehicles categorized as non-hazardous waste (index number 16 01 06) and 27 legal entities/entrepreneurs have a transport permit, and 16 operators for storage of waste vehicles categorized as hazardous waste (index number 16 01 04*), 137 legal entities/entrepreneurs have obtained transport permits, and 229 operators for storage of waste vehicles categorized as non-hazardous waste (index number 16 01 06).

Waste containing asbestos

The removal of asbestos-containing waste in maintenance and demolition activities is subject to control and supervision by the labor inspectorate in accordance with the relevant occupational safety and health laws. There is no special collection system, but general rules for hazardous waste collection apply. About 70 companies have a permit for the collection of asbestos-containing waste equipment, 57 have a permit for the collection of asbestos-containing waste insulation material, and 54 have a permit for the collection of asbestos-cement waste products.

Packaging waste

Packaging waste from households is collected by waste management companies (public utility companies) as waste mixed with municipal waste, while private companies enter into contracts with local authorities to purchase some types of packaging waste (usually PET and cardboard, high market value waste). Furthermore, in accordance with Article 43 of the Law on Waste Management, municipalities must organize separate waste collection and establish the frequency of waste collection for recyclable products (paper, metal, plastic and glass). Currently, the system of separate collection of packaging waste from households has not been extended to the whole country.

The most common types of containers used for waste packaging are 1.1 m3, 5 m3 and 3 m3, while in some urban areas 240 l bins are used, and sometimes bags, in which recyclable household waste is collected. In rural areas where recyclables are collected separately from mixed municipal waste, PUCs provide bags. Waste collection centers are open in several major cities, managed either by PUCs or by private companies.

Packaging waste from industrial and commercial flows is collected by private companies. This waste is reported in collective schemes, and is managed as part of the extended responsibility of the producer. However, some types of packaging waste (e.g., paper and PET of high market value) are collected and recycled from the extended producer responsibility system (Specific Plan for the Implementation of the Packaging and Packaging Waste Directive).

In addition to the quantities reported in the collective scheme system, which include a number of collectors and recyclers, there are companies that have a collection permit and can collect packaging waste from industrial and commercial flows, but do not cooperate with collective operators.

In 2020, collective operators with valid licenses conducted activities for 1,918 legal entities or entrepreneurs.

The informal sector has been collecting quality packaging waste for decades. In the legal sense, the activities of the informal sector are not regulated by the legislation of the Republic of Serbia. According to some estimates, the sector of informal waste collection in the Republic of Serbia consists of 30,000 to 50,000 individual collectors, who perform their activities according to the principle of informal economy.

Waste containing, consisting of or contaminated with Persistent Organic Pollutants waste (*POPs* waste)

Based on the polluter pays principle, the waste generator is responsible for the collection and treatment of devices containing PCBs when they become waste. There is no special waste collection system for waste that contains PCBs, nor is it considered necessary. One operator is licensed to treat waste oils containing PCBs. 13 other companies are licensed to treat some types of waste that contain PCBs, but do not perform treatment.

Medical and pharmaceutical waste

Medical waste management (health care and other institutions) is responsible for medical waste management. Medical and pharmaceutical waste is subject to a separate system of separate collection. This system has been established in all health care institutions in the Republic of Serbia. Producers are obliged to either treat the waste themselves in accordance with the applicable legal provisions, or to conclude a contract with the operator of the plant for the treatment of this waste.

Sludge from municipal wastewater treatment plants

Depending on the treatment chosen, the sludge collected from the wastewater treatment plant will be transported for treatment or disposal at a sanitary landfill or at a specially established mono landfill.

Construction and demolition waste

The collection and disposal of construction and demolition waste is subject to the polluter pays principle, which means that the waste producer is solely responsible for the legal and safe disposal (final disposal or recycling) of the waste generated. Mineral construction waste, as well as mixed construction waste, is mostly disposed of in inadequate local landfills. Only metal waste from construction and demolition waste is collected on a larger scale. At present, the practice of separating hazardous and non-hazardous construction waste is not applied sufficiently.

Although separation at the site of occurrence during demolition and reconstruction is essential to enable the recycling of construction waste, very little is being done in the Republic of Serbia. Even when separating hazardous components (e.g., insulation materials; asbestos-containing construction materials; bituminous mixtures containing coal tar; tarred products) as well as recyclable parts (e.g., wood, glass, plastics and metals) from mineral construction waste during demolition and reconstruction activities, very small amounts of these fractions are separated.

For construction waste, including excavated soil from the contaminated area (Group 17 of the Waste Catalogue), the following permits were issued to companies by October 2021 (Register of the Agency on Issued Waste Management Permits): 619 permits for collection; 622 transport permits; 485 storage permits and 386 treatment permits.

Since the responsibility for waste management in demolition and reconstruction activities lies with the investor, and the waste generated in these activities largely depends on the location and type of building, the collection should be organized by the owner of the waste, e.g., by concluding contracts with companies with valid permits to manage this waste stream. A special regulation is needed to regulate the management of this waste stream.

3.4.3 Existing Infrastructure for Treatment and Disposal of Special Waste Streams

In the current conditions, waste recycling capacities are not organized.

There are several **waste tire** recycling plants, built with private sector investment. From the tires that are recycled, rubber granulate is obtained, which is used for the production of various products such as bases for sports fields, bases for children's playgrounds in parks, wheels for containers and bins, etc. Part of the waste tires is used as an alternative fuel in cement plants. Part of the tires are retreaded and put back on the market.

There is a capacity for the treatment of **spent batteries** and the production of lead alloys. There is no established capacity to **treat worn out portable batteries**.

There are also facilities for recycling **waste vehicles**. The process of preparation for reuse begins in the dismantling or treatment plant, where the contaminants are first removed

and then the vehicle is dismantled (sometimes these two steps are combined into one - disassembly or dismantling). Removal of contaminants includes removal of hazardous parts and substances such as starters, fuel, other liquids, airbags and all mercury-containing parts. Waste treatment activity during 2020 of code 16 01 04 * was reported by six operators, and waste of code 16 01 06 was reported by four operators. In addition to these authorized operators, the activity of the informal sector in the various stages of dismantling can be assumed, given the discrepancies between the estimated and registered number of waste vehicles per year.

Limited capacities exist for recycling waste oil (R9) and using oil as an energy source (R1). At least ten legal entities that had a valid hazardous waste treatment permit at the end of 2020 can be classified as physical and chemical treatment plants (including waste oil treatment).

For the treatment of waste electrical and electronic equipment, there are several plants for manual disassembly, disassembly of cathode ray tubes, treatment of refrigeration devices and freezers, treatment and removal of cables, discharge of fluids from refrigeration devices and freezers, treatment of gas bulbs. Recycling facilities are available for some pure fractions of plastic, while certain types of plastic are exported for treatment (for example, computer cases). Hazardous computer components, such as CRT monitors or fluorescent dust, are currently being stored and exported. The remaining non-hazardous fractions are disposed of in landfills or incinerated in cement plants. There are at least five companies operating in the Republic of Serbia that deal with the recycling of waste electrical and electronic equipment. In addition to authorized operators of special waste streams, the activity of informal operators in different phases of waste treatment can be assumed.

10 companies have a permit for the treatment of hazardous waste from electrical and electronic equipment (16 02 15*), and 89 companies have a permit for the treatment of non-hazardous waste from electrical and electronic equipment (16 02 14). In practice, 13 companies are actively working on the reuse and recovery of waste from electrical and electronic products as secondary raw materials.

In 2020, one plant treated fluorescent tubes containing mercury. seven companies have a permit for the treatment of fluorescent tubes.

Regarding mining waste, no operator has a permit for the collection, transport, treatment or disposal of waste from group 01. The Ministry does not issue permits for waste from this group, because this waste is disposed of in accordance with the Law on Mining and Geological Research.

The most commonly recycled waste materials in the Republic of Serbia are metal waste and packaging waste (paper/cardboard, plastic/PET, wood and glass).

There are several plastic recycling operators in the Republic of Serbia that recycle plastic. There are plants for processing PET plastic - large companies that process from 60 to 3,000 tons per month, as well as large plants that do not process PET plastic, but produce foil, hoses, pipes or granules of low-density polyethylene. The collected PET waste is mainly sorted, washed, baled, and then recycled into flakes, which are exported. Potential capacity for fiber production exists, but given the current stage of industrial and economic development, capacity is likely to develop when the collected materials are clean enough and when they are quantitatively sufficient to justify economy.

There is one glass recycling plant. Glass recycling is not a common activity in the Republic of Serbia. One operator recycles glass packaging waste. The plant has sufficient capacity to dispose of the total amount of separately collected glass packaging waste in the Republic of Serbia (about 15,000 tons per year), under specific quality standards.

Waste paper, especially cardboard, is recycled in the Republic of Serbia, with a capacity of more than 85,000 tons, and significant amount of waste paper is exported. At the same time, a significant amount of waste paper is imported for recycling. No need for additional capacity.

In the Republic of Serbia there is a plant for recycling multilayer paper packaging with a capacity of about 3,500 tons per year.

Recycling of ferrous and non-ferrous metals in the Republic of Serbia is quite efficient, and it is enabled through a large network of collectors and customers that cover almost every local government. Metal waste collected in Serbia is further treated in foundries and steel mills.

Existing recycling capacities and an industry that could use secondary raw materials in production need to develop and improve technology. In parallel with the establishment of separate collection, the private sector recycling industry will expand in relation to demand.

Open type plants for the treatment of animal by-products of Category 1, which apply basic processing methods, exist in Cuprija and Indjija. Installed capacities for processing Category 1 materials are 200,000 tons per year. Incineration and co-incineration are performed in furnaces in Nis and Cuprija. Co-incineration of meat and bone meal is also performed in four facilities, namely: two brickyards, one cement plant in one facility in the field of chemical industry (Program for improving the management of animal by-products for the period from 2020 to 2024, 2020, Veterinary Directorate). Competence for waste of animal origin is with the Ministry in charge of Agriculture, Forestry and Water Management.

The existing infrastructure for medical waste management in the Republic of Serbia includes the treatment of waste that is subject to special requirements for the prevention of infection (18 01 03*) - sterilization in devices for low-temperature treatment of medical waste, which can then be disposed of in landfills - disinfection/sterilization of infectious waste and sharp objects and crushing/grinding of sterilized waste and consists of a network of central and local treatment sites. All treatment sites are located within health care institutions in the Republic of Serbia. There are also several private operators that treat medical waste.

The existing infrastructure for the treatment of construction and demolition waste in the Republic of Serbia includes only a few crushing plants and recycling less than 1,000 tons of waste per year, although a large number of operators are licensed to treat various types of construction and demolition waste. The treatment of construction and demolition waste as a substitute for primary resources for construction activities is quite underdeveloped in the Republic of Serbia. If it is created in reconstruction or demolition activities, mineral waste from construction and demolition is used for leveling or other leveling of surfaces. Bituminous material is used to some extent for roads, or reused on the construction site itself for road maintenance.

As there has been an increase in construction in the last few years, so has the amount of construction waste increased. All attention is focused on the recycling of non-hazardous materials from construction waste. The main stages within the recycling process are sorting, crushing and sifting, and the final product is an aggregate that can be used in construction, for landscaping and as a substitute for gravel in concrete elements. In Belgrade, in accordance with the Agreement on Public-Private Partnership of the City of Belgrade in providing municipal waste treatment and disposal services and construction of waste treatment and disposal facilities, a construction and demolition waste treatment plant was built, with a capacity of 200,000 t year, in Vinca and is in trial operation.

In October 2021, 386 companies had a valid permit for the treatment of non-hazardous mineral construction waste (one or more index numbers 17 01 01; 17 01 02; 17 01 03; 17 01 07; 17 05 04; 17 05 08).

The waste recycling infrastructure system is not balanced so that efficiency can be increased, and separate waste collection is not sufficiently developed in relation to recycling capacities.

3.5 Existing Economic and Other Waste Management Instruments

Economic instruments in municipal waste management have two main goals: to cover costs and to influence the behavior and habits of citizens. Economic instruments do not replace, but complement and strengthen regulatory and other measures. The EU highlighted economic instruments as one of the important tools for improving the implementation of the waste hierarchy in the EU.

The economic instruments that are in use in the Republic of Serbia are as follows:

- **Fees for the provision of municipal waste management services**

Waste management services, such as the collection and disposal of municipal waste, are paid for by users. Fees are calculated per square meter of residential or commercial space. Fees for households are collected on a monthly basis by utility companies that collect, transport and dispose of waste, or are realized through utility companies that were established to consolidate the collection of all utility services.

- **Fees for packaging and packaging waste**

Based on the system of extended producer responsibility as provided by the relevant EU directive.

- **Fees for special waste streams**

Electrical and electronic products, batteries, tires, accumulators, medicines, vehicles, oil, are part of the products for which a special fee is paid for marketing in the Republic of Serbia. All these products can be considered as products that will be included in special waste streams, and a special fee is paid for them, as part of the extended producer responsibility mechanism.

- **Incentives for the waste management sector**

Incentives are awarded through a public competition, for the treatment or reuse of certain types of waste, as well as for the treatment of plastic bags. Resources for such incentives and public investments come from the state budget.

- **Fee for plastic bags**

Mandatory fee for plastic bags, in accordance with the Law on Fees for the Use of Public Goods is an economic instrument aimed at waste prevention. According to the waste hierarchy, waste prevention is the most favorable option. The application of this instrument is a way to achieve the implementation of the EU directive on reducing the consumption of plastic bags.

3.6 Types and Quantities of Imported/Exported Waste

In accordance with the Law on Waste Management, the import of hazardous waste is not allowed, except for the purpose of processing and energy production. Non-hazardous waste may be imported for the purpose of reuse provided that there is a facility for the treatment of such waste in the Republic of Serbia. Exceptionally, certain types of hazardous waste can be imported, which are used in the industry of the Republic of Serbia as secondary raw materials, in accordance with the national goals for the treatment of such waste. In that case, the import

of waste is done on the basis of a permit issued by the Ministry. The government determines which types of hazardous waste can be imported as secondary raw materials.

Waste that cannot be treated or disposed of in an acceptable and efficient way for the environment due to the lack of technical possibilities and facilities in the Republic of Serbia, must be exported from the country.

According to the statistical data of the Environmental Protection Agency, during 2020, 424,071 tons of waste were exported, of which 12,796 tons were hazardous waste. Table 3.18. gives annual quantities of exported waste from the Republic of Serbia.

Table 3.18. *Export of waste from the Republic of Serbia in the period 2017-2020. (Source: Environmental Protection Agency, 2021)*

Waste export (t)	**2017**	**2018**	**2019**	**2020**
Hazardous waste	9,944	11,074	17,273	12,796
Non-hazardous waste	430,045	332,751	398,517	411,275
Total	**439,989**	**343,825**	**415,790**	**424,071**

More than half of the exported waste is metals, of which the most common are metals that contain iron. Significant quantities of exported waste are waste paper and cardboard and paper packaging, then glass and plastic packaging, slag from iron casting furnaces and waste edible oils and fats. Exports of hazardous waste include lead batteries and accumulators, followed by hazardous components removed from discarded electrical and electronic equipment, waste from thermal metallurgy of lead and soil and waste acids from chemical surface treatment and metal protection.

Table 3.19. *Import of waste to the Republic of Serbia in the period 2017-2020 (Source: Environmental Protection Agency, 2021)*

Waste import (t)	**2017**	**2018**	**2019**	**2020**
Hazardous waste	1,081	996	5,958	7,109
Non-hazardous waste	176,107	231,154	222,040	289,414
Total	**177,188**	**232,150**	**227,998**	**296,523**

During 2020, waste paper and cardboard and waste paper and plastic packaging make up more than half of the amount of waste imported. The representation is followed by grinding waste from the thermal processes of the iron and steel industry. Hazardous waste is lead batteries, slag from thermal metallurgy of lead and waste from mechanical treatment of waste containing hazardous substances. Large quantities of recyclable materials are exported for which the Republic of Serbia has processing capacities. Therefore, it seems that the supply and demand of recyclable materials do not always coincide.

3.7 Condition Assessment and Problem Analysis

The main problems and challenges related to waste management in the Republic of Serbia are as follows:

- Coverage of municipal waste collection services is 86.4% of the population, according to the report of the Environmental Protection Agency for 2020, which is insufficient;

- Separate collection of recyclable waste, except for packaging waste from households, has not yet been adequately implemented. Separate collection of textiles and hazardous waste fractions produced by households was not carried out. Biowaste is not systematically separated at the source and is not recycled, although initial measures have been taken. There are not enough waste collection centers in local governments;
- Targets for municipal waste recycling, which were set in the previous period, have not been achieved. The recycling rate for municipal waste, according to the Environmental Protection Agency, and calculated according to the new EU methodology, was 15.5% in 2020;
- Most of the municipal waste is disposed of untreated in landfills, and a significant part of municipal waste is still disposed of in unsanitary landfills;
- Insufficient number of regional centers for municipal waste management built. The basic concept of development includes the construction of infrastructure in waste management: regional waste management centers (which includes regional landfills, transfer stations, recyclable waste separation plants, composting plants), hazardous waste treatment plants, etc.;
- Adequate network of hazardous waste treatment facilities has not been established. The total production of hazardous waste in Serbia is about 68,000 tons per year. Capacities for chemical and physical treatment of hazardous waste do not fully meet the necessary requirements, while sites for central storage of hazardous waste have not been established;
- Hazardous household waste is not collected separately from mixed municipal waste;
- There are only limited capacities for the treatment and disposal of hazardous waste. In recent years, the processes of solidification and bioremediation of hazardous waste have been applied as a pre-treatment technique in individual cases;
- Lack of capacity for incineration of organic industrial and medical waste;
- conducting waste reporting in accordance with the requirements of national legislation is not satisfactory. One reason is the fact that the informal sector plays a significant role in collecting recycling materials from households. In addition, reporting on the collection and treatment of mixed and separately collected municipal waste is incomplete;
- Recycling of construction and demolition waste has not been developed. Waste fractions with high economic value, such as metals, are mainly recycled, while most of the waste from construction and demolition is disposed of in inappropriate locations. Quality standards for reused construction waste are not applied and a regulation governing this waste stream is lacking;
- Insufficient capacity for recycling and reuse, at least for some types of waste, such as glass, wood and aluminum;
- Collection and recycling of waste oil is insufficient. The scheme for collecting waste tires is underdeveloped. Currently, the collection of waste from electrical and electronic equipment is based on the selective collection of profitable waste from electrical and electronic equipment. A regular system for collecting industrial batteries and accumulators has not been established;

– Possibilities of PCB waste treatment in the Republic of Serbia, i.e., oils and equipment containing PCBs are not enough;

– Although sound bases for the treatment of infectious waste have been established throughout the country, the system is not yet fully developed.

By not harmonizing national legislation with EU regulations, the Republic of Serbia risks that the trend of lagging behind neighboring countries and the EU in waste management will continue and that environmental pollution, as well as degradation of space, will continue. There would also be a danger of closing existing markets and making new ones inaccessible due to non-use of prescribed measures and standards, i.e., due to reduced competitiveness of the economy at the international and domestic level. Furthermore, failure to take additional measures would have a negative impact on the process of accession to the EU, membership in international organizations, and above all on sustainability in waste management and impact on environmental degradation and human health. Given that the disposal of one ton of untreated waste at the landfill contributes to the emission of 0.83 t CO2 eq, if this practice continues, the total amount of waste that would be disposed of in 2030 would be 29,188,330 t. This would contribute to CO2 eq of 24,226,314 t. In terms of environmental impact and reducing the risk of climate change, the current state of waste management in the long run until 2030 is unsustainable, because it contributes to environmental degradation in the long run. By applying the existing measures and continuing the existing practice, the fulfillment of the general and specific goals of the Program cannot be achieved.

In conclusion, the implementation of measures and activities set out in the Strategy for the period 2010-2019, whose implementation has started, should be continued in the future, but additional measures must be prescribed, and more needs to be done to implement these measures.

In the forthcoming period, priority measures relate to the selection of waste at source, increasing the level of waste recycling and building the missing infrastructure, in order to create the basis for meeting the objectives set in the key EU Directives in the waste sector. The purpose is to develop and improve the waste management system, including the completion of the legislative framework and planning documents in this sector.

3.8 Projections of types and quantities of waste for the period from 2022 to 2031

3.8.1 Municipal Waste

During the projection of the amount of municipal waste that will be generated by 2030, the change in the number of inhabitants and the change in the living standard of the citizens were taken into account. The projection of the increase in the number of inhabitants covered by the system of organized collection of municipal waste from the current 86.4% to 100% was also taken. The modeling obtained data on the projected quantities of waste at the level of the Republic of Serbia for the observed period.

Table 3.20. *Projected quantities of generated municipal waste for the Republic of Serbia in the period from 2022 to 2030*

Year	Amount of waste generated		
	kg/ Per capita/day	kg/ Per capita/ year	Tone per year
2022	1.19	434.3	3,033,876
2023	1.21	442.0	3,080,319

2024	1.23	450.0	3,129,084
2025	1.26	458.4	3,180,295
2026	1.28	467.1	3,234,082
2027	1.30	476.1	3,290,582
2028	1.33	485.5	3,349,939
2029	1.36	495.4	3,412,307
2030	1.39	505.6	3,477,846

As for the projected values for the composition of municipal waste, it was assumed that the only fraction (in terms of mass share) that will reduce biowaste in the future is the waste fraction (garden and food waste), while for all other waste categories a model of a certain increase is envisaged. The share of biowaste related to garden waste and food waste is projected to be reduced to 34.7% in 2030. These assumptions can be made in light of expected biodegradable waste management activities, for example, the introduction of composting containers for households, as well as composting plants for green waste, to which citizens can deliver green waste, or to which green waste is brought from city parks etc. In addition, based on the model, it is predicted that in 2030 the percentage of paper and cardboard will be 14%, plastic 13.8%, glass 5.3% and metal 6.7%, while all other waste categories together will have a share of 25.5% of the total quantity.

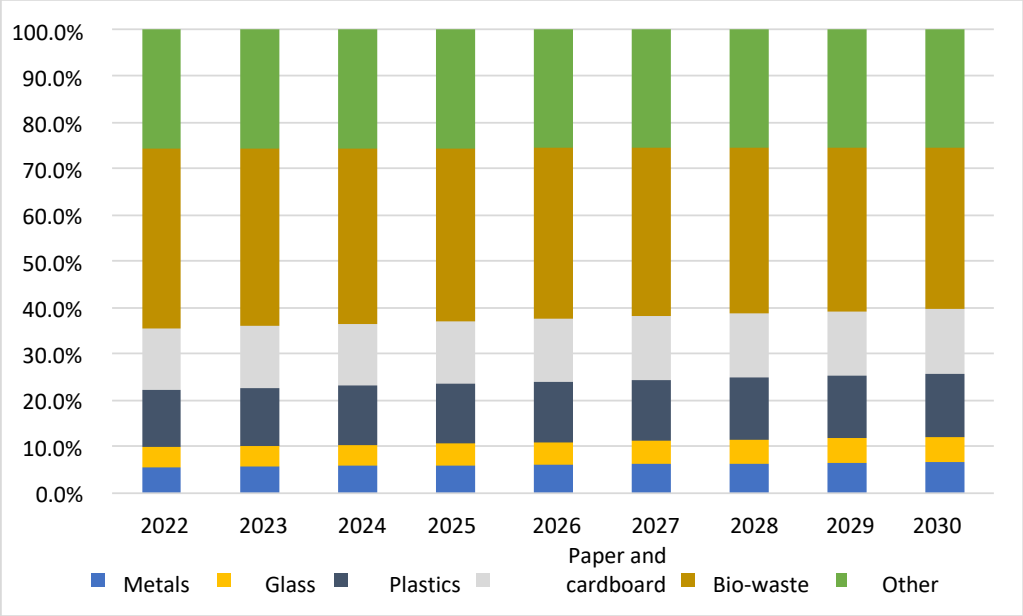


Table 3.3. *Projected composition of generated waste for Serbia in the period from 2022 to 2030 (%)*

Table 3.21. *Projection of the amount of biodegradable municipal waste for Serbia in the period from 2022 to 2030 (t/year)*

		Different sources of biodegrable municipal waste (t/year)				
Year	**Total municipal waste (t/year)**	**Biowaste** (garden and food)	**Paper and cardboard**	**Other** (textile, wood, leather, fine particles, etc.)	**Green waste** (parks and public spaces)	**Total biodegradable waste (t/year)**
2008* Potential reference year	2,374,375			**1,602,525**		
2022	3,033,876	1,181,580	360,328	271,778	91,016	**1,904,702**
2023	3,080,319	1,183,116	368,705	275,947	92,410	**1,920,178**
2024	3,129,084	1,185,130	377,422	280,294	93,873	**1,936,718**
2025	3,180,295	1,187,640	386,497	284,827	95,409	**1,954,373**
2026	3,234,082	1,190,665	395,950	289,556	97,022	**1,973,193**
2027	3,290,582	1,194,223	405,803	294,490	98,717	**1,993,234**
2028	3,349,939	1,198,335	416,078	299,639	100,498	**2,014,550**
2029	3,412,307	1,203,021	426,798	305,014	102,369	**2,037,202**
230	3,477,846	1,208,302	437,989	310,625	104,335	**2,061,251**

The calculation of the total amount of municipal biodegradable waste in the Republic of Serbia is based on the results obtained on the basis of measurements and conducted analyzes of the composition of waste in the municipalities of the Republic of Serbia. Based on the results of measurements in the field, the following sources of biodegradable municipal waste were identified to be taken into account: garden and food waste (100%), paper and cardboard (90%) and all remaining waste (35%) which contains biodegradable categories such as textiles, wood, leather, fine elements, etc. The amount of biodegradable waste originating from parks and public areas should also be

considered. In the Republic of Serbia in 2008 (as a potential reference year) of the total quantity of municipal waste, about 67.5% was biodegradable waste. This value corresponds to the mass of 1,602,525 tons of generated biodegradable municipal waste, i.e., 214 kg per capita per year. Using the results obtained by modeling, the projected values of generated biodegradable municipal waste by 2030 are presented in Table 3.23.

Based on the amount of biodegradable municipal waste of 1,602,525 t from 2008, which was taken as the reference year, the quantities to be diverted from landfills in the Republic of Serbia in the period covered by this Program were calculated. It can be concluded that by the end of 2028 and the achievement of the goal of allowing the disposal of a maximum of 75% of the amount of biodegradable municipal waste generated in 2008, appropriate treatment options should be found for about 812,656 tons of this type of waste. According to the same principle, in the next period, the necessary quantities should be determined, which should be redirected from the landfill in order to reach and set the goals for 2032 and 2039, respectively.

Similarly, for the purpose of calculating the amount of packaging waste that needs to be recycled and reused in order to meet the defined goals in the future, data on the amount and composition of waste obtained using the model were used. The specific values of the projected quantity of packaging and individual packaging materials are also presented in Table 3.22. Based on these data, we can expect an increase in the amount of packaging placed on the market in 2030 to 534,285 tons.

Table 3.22. *Projected quantity of packaging placed on the market for Serbia from 2022 to 2030)*

Year	Packaging materials (t/year)						Total
	Plastic	Wood	Metal	Glass	Paper and cardboard	Other	
2022	98,509	83,297	19,378	56,546	131,950	715	**390,395**
2023	102,449	86,629	20,153	58,808	137,228	744	**406,011**
2024	106,548	90,094	20,959	61,161	142,717	773	**422,252**
2025	110,809	93,698	21,797	63,607	148,426	804	**439,142**
2026	115,242	97,446	22,669	66,151	154,363	837	**456,708**
2027	119,852	101,344	23,576	68,797	160,537	870	**474,976**
2028	124,646	105,398	24,519	71,549	166,959	905	**493,976**
2029	129,632	109,614	25,499	74,411	173,638	941	**513,735**
2030	134,817	113,999	26,519	77,388	180,583	979	**534,285**

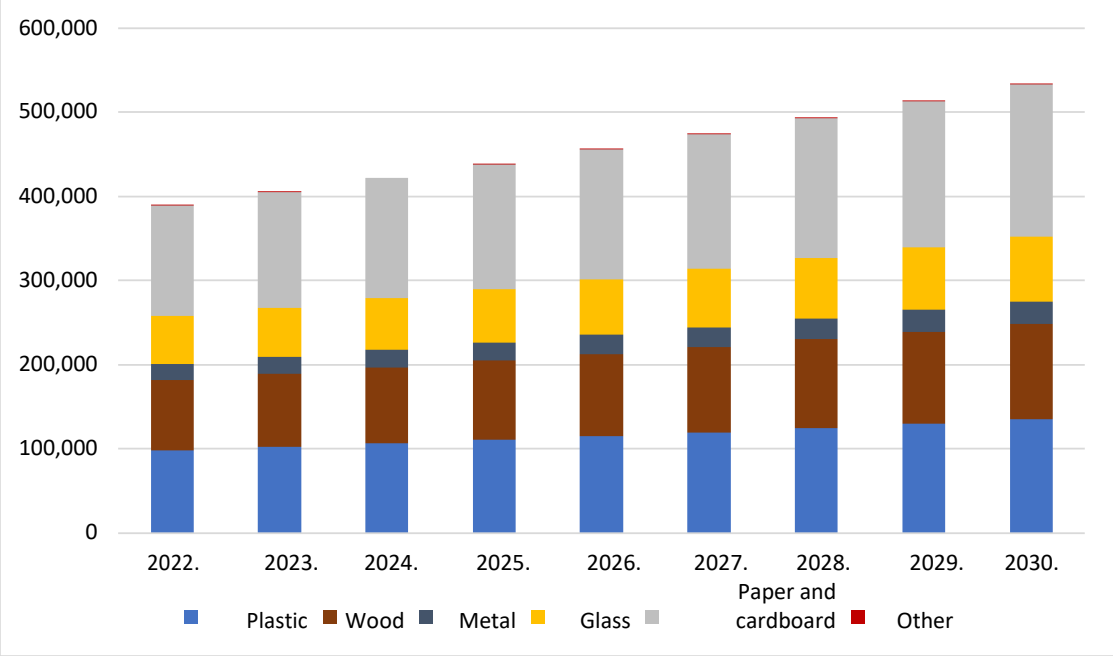


Figure 3.4. *Projections of packaging placed on the market for Serbia from 2022 to 2030 by type of material (%)*

3.8.2 Industrial and Hazardous Waste

Future quantities of waste depend on demographic, economic and social factors. Development in the waste management sector, e.g., improving the system of separate waste collection also has a high impact on future quantities and composition of waste. The forecast of future quantities of hazardous waste therefore requires the prediction of many uncertain factors. The accuracy of the forecast, of course, depends on the accuracy of data on current quantities and quality of waste.

The projection of hazardous waste generation by 2030 will depend on the work of the industry. Quantities are expected to increase to 280,000 t/year in 2030 (chemical waste and sludge from industry and trade, waste from secondary waste treatment, contaminated soils, etc.).

Table 3.23. *Expected categories and quantities of hazardous waste in the Republic of Serbia*

Waste category	Expected quantity of hazardous waste (t)
Used solvents	1,699
Waste from acid, base and solidified waste	5,033
Used oils	22,316
Chemical waste (about 50% organic and 50% inorganic)	24,034
Sludge of industrial effluents	7,850
Sludge and liquid wastes from waste treatment processes	699
Medical waste	5,000
Glass waste	0
Wood waste	466

Waste category	Expected quantity of hazardous waste (t)
Wastes containing PCBs (polychlorinated biphenyls)	84
Discarded equipment	13,800
Discarded vehicles	45,700
Waste batteries and accumulators	18,000
Mixed and undifferentiated materials	3,952
Sorting residues	6,897
Mineral wastes from construction and demolition	530
Other types of mineral waste	100,000
Combustion waste	12,400
Soils	3,278
Mineral waste from waste treatment and waste stabilization	6,897
TOTAL	**278,635**

3.8.3. Special Waste Streams

Based on estimates of current quantities of waste vehicles and waste tires and projected development, it is estimated that up to 102,000 tons of waste vehicles and up to 90,000 tons of waste tires will be generated in 2030.

Based on the collected and treated quantities, as well as on the projections of the quantities placed on the market, it is assumed that in the coming years between 15,000 and 18,000 tons of waste batteries will be produced. It is estimated that the collection of waste portable batteries will increase as follows: 0.04 kg per capita in 2025, 0.05 kg per capita in 2027 and 0.06 kg per capita in 2031.

Based on estimates of current quantities placed on the market and information on waste oil collection, it is estimated that between 22,000 and 30,000 tons of waste oil will be generated annually.

Estimates of the amount of electrical and electronic equipment placed on the market were made taking into account GDP growth, population change and other indicators. Estimates show that the placement of electrical and electronic equipment on the market in 2025 will amount to 12.1 kg per capita, i.e., it can be expected that about 15,000 tons of this waste will be collected separately in 2024, and 38,000 tons in 2031 in the Republic of Serbia.

An amount of 2,100 t per year of mercury-containing waste fluorescent tubes can also be expected. The introduction of separate collection of hazardous waste from households and the strengthening of extended producer responsibility schemes can significantly increase the amount of separately collected fluorescent tubes. However, based on technological changes, it is assumed that the potential for waste fluorescent tubes will not increase in the next ten years.

Based on an estimated stock of 2.1 million tons of asbestos (estimated by historical asbestos consumption; the stock consists mainly of asbestos cement, to a lesser extent asbestos insulation material and asbestos PVC floors), an estimated amount of up to 45,000 tons per year, depending on the rate of renovations and reconstructions of existing buildings. This amount is the upper limit. By adjusting the expected amount of asbestos waste (from the construction sector) to the expected amount of construction and demolition waste, the amount of 10,000 tons per year is reached as the most probable.

According to forecasts, it is expected that in 2030, about 600,000 tons of packaging will be placed on the market in the Republic of Serbia. It can be assumed that all packaging placed on the market in a given year becomes packaging waste in the same year. The structure of the packaging material is expected to remain on average 14% glass, 25% plastic, 34% paper and cardboard, 5% metal, 21% wood and less than 1% residue.

It is expected that the number of small devices containing PCBs (capacitors), which are the result of proper treatment of waste electrical and electronic equipment, especially large household appliances, will remain at a few, up to 10 tons per year until 2030. In addition, it is expected that the potential annual number of oils containing PCBs will remain at the same level until 2030 as it is today, i.e. 125 to 185 t per year. It is expected that the amount of infectious medical waste of 5,000 tons per year will remain constant during the planned period. It is estimated that the total production of pharmaceutical waste will be 60 tons per year.

With regard to animal by-products, quantities will be decreasing in the upcoming years.

Rough estimates of the total amount of agricultural waste predict quantities of 12.8 million tons of straw. This waste largely remains in the agricultural sector. However, this waste has significant potential for the production of alternative energy (biogas, biomass incineration)).

It is estimated that sludge production capacity from existing wastewater treatment plants, such as those currently in the planning or construction phase, can be expected in the range of 17,690 - 22,852 t of wet sludge under nominal load, but an increase in sludge production capacity can be expected from 2028 or 2029. It is estimated that sludge production will reach an annual amount of 135,190 t of dry material after the Urban Wastewater Treatment Directive is fully implemented by 2041.

Based on current quantities and selected economic indicators, it is expected that in 2030, at least 2.4 million tons of construction and demolition waste will be produced in the Republic of Serbia, including excavated soil. Based on data from EU countries, the potential production of construction and demolition waste is estimated at 3.6 million tons per year.

Improved mining waste management is likely to lead to an increase in the amount of hazardous waste from mining operations, i.e., mining waste, which will be treated in dedicated facilities. Waste from energy can be expected to be generated in the near future in the amount of at least 10 million tons per year.

No waste from the titanium dioxide production is expected.

The quantities of secondary waste from waste treatment, which are generated in waste management operations, largely depend on the level of infrastructure for waste treatment. Fractions of secondary waste, which will be generated in the future (if the proposed infrastructure is implemented), may include, inter alia: production of fuels from mechanical treatment (up to 300,000 t per year), output fractions of biological treatment plants (up to 60,000 t per year), organic residues and sludge from physical and chemical treatment (up to 12,000 t per year), shredder residues in which waste vehicles and waste from electrical and electronic equipment (at least 10,000 t per year) and digestate from anaerobic digestion are treated.

3.8.4. Expected Types and Quantities of Waste to be Imported/Exported

Economic integration and accession of the Republic of Serbia to the EU are likely to increase exports, as well as imports of recyclable waste, e.g., metal, paper and plastic waste. It is expected that the export of hazardous waste that requires specific treatment, and which cannot be provided in an economical way for the amount of waste generated in the Republic of Serbia, will continue and increase in the future. This type of waste includes, among other things:

1) wastes from the steel industry (e.g., filter cleaning wastes) and wastes from chemical surface treatment of metals;
2) special types of waste electrical and electronic equipment, such as gas lamps and hazardous components removed from discarded equipment;
3) specific waste containing asbestos, which cannot be disposed of in a landfill, e.g., 15 01 11* (however, small quantities are expected);
4) packaging waste contaminated with hazardous substances;
5) pharmaceutical waste;
6) portable batteries and accumulators;
7) waste from flue gas treatment in waste incinerators[1];
8) specific PCB waste, other waste containing POPs.

4. VISION

The vision stemming from the analysis of the current situation and potential in the field of waste management is to minimize the impact of waste on the environment and increase resource efficiency on the principles of circular economy, which will control waste generation, waste recovery and incentives to invest and promote economic opportunities deriving from waste.

This vision can be achieved if principles based on reducing environmental pressures and ensuring a better quality of life for citizens are consistently applied, with a clear and sustainable development perspective and building a stimulating environment for establishing a circular economy model.

In accordance with the vision, the general and specific goals of waste management have been determined and the measures and instruments and activities necessary for their realization have been developed.

5. GENERAL AND SPECIFIC OBJECTIVES

5.1. General Objective

The general objective is to develop a sustainable waste management system in order to conserve resources, health of the people and reduce negative environmental impacts and space degradation.

These include: waste prevention, reduction of recyclable waste in landfills, reducing the share of biodegradable waste in municipal waste, reducing the negative impact of landfilled waste on the environment, climate and human health and waste management according to the principles of circular economy.

[1] This waste stream will become relevant when waste incineration facilities are available in Serbia.

The progress made in achieving the overall objective of the Program will be monitored through the following indicators:

1) level of municipal waste disposed of in non-sanitary landfills in relation to the total amount of waste generated by municipal waste (%),
2) degree of hazardous waste disposed of (%).

The implementation of environmental policy is based on the precautionary principle and the principle of prevention, namely, each activity must be planned and implemented in a way that causes the least possible change in the environment and poses the lowest risk to the environment and human health, reduce space and consumption of raw materials and energy in construction, production, distribution and use.

The key principles that should be taken into account when establishing and implementing a waste management plan are implemented through the following principles that should guide the waste management system in the Republic of Serbia.

Sustainable development principle

The principle of sustainable development presupposes meeting the needs of today's generation without endangering future generations and their needs. Sustainable development seeks to achieve economic and social development and environmental protection in a balanced way. Sustainable waste management means implementing all necessary measures for the efficient, prudent and responsible use of resources, reducing the amount of waste generated, and when waste generation cannot be avoided, handling in a way that contributes to sustainable development goals, including reintroduction of resources into the post-recycling cycle.

Circular economy principle

Applying the principles of circular economy promotes competitiveness, innovation, protects the environment and space, but at the same time contributes to economic growth and has the potential to create a significant number of new jobs, while preserving valuable and scarce natural resources and adding new values to waste materials.

Precautionary principle

The precautionary principle means that "in the event of the possibility of serious and irreparable damage, the absence of full scientific reliability shall not be a reason not to take measures to prevent environmental degradation". Every activity must be planned and executed in such a way as to cause the least possible changes in the environment. In the case of potential and significant environmental impacts, preventive actions should be taken, and in particular the use of environmental impact assessment instruments should be supported.

Choosing the most optimal option for the environment principle

Choosing the most optimal option for the environment is a systematic approach. Assessing the impact of different options on the environment allows determining the option or combination of options that brings the greatest benefit and/or least harm to the environment as a whole, with acceptable costs and profitability, both in the long run and in the short term. In case of conflict between the principle of proximity or the application of the waste hierarchy with the principle of choosing the most optimal option for the environment, preference may be given to choosing the most optimal option for the environment.

Self-sufficiency principle

The application of the principle of self-sufficiency implies the establishment of an integrated and suitable network of facilities for reuse and disposal of mixed municipal waste,

including the collection of this type of waste generated by other waste producers, taking into account the best available techniques.

The network is formed so that it is sufficient for the Republic of Serbia for waste disposal and transport, taking into account the geographical characteristics of the region and the need for separate facilities for certain types of waste.

This network should enable the disposal or reuse of waste in one of the nearest appropriate facilities, using the most appropriate methods and technologies in order to ensure a high level of environmental protection and public health.

Principle of proximity and regional approach to waste management

Waste should be treated or disposed of as close as possible to the place of origin, i.e. in the region where it originated, in order to avoid the adverse effects of transport on the environment. The choice of site for a treatment and/or reuse and/or disposal facility depends on local conditions and circumstances, the type and amount of waste, the mode of transport and disposal, economic viability, and the potential environmental impact. Regional waste management is ensured by the development and implementation of regional strategic plans in accordance with the Program, based on European legislation and national policies.

Principle of waste management hierarchy

Hierarchy in waste management implies the following order of priorities in waste management practice:

- **Prevention**: Measures taken before a substance, material or product becomes waste to reduce: the amount of waste, including reuse of the product or extension of the life of the product; harmful effects of waste on the environment and human health; content of harmful substances in materials;

- **Preparation for reuse**: Procedures related to the reuse of waste involving cleaning (e.g., old clothes), functional testing (e.g., electrical and electronic devices or their components), or repair and recovery of discarded equipment, which prepares products or components of waste products for reuse without any other pre-treatment;

- **Recycling**: Processing of waste materials into products, materials or substances, whether for original or other purposes (“bottle to bottle”, "metal to metal", composting);

- **Other reuse operations**: Use of waste value for other useful purposes by replacing other materials that would otherwise be used to perform a particular function, or waste that would be ready to perform that function, in a plant or wider economy (e.g., material backfilling, reclamation, energy production, other energy benefits or chemical use);

- **Disposal**: Any operation that does not reuse waste, even when materials are reused or when energy is produced as a secondary effect of such an operation (e.g., incineration not intended for energy production, landfilling).

However, the waste management hierarchy is not an absolute principle. Measures should be taken to reach a solution that will create the best possible overall result for the environment. General principles of environmental protection must also be taken into account, such as the precautionary and sustainability principles, technical feasibility and economic viability, resource protection, as well as the general impact on the environment, human health, the economy and the social aspect. In special cases, it may be necessary to deviate from a strict

hierarchy in order to align with other key principles. For example, for POPs-containing waste (POPs content above the “lower limit” as defined in the Stockholm Convention guidelines or relevant regulations), preference is given to other treatments that destroy or alter POPs content (e.g., incineration) over recycling.

Principle of extended producer responsibility

The extended producer responsibility scheme is a program of internationalization of environmental costs and consumption of a particular product. Product manufacturers are responsible for the impact of manufactured goods throughout the product life cycle, including disposal. Manufacturers bear the greatest responsibility, because they affect the composition and characteristics of products and packaging. The manufacturer should take care to minimize the generation of waste, the development of recyclable products and the development of markets for the reuse and recycling of their products. Manufacturers or, if this is not the case, importers and sellers may fulfill their obligations individually or together (involvement in collective operators) depending on the specific implementing legislation.

***Polluter pays* principle**

In order to ensure financially sustainable activity in waste management, the "polluter pays" principle will be applied. Polluters must bear the full cost of the consequences of their activities. The costs of waste collection, treatment and disposal must therefore be included in the price of the product. The principle of full cost recovery for waste collection and disposal services should be applied, as well as the introduction of financial incentives for waste reuse and recycling.

5.2. Specific Objectives

The following specific objectives are set to achieve the general objective of the Program:

Specific objective 1: Improved municipal waste management system through increased recycling rate, reduced disposal of biodegradable waste in landfills and reduced disposal of waste in unsanitary landfills

In order to achieve this specific objective, it is necessary to achieve the following:

- increasing the recycling rate of municipal waste to a total of 25% by weight by 2025 and 35% by 2030;
- increase the rate of preparation for reuse and recycling of municipal waste to a minimum of 55% by weight by the end of 2025 and a minimum of 60% by weight by the end of 2030
- reduction of disposal of biodegradable waste in landfills by 2028, to 75% of the total amount of biodegradable waste generated in 2008
- by the end of 2029, a separate collection of at least paper, metal, plastic, glass and textiles to have been established
- increase the biowaste recycling rate to 20% by 2025 and 40% by 2029;
- increase the recycling rate of paper and cardboard to 25% by 2025 and 35% by 2029;
- reduction of waste disposal in unsanitary landfills to 0% by 2034.

Specific objective 2: Sustainable hazardous and industrial waste management system in place

In order to achieve this specific objective, it is necessary to achieve the following:

– by the end of December 2029, to establish separate collection of hazardous waste fractions produced by households

– build capacities for hazardous and industrial waste management.

Specific objective 3: Increased rate of collection, reuse and recycling of special waste streams and more efficient use of resources

In order to achieve this specific objective, it is necessary to achieve the following:

– increase the coverage of the system of separate collection of packaging waste to 100% by 2028

– recycling of the mass share of total packaging waste from 65% by 2025 and 70% by 2030

- 50% by weight for plastics by 2025 and 55% by 2030[2]
- 25% by weight for wood by 2025 and 30% by 2030
- 70% by weight for ferrous metals by 2025 and 80% by 2030
- 50% by weight for aluminum by 2025 and 60% by 2030
- 70% by weight for glass by 2025 and 75% by 2030
- 75% by weight for paper and cardboard by 2025 and 85% by 2030

– increase the collection rate of waste portable batteries and accumulators to a total of 25% by weight by 2031;

– increase the rate of collection of waste electrical and electronic equipment from households to 45% by 2031;

– increase the rate of preparation for reuse, recycling and other types of reuse of materials, including spreading waste as a substitute for other materials with non-hazardous construction and demolition waste, excluding natural materials defined in category 17 05 04 on the waste list by 40% by 2029.

Specific objective 4 Strengthened capacity of institutions in the field of waste management and regulations harmonized with EU regulations

Strengthening the capacity of institutions refers to the harmonization of the legal framework with the *Acquis communautaire*, improving monitoring and reporting in the field of waste management, strengthening the capacity of the Environmental Protection Agency and strengthening the capacity of the Environmental Inspectorate. It also implies strengthening the capacity of local self-governments and state administration, as well as regional waste management companies.

[2] *Article 9 of Directive (EU) 2019/904 (Disposable Plastics Directive) requires Member States to take the necessary measures to ensure separate collection for the recycling of plastic bottles.*
(a) by 2025, of the quantity of waste disposable plastic products listed in Part F of the Annex (beverage bottles) - 77% of such disposable plastic products placed on the market in that year;
(b) by 2029, of the quantity of single-use waste plastic products listed in Part F of the Annex (beverage bottles) - 90% of such disposable marketable products are placed on the market in a given year.

6. CONCEPT FOR ACHIEVING THE OBJECTIVES OF THE PROGRAM

In order to achieve the vision, general and specific objectives of the Program, in accordance with the relevant EU directives related to waste management and the implementation plans developed which analyzed different scenarios, a concept was developed to establish a functional system using circular economy and market development for recycled materials.

This implies full compliance with the requirements of EU Directives and the implementation of commitments in the EU accession process. Further harmonization of regulations, adoption of amendments to the Law on Waste Management and the Law on Packaging and Packaging Waste and relevant by-laws is required. The necessary reforms relate to strengthening the existing administrative capacities, especially the capacities of the institutions and bodies in charge of planning, control, supervision, reporting and certification, as well as establishing close cooperation between the Ministry, EPA and LSGUs for the purpose of technical support and administrative assistance, as well as for the implementation of economic instruments, raising public awareness, creating and managing an information system.

In addition, in order to establish an integrated waste management system, it is necessary to build appropriate infrastructure, establish waste management systems for different types of waste, apply appropriate economic instruments and ensure sustainable financing of these systems.

In order to determine the scope of measures needed to achieve the objectives set by 2031, the complete infrastructure needed to establish an integrated waste management system was considered, which would enable the Republic of Serbia to fully implement the requirements of EU Directives in the long run.

6.1. Necessary Infrastructure for Municipal Waste Management

The integrated municipal waste management system contains the following key elements:

– establishment of regional systems, formation of responsible regional bodies and adequate administrative and technical capacities for the implementation of regional projects.

– introduction of separate collection of recyclable materials by establishing a system of (at least) two bins - one for mixed waste and the other for recyclable waste. Depending on the needs of the region, the number of bins may be higher (for waste subject to collective schemes, a proportional contribution). The system will gradually progress by increasing the volume of separate collection of the following materials for recycling: glass (~ 100% packaging) and paper and cardboard (~ 50% packaging, ~ 50% non-packaging waste);

– Establishment of separate collection of municipal biowaste starting with green waste collection;

– introduction of secondary separation of recyclable products by establishing regional waste centers with appropriate clean lines for separation, so that recyclable waste can be separated into certain fractions for further processing - in each waste management region;

– Establishment of a network of waste collection centers throughout the country: depending on population density, one or more waste collection centers will be established in each municipality. The centers will function as "recycling yard", where citizens will bring waste that must not be disposed of in household waste containers, including e.g., bulky waste, special types of waste, green waste, hazardous household waste, waste electrical and electronic equipment, batteries, etc.;

– After assessing regional needs, establish sufficient capacity for transfer stations;

– construction of small lines for composting organic municipal waste, including the provision of appropriate transport vehicles; specific equipment required (equipment for mixing materials, sieves), can be financed and managed by several small plants in cooperation;

– introduction of home composting in rural and semi-rural areas in order to recycle organic waste from households;

– construction of a plant for biological treatment of municipal waste at a regional level. In these plants, separated biowaste (e.g. food waste) and residues of contaminated / impure biodegradable waste from the separation and treatment process will be treated. The two waste streams will be separated from each other ;

– construction of a municipal waste incineration plant in Belgrade with an incineration capacity of 340,000 t/year, installed production capacity of 25 MW and production of thermal power of 56 MW and construction of plants for thermal treatment (thermovaluation) of non-recyclable waste in Nis and Kragujevac, with the production of electricity and heat;

– Based on the concluded agreements and cooperation between municipalities and regions, sanitary landfills will be established at the level of the region for waste management;

– closure of unsanitary landfills and removal of illegal landfills, including reclamation of closed landfills and remediation of illegal landfill sites in regions where sanitary landfills operate.

New investments in the field of waste will be more focused on the separation of waste at the source and recycling of waste, i.e., more efficient use of resources. Before any decision is made to build new landfills, attention must be paid to increasing efforts to reduce waste through waste prevention, separation and recycling.

In Figure 6.1. a scheme is presented that provides an insight into the planned infrastructure for municipal waste management.

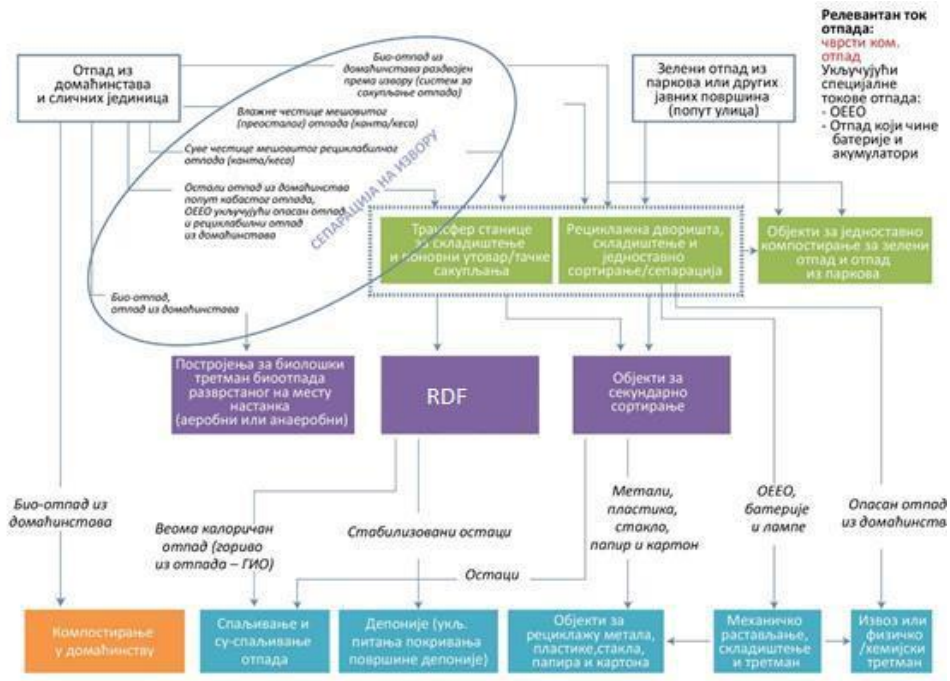


Figure 6.1. *Municipal waste management infrastructure*

6.1.1. Regional Approach

At the strategic and investment level, the Republic of Serbia relies on the option of regional waste management. The development of an integrated waste management system and the appropriate infrastructure needed for municipal waste management is under development. In the next period, the formation of waste management regions will continue, which are formed through the cooperation of local self-government units and the construction of regional waste management infrastructure. Regional, integrated waste management systems are planned to provide local waste management services according to EU standards.

The regional concept seeks to make services more efficient and effective by grouping key functional units (collection, transport and separation) to a level where recyclable materials and special waste streams can be set aside for appropriate treatment and the rest for final disposal. Further unification of municipalities for joint waste management will establish a system of regional waste management centers, which makes the necessary infrastructure for municipal waste management.

The program provides guidelines for the establishment of these regions, but the choice of which region to join remains the decision of each local government within the decentralized provision of municipal waste management services. The Law on Waste Management stipulates that the region must have at least 250,000 inhabitants. The purpose of this approach is to provide economies of scale for the development of more effective treatment technologies. Decentralized decision-making allows local governments some flexibility in joining a regional waste management company that provides the best value services for estimated costs. Regional structures are established through inter-municipal agreements on cooperation between local governments.

The infrastructure required for the establishment of a fully functional regional municipal waste management system in accordance with the above EU directives is divided into three phases.

Table 6.1. *Infrastructure planned for municipal waste management*

	High density population, major cities - Belgrade	Regions with large settlements – Novi Sad, Nis, Kragujevac	Other regions
Phase 1	• Waste collection and transport equipment to ensure 100% service coverage • Transfer stations (where applicable) • Primary separation of recycled material (initially two-bin system, with the prospect of further development) • Secondary separation at the regional level • Home composting (30%) • Primary separation of green waste and local composting level • Waste collection centers (bulky waste, electrical waste electronic equipment, waste oil, hazardous household waste) • Landfills that fully meet the engineering requirements and technological standards • Closure of existing landfills (cessation of operation, establishment of controlled entrance and fencing) • Monitoring and reporting equipment		
Phase 2	Converting waste to energy Further development of primary separation Home composting volume increase	RDF production Home composting volume increase	Further development of primary separation Home composting volume increasing Separate collection and biological treatment of waste
Phase 3	Further separate collection and biological treatment of biodegradable waste Home composting volume increasing Reclamation of closed unsanitary landfills		

6.1.2. Waste Collection and Transport System

Collection includes waste collection, including preliminary sorting and storage of waste for transport to waste treatment facilities.

6.1.2.1. Primary separation

Better primary separation is considered a mandatory part of the waste collection system. For municipal waste, it is done at the household level, as well as in small companies and institutions that generate similar waste. The system includes on-site sorting into two fractions (dry and wet) and additional containers (i.e., containers to be procured in addition to the existing ones currently used for mixed waste).

The requirement for recycling of 50% of municipal waste will be achieved by establishing integrated regional municipal waste management systems throughout the Republic of Serbia, which will collect separately recycled materials and fractions for recycling that will be prepared by secondary waste separation, as well as establishing a line for composting and home composting for the treatment of the organic fraction of municipal waste.

The Republic of Serbia will prescribe the necessary measures to achieve the goal of reuse and recycling of waste materials such as paper, metal, plastic and glass from households and possibly from other sources, as these waste streams are similar to household waste.

Establishing a two-bin system is the most basic system and provides a starting point in the regional structure of integrated waste management. One for mixed waste and the other for recyclable waste (plastics, metals, paper and other recyclable waste other than glass), which covers 100% of the population of the Republic of Serbia (Phase 1 of infrastructure construction). Separate collection of glass will be established at designated collection points ("recycling islands").

Progressive addition of containers is planned in order to increase the quantity and quality of recyclable materials. The minimum necessary is the introduction of additional bins are vehicles and awareness campaigns for the separate collection of biodegradable waste and glass.

Separately collected biodegradable waste (managed through different waste streams - green waste, food waste and recyclable materials such as paper) improves the efficiency and effectiveness of the biodegradable waste treatment process and reduces contamination of other materials. Glass is a problem for the base system due to its high weight, low value and handling problems.

Waste streams separated at the source, such as biowaste, must be directed to biological treatment, and other recyclable materials such as metal, plastic, glass, paper and cardboard and wood, are directed to materials reuse operations in industrial processes.

Achieving separate collection of at least paper, metal, plastic, glass and textiles will be possible by the end of 2029.

It is planned that the collection of completely separate biowaste in all regions will be possible by the end of 2039, which exceeds the duration of this Program. The calculation of municipal biowaste entering aerobic or anaerobic treatment as recycled will be possible only if it is collected separately or separated at source, in accordance with EU directives.

Achieving the establishment of separate collection of hazardous waste fractions produced by households is planned by the end of 2029.

6.1.2.2. Waste collection and transport vehicles

Waste collection infrastructure needs relate to collection containers and vehicles for waste collection and transport. The number of vehicles is estimated based on the specific characteristics of each region, including the amount of waste collected per shift, the daily amount of waste generated by local governments, the annual amount of waste generated, the frequency of waste collection, the number of households, etc. When defining the need for additional vehicles, it is necessary to take into account the age and capacity of the existing car fleet infrastructure.

6.1.2.3. Waste collection centers

An approach of creating a network of waste collection centers across the country is proposed. In the first phase, each municipality will have one center for waste collection, so later more facilities will be added, depending on the needs. These sites will serve as "recycling yards" for the collection of waste that must not be disposed of in containers (containers and bins) for municipal waste (e.g., bulky waste, special waste streams such as waste from electrical and electronic equipment, batteries, waste oil, then hazardous household waste, etc.). Collection centers will also provide appropriate bins/containers for separate collection of at least textiles, waste electrical and electronic equipment and batteries. In addition, there will be places in the collection centers for the collection of packaging waste and biowaste (First phase of infrastructure construction). The construction of waste collection centers must begin in 2022

in all municipalities within the First Phase. Waste collection centers are currently established in some municipalities, and by 2032 all municipalities should have established and functional waste collection centers.

6.1.2.4. Transfer stations

In order to strengthen the management of waste streams that are not treated on site or that are treated in remote centralized facilities, it is necessary to establish a transfer station for waste handling.

Where economically viable, transfer stations may be introduced to reduce transport costs and the number of vehicles passing through the settlement. The number of transfer stations in each region is defined during the technical assessment of future regional systems, primarily as a function of the distance from the treatment plant or landfill and the amount of waste to be transported. Additional transfer stations may be introduced at later stages, if circumstances change. Transfer stations are of particular value where regions seek to reduce the number of regional landfills to be built through cooperation with neighboring regions that already have a regional landfill.

6.1.3. Waste Treatment Plants

6.1.3.1. Secondary separation lines

Where primary separation is carried out at the source (household) - i.e., where there is a "dry" bin in which recyclable waste is collected, a facility for secondary separation of recyclable materials is needed. Each regional system will have a secondary separation line. Secondary waste separation implies the establishment of regional plants with appropriate lines for the separation of recyclable waste by fractions (First phase of infrastructure construction). Separated waste is pressed and baled for recycling.

Achieving the goals related to the recycling of municipal waste is planned in the following periods: by the end of 2025 the recycling rate of municipal waste will increase to a total of 25% by weight, and by the end of 2030, to 35% by weight.

The plan for achieving the final goals that will be included in the next Waste Management Program for the period 2032 – 2041, is as follows: by the end of 2035, the recycling rate of municipal waste will increase to a total of 45% by weight; by the end of 2039, the municipal waste recycling rate will increase to a total of 50%, by the end of 2044, the municipal waste recycling rate will increase to a total of 55%; by the end of 2049, the municipal waste recycling rate will increase to a total of 60% by weight, and finally by the end of 2054, the municipal waste recycling rate will increase to a total of 65% by weight.

6.1.3.2. Composting plants

Composting is planned as the most affordable option for the treatment of biodegradable waste for the first phase of infrastructure construction and development of regional waste management systems. During the First Phase, it is planned to collect and build a separate site in the municipality for composting green waste in the open. This model can be extended during the Second Phase, depending on progress in meeting objectives and constraints in terms of affordability.

Composting lines involve the construction of small composting facilities, including appropriate compost transport vehicles for the purpose of recycling biodegradable municipal waste (Second phase of infrastructure). The capacities of composting plants at the municipal level will be in the range of 500 to 5,000 t per year (small biological treatment plants).

6.1.3.3. Waste fuel extraction plants

Waste fuel plants provide the option to produce refuse-derived fuel (RDF) in combination with biological treatment in the largest waste management regions (e.g., Novi Sad) where they can be afforded. These plants will be equipped for the treatment of both primarily separated material (recyclable material) and residual waste streams, so that they will produce materials for recycling, compost and refuse-derived fuel (RDF) for plants for energy production from waste, co-incineration in cement furnaces or for thermal power plants.

6.1.3.4. Biological treatment plants

After extraction of the material sorted at the source in accordance with the set goals, the residual waste will be further treated in the selected regions. Biological treatment is considered a financially advantageous central regional solution for the disposal of untreated biodegradable waste from landfills.

This plant aims to treat separately the remaining impure biodegradable fraction of mixed waste and separately the flow of collected waste from food. The plants will be planned so that the processing of the two waste streams is separated, in order to enable the recycling of clean waste from food residues. The type of technology to be applied (e.g. aerobic or anaerobic) will be defined at the design stage. By planning the maximum level of primary separation before treatment, these plants will contribute to the diversion of biodegradable waste from landfills, and achieve high recycling targets defined by the package of EU Directives for circular economy.

The construction of infrastructure for the treatment of large amounts of biodegradable waste is planned in the second phase. Facilities with a total capacity of 380,000 tons per year are necessary to ensure the proper implementation of EU directives. Starting in 2022, regions that collect more than 85,000 tons of municipal waste should prepare feasibility studies for the treatment of separately collected biowaste in large biological treatment plants. The required capacity must be installed by 2037.

The capacity of large biological treatment plants should be in the range of 50,000 to 100,000 t per year. In order to achieve greater economic benefits, equipment for the use of biogas and its use for own or public needs should be provided.

6.1.3.5. Home composting

The introduction of modern waste management in the regions requires accurate measurement of waste quantities. The "home composting" component is a package of support to local authorities and citizens for the treatment of biodegradable waste at home and reducing the amount of waste entering the household waste collection system, which reduces landfill space and disposal fees. The landfill fee should encourage a reduction in the amount of waste disposed of. The focus of this measure is on rural areas where home composting space is more accessible and where there is the greatest benefit from reducing separate collection and transport costs. All households in rural areas will be supplied with home composters and will use their own compost. Active public participation will be encouraged and facilitated through targeted public information campaigns and direct support. It is estimated that home composting in suburban/rural households will begin with the removal of 30% of biodegradable waste when regional infrastructure becomes operational, and will achieve 60% efficiency through additional communication measures and assistance in the coming years.

Home composting must start from 2022 in all municipalities within the First Phase. Home composting will be established in suburban/rural households in all municipalities of the waste management region by 2032.

Thus, biowaste will be separated and recycled at the source (home composting in rural areas) and collected separately for recycling in urban areas (Second phase of infrastructure).

6.1.3.6. Energy recovery from waste

The plan for the development of the waste management system in Serbia includes one waste incineration and energy production plant in Belgrade, with a capacity of 340,000 t/year, and two plants for thermal treatment (thermovalorisation) of non-recyclable waste in Nis and Kragujevac, with the production of electricity and heat. There are also three cement plants in the Republic of Serbia, and two (Lafarge Beocin and CRH Novi Popovac) have a permit for the use of thermal treatment of energy obtained in the process of waste incineration in cement kilns.

6.1.4. Waste Disposal at Regional Sanitary Landfills

The remaining waste will be disposed of in regional sanitary landfills built according to the requirements of the EU Landfill Directive. The landfill construction process can be divided into several phases. The initial phase will include the construction of the first landfill cell (5-7 ha or approximately 5-7 years capacity), except in cases where a more detailed assessment has been carried out to take into account local conditions and associated infrastructure. After that period, additional cells will be funded by regional waste management centers through operating costs, using revenue from tariffs/cost recovery measures. It is not necessary for all regions to have regional landfills; some regions will use regional landfills that exist in neighboring regions.

The number of unsanitary landfills will be reduced to zero, and the first phase of infrastructure will be fully built and operational by the end of 2034, if all the conditions for financing infrastructure development are met.

The second phase of the infrastructure will be fully built and operational by the end of 2039.

To calculate the targets for the diversion of biodegradable waste, 2008 was proposed as the reference year, due to the lack of previously reliable data. During 2008, 2,374,375 t of municipal waste was produced, of which 1,602,525 t was biodegradable waste (67.5%). Redirection of biodegradable waste will be achieved by increasing the level of home composting in rural areas, and the implementation of composting sites in each municipality, redirection of green waste from public areas, redirection of paper/cardboard implementation of recycling plans and construction of treatment plants.

The effects of biodegradable waste management are reduced greenhouse gas generation, reduced landfill space use and the potential for better quality recyclable materials by less cross-contamination of different waste streams.

When determining priority measures for the implementation of requirements from EU Directives, it is necessary to analyze the generation of biodegradable waste in waste management regions in the Republic of Serbia, the level of infrastructure development, operational and management experience of responsible institutions and availability of waste management components. It is necessary to analyze the amount of biodegradable waste, which is also included in the targets for recycling mainly paper and cardboard, but also wood and textiles.

The target value is to reduce the disposal of biodegradable waste in landfills by 2028, to 75% of the total amount of biodegradable waste generated in 2008, and the final target is 50% by the end of 2032 and 35% by the end of 2039. Although the complete infrastructure for the diversion of biodegradable waste will be built by 2037, it is expected that there will be a significant period of adjustment for the operation of these systems according to the required standards. Reduction of landfill disposal to a maximum of 10% of the total amount of municipal waste by the end of 2049 will be ensured by economic measures to prevent and reduce waste generation, high degree of primary separation and waste treatment, home composting and stabilization of the remaining biodegradable waste fraction.

The application of the following measures is taken as the basis for achieving the goals:

Plan to reduce the disposal of biodegradable waste in landfills by the end of 2028 to **75% of the 2008 amount:**

1) home composting of 30% of produced biodegradable waste from rural parts of designated waste management regions: Belgrade, Subotica, Vranje, Krusevac, Uzice, Pancevo, Pirot, Sremska Mitrovica, Nova Varos, Kragujevac, Valjevo, Sombor, Kikinda, Lapovo, Jagodina, Leskovac, Smederevo, Vrsac, Novi Sad;
2) separation at source and composting sites in each established region to remove green waste from parks and streets;
3) separation of paper and cardboard due to the implementation of basic infrastructure;
4) construction of facilities for the conversion of waste into energy in Belgrade, Nis and Kragujevac, facilities for RDF/biological treatment in Novi Sad, and biological treatments in the regions for waste management in Uzice and Subotica.

Plan to reduce the disposal of biodegradable waste in landfills by the end of **2032 to 50% of the 2008 amount:**

1) home composting of 60% of produced biodegradable waste from rural parts of the region from the First Phase (where home composting is already at the level of 30% in rural areas): Belgrade, Subotica, Vranje, Krusevac, Uzice, Pancevo, Pirot, Sremska Mitrovica, Nova Varos , Kragujevac, Valjevo, Sombor, Kikinda, Lapovo, Jagodina, Leskovac, Smederevo, Vrsac, Novi Sad;
2) home composting of 30% of produced biodegradable waste in the established regions for this period: Zrenjanin, Kraljevo, Nis, Indjija;
3) separation at the source and composting sites in each designated region for the removal of green waste from parks and streets;
4) separation of paper and cardboard due to the implementation of basic infrastructure in the above waste management regions;
5) construction of biological treatment facilities in Sremska Mitrovica and Belgrade-waste management regions:

Plan to reduce the disposal of biodegradable waste in landfills by the end of 2039 to 35% of the amount from 2008, which will be included in the next Waste Management Program to achieve the final goal:

1) home composting of 60% of produced biodegradable waste from rural areas of the region from the First and Second Phase: Subotica, Vranje, Krusevac, Uzice, Pancevo, Pirot, Sremska Mitrovica, Nova Varos, Kragujevac, Valjevo, Sombor, Kikinda,

Lapovo, Jagodina, Leskovac, Smederevo , Vrsac, Novi Sad, Belgrade, Zrenjanin, Kraljevo, Nis, Indjija;

2) home composting of 30% of produced biodegradable waste from rural areas in the identified regions for this period: Loznica, Pozarevac and Zajecar
3) separation at source and construction of composting sites in each established region for the removal of green waste from parks and streets;
4) application of separate collection of biodegradable household waste (food and green waste) in regions with RDF/biological treatment;
5) separation of paper and cardboard due to the implementation of basic infrastructure;
6) construction of additional facilities for biological treatment in the following regions for waste management: Vranje, Krusevac, Pancevo, Pirot, Valjevo, Sombor, Kikinda, Lapovo, Zrenjanin, Kraljevo.

The proposed system provides for the introduction of separate collection of biodegradable waste in the Second Phase, public engagement and economic measures, but provides for affordable biodegradable waste treatment facilities, if necessary, to ensure that the 35% reduction target for biodegradable waste is met by end of 2039.

In addition to infrastructure measures, new business models for the circular economy and waste prevention measures have been identified as important policy measures to achieve these goals.

Construction of regional biological treatment plants, composting plants at the local level, where separately collected biowaste (food and green waste) will be delivered for subsequent treatment and application of separate collection of food waste that will be gradually implemented by 2049 are measures needed to provide progressive treatment of biowaste in a way that minimizes the generation of greenhouse gases and maximizes the preservation of biological material.

6.1.5. Closure of Unsanitary Landfills

The third phase is planned for a later period and includes the reclamation of old landfills and taking environmental protection measures, covering landfills and providing conditions for vegetation growth in accordance with the surrounding nature. Reclamation also includes the removal of waste from smaller landfills and dumps to larger landfills. After reclamation, former landfills and dumps can be used for other purposes. In general, the closure process contains the following steps:

1) during the first step, closure involves suspending operations and preventing waste disposal at unsanitary landfills and dumps (including cheap measures such as blocking access roads, fencing areas, placing information signs and other actions that will be selected as most effective in each case.).
2) the second step involves rehabilitating and recultivating old landfills and taking environmental protection measures. Remediation measures include compaction of the landfill body with slope stabilization, degassing of the landfill by installing a network of biothorns, installation of a drainage system for collecting leachate if possible, i.e. construction of inspection wells for leachate, construction of circumferential channels for atmospheric water, installation of impermeable barriers for atmospheric water on the surface of landfills and geosynthetic substrates for the humus layer under the future vegetation cover. Establishing monitoring of surface and groundwater and soil conditions is also needed.

Reducing landfill use and developing waste management systems will be achieved through institutional, financial/economic, technical and administrative measures (e.g., setting and achieving targets, prioritizing waste separation at source, and financing of cultures). If all the conditions for financing the development of infrastructure are met, all unsanitary landfills in the Republic of Serbia will be closed by the end of 2034.

6.1.6. Awareness Campaigns

Information campaigns will be conducted continuously. The introduction and success of modern waste management systems requires a greater understanding and acceptance of the principles of environmental protection and waste management objectives by the public than ever before. Citizens will be encouraged to implement measures such as waste identification, separation and disposal in a way that allows systems to operate efficiently and effectively. These activities cannot be reported without the role of civil society organizations, which have been the most engaged so far

Support to public awareness is considered part of certain capital investment projects (e.g., introduction of on-site separation and home composting). The introductory campaigns are planned for a period of 15 months - three months before the system is put into operation and twelve months after that. Typical activities include setting up an information team at a waste management institution, preparing a campaign, polling, preparing information material, organizing trainings and events, reviewing progress and adapting the approach.

6.2. Necessary Infrastructure for Industrial and Hazardous Waste Management

Hazardous waste management infrastructure will be developed by investing mainly in the private sector. These investments must be made in accordance with the "polluter pays" principle. All hazardous waste treatment facilities must be built in accordance with international standards. Taking into account the estimated amount of waste for the period 2021 - 2031 and comparing these quantities with the currently available infrastructure, ensuring the appropriate treatment of hazardous and industrial waste will be achieved by establishing the following infrastructure:

1) Establishment of centers for the collection of hazardous waste from households (waste oils, waste electrical and electronic appliances, waste batteries, etc.) in each local government;

2) construction of regional warehouses of hazardous waste for its safe collection and storage until treatment in five regions in the Republic of Serbia;

3) construction of facilities for physical and chemical treatment of inorganic and organic hazardous waste and sludge and its storage (this will include transport of residues for further treatment (preparation of fuel from waste/RDF, landfill or export); chemical treatment, capacity 50,000 t/year Residues are sent for further treatment (e.g., preparation of fuel from waste), to proper landfills, or exported from the Republic of Serbia.

4) establishing capacities for incineration of organic industrial and medical waste (incinerators), in combination with capacities for preparation of fuel from waste (RDF); one plant with a capacity of about 30,000 t/year is planned, and for certain types of hazardous waste, it can be partially realized by co-incineration in industrial plants.

5) construction of one landfill for disposal of inorganic industrial hazardous waste, combined with capacities for solidification of sludge from hazardous waste streams - capacity 28,000 - 38,000 t \year;

6) construction of cassettes at regional sanitary landfills, for the reception of asbestos waste.

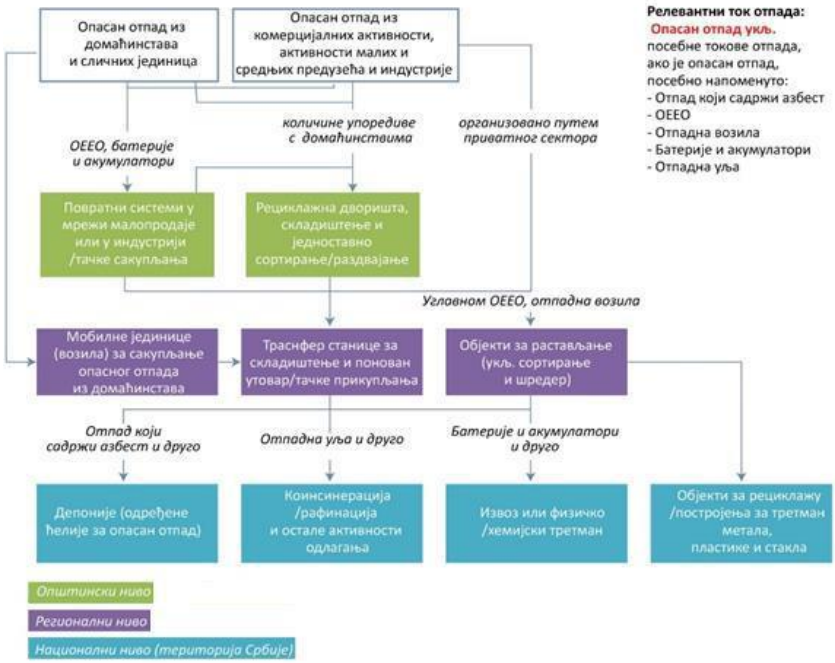


Figure 6.2. *Hazardous waste management infrastructure*

6.2.1. System of Separate Collection of Hazardous Waste from Households

It is necessary to determine the locations of centers for the collection of hazardous waste from households (waste oils, waste electrical and electronic appliances, waste batteries, etc.) in municipalities, which may be next to the centers for separate collection of recyclable waste. Centers for the collection of hazardous waste from households will be equipped with special containers for the collection of batteries, accumulators, packaging from paints and varnishes, pesticides, waste oil, waste from electrical and electronic products, etc. These units will be located next to the waste collection centers. These units are integrated into recyclable waste collection centers and require particularly well-trained staff.

In addition, within the regional waste management centers, warehouses for hazardous waste from households will be built, where hazardous waste from hazardous waste collection centers from households will be brought.

The system of hazardous waste delivery from households can also be supported by mobile collection units. This means that once or twice a year, the vehicle can visit remote areas or less mobile citizens and pick up hazardous waste from households. This vehicle must be adequately equipped and operated by trained personnel. In this case, citizens would be informed about the place and working hours of the mobile waste collection unit.

What all options have in common is that the delivery of hazardous waste from the household should be free for citizens in order to achieve a high percentage of hazardous waste collection and avoid contamination of recyclable components.

6.2.2. Central Regional Hazardous Waste Storage

It is necessary to establish central regional hazardous waste storage facilities, intended for safe storage and preparation of industrial hazardous waste for further treatment or export. Legal entities or operators will be able to deliver their hazardous waste to these central regional warehouses, of which there will be five in the territory of the Republic of Serbia. To define potential locations for the construction of a warehouse, it is necessary to know the locations where hazardous waste is generated in larger quantities. In order to define potential sites for the construction of these warehouses and to ensure some investment security, it will be necessary to analyze regional needs in terms of origin, type and amount of hazardous waste to be stored.

Central regional hazardous waste storage facilities are planned in the following districts: City of Belgrade, Central Banat District, Podunavlje District, Macva District and Nisava District.

Such hazardous waste storage facilities should be managed by companies with experience in the collection, transport, packaging, handling and/or treatment of hazardous waste, which are managed according to market rules. Such regional repositories should not be part of a hazardous waste treatment facility but should operate independently. Central regional warehouses have the function of transfer stations equipped for temporary storage, repackaging, reloading in larger transport units, preparation for transport and further treatment, reloading in larger trucks for long-distance transport or even export. In order to define potential sites for the construction of these warehouses, and to provide some security for private investment, it will be necessary to analyze regional needs in terms of origin, type and amount of hazardous waste stored. The final decision depends on more detailed planning steps regarding regional needs and the readiness of private operators. The expansion of the hazardous waste separation system in trade and industry is necessary to improve the efficiency of all subsequent waste management steps. In other words, without the possibility of separating waste at the source, further procedures become much more expensive and technically much more complex, because such mixtures are difficult to separate at a later stage of handling.

6.2.3. Plants for Physical and Chemical Treatment of Hazardous Waste and Sludge

Data on the type and amount of hazardous waste generated in the Republic of Serbia with regard to future changes in the industrial sectors of the Republic of Serbia show that the need for construction and operation of facilities for physical and chemical treatment of hazardous waste is obvious.

Construction of facilities for physical and chemical treatment of hazardous waste and sludge and facilities for storage of liquid streams of industrial waste (solvents, acids, bases and sludge) is planned in Raska, Rasina, Bor and Zajecar administrative districts.

Capacities should be developed gradually and modularly. Finally, the capacity of the facility for physical and chemical treatment of hazardous waste should cover the needs of about 50,000 tons of waste per year until 2035, based on the total amount of relevant types of hazardous waste generated annually in the Republic of Serbia. The plant should contain all the necessary (and most often determined) elements for the treatment of hazardous organic and inorganic waste. Possibilities of obtaining fuel from the rest of hazardous waste streams should also be considered. The technical documentation will define the appropriate technology and capacities for all units within the facility, as well as organizational and operational characteristics of the facility, all in accordance with international standards and latest achievements, as defined in reference documents for best available techniques in waste management.

6.2.4. Incineration of Hazardous Waste

An incinerator is needed for the treatment of hazardous industrial and medical waste, with a capacity of about 30,000 t/year. The center also includes a landfill, with a capacity of 28,000 - 38,000 t/year, as well as a hazardous waste storage facility. This complex of hazardous waste treatment facilities must be built in accordance with international standards. The planned plant has sufficient capacity for the entire amount of hazardous waste produced annually in the Republic of Serbia.

Hazardous waste incineration plants will be considered in the coming period in accordance with the needs and capacities of existing plants (cement plants, thermal power plants, etc.). Production capacities of existing plants with the possibility of thermal treatment of waste (cement plants, thermal power plants) can be used for co-incineration of certain types of waste, if they meet all the conditions prescribed by law. The entire industry of the Republic of Serbia should work towards finding ways to use hazardous waste in industrial processes with energy production.

In the long run and with more available data on needs, the Republic of Serbia could focus on establishing a central plant for the incineration of hazardous and medical waste. Residues such as packaging waste contaminated with hazardous substances (e.g., packaging waste contaminated with pesticides, chemicals, PCBs, etc.) that must not be incinerated in cement plants require this type of treatment, otherwise the waste must be exported for permanent disposal.

6.2.5. Disposal of Hazardous Waste in Landfills and Solidification/Stabilization of Hazardous Waste before Disposal

The construction of a hazardous waste landfill is required for several types of hazardous waste. Hazardous waste must not be disposed of without prior treatment, so capacities for solidification/stabilization of hazardous waste are required before disposal at the landfill.

There are currently no approved sites for hazardous waste landfills in the Republic of Serbia. Once the sites are identified and approved, the new facilities will be built in line with EU requirements. A system of integrated permits is applied to hazardous waste treatment plants, in accordance with the law.

Mechanisms need to be developed to address historical pollution and/or remediation of environmental damage caused by inadequate waste management. The Cadaster of Contaminated Sites is maintained by the Environmental Protection Agency, and is an integral part of the Land Information System. Risk assessment of contaminated sites with a list of priorities for remediation is also part of the Information System. Obligations of all participants (Republic, Autonomous Province, local self-government, operator, owner) for the implementation of the rehabilitation process are determined by law.

6.2.6. Disposal of Other Industrial Waste

Waste from the energy sector, fly ash and slag, as by-products of coal combustion in thermal power plants and coal-fired heating plants, which are disposed of in landfills, can be used in road construction (lower and upper bearing layer, asphalt mixtures, stabilization), cement production as a raw material for the production of Portland cement clinker and as a mineral additive in the production of cement), for the production of binders and mortars, in the production of concrete (provided it meets the requirements of standard SRPS EN 450), in the production of concrete prefabricates, blocks, sintered ceramics and fibers, sintered light aggregate, etc. Gypsum from desulphurization of flue gases from thermal power plants, as a

by-product, can be further used in the production of gypsum - cardboard and gypsum boards, plasters, coatings, etc. This would reduce the disposal of this waste in landfills. To promote greater utilization of fly ash, it is necessary to improve the regulation on the cessation of waste status, which provides quality criteria.

6.3. Necessary Infrastructure for the Management of Special Waste Streams

In addition to reducing the amount of biodegradable waste disposed of in landfills, specific targets for recycling and reuse of special waste streams must be met. It refers to:

1) targets for recycling and reuse of packaging waste;
2) objectives of collection, recycling and reuse of waste electrical and electronic equipment;
3) goals of collection and recycling of batteries and accumulators;
4) targets for recycling and reuse of waste vehicles;
5) construction waste recycling targets (excluding excavated soil).

Achieving the full specific targets for separate collection, recycling and reducing the generation of special waste streams goes far beyond the timeframe of this Program.

The construction of infrastructure for the management of special and other waste streams will be developed by private sector investment, based on waste management permits and regulations on ways and procedures for the collection, transport, treatment and disposal of special waste streams. It is necessary to create a management system (collection, storage, dismantling and other types of treatment, final disposal) for all special waste streams regulated by the EU and national waste legislation.

The quality of recycling is essential when it comes to compliance with other EU objectives (the 65% Waste Framework Directive “preparation for re-use and recycling”). By-products from the recycling process, which are correlated with impurities that may be found in the primary waste fractions collected, must be taken into account; this means that emphasis must be placed on collection schemes that can ensure the high quality of the materials collected.

For the purpose of expanding the network of separate collection of packaging waste, it is necessary to set up collection points with containers for separate collection of packaging waste (for glass, metal, paper, PET).

Considering the reported quantities of metal and plastic waste, the existing recycling/reuse capacity does not need to be expanded. For other packaging waste, the need for additional capacity can be assessed through separate collection at the place of origin. For example, packaging glass is recycled in only one facility. Wood waste is used for heating (as briquettes and pellets), and to a limited extent, in cement kilns. Wood packaging, especially pallets, is reused (repaired) during the use phase and the useful life of that packaging. When they can no longer be used as pallets, they are usually recycled into slabs.

In parallel with the establishment of separate collection, the private sector recycling industry will expand in relation to demand.

In order to benefit from recycling products, various related activities need to be carried out at the local level. These activities include reuse, as one of the ways to strengthen the national economy through local activities.

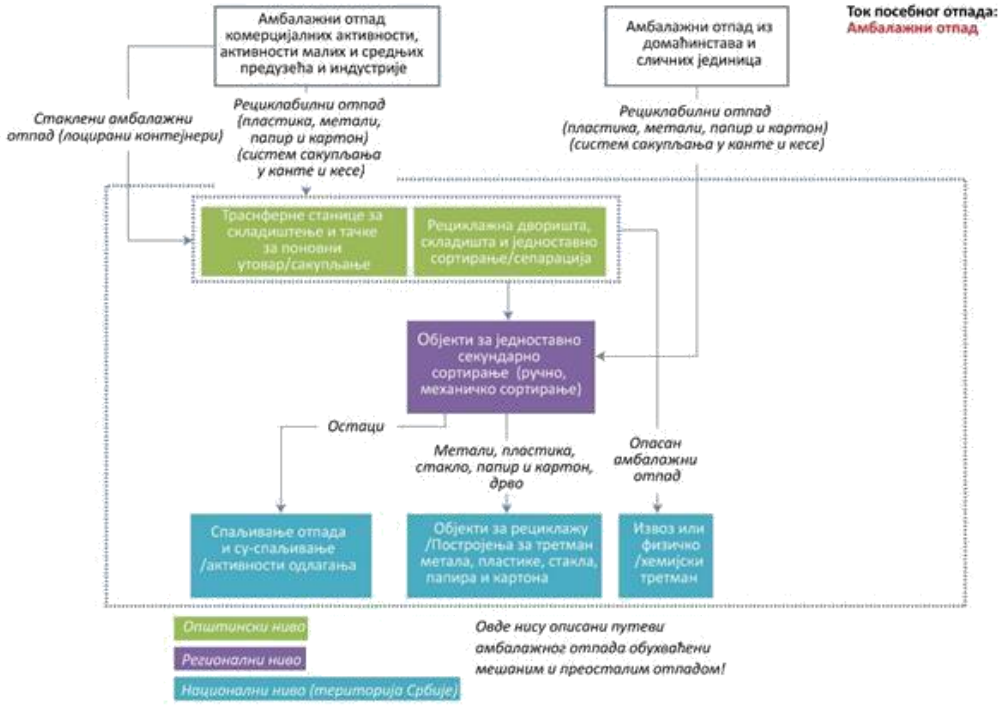


Figure 6.3. *Packaging waste management infrastructure*

The establishment of an adequate network for the collection of portable used batteries and accumulators is needed by 2025. Sorting of mixed portable batteries should begin as soon as the appropriate collected quantities are available. Medium-term needs can be met by integrating the necessary sorting activities into a plant for dismantling waste electrical and electronic equipment, without incurring large additional costs. For the purpose of establishing the collection of used batteries, the following is required:

α. one mobile waste collection center in each waste management region, a total of 27;

β. one regional storage in each waste management region, a total of 27.

Having in mind the current and expected future quantities of portable batteries in Serbia, it is considered that after estimating the required capacities, it will be enough to establish one sorting plant.

As far as car batteries are concerned, the Republic of Serbia has sufficient treatment capacity, and if the quantities increase in the future, the market will react by developing additional capacities.

Transitional collection targets, calculated on the basis of the total mass of collected waste from electrical and electronic equipment, expressed as a percentage of the average mass of electrical and electronic equipment placed on the market in the three-year period 2018-2020, will be achieved by 2031.

The goals will be achieved by increasing the level of waste collection from electrical and electronic equipment, construction of centers for waste collection from electrical and electronic equipment from households. 169 such centers are planned, which will become operational by the end of 2028.

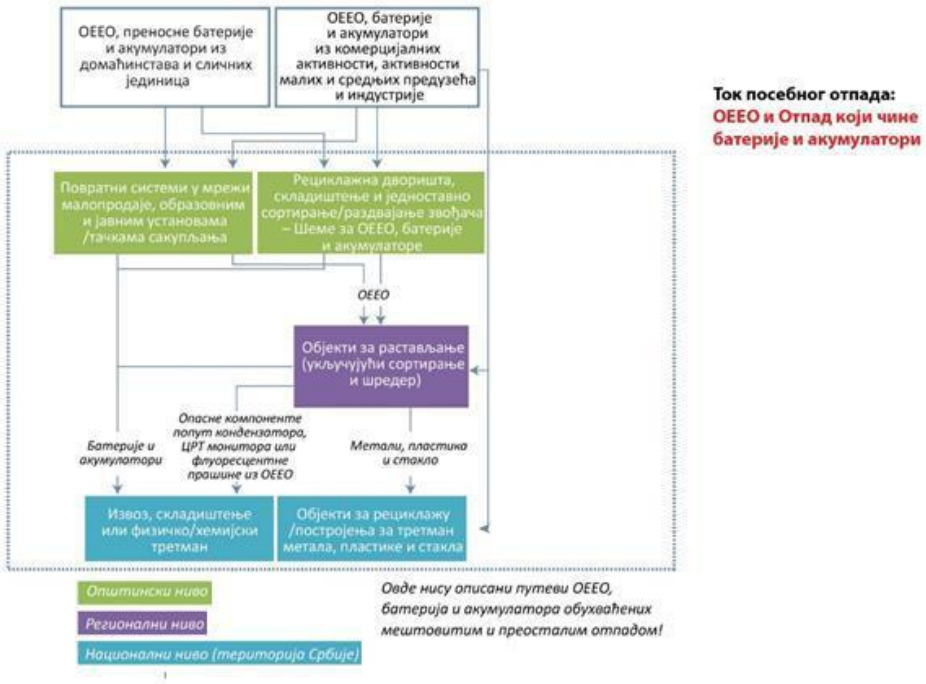


Figure 6.4. *Infrastructure for waste management of electrical and electronic equipment and waste batteries and accumulators*

Request to achieve reuse target[3] of 40% by the end of 2029, for construction and demolition waste will be achieved by establishing an infrastructure for pre-treatment of construction and demolition waste at the regional level before recycling, determining the location of treatment and the operation of one mobile treatment plant in the region. The ultimate goal is the pre-treatment of 70% of construction and demolition waste by the end of 2034. Uncontaminated soil and other natural material excavated during construction, where it is certain that the material will be used for construction in its natural state at the site from which it was excavated, is not included in these 40% and 70%, respectively.

It is necessary to introduce separate collection of mineral construction waste in order to increase the recycling rate, and separate collection of hazardous waste from construction and demolition generated at a particular site. So, non-hazardous mixed construction waste, which is suitable for recycling, should be stored separately and transported to the appropriate recycling plant. Mixed construction waste of low quality, which is not suitable for recycling, should be taken to a registered landfill.

It is proposed to establish locations with mobile units at the regional level for construction and demolition waste. Considering that the installation and maintenance of construction and demolition waste management systems is the responsibility of market participants, these installations should primarily be established by the private sector. Excavation soil can be used for backfilling and leveling the terrain, for devastated locations, etc.

Conditions for achieving the goal of preparation for reuse, recycling and other reuse of materials, including the process of backfilling using waste instead of other materials, by 40% by 2029 and 70% of construction and demolition waste in 2034, will be created by establishing infrastructure for pre-treatment of construction and demolition materials at the regional level before recycling, by designating special areas for processing, as well as establishing the infrastructure for the operation of one mobile processing machine in the region. For the needs of construction and demolition waste management, the following is required:

[3] *Preparation for reuse, recycling and reuse of waste material, including waste spreading procedures to replace other materials.*

1) mobile plants for the treatment of construction and demolition waste; one mobile plant is planned in each waste management region, in total - 26;

2) construction and demolition waste treatment plant; at least one plant in Belgrade, with the capacity of 200,000 t/year;

3) providing appropriate sites for the treatment of construction and demolition waste and storage of this waste after treatment in each local self-government.

Asbestos from construction and demolition waste can be disposed of in special cells of regional sanitary landfills.

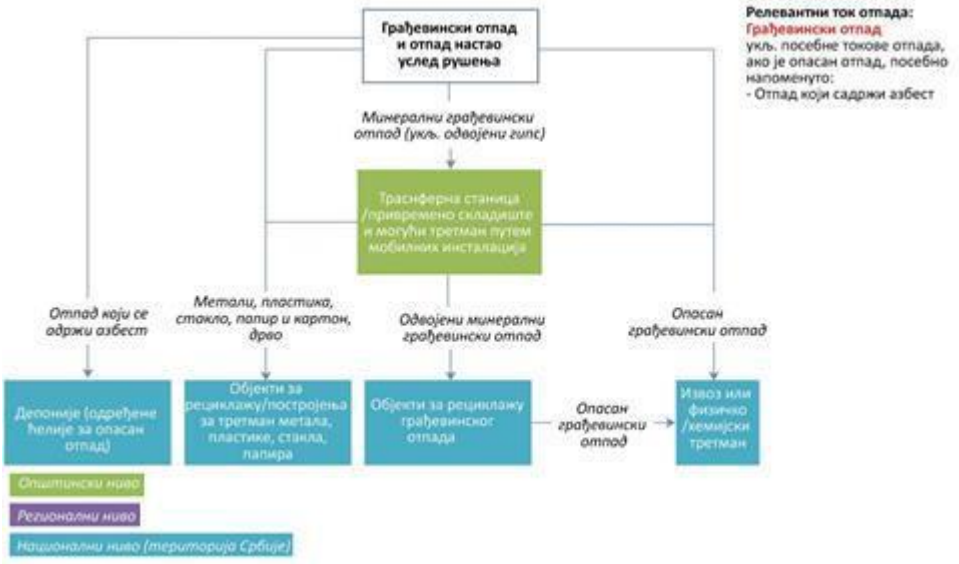


Figure 6.5. *Construction and demolition waste management infrastructure*

For the purpose of establishing a waste vehicle collection network, it is necessary to build waste vehicle collection stations established in larger cities (Uzice, Kraljevo, Novi Sad, Valjevo and Nis), five collection stations in Belgrade and two in each of the other waste management regions.

For the needs of waste oil management, the existing treatment capacities (thermal treatment and recycling) far exceed the amount currently collected. According to available data, the potential treatment capacity can be estimated in the range of 25,000 t for recycling/reuse and 16,000 t for energy production. It is necessary to provide better separate collection of waste oil and provide treatment of waste oil in accordance with law.

It is necessary to further develop a system of separate collection of waste tires and the treatment of all separately collected waste tires. It is also necessary to ensure the recycling of at least 80% of the mass of separately collected waste tires per year.

For the purpose of establishing an adequate network of facilities for the treatment of hazardous medical and hazardous pharmaceutical waste, it is necessary to build a facility for the incineration of hazardous medical and hazardous pharmaceutical waste.

When planning long-term investments in management infrastructure for sludge from municipal wastewater treatment, it should be borne in mind that the EU gives priority to the use of sludge materials. It is necessary to focus on the maximum utilization of energy from sludge and the possibility of using sludge (e.g., as fertilizer). Based on the quality of the sludge, the preferred possibilities for reuse are: composting (R3); co-incineration (R1); co-incineration in cement plants (R1); mono-incineration (burning of only sewage sludge). Sludge owners are

obliged to ensure proper disposal and use of sludge from wastewater. Objectives, measures and activities for sludge management from wastewater treatment will be determined by a special Program.

As treatment options for secondary waste from waste treatment may include specific technologies or even export to other countries for treatment, and as they largely depend on the options applied in primary treatment, no clear needs assessment has been identified so far. Responsibility for treatment and handling remains with the operator or may be transferred to other licensed operators. At a time when significant amounts of these waste streams are generated, feasibility studies are being carried out to help clarify possible treatment options, in particular taking into account the environmental impact assessment and the minimum requirements taken into account in the permitting process for such facilities.

6.4. Necessary Economic and other Instruments for Waste Management

The Republic of Serbia will apply various economic instruments, financial and non-financial incentives to achieve changes in the waste management sector. The implementation of certain instruments will be continued, and new instruments will be considered in case they are deemed necessary to achieve the set objectives, after conducting analyzes and determining acceptable transition periods for system adjustment. The implementation of these instruments will lead to a reduction in waste generation, an increase in the amount of waste that is separated at the place of origin, an increase in the amount of recycled material. Some of the instruments will contribute to the financing of investments in the waste management system and the coverage of operating costs.

Tariffs

The current level of tariffs for households for waste management services generally reflects a very low, non-compliant infrastructure. Tariffs vary considerably, mostly around 0.5% of household income. They will inevitably have to be gradually increased by building infrastructure. The affordability limit is considered 1.5% of household income. Targeted tariffs (such as pay-as-you-throw schemes) will be implemented to enable further development of basic infrastructure and administrative systems.

Reform of public utility companies

The increased complexity of modern waste management systems will require greater technical and administrative capacity of utility companies. Currently, many local utilities have significant cross-subsidization of activities, making it difficult to control the cost of specific activities. Utility reform should lead to greater regionalization of services in order to achieve greater financial efficiency and utilize the necessary skills.

Waste disposal fees

Additional fees to the already existing landfill fees are expected to be part of the future incentive scheme. The purpose of these fees is to make the use of landfills that do not meet the prescribed conditions more expensive compared to landfills that do not meet these requirements. Once all regions are covered by eligible waste disposal services, the fees will be developed to encourage the prevention, recycling and treatment of biodegradable waste.

Packaging deposit system

The deposit return system will most likely contribute to the increase of collected and recycled quantities of packaging waste. The deposit system also affects the quality of the collected packaging waste, there are far fewer impurities. In short, a refund system could

contribute to meeting the EU's reuse and recycling targets. The biggest challenge is facing the relatively high cost of investing in the system.

Pay-as-you-throw

Waste fees formed according to the "pay-as-you-throw" approach represent the application of the polluter pays principle. The purpose of this fee is for households and legal entities to be able to influence the amount of money they pay for municipal waste collection services for as much waste as they generate. If they separate waste at the place of origin, compost, etc., they may require a smaller amount of waste fees. Although this type of waste fee is easier to apply in areas with family homes, it is currently more common in urban areas.

Extended producer responsibility

The experience of other EU member states shows that extended producer responsibility is an effective mechanism both for achieving the goals of EU legislation regarding waste and for the organization of the market itself, but under the supervision of environmental authorities.

In addition, the new EU Circular Economy Action Plan sets new targets for recycling, and mandatory deposit programs are listed as one possible measure to help countries achieve these goals.

After the full transposition of EU legislation, it is necessary to develop a system of collective operators in order to fully develop a program of extended producer responsibility in accordance with the obligations of EU legislation.

It is necessary to introduce schemes for the implementation of extended producer responsibility with clearly defined geographical, production and material coverage, on the entire territory of the Republic of Serbia. Adequate availability of waste collection systems should be ensured and the necessary financial and organizational resources should be provided to meet the obligations of extended producer responsibility.

6.5. Summary of the Infrastructure Needed for Program Implementation

Table 6.2. *Capacities of new plants for collection, reuse, treatment, and disposal of waste*

Overview of needs for a new Infrastructure	Level of Implementation	First phase (capacity)	Second phase (capacity)	Relevant waste streams
Establish a system of waste collection bins for separate collection of communal waste that covers 100% of the population of the Republic of Serbia.	Household level Municipal level	179 additional new trucks for the collecting. Minimum two containers for separate collection of dry and damp factions - 3,140,806 (120-litre containers, mostly for private houses). 46.399 (containers of 1.1 m3). After establishing sites for the collection of green waste, introduce a third bin for separate collection of bio waste.	Development of a separate system of biowaste collection. The number of required containers must be determined by estimation of available capacity of biological treatment plants. Typical containers: 0.12 m^3 and 0.24 m^3 for family houses, 1.1 m^3 for collective housing.	Municipal waste from Households (including packaging waste, biowaste), mixed municipal waste.
Establish a network of centers for waste collection across land for various municipal waste including household hazardous waste.	Municipal level	Construction of one waste collection center in each municipality and one center for the collection of household hazardous waste.	Further development based on demand.	Household waste (including packaging waste, waste from electrical and electronic equipment, batteries, green waste, etc.).
Build a transfer station for the purpose of reloading waste before further transport in regional centers.	Regional level	Number of transfer stations in each region is defined during the technical assessment of future regional systems, primarily depending on the distance to the landfill and quantities of waste transported. In total 42 stations are planned.		Mostly municipal waste

Overview of needs for a new Infrastructure	Level of Implementation	First phase (capacity)	Second phase (capacity)	Relevant waste streams
Establish regional waste management centers with appropriate lines for separation of waste that can be recycled - in every waste management region.	Regional level	Total required capacity ~ 750,000 t per year. It is planned that in each region there is one line for secondary separation. ~ 25-30,000 tons per year.		Household waste (including packaging waste, waste from electrical and electronic equipment, batteries, hazardous waste).
Establish a sanitary landfill in each waste management region in Serbia.	Regional level	For planning purposes, it is assumed that infrastructure of each regional system includes an appropriate landfill, unless there are already some interregional cooperation agreements in terms of waste disposal landfill. In some regions exists partial or complete infrastructure.		Non-hazardous waste, residual municipal waste.
Build small composting plants (composting lines) for composting biowaste.	Municipal level	One location per municipality for easy composting of green waste and separately collected biowaste is planned within the First Phase. A total of 160 locations.	The network can be expanded during Second Phase, depending on progress in fulfillment goals and price constraints accessibility.	Green and park waste, biowaste separated in place origin (kitchen, garden and plant waste).
Introduction of home composting in rural areas.	Household level Municipal level	Establish home composting for citizens in rural and semi-urban areas, advise and provide support to interested citizens 512,190 (700–900-liter containers). Mainly for individual households in semi-rural and suburban area.	Further development based on demand.	Biodegradable waste from households

Overview of needs for a new Infrastructure	Level of Implementation	First phase (capacity)	Second phase (capacity)	Relevant waste streams
Build large plants for biological treatment of biowaste separated on place of origin.	National level		Capacity for 380.000 tons per year is required by 2034. A detailed assessment of options is needed for a biological treatment of waste at sites for composting green waste, sewage treatment plants or construction of new plants for separately collected biowaste.	Green and park waste from, biowaste separated in place origin (garden and kitchen waste)
Build RDF plants for municipal waste from households.	National level		3 plants of average capacity ~ 75,000 t per year. The infrastructure is predicted in three regions: Novi Sad, Kragujevac, Nis.	Residual mixed municipal waste, sewage sludge.
Build plants for incineration of municipal waste with the production of electricity and heat	National level		One plant in Belgrade, with a capacity of 340,000 t / year and two more plants in Nis and Kragujevac.	
Interruption and closure of all unsanitary landfills and dumps and reclamation of closed landfills and dumps.	Municipal level/Regional level	Shutdown and prevention of waste disposal at unsanitary landfills and disposal areas (includes cheap measures such as blocking access roads, fencing territory, placing signs with information and other actions to be chosen as the most efficient in each specific case. These investments may be included in the First or Second infrastructure financing phase or can be implemented as stand-alone programs.		

Overview of needs for a new Infrastructure	Level of Implementation	First phase (capacity)	Second phase (capacity)	Relevant waste streams
Build regional warehouses	National level	Build five regional warehouses for hazardous waste		Hazardous waste from legal entities and hazardous waste from centers for collecting hazardous waste from households
Build a plant for physical and chemical treatment of hazardous waste.	National level	Construction of two facilities for physical and chemical treatment of inorganic and organic hazardous waste and sludge with units for storage of liquid streams of industrial waste and sludge. The required capacity is at least 50,000 tons per year.		Hazardous waste, waste oil.
Capacity building for burning organic industrial and medical waste.	National level	~ 30,000 tons per year, partially by co-incineration in industrial drives.		Hazardous waste, medical and pharmaceutical waste.
Build a landfill / cassette for hazardous waste disposal.	National level	Separate cassettes on regional sanitary landfills for waste from construction and demolition and asbestos. A feasibility study needs to be prepared to determine the best location for construction of infrastructure and to explore infrastructure options.	1 landfill for hazardous waste, ~ 50,000-70,000 tons of dangerous inorganic waste.	Hazardous waste, waste that contains asbestos, medical waist, pharmaceutical waste.
Special containers for packaging waste will be installed in all municipalities in Serbia.	National level	1 location with containers for glass and paper per 700 inhabitants. In addition, 1 container for plastic per 1400 inhabitants.		Packaging waste, glass, plastic.

Overview of needs for a new Infrastructure	Level of Implementation	First phase (capacity)	Second phase (capacity)	Relevant waste streams
Establish mobile facilities for the treatment of mineral waste from construction and demolition.	Regional level	One mobile unit per region. Total of 26.		Mineral waste from construction and demolition.
Establishment of one mobile plant for collecting portable batteries in the region.	National level	One mobile unit per region. Total of 26		Used portable batteries
Establishing appropriate collection networks for waste vehicles.	National level	By 2025, three certified waste collection plants will be established in larger cities (Uzice, Kraljevo, Novi Sad, Valjevo and Nis), five certified facilities for the disposal of waste vehicles will be established in Belgrade, and two facilities will be established in each of the remaining region.		

7. MEASURES FOR ACHIEVING GOALS AND THEIR IMPACT ON THE ENVIRONMENT

7.1. Measures for Fulfillment of Specific Objectives

Measures for fulfillment of the specific objectives are measures initiated in the previous period and new measures determined on the basis of the presented concept of integrated waste management based on set EU standards. In line with these standards, priority has been given to separate waste collection and recycling, as well as obligations undertaken for the EU accession. The duration of most measures is longer than the duration of the Program, with performance indicators determined for the last year of the Program. A few measures have a shorter duration, which is specifically indicated.

Specific objective 1: Improved municipal waste management system through increased recycling rate, reduced disposal of biodegradable waste in landfills and reduced disposal of waste in unsanitary landfills

The implementation of this objective is based on the provisions of the EU Waste Framework Directive 2008/98/EC as amended by Directive (EU) 2018/851, the EU Landfill Directive 1999/31/EC as amended by Directive (EU) 2018/850 and the EU Directive for Packaging and Packaging Waste 94/62 / EC as amended by Directive (EU) 2018/852.

Measure 1.1. Extension of collection coverage to 100%

This measure aims to increase the number of inhabitants covered by the municipal waste collection system gradually to 100%. The measure continues from the previous period. The needs of waste collection infrastructure relate to appropriate containers and vehicles for waste collection and transport. The number of trucks in each local government should be estimated based on the specific characteristics of each region, including the amount of waste collected per shift, the daily amount of waste generated in the municipality, the annual amount of generated waste, the frequency of waste collection, number of households, etc. When defining the need for additional vehicles, the age and capacity of the existing fleet infrastructure were considered.

Relevant institution: local self-government units.

Implementing partners: public utility companies, private companies

Type of measure: Provision of Goods and Services (PGS)

Measure 1.2. Improvement of the system for separate collection and recycling of municipal waste

To implement this measure, which is continued from the previous period, the following is required:

- harmonization of national regulations with the EU Package for Circular Economy
- introduction of separate collection of recyclable materials by establishing a system of (at least) two bins - one for mixed waste and the other for recyclable waste - covering 100% of the population of Serbia (for waste which is subject to collective schemes by proportional contribution);

- establishing a network of waste collection centers throughout the country: depending on population density, one or more centers will be established in each municipality. These centers will be used as "recycling yards", where citizens will bring waste that must not be disposed of in household waste bins, including e.g., bulky waste (e.g., old furniture), special types of waste, green waste, hazardous household waste, electrical and electronic equipment waste, batteries waste oil and the like;
- introduction of secondary separation of recyclable products by establishing regional waste management centers with appropriate secondary separation lines, so that recyclable waste can be separated into certain fractions for further processing - in each waste management region;

The target value is to increase the recycling rate of household waste to a total of 25% by weight by 2025 and 35% by 2030, and the final target is 50% by the end of 2039 and 65% by the end of 2054.

By 2025, the preparation for reuse and recycling of municipal waste will increase to a minimum of 55% by weight, and by 2030 to 60% by weight.

Although packaging material is listed in subgroup 15 01 of the Waste Catalog, packaging waste is considered part of municipal waste. The collection and recycling of municipal packaging waste by type of material assumes that by 2028, 100% separate collection will be introduced in the Republic of Serbia and that awareness-raising and education campaigns will lead to an adequate response from citizens.

It is necessary to establish a two-bin waste collection system - one for mixed waste and the other for recyclable waste covering 100% of the population. They will be gradually supplemented by separate collection of the following materials for recycling: glass (~ 100% packaging), secondary waste separation - existence of regional waste management centers with lines for secondary separation of recyclable waste, as well as separate collection of biowaste. By the end of 2029, Serbia should establish a separate collection for paper, metal, plastic, glass, and textiles.

Collection points ("recycling islands") with containers for separate collection of packaging waste (for glass, metal, paper, PET), biodegradable waste and other mixed waste in the period up to 2031 are planned in the following regions: Vranje, Krusevac, Uzice, Pancevo, Pirot, Sremska Mitrovica, Nova Varos, Novi Sad, Kragujevac, Zrenjanin, Valjevo and Belgrade.

An addition approach is also proposed to create a network of waste collection centers across the country. In the First phase, each municipality will have one center for waste collection, so later more facilities will be added, depending on the needs.

Plants for the secondary separation of recyclable waste are planned where the primary separation was carried out at the place of origin (household). Each regional system will have a secondary separation line.

Relevant institution: local self-government units.

Implementing partners: public utility companies, regional utility companies, Ministry of Environmental Protection, Autonomous Province

Type of measure: PGS

Measure 1.3. Establishment of separate collection of biodegradable waste to reduce its disposal in landfills

Separate collection of biodegradable waste needs to be established; it is necessary to build the required infrastructure, including regions working on the model of public-private partnership, to achieve partial compliance with the EU Waste Directive and the Landfill Directive in line with the objectives.

The target value is to reduce the disposal of biodegradable waste in landfills by 2028, to 75% of the total amount of biodegradable waste generated in 2008, or 50% by the end of 2032 and finally to 35% by the end of 2039. Reduction of municipal waste disposal at landfills to a maximum of 10% by the end of 2049 will be ensured by economic measures to prevent and reduce waste generation, high degree of primary separation and waste treatment, home composting and stabilization of the remaining fraction of biodegradable waste.

Redirection of biodegradable waste will be achieved by increasing the level of home composting in rural areas, separate collection and composting of green waste in municipalities, redirection of green waste from public areas, redirection of paper/cardboard using recycling strategies, and construction of treatment plants. Composting is planned as the most affordable option for the treatment of biodegradable waste. It is planned to collect and build a separate location in the municipality for composting green waste in the open. This model would be extended to RDF/biological treatment in the regions of Novi Sad, Kragujevac, Uzice and Subotica.

In addition to reducing the amount of biodegradable waste disposed of in landfills, the defined measures will contribute to meeting the recycling targets for packaging paper and cardboard.

It is important to note that according to the Waste Framework Directive, municipal biowaste entering aerobic or anaerobic treatment from 1 January 2027 can only be considered as recycled if it is collected separately or separated at the place of origin.

Relevant institution: local self-government units

Implementing partners: public utility companies, regional utility companies, Ministry of Environmental Protection, Autonomous Province

Type of measure: PGS

Measure 1.4. Establishment of new regional centers with sanitary landfills

This measure, which was started in the previous period, continues. It is necessary to form inter-municipal agreements on joint waste management in regions that do not have an agreement; establish local and regional waste management institutions and build capacity; adopt regional and local waste management plans; work on raising public awareness of the need and conditions for the construction of regional waste management centers.

The first phase envisages the construction of regional waste management centers in all regions.

Where economically viable, transfer stations may be introduced to reduce transport costs and, in some cases, the number of vehicles passing through the populated place. Transfer stations are considered more of a possibility than a necessary element of the system. The number of transfer stations in each region is defined during the technical assessment of future regional systems, primarily as a function of the distance from the landfill and the amount of waste to be transported. Additional transfer stations may be introduced at later stages if circumstances change. Transfer stations offer special value where regions seek to reduce the number of landfills that need to be built through cooperation with neighboring facilities.

The remaining waste will be disposed of in regional sanitary landfills built according to the requirements of the Landfill Directive. For cost estimation, the construction process is divided into several parts. The first phase will include the installation of the first cell (5-7 ha or approximately 5-7 years capacity) in the landfill itself (except in cases where a more detailed assessment has been carried out to consider local conditions) and related infrastructure. After this period, the additional cells will be financed by the regional waste management centers as an operating cost, using revenue from tariffs / cost recovery measures. It is not envisaged that all regions will have dedicated landfills, some will use neighboring facilities.

The amount of waste disposed of in existing unsanitary landfills will also be gradually reduced.

It is accepted that the use of landfills at the bottom of the waste hierarchy is the least desirable of all options. Progressive reduction of landfill waste will be implemented through the following multiple approach:

- institutional - targets for recycling and diversion of biodegradable waste will be integrated into local, regional and national planning documents. Initially, local governments should have support in meeting their goals through appropriate technical and infrastructural assistance, but implementation measures should also be strengthened;

- financial / economic - investment planning and financing should give priority to primary separation and diversion of biodegradable waste, while economic instruments such as landfill fees should affect reduced landfill disposal;

- technical - the choice of technical solutions and infrastructure investments for each project should be clarified in feasibility studies. Technical solutions should take into account national policies and institutional and economic measures. For example, requiring a waste management region to have at least 250,000 inhabitants and encouraging more than one region to share the same regional sanitary landfill.

By 2030, it is planned to open regional centers in: Nova Varos, Belgrade, Krusevac, Kragujevac, Valjevo, Pozarevac, Vranje, Novi Sad, Inđija, Sombor, Smederevo, Pancevo, Kraljevo, Nis, Zrenjanin and Vrsac.

The following regions are not expected to build their regional sanitary landfills within the Regional Waste Management Centers: Vrsac, Zrenjanin and Smederevo[4]. The Decision on Collective Provision and Implementation of Waste Management was passed by the Government of the Republic of Serbia in support of this approach, providing guidelines for the wider use of existing capacities of regional sanitary landfills. Regional Waste Management Centers remain in place, which will have other necessary waste treatment facilities. Technical documentation for alternative transport and treatment solutions will provide the final assessment and proposal.

The ultimate goal is to form all regional systems and regional centers by 2034, and to dispose of all municipal waste in regional sanitary landfills, not in non-sanitary landfills.

Relevant institution: local self-government units

Implementing partners: public utility companies, regional utility companies, Ministry of Environmental Protection, Autonomous Province

[4] Planning investment costs for now assumes that landfills will still be needed for those regions. Once the technical documentation for alternative transport and treatment solutions is developed, the costs will be updated

Type of measure: PGS

Measure 1.5. Introduction of economic instruments to encourage change in the municipal waste management sector

Reform of the tariff system for municipal waste management is needed. Tariff reform for municipal waste management should introduce the principles of pay as much as you throw away and reimbursement of costs, considering affordability. This means that a significant part of the total compensation will be directed to the amount of waste generated to encourage prevention and reuse of waste. Fees for the waste management service must be restructured to be based on the number of containers and discharges, instead of lump sums (number of persons or square meters of living space). Lower tariffs may be introduced for separately collected recyclables to provide an incentive for citizens to separate waste at the point of origin.

The increased complexity of modern waste management systems requires greater technical and administrative capacity than utility companies. Utility reform is needed, which is likely to lead to greater regionalization of services to achieve greater financial efficiency.

It is proposed to introduce a fee for the use of the landfill, which requires harmonization of regulations. The introduction of a landfill use fee can have a special impact on reducing the amount of landfills for the following types of waste: mixed municipal waste, mineral construction waste, hazardous waste. This is expected to be part of a future incentive scheme. In the first place, disposal fees would be higher for existing non-sanitary landfills to encourage local governments to sign an inter-municipal agreement and build sanitary landfills. Once all regions are covered by eligible landfill services, the fees will be developed to encourage the prevention, recycling, and treatment of biodegradable waste.

The range of measures will probably be progressively wider and deeper as the experience of the Republic of Serbia increases, economic development and understanding of the population, as well as adaptation to changes in the EU environmental acquis.

Relevant institution: Ministry of Environmental Protection**,** Ministry of Finance, Ministry of Public Administration and Local Self-government

Implementing partners: local self-government units, Autonomous Province

Type of measure: Incentive (I)

Measure 1.6. Closure and rehabilitation of existing non-sanitary landfills for municipal waste

This measure will not be fully implemented during the period covered by this Program. The number of unsanitary landfills will be reduced to zero by the end of 2034, if all the conditions for financing the development of infrastructure are met.

The first step in closing all non-sanitary landfills is planned immediately after the opening and commissioning of new regional sanitary landfills. This phase is already being implemented and will continue until the commissioning of all planned regional landfills.

However, the second step will include the reclamation of all unsanitary landfills and will begin after the establishment of all planned regional landfills.

Relevant institution: local self-government units

Implementing partners: Ministry of Environmental Protection, Autonomous Province

Type of measure: PGS

Measure 1.7. Conducting an information campaign on the municipal waste management system intended for citizens

Awareness-raising campaigns on the separation of household waste and similar facilities involving hazardous waste (including pharmaceutical and medical waste), biowaste (including food and garden waste), and other recyclable materials (plastic, metal, wood, glass, paper and cardboard) will be implemented at different levels. On-site waste separation campaigns will target, inter alia, schools and all levels of education to familiarize young people/stakeholders with current waste management systems. Training courses should be introduced as an integral part of educational programs. Brochures and courses will also be shared. Households will be informed about the needs and possibilities of the system. This includes information on the location, type, marking and size of the containers (and waste collection centers) available in the vicinity of the settlement, and on the type of waste covered by each type of container. The role of civil society organizations in the implementation of the information campaign on the municipal waste management system intended for citizens is especially important.

In rural and semi-urban areas of the waste management region, citizens and households will be provided with the possibility of home composting. Therefore, targeted information campaigns will be conducted to enable active participation of the public and citizens. The exchange of information and experiences at the local, regional, and national levels is particularly useful in order to improve awareness raising.

Relevant institution: Ministry of Environmental Protection, Autonomous Province, local self-government units

Implementing partners: Ministry of Education, Science and Technological Development, Ministry of Health, Ministry Trade, Tourism and Telecommunications, Serbian Chamber of Commerce, civil society organizations

Type of measure: Informative-educational (IE)

Specific objective 2: Sustainable hazardous waste management system in place

The implementation of this objective is based on the provisions of the EU Waste Framework Directive 2008/98 / EC as amended by Directive (EU) 2018/851 and the EU Industrial Emissions Directive 2010/75 / EU.

2.1. Establishment of a network for the collection of hazardous waste from households

This measure envisages the establishment of at least one center for separate collection of hazardous waste from households in each municipality in the Republic of Serbia. In addition to enabling the separate collection of recyclable materials and special household waste streams, these sites will be equipped and have adequate staff to receive hazardous household waste. The collected hazardous waste will be regularly delivered to waste management operators who have the appropriate permits or to regional hazardous waste warehouses. By the end of 2029, the Republic of Serbia will establish a separate collection of hazardous waste fractions produced by households.

In addition, for specific hazardous waste streams (such as pharmaceutical waste, batteries), a collection system or the possibility of return free of charge, or within a collective scheme, will be established.

Relevant institution: Ministry of Environmental Protection, Autonomous Province, operators in hazardous waste management

Implementing partners: local self-government units

Type of measure: PGS

Measure 2.2. Capacity building for storage, treatment and disposal of hazardous waste

It is necessary to build five regional hazardous waste warehouses in five regions of the Republic of Serbia, which are mainly managed by private operators in the waste management sector. It is envisaged that hazardous waste from hazardous waste collection centers from households, from shops (recovery of specific hazardous waste from households) and various enterprises (hazardous industrial waste) will be transported to warehouses from which it is further shipped to hazardous waste treatment facilities or is exported.

It is planned to build at least one plant for physical and chemical treatment of inorganic and organic hazardous waste and sludge with units for storage of liquid streams of industrial waste (solvents, acids, bases, oily waste) and sludge. The minimum required capacity is ~ 50,000 t per year, and it should be developed modularly. Residues are sent for further treatment (e.g., preparation of RDF- fuel from waste) to proper landfills or exported from the Republic of Serbia.

Establishment of capacities for incineration of hazardous waste with capacities for preparation of fuels from organic hazardous waste streams. The total required capacity is ~ 30,000 t per year for certain types of hazardous waste, and it can be partially realized by co-incineration in industrial plants.

It is necessary to establish a landfill for inorganic hazardous industrial waste with capacities for solidification of sludge from hazardous waste streams before disposal. The required capacity is between 28,000 and 38,000 tons per year.

It is necessary to conduct public awareness campaigns and inform the general public or target groups and stakeholders about hazardous waste at all stages of planning and capacity building for hazardous waste storage and treatment.

Relevant institution: Ministry of Environmental Protection, Autonomous Province.

Implementing partners: Serbian Chamber of Commerce, private partners, operators in hazardous waste management.

Type of measure: PGS

Measure 2.3. Identification, recovery, and remediation of contaminated sites

Based on the Cadaster of Contaminated Sites maintained by the Environmental Protection Agency, there is an urgent need for recovery and remediation for all sites that are potentially contaminated and pose a risk to the environment. According to the priorities, it is necessary to prepare technical documentation and carry out recovery and remediation. Remediation of sites with historical hazardous waste is also needed.

Relevant institution: Ministry of Environmental Protection, Autonomous Province.

Implementing partners: Environmental Protection Agency, local self-government units, industrial plants

Type of measure: PGS

Specific objective 3: Increased rate of collection, reuse and recycling of special waste streams and more efficient use of resources

The implementation of this objective is based on the provisions of the EU Waste Framework Directive 2008/98 / EC as amended by Directive (EU) 2018/851, the EU Packaging and Packaging Waste Directive 94/62 / EC as amended by Directive (EU) 2018/852 and other EU Directives relating to specific waste streams, in particular: used batteries and accumulators, waste oils, waste vehicles, electrical and electronic equipment waste, POPs waste (containing long-term organic pollutants) and PCB waste (containing polychlorinated biphenyls), medical waste, asbestos from construction and demolition waste, packaging waste

Measure 3.1. Establishment of collective operators for special waste streams (waste from electrical and electronic equipment, spent batteries and accumulators and waste vehicles, etc.) according to the principle of extended producer responsibility for the entire product life cycle

In order to improve the management of special waste streams in the Republic of Serbia, it is planned to introduce a collective scheme of extended producer responsibility according to the provisions of the revised Waste Framework Directive. The Law on Waste Management should prescribe the establishment of collective schemes for packaging waste, waste vehicles, waste from electrical and electronic equipment and spent batteries and accumulators. An assessment will be made as to whether special waste streams, such as waste oil, pharmaceutical waste, waste tires, will be covered by the principle of extended producer responsibility. A clear division of responsibilities for packaging waste management is needed between municipalities and collective schemes. Contractual arrangements between them should allow municipalities to influence decisions regarding the performance of the packaging collection system (which is an obligation of the collective scheme). This obligation may also include organizational responsibility and responsibility to contribute to waste prevention through product reuse and recyclability.

It is necessary to improve the regulations governing the application of the principle of extended producer responsibility - setting minimum standards for the treatment of certain waste streams and establishing a legal framework for collective schemes for individual waste streams and establishing a legal basis for the national register of manufacturers / importers of electrical and electronic equipment, batteries and accumulators. and other waste streams for which collective schemes will be introduced. The introduction of collective operators to implement extended producer responsibility should have clearly defined geographical, production and material coverage, without limitation to those areas where waste collection and management is most profitable.

Relevant institution: Ministry of Environmental Protection

Implementing partners: collective operators, producers, importers and distributors of products that after use become special waste streams, the Autonomous Province, local self-government units, the Environmental Protection Agency.

Measure type: Regulatory (R)

Measure 3.2. Improving the network for collecting special waste streams

It is necessary to expand the existing networks for separate waste collection in all municipalities, at least for glass, plastic and metal, paper, and cardboard. Increasing the coverage of the system of separate collection of packaging waste to 100% is planned by 2028.

It is necessary to expand the network of waste collection from electrical and electronic products, by expanding the collection infrastructure, by establishing centers for waste collection in municipalities, where citizens can bring waste from electrical and electronic products. Data quality also needs to be improved, including quality checks, and strengthening monitoring procedures to include all waste equipment. A network of preparation for re-use of registered and authorized operators at the national level should also be established.

It is necessary to expand the network of collection of spent portable batteries, by establishing centers for waste collection in municipalities. To collect portable batteries, it is necessary to provide one mobile collection plant per region (27 regional waste management centers).

To achieve the best option for the environment, as well as the appropriate treatment of waste vehicles throughout the Republic of Serbia, it is necessary to establish a collection network. At least three authorized warehouses for taking over waste vehicles should be established in larger cities (Uzice, Kraljevo, Novi Sad, Valjevo and Nis), and five such warehouses should be established in the city of Belgrade, and two facilities in each of the remaining regions. It is necessary to organize informing of the citizens about the possibilities of handing over waste vehicles.

For separate collection of **waste from construction and demolition**, it is necessary to adopt a regulatory framework that includes waste separation at the place of origin and selective demolition in order to separate hazardous components during construction works, as well as the obligation to develop a Demolition Plan.

Waste oil collection needs to be improved.

It is necessary to provide a system of separate collection of waste tires.

It is necessary to further improve the implementation of separate collection of hazardous waste from medical and veterinary activities and to set minimum technical conditions for pre-treatment of medical waste in public health institutions. Pharmacies need to take waste medicines from the public, as this can help ensure the separate collection of different pharmaceutical waste. It is necessary to organize a campaign to raise public awareness and develop guidelines for the collection of expired medicines from households.

Relevant institution: Ministry of Environmental Protection, Autonomous Province.

Implementing partners: local self-government units, Environmental Protection Agency, public and private companies in the construction sector, Ministry of Construction, Transport and Infrastructure, Ministry of Health, Ministry of Agriculture, Forestry and Water Management, Serbian Chamber of Commerce.

Type of measure: PGS

Measure 3.3. Capacity building for treatment and disposal of special waste streams

It is necessary to build regional warehouses in each regional center and appropriate containers for waste disposal of electrical and electronic equipment, as well as batteries and accumulators.

It is necessary to establish a network for pre-treatment of construction waste before recycling across the country. It is planned to set up mobile plants for the treatment of

construction and demolition waste, one mobile plant in each waste management region. All municipalities will determine the appropriate locations for the operation of the mobile plant for construction waste and for the storage of treated construction and demolition waste. It is also important to strengthen the market for recycled construction waste aggregate. Introduce quality standards for aggregates, determine the legal basis for the mandatory use of manufactured aggregates up to a certain share (e.g., 10%) in public procurement procedures (green rules on public procurement). In order to promote the recycled aggregate, it is necessary to improve the regulation on the cessation of waste status, which provides quality criteria.

It is necessary to establish a network of cassettes for the disposal of asbestos-containing waste in sanitary landfills. Cassettes for the disposal of asbestos-containing waste in sanitary landfills should be introduced. Concentrating asbestos-containing waste at one hazardous waste landfill would increase the transport distance, so joint disposal at sanitary landfills is more appropriate. Citizens will be informed about the risks of handling asbestos-containing material and the possibilities of handing it over to waste collection centers. The civil sector, utilities and citizens will be involved in these campaigns.

It is necessary to establish one plant for sorting mixed portable batteries**.**

It is necessary to provide waste oil reuse capacities.

It is necessary to ensure the treatment of all separately collected waste tires. Targets for recycling of 80% and for energy production of 20% of collected waste tires need to be adjusted. This will be based on an analysis of waste rubber processing infrastructure (co-incineration capacity in cement plants, rubber granulate or powder plants) and the market for the use of such secondary rubber granules or powder (including asphalt production, floor production plants, roofing materials, etc. and the demand for these products).

It is necessary to consider the need for temporary storage, treatment, and disposal of POPs waste generated in Serbia, to realize self-sufficient management of waste containing POPs in the medium term.

It is necessary to build a plant for incineration of medical and hazardous pharmaceutical waste.

Relevant institution: Ministry of Environmental Protection, Autonomous Province.

Implementing partners: local self-government units, Environmental Protection Agency, other competent ministries, private partners.

Type of measure: PGS

Specific objective 4. Strengthened capacities of institutions in the field of waste management and harmonized regulations with EU regulations

Measure 4.1. Continue to align the legal framework with the EU acquis

This measure aims to harmonize waste legislation in the Republic of Serbia and the acquis Communautaire. Moreover, the constant development of the legal framework to support the circular economy in the EU requires further adjustment of the legislation of the Republic of Serbia on waste in the process of EU accession. The key regulations that need to be developed or amended in order to implement the Program are the following:

- Law on Waste Management;
- Law on Packaging and Packaging Waste;

- Law on Fees for the Use of Public Goods
- Law on Integrated Prevention and Control of Environmental Pollution;
- Regulation on Waste Disposal in Landfills;
- Decree on the plan for the reduction of packaging waste for 2025-2030
- Regulation on Construction and Demolition Waste Management;
- Regulation on minimum requirements for extended producer responsibility programs for certain specific waste streams;
- Regulation on Waste from Mercury and Mercury Compounds;
- Decree on Criteria for Selection of Waste Management Infrastructure Locations;
- Decree on the amount and conditions for the allocation of incentive funds
- Rulebook on categories, testing and classification of waste;
- Rulebook on the treatment of devices and waste containing (PCB);
- Rulebook on the list of electrical and electronic products, measures to prohibit and restrict the use of electrical and electronic equipment containing hazardous substances, methods and procedures for the disposal of waste from electrical and electronic equipment;
- Rulebook on the manner and procedures of managing used batteries and accumulators;
- Rulebook on the manner and procedure of waste vehicle management;
- Rulebook on the content of the request for entry in the Register of by-products and the Register of waste that has ceased to be waste;
- Rulebook on technical requirements and other special criteria for certain types of waste that cease to be waste;
- Rulebook on the manner and procedure of waste tire management;
- Rulebook on the manner and procedure of waste oil management;
- The Rulebook on technical and other requirements for plastic bags with additives for oxidative degradation and biodegradation, on conformity assessment and conditions to be met by the notified body.
- Rulebook on technical and other requirements for plastic carrying bags and on conformity assessment;
- and other regulations arising from the obligation to comply with EU regulations

In accordance with possible changes in EU regulations, further harmonization of regulations of the Republic of Serbia will be carried out.

Relevant institution: Ministry of Environmental Protection, Autonomous Province.

Implementing partners: other ministries, Chamber of Commerce, operators, civil society organizations

Type of measure: R

Measure 4.2. Strengthening administrative and institutional capacities for waste management

It is necessary to strengthen the capacity of local self-government units, municipalities, and cities, to achieve full implementation of local waste management services. Moreover, it is important to develop and implement training programs and technical and financial assistance to municipalities. In addition, strengthening administrative capacity by hiring staff and providing additional training at the state level (Ministry, relevant departments) and at the provincial level (Secretariat for Urbanism and Environmental Protection of the AP Vojvodina, relevant departments) is an imperative.

There is a strong need to further strengthen inter-institutional cooperation and coordination of processes in this area. Human resources are needed to: develop and set environmental/technical standards and guidelines; development of waste management strategy and planning of implementation at central and local level; issuing permits; supervision, monitoring and inspection of waste management facilities and activities; initiation and implementation of criminal enforcement actions; and data collection, analysis and reporting.

A review of the efficiency of existing waste management regions and the setting up of waste management regions in areas not yet established is planned, including the establishment of regional enterprises. Local governments are obliged to adopt local and regional waste management plans, in accordance with the law.

The expansion of the list of waste management facilities, in line with the Industrial Emissions Directive, implies a larger number of waste management facilities that will be required to obtain an integrated permit. From the above, there is a need to strengthen the institutional capacity of the competent authorities that will issue these permits.

Relevant institution: Ministry of Environmental Protection, Autonomous Province, local self-government units

Implementing partners: Ministry of Finance, Ministry of Public Administration and Local Self-Government

Type of measure: Institutional-managerial-organizational (IMO)

Measure 4.3. Strengthening the capacity of the environmental inspection

It is necessary to strengthen the inspection to control the implementation of regulations related to waste management, to achieve full compliance of the work of stakeholders with their legal obligations. Capacity building through recruitment and additional training is needed. Compliance with the Waste Management Inspection Manual, which provides concise guidelines for waste inspection when inspecting waste management facilities, is required.

It is also important to strengthen inter-institutional cooperation in inspection activities, between environmental inspectors, labor inspection (among other things for safe removal of asbestos), veterinary inspection (among other things in the case of joint treatment of animal by-products in waste treatment plants), traffic inspection (on road control of waste transport, application of ADR in waste transport), etc.

Relevant institution: Ministry of Environmental Protection, Autonomous Province, local self-government units

Implementing partners: Ministry of Finance, Ministry of Public Administration and Local Self-Government, Ministry of Labor, Employment, Veterans and Social Affairs, Ministry of Construction, Transport and Infrastructure

Type of measure: IMO

Measure 4.4. Improving monitoring and reporting in the field of waste management and further development of the information system

It is necessary to improve reporting in the field of waste management by establishing a more efficient waste movement system and to introduce electronic record keeping and movement reporting through applications. It is important to conduct a statistically representative analysis of the composition of municipal waste and subsequent harmonization between the data set on municipal waste and packaging waste. Further adjustment of the national reporting methodology in line with EU requirements in the scope of waste regulations, complemented by a circular economy package, is needed. It is necessary to control the quality of data and reports in accordance with the requirements of the relevant EU legislation. The administrative capacity of the Environmental Protection Agency needs to be strengthened by providing sufficient staff and additional training. It is necessary to ensure the reliability of data, traceability of documents and easy control of all participants in the management system of packaging and other waste streams.

Competent institution: Ministry of Environmental Protection, Environmental Protection Agency

Implementing partners: Autonomous Province, local self-government units, operators

Type of measure: IMO

Table 7.1. *Key performance indicators in relation to general and specific objectives and measures for their implementation*

Goals	Indicator	Starting value 2020	Target value 2031	Verification source
General goal: Development of a sustainable waste management system in order to reduce environmental pollution and degradation of space in accordance with EU regulations	Level of municipal waste disposed of in non-sanitary landfills in relation to the total amount of waste generated by municipal waste (%)	81	17.8	Annual State of the Environment Reporting in the Republic of Serbia (EPA)
	Level of disposed hazardous waste (%)	40	80	Annual State of the Environment Reporting in the Republic of Serbia (EPA)
Specific objective 1: Improved municipal waste management system through increased recycling rate, reduced disposal of biodegradable waste in landfills and reduced disposal of waste in unsanitary landfills	Rate of preparation for reuse and recycling of municipal waste (%)	-	60	Annual State of the Environment Reporting in the Republic of Serbia (EPA)
	Municipal waste recycling rate (%)	15.5	35	Annual Report on Packaging and Packaging Waste Management in the Republic of Serbia (EPA)
Measure 1.1. Extension of collection coverage to 100%	Average coverage of waste collection (%)	86,4	100	Annual State of the Environment Reporting in the Republic of Serbia (EPA)
Measure 1.2. Improvement of the system for separate collection and recycling of municipal waste	Degree of separately collected municipal waste (%)	16.4		Annual State of the Environment Reporting in the Republic of Serbia (EPA)
	Paper and cardboard recycling rate (%)		35	Annual State of the Environment Reporting in the Republic of Serbia (EPA)
Measure 1.3. Establishment of separate collection of biodegradable waste to reduce its disposal in landfills	Biowaste recycling rate (%)	1	40	Annual State of the Environment Reporting in the Republic of Serbia (EPA)
Measure 1.4. Establishment of new regional centers with sanitary landfills	Rate of biodegradable waste landfilled (%) compared to 2008.	87	60	Annual State of the Environment Reporting in the Republic of Serbia (EPA)
Measure 1.5. Introduction of economic instruments to encourage changes in the municipal waste management sector	*A pay-as-you-throw* tariff system has been established	no	yes	Annual State of the Environment Reporting in the Republic of Serbia (EPA)
	Fee for waste disposal in unsanitary landfills introduced	no	yes	Annual State of the Environment Reporting in the Republic of Serbia (EPA)
Measure 1.6. Closure and rehabilitation of existing non-sanitary landfills for municipal waste	Degree of closed unsanitary landfills (%)	0	80	Annual State of the Environment Reporting in the Republic of Serbia (EPA)

Measure 1.7. Conducting an information campaign on the municipal waste management system intended for citizens	Number of conducted information campaigns on the municipal waste management system intended for citizens	0	30	Reports of the Ministry, the Autonomous Province and local self-governments
Specific objective 2: Established network of hazardous and industrial waste collection and treatment	Constructed infrastructure for collection and treatment of hazardous and industrial waste	no	yes	Annual State of the Environment Reporting in the Republic of Serbia (EPA)
Measure 2.1. Establishment of a network for the collection of hazardous waste from households	Number of constructed centers for collection of hazardous waste from households	0	151	Annual State of the Environment Reporting in the Republic of Serbia (EPA)
	Number of constructed regional warehouses of hazardous waste from households	0	26	Annual State of the Environment Reporting in the Republic of Serbia (EPA)
Measure 2.2. Capacity building for storage, treatment, and disposal of hazardous waste	Number of constructed regional central warehouses for hazardous waste	0	5	Annual State of the Environment Reporting in the Republic of Serbia (EPA)
	Number of facilities built for physical and chemical treatment of hazardous waste	0	2	Annual State of the Environment Reporting in the Republic of Serbia (EPA)
	Number of hazardous waste incineration plants built combined with capacities for fuel preparation from organic hazardous waste streams	0	1	Annual State of the Environment Reporting in the Republic of Serbia (EPA)
	Number of hazardous waste co-incineration plants	0	3	Annual State of the Environment Reporting in the Republic of Serbia (EPA)
	Number of plants for solidification of inorganic hazardous waste sludges	0	1	Annual State of the Environment Reporting in the Republic of Serbia (EPA)
	Number of landfills for inorganic hazardous industrial waste	0	1	Annual State of the Environment Reporting in the Republic of Serbia (EPA)
Measure 2.3.	Number of recovered contaminated locations	0	6	Annual State of the Environment Reporting in the Republic of Serbia (EPA)
Specific objective 3: Increased recycling rate of special waste streams and more efficient use of resources	Degree of recycling of packaging waste (%)	54,2	70	Annual State of the Environment Reporting in the Republic of Serbia (EPA)
	Degree of recycling of construction and demolition waste (%)	1	40	Annual State of the Environment Reporting in the Republic of Serbia (EPA)
Measure 3.1. Establishment of collective operators for special waste streams (for waste from electrical and electronic	Defined minimum requirements for extended producer responsibility programs for certain specific waste streams	no	yes	Annual report on Products that after use become special waste streams in the Republic of Serbia (EPA)

equipment, used batteries and accumulators and waste vehicles, etc.) according to the principle of extended producer responsibility for the entire product life cycle	Established collective schemes	no	yes	Annual report on Products that after use become special waste streams in the Republic of Serbia (EPA)
Measure 3.2. Improving the network for collecting special waste streams	Degree of collection of waste batteries and accumulators (%)		25	Annual Products that after use become special waste streams in the Republic of Serbia (EPA)
	Degree of collection of waste from electrical and electronic equipment from households (%)		45	Annual Products that after use become special waste streams in the Republic of Serbia (EPA)
Measure 3.3. Capacity building for treatment and disposal of special waste streams	A regulation has been adopted defining the manner of dealing with construction and demolition waste	no	yes	Ministry report
	Number of mobile plants for the treatment of construction and demolition waste that are in the register of the Environmental Protection Agency	0	26	Annual report on Products that after use become special waste streams in the Republic of Serbia (EPA)
	Degree of separately collected packaging waste (%)	59.8	100	Annual report on Products that after use become special waste streams in the Republic of Serbia (EPA)
Specific objective 4: Strengthened capacities of institutions in the field of waste management and harmonized regulations with EU regulations	Compliance of regulations in the field of waste management with EU directives	no	yes	Ministry report
	Harmonized reporting system on waste management with EUROSTAT according to EU regulations	no	yes	Report of the Environmental Protection Agency
	New regional companies formed	0	10	Annual State of the Environment Reporting in the Republic of Serbia (EPA)
Measure 4.1. Continue to align the legal framework with the EU acquis	Degree of adopted regulations in relation to the number planned for the implementation of the Program (%)	0	100	Ministry report
Measure 4.2. Strengthening administrative and institutional capacities for waste management	Number of signed inter-municipal agreements for the establishment of a waste management region	0	10	Annual State of the Environment Reporting in the Republic of Serbia (EPA)
	Degree of developed new regional and local waste management plans (%)	0	100	Annual State of the Environment Reporting in the Republic of Serbia (EPA)

Measure 4.3. Strengthening the capacity of the environmental inspection	Total number of trainings to strengthen the capacity of the waste management inspection	0	10	Reports of the Ministry, the Autonomous Province and local governments
Measure 4.4. Improving monitoring and reporting in the field of waste management and further development of the information system	Monitoring and reporting system improved	No	Yes	Report of the Environmental Protection Agency

The performance indicators of the measures refer to the monitoring of their implementation until the end of the Program. Within the action plans, it is possible to determine other indicators that will be able to monitor the performance in the implementation of measures for the duration of a particular action plan.

In cases where there are no reliable data for the initial values of indicators, these values will be determined through appropriate activities that will be planned in the first action plan for the implementation of the Program.

7.2. Costs and Financing of the Program until 2031 and Financial Effect Analysis

7.2.1. Program Implementation Costs

Costs of implementing the Program in the period 2022-2031 were calculated based on data specified in the Specific Implementation Plans for each of the relevant EU directives in the field of waste management.

7.2.1.1. Municipal waste

The costs of overcoming infrastructural deficiencies for municipal waste are divided into three phases. Costs related to the first phase of infrastructure include elements that are essential for the establishment of waste management systems, such as: land acquisition, monitoring and reporting equipment, construction of new regional sanitary landfills, primary and secondary separation, collection systems, transfer stations, waste collection centers, green waste composting sites and easy closure. During the Second Phase, the construction of three RDF plants and one waste incineration facility in Belgrade is planned, as well as the introduction of home composting for individual households. Furthermore, it is assumed that some elements of the system already exist before the application of additional elements, to ensure an adequate schedule of actions. For example, the introduction of biowaste collection in the regions after the introduction of RDF and biological treatment. The third phase is related to the construction of sixteen biological treatment plants, separate collection of food waste as well as complete remediation and reclamation.

A total of 1,051 million euros is needed to implement all elements of the new infrastructure and solve problems related to pollution from old landfills and dumps, of which a total of **823.86 million euros** is needed for the duration of the Program. Most of the costs relate to RDF (including biowaste collection), biological treatment and incinerator (37%). The next most expensive elements are the closure (both phases) of unsanitary landfills (about 18%) and the opening of new regional landfills (13%).

In addition to the listed costs covered by the Landfill Directive, the investment costs of municipal waste management also include investment costs that are foreseen to meet the requirements set by the Waste Framework Directive. Some of them are already included in the total investment costs shown in the Landfill Directive, while some need to be added.

Costs for basic infrastructure that are indirectly related to the objectives set in Article 11 of Waste Framework Directives, i.e., infrastructure required for the implementation of primary, secondary separation of waste and green waste and home composting include the purchase of 479 vehicles for waste collection, the establishment of 151 collection centers, procurement of 46,399 1.1 m³ containers, 3,140,806 120-liter bins, 1,024,380 600-liter household composters and 160 green waste composting plants. The total amount of these costs is 218,364,534 euros and are included in the total investment costs of meeting the requirements of the Landfill Directive.

5,297,562 euros is expected for information campaigns related to primary waste selection and home composting and these costs are included in the total investment costs of meeting the requirements of the Landfill Directive.

Recyclable bins (within the "two bins" system) will be supplemented with containers for separate collection of glass and paper and cardboard. In order to achieve high recycling rates (55% -65%) calculated according to the new calculation rules, additional measures are needed, including the establishment of collection points throughout the country. Each collection point must be equipped with at least a glass container, "two bins" (= a container for other recyclable materials, such as plastic, metal, paper, etc.), and, if desired, a container for separate collection of biowaste. In addition to the main costs of the necessary collection equipment (recycling containers), a smaller part of the costs relates to their arrangement and labeling in order to be recognizable and easily noticeable. The estimated total cost of establishing fully equipped 10,000 collection points throughout the country is 19,000,000 euros.

Before starting the work of "recycling yards", an adequate financial mechanism must be developed, which means that the collective operator will bear the proportional costs for separate collection of packaging waste (in two bins, glass packaging) and for sorting packaging waste by secondary separation (extended producer responsibility). The collective operator shall bear the real costs shown through the efficient service and the quantities collected.

Based on the recommendations related to the collection and treatment of biowaste, ie the envisaged measures to encourage high-level recycling of biowaste, including composting and digestion, which encourage home composting and promote the use of materials from biowaste, it is necessary to assess investment needs for separate collection and composting of biowaste, in addition to the quantities already provided for in the Landfill Directive. These additional investments amount to about 52 million euros and include 27,729,529 euros for biowaste collection and 24,071,871 euros for composting plants.

It is assumed that separate collection of biowaste from municipal waste would be gradually extended to all areas where home composting is not possible. Composting plants will be used for the treatment of separately collected biowaste in 5 regions.

Textile collection requires additional investment costs to provide containers for separate collection of textiles in all collection centers (3 containers per collection point in urban settlements). Options which are available: pallet cages in case of internal collection (about 100,000 euros) or special weather-resistant containers (approximately 150,000 euros).

The following table presents an overview of the total investment costs related to municipal waste management in the period 2022-2049, as well as for the period of implementation of the Program 2022-2031.

Table 7.1. *Municipal waste management - total investment costs (in euros, constant prices from 2021)*

Measures	2022-2049.	2022-2031.
Measures foreseen by the Landfill Directive	1.051.142.857	823.857.143
Total for the Waste Framework Directive (excluding double counting of costs related to the Landfill Directive)	75.901.400	42.167.444
Secondary separation	5.000.000	2.777.778
Waste collection centers ("recycling yards")	19.000.000	10.555.556
Textile collection (containers in collection centers)	100.000	55.556
Biowaste collection (containers and bins)	27.729.529	15.405.294
Composting plants (additional capacities)	24.071.871	13.373.262
Total	**1.127.044.257**	**866.024.587**

In addition to investment costs, it is estimated that the implementation of the measures provided for in the Landfill Directive will need to cover around € 5,520 million of operating costs during the period 2021-2049.

7.2.1.2. Hazardous waste management

Estimated hazardous waste management costs for the Waste Framework Directive include:

1) construction of five regional warehouses for hazardous waste in five regions of Serbia;
2) construction of two facilities for physical and chemical treatment of inorganic and organic liquid hazardous waste and sludge with storage units for liquid industrial waste and sludge flows;
3) construction of two small regional capacities for incineration of organic industrial and medical waste possibly in combination with capacities for preparation of fuel from waste (RDF) from organic hazardous waste streams;
4) construction of one plant for disposal of inorganic industrial hazardous waste with capacities for solidification / stabilization of hazardous waste.

The total value of the required investments is estimated at 33,000,000 euros. Unit costs and total investment costs for hazardous waste treatment are shown in the following table.

Table 7.2. *Investment costs of hazardous waste treatment and disposal facilities (in euros, constant prices from 2021)*

Object type	Number of objects	The cost of one plant	Investment value
Regional hazardous waste storage facility	5	800.000	4.000.000
Facility for physical and chemical treatment of hazardous waste	2	8.000.000	16.000.000
Hazardous and medical waste incinerator	2	1.500.000	3.000.000
Hazardous waste landfill	1	10.000.000	10.000.000
Total			**33.000.000**

7.2.1.3. Management of special waste streams

Total costs for the management of special waste streams relate to costs associated with the disposal of electrical and electronic waste, batteries and accumulators, packaging and packaging waste, as well as construction and demolition waste.

Electrical and electronic waste

The costs required for full compliance with the Electrical and Electronic Waste Directive are € 25,492,900. According to the place of waste collection, investment costs can be divided into:

Retail stores. It is necessary to provide boxes or containers for the reception and temporary storage of electrical and electronic waste in retail facilities. Assuming that the estimated average price for one corresponding box is around 20 euros, the total investment costs are 200,000 euros.

Municipalities. The total cost is about 22.65 million euros. These costs are included in the costs related to measures to comply with the Landfill Directive and should not be charged additionally.

Regional warehouses. Investment costs include the construction of regional warehouses in each regional center and appropriate containers for the disposal of electrical and electronic waste and amount to about 2.64 million euros. Regional storage means the storage of hazardous waste from households, including special waste streams collected in municipalities. The total costs of building regional warehouses were also used in the document on batteries and accumulators, and should not be calculated twice.

The following table presents the amount of investment costs required for the implementation of the Directive on Waste from Electrical and Electronic Equipment in the Republic of Serbia.

Table 7.3. *Investment costs for the implementation of the Directive on Electrical and Electronic Waste in the Republic of Serbia (in euros, constant prices from 2021)*

Collection point	Collection / plant equipment	Number of collection points	Unit cost (euros)	Total costs (euros)	Note
Retail stores	box	10.000	20	200.000	
Municipality	waste collection centers	151	150.000	22.650.000	Included in the Landfill Directive
Regional warehouse	warehouse	26	100.000	2.600.000	Included in the Batteries and Accumulators Directive
Regional warehouse	container	260	165	42.900	
Total				**25.492.900**	

If the costs provided for the Landfill and Batteries and Accumulators Directives are excluded from the total amount of investment costs, the total investment costs amount to 242,900 euros.

Batteries and accumulators

The costs required for full compliance with the Electrical and Electronic Waste Directive are 3,419,800 euros. According to the place of waste collection, investment costs can be divided into:

Municipalities. To collect portable batteries, it is necessary to provide one mobile collection plant per region (27 regional waste management centers). For 26 regional centers, the total investment costs amount to 520,000 euros. In addition, 169 city collection centers should be operational by 2032. These centers will also serve as centers for collecting spent batteries and accumulators from households. A cost estimate for these centers has been made. However, the assumption is that the additional costs for special boxes for collecting portable batteries will be 50 euros per box or a total of 17,000 euros (about two boxes per center).

Retail stores. It is necessary to provide boxes / small containers that are delivered to traders and other collection points. The estimated cost for a small collection container (box) is about 20 euros and the total cost is 200,000 euros.

Public institutions / companies. It is important to provide boxes for public institutions as well. Currently in Serbia there are about 2,000 state and local authorities, institutions, faculties, schools, public companies, etc. The total cost of installing the appropriate boxes for collecting portable batteries is 40,000 euros.

Regional warehouses. Repositories / containers for collection and / or temporary storage facilities are also required. It is estimated that it is necessary to provide 10 containers for each regional center, i.e. a total of 260 containers with a total value of 42,900 euros. The Regional Warehouse for Hazardous Household Waste is an integral part of the Regional Center. Regional storage also includes special waste streams collected from citizens at municipal waste collection centers. The estimated cost of building such a storage facility for

all types of hazardous household waste, including portable batteries, is around 100,000 euros. The total cost of building the warehouse is 2.6 million euros and their construction is also planned as part of measures to meet the requirements of the Directive on Electrical and Electronic Waste.

The following table provides an overview of the investment needs for the collection of portable batteries and accumulators.

Table 7.4. *Investment costs for the collection of portable batteries (in euros, constant prices from 2021)*

Collection point	Waste collection equipment / facility	Number of collection points	Equipment price (euros)	Total costs (euros)
Retail store	box	10.000	20	200.000
Public institutions / companies	box	2.000	20	40.000
Municipalities /regions	mobile collection centers	26	20.000	520.000
City Collection Center	box	338	50	16.900
Regional storage	warehouse	26	100.000	2.600.000
Regional storage	container	260	165	42.900
Total				**3.419.800**

Packaging and packaging waste

The total investment costs for the disposal of packaging and packaging waste amount to 49.5 million euros. These costs include:

1) additional investment costs for separate glass collection. The cost estimate is based on the assumption that 10,000 glass containers will be distributed nationwide in all municipalities, and that the price of the container is 300 euros;
2) additional investment costs for separate collection of plastic bottles. The cost estimate is based on the assumption that 5,000 glass containers will be distributed nationwide in all municipalities, and that the price of the container is 300 euros;
3) additional capacities for sorting and processing of plastic packaging. The estimated investment costs are approximately 15 million euros for a capacity of 25,000 tons, which means that for the processing of 75,000 tons of plastic packaging, the total value of the necessary investments would be about 45 million euros.

The following table provides an overview of investment needs for packaging and packaging waste management.

Table 7.5. *Investment costs for packaging and packaging waste management (in euros, constant prices from 2021)*

Measure (type of equipment / plant)	Number	Unit costs (euros)	Investment costs (euros)
Glass collection - 10,000 containers of 1.1 m^3	10.000	300	3.000.000
Collection of plastic bottles - 5,000 containers of 1.1 m^3	5.000	300	1.500.000
Additional capacities for plastic packaging (capacity of 25,000 t / year)	3	15.000.000	45.000.000
Total			**49.500.000**

Waste from construction and demolition

Having in mind the envisaged regional concept of waste management and the projected amount of construction and demolition waste produced annually (300,000 - 400,000 t) that should be treated, it is recommended to provide one mobile plant per region. These plants treat non-hazardous waste (asphalt, tiles, bricks, natural stone, ceramics and rubble), and the result of processing are fractions of different sizes as the final product for further use. Having this approach in mind, it is estimated that the total investment required for construction and demolition waste management is **15,450,000 euros**.

The total and unit costs of treatment of this waste are shown in the following table.

Table 7.6. *Costs of construction and demolition waste treatment plants (in euros, constant prices from 2021)*

Number of regions	Number of municipalities	Infrastructure costs by region (euros)	Costs of mobile plants per municipality (euros)	Total Costs (euros)
27		50.000	250.000	8.100.000
	147	50.000		7.350.000
Total				**15.450.000**

Total costs for managing special waste streams

The total cost of managing special waste streams is **68,612,700 euros** for the period 2022-2049. The following table provides an overview of the total investment costs for managing specific waste streams.

Table 7.7. *Investment costs for the management of special waste streams (in euros, constant prices from 2021)*

Waste streams	Investment costs (euros)
Electrical and electronic waste *	242.900
Batteries and accumulators	3.419.800
Packaging and packaging waste	49.500.000
Waste from construction and demolition	15.450.000
Total	**68.612.700**

* The costs required for full compliance with the Electrical and Electronic Waste Directive are 25,492,900 euros, but to avoid overlap (double counting) with the Landfill Directive and the Batteries and Accumulators Directive, the table only shows costs that are not already included in the two directives.

7.2.1.4. Total investment costs for the implementation of the Program

The total investment costs required for the implementation of the Program are presented in the following table. The costs are given both for the entire period needed for harmonization of the waste management in the Republic of Serbia with the relevant directives of the EU (2022-2049), and for the period covered by this Program (2022-2031).

Table 7.8. *Total investment costs necessary for waste management in Serbia (in euros, constant prices from 2021)*

Waste streams	2022-2049.	2022-2031.
Municipal waste management	1.127.044.257	866.024.587
Hazardous waste management	33.000.000	25.384.615
Management of special waste streams	68.612.700	48.195.941
Total	**1.228.656.957**	**939.605.144**

7.2.2. Funds Needed for Financial Support to the Implementation of Measures

7.2.2.1. Dynamics of required funds

The projection of investment costs on an annual basis for the period of implementation of the Program (2022-2031) is based on the following assumptions:

1) periods of implementation of measures are given on the basis of information and data from this Program;

2) if the distribution of costs is not clearly indicated, the costs are evenly distributed over the years during the planned period for the implementation of measures;

3) sources of financing are divided into public and private sectors, except for investments for the Landfill Directive, which sets out a more detailed proposal for sources of financing investment costs.

The following table shows the projection of investment costs observed by waste management flows.

Table 7.9. *Projection of investment costs and sources of financing (millions of euros, constant prices from 2021).*

Waste management flows	Total 2022-2049.	Total 2022-2031.	2022.	2023.	2024.	2025.	2026.	2027.	2028.	2029.	2030.	2031.
Municipal waste (WFD)	75,901	42,167	4,217	4,217	4,217	4,217	4,217	4,217	4,217	4,217	4,217	4,217
Public sector	75,901	42,167	4,217	4,217	4,217	4,217	4,217	4,217	4,217	4,217	4,217	4,217
Municipal waste (LD)	1.051,143	823,857	113,500	113,500	113,500	113,500	113,500	113,500	35,714	35,714	35,714	35,714
Private sector	447,000	399,571	60,500	60,500	60,500	60,500	60,500	60,500	9,143	9,143	9,143	9,143
EU funds	170,000	111,571	13,833	13,833	13,833	13,833	13,833	13,833	7,143	7,143	7,143	7,143
Donors	11,143	9,429	1,000	1,000	1,000	1,000	1,000	1,000	0,857	0,857	0,857	0,857
National participation	152,000	98,143	12,167	12,167	12,167	12,167	12,167	12,167	6,286	6,286	6,286	6,286
Loans	271,000	205,143	26,000	26,000	26,000	26,000	26,000	26,000	12,286	12,286	12,286	12,286
Hazardous waste (WFD)	33,000	25,385	2,538	2,538	2,538	2,538	2,538	2,538	2,538	2,538	2,538	2,538
Public sector	33,000	25,385	2,538	2,538	2,538	2,538	2,538	2,538	2,538	2,538	2,538	2,538
Waste from construction and demolition (WFD)	15,450	11,885	1,188	1,188	1,188	1,188	1,188	1,188	1,188	1,188	1,188	1,188
Public sector	15,450	11,885	1,188	1,188	1,188	1,188	1,188	1,188	1,188	1,188	1,188	1,188
Electrical and electronic waste	0,243	0,202	0,020	0,020	0,020	0,020	0,020	0,020	0,020	0,020	0,020	0,020
Private sector	0,200	0,167	0,017	0,017	0,017	0,017	0,017	0,017	0,017	0,017	0,017	0,017
Public sector	0,043	0,036	0,004	0,004	0,004	0,004	0,004	0,004	0,004	0,004	0,004	0,004
Battery and accumulators	3,420	3,109	0,311	0,311	0,311	0,311	0,311	0,311	0,311	0,311	0,311	0,311
Private sector	0,240	0,218	0,022	0,022	0,022	0,022	0,022	0,022	0,022	0,022	0,022	0,022
Public sector	3,180	2,891	0,289	0,289	0,289	0,289	0,289	0,289	0,289	0,289	0,289	0,289
Packaging and packaging waste	49,500	33,000	3,300	3,300	3,300	3,300	3,300	3,300	3,300	3,300	3,300	3,300
Public sector	49,500	33,000	3,300	3,300	3,300	3,300	3,300	3,300	3,300	3,300	3,300	3,300
TOTAL	**1.228,657**	**939,605**	**125,075**	**125,075**	**125,075**	**125,075**	**125,075**	**125,075**	**47,289**	**47,289**	**47,289**	**47,289**

WFD – Waste Framework Directive
LD – Landfill Directive

In addition to investment costs, the implementation of measures in the field of waste management requires other costs - operational and administrative costs. Operating costs relate to the operation and maintenance of waste collection and treatment systems, landfilling, recycling and other activities in this sector. Administrative costs refer to the costs of strengthening administrative capacity (for example, hiring new staff).

It is estimated that around 5,520 million euros of operating costs should be covered for the Landfill Directive during the period 2021-2049, through waste management tariffs. It is very important to enable full reimbursement of operating costs through tariffs paid by users. The analysis of affordability has shown that, although tariffs will have to increase significantly, the overall burden remains below the level of maximum availability, which means that the proposed implementation plan is sustainable. However, further acceleration of the investment process in order to fully comply with the requirements of the Directive (e.g., due to shortening the implementation period) is not possible, because tariffs for the population in the field of waste management will have to be higher than the maximum acceptable tariffs.[5]

One of the potential funding structures for waste management projects is given for the Landfill Directive. When it comes to measures under this directive, the private sector is expected to cover about 43% of necessary investments, the EU about 16% and donors 1%, while the national contribution is expected to reach 40%, including potential loans involving up to 26% of the total investment costs. If the distribution of funding sources is observed within the part of investments falling on the public sector, the EU is expected to cover about 28% of investment needs, donors 2%, while the national contribution is expected to reach 70%, including loans. The structure of funding by year in accordance with this approach is shown in the previous table.

7.2.2.2. Possible sources of funding

The costs of implementing measures aimed at meeting the requirements of the relevant directives in the field of waste will be borne by both the public and private sectors.

Optimal absorption of available funds from various programs is extremely important for the successful implementation of measures. In essence, in order to meet the requirements of various Waste Directives in the Republic of Serbia, it is desirable to use a combination of domestic and foreign sources of funding:

1) national public funds, i.e., budgets - state, provincial and local;
2) EU funds (IPA and other funds);
3) bilateral grants;
4) loans from international financial institutions and commercial banks.

The main domestic source of funding for environmental protection is the budget of the Republic of Serbia, and the distribution of funds depends on the possibility of the budget balance. The other sources include municipal budgets, fee, and fee revenues, as well as commercial sector funds.

Economic instruments applied in the Republic of Serbia include fees and charges, as well as incentives and subsidies. Charges are one of the environmental economic instruments, which aims to promote the reduction of pressures on the environment by applying the principles of "polluter pays" and "user pays". According to the latest available data for 2020,

[5] [5] The total share of expenditures for waste collection and treatment services in household income should not exceed 1.5%. Maximum acceptable tariffs for the population should be designed in accordance with this restriction.

total revenues from environmental fees this year amounted to 7.74 billion dinars, or 0.14% of GDP. Fees for SO2, NO2, particles and deposited waste, fees for products that become waste through their use, and special fees for protection and improvement of the environment have the largest share.

Investments from economic sectors in 2020 amounted to 3.62 billion dinars, or 0.07% of GDP. In relation to total funds, energy and mining have the largest share with 85.9%.[6] According to available data, total investments can be analyzed, but not the structure of sources of these funds. This means that there is no complete data on how much was invested from the budget, nor from own revenues, loans, donations, or other sources.

Incentives and subsidies granted in 2020 amounted to 4.79 billion dinars, or 0.09% of GDP. Incentives for reuse and use of waste have the largest share in the structure of these funds in the amount of 79.9%.[7]

Foreign sources of funding include grants and loans from international financial institutions, the EU, and bilateral donors. In 2020, the major donors or landers for the sector of environmental protection are the EU with 4.9 billion dinars and the Federal Republic of Germany with 1.94 billion dinars, the European Union with 1.9 billion dinars and the Kingdom of Sweden with 448 million dinars, and for the sector "Water supply and waste remediation" the Federal Republic of Germany with 872 million dinars and Switzerland with 90 million dinars).

The private sector will bear the costs of the measures as identified in the directives relevant to waste. Despite limited access to affordable finance, several programs support private sector investment in the Republic of Serbia, which, although not focused, includes investment to address environmental issues. Namely, financial resources for the private sector are:

1) commercial banks and microfinance institutions;
2) state support through the Development Agency of Serbia[8] and the Development Fund of the Republic of Serbia[9] and the Ministry in charge of economy;
3) other sources (mainly national and international support programs such as the Innovation Fund[10]).

Other donors providing support to the private sector are GIZ, UNDP, UNIDO, the Kingdom of Norway, etc. which refers to the improvement of competitiveness, local and regional development, cluster development, etc.

In the EU, state aid refers to the public financial support of a particular private company or companies that may distort competition and affect trade between Member States. State aid is therefore generally prohibited, although exceptions may be made to ensure a well-functioning and fair economy. EU state aid rules also apply to IPA funding. Grants given to individuals or open to all private companies in a given country do not count as state aid.

In the Republic of Serbia, the Law on State Aid Control ("Official Gazette of the RS", No. 73/19) regulates state aid control in order to protect market competition. According to this law, the state aid provider is the competent body of the Republic of Serbia, autonomous

[6] Environmental Protection Agency (2021). Report on economic instruments for environmental protection in the Republic of Serbia for 2020.
[7] Environmental Protection Agency (2019). Report on economic instruments for environmental protection in the Republic of Serbia for 2020.
[8] https://ras.gov.rs/
[9] https://fondzarazvoj.gov.rs/
[10] http://www.inovacionifond.rs/

province or local self-government unit, ie the legal entity that manages and / or disposes of public funds and grants state aid in any form. In contrast, the beneficiary of state aid is a market participant, ie any legal and natural person who performs economic activity, i.e., activity of production or trade of goods or provision of services on the market and to whom state aid is granted in any form.

Small value aid is aid that does not significantly affect the distortion of competition in the market and trade between the Republic of Serbia and EU member states. The decision on the justification of the grant is made by the grantor of small value, who informs the Commission for the Control of State Aid about the granted aid.

With regard to access to sources of financing, the position of small and medium enterprises has improved in recent years with the functioning of the Development Agency of the Republic of Serbia and the Development Fund. These institutions provide financial assistance to beginners, entrepreneurs, and small and medium-sized enterprises through credit lines at favorable interest rates or guarantees.

One of the ways to finance waste management measures can be a public-private partnership (PPP). The private sector can be an essential source of financing capital investments and the transfer of technical and operational knowledge. Through a public-private partnership arrangement, the private sector can be involved in the utility sector (PCC) and the realization of capital investments in the sludge and waste management sector.

According to the Law on Public-Private Partnerships and Concessions, it is a long-term cooperation between public and private partners to provide funding, construction, reconstruction, management or the maintenance of infrastructure or other facilities of public importance and the provision of services of public importance that may be established by contract or through institutions or concessions.

The Law on Public-Private Partnerships and Concessions introduced order in this area and explained and clarified many unclear issues when PPP projects started in the Republic of Serbia. However, when involving the private sector, it is important to choose options that will motivate private partners, but the public sector should always be aware of its goals and interests. Therefore, before making any decision, the public partner must define what he wants to get from the private partner: technical and managerial knowledge and expertise; inclusion of new technologies; investments in facilities and infrastructure or any combination of the above.

The advantages of PPP are the implementation of demanding projects that would be difficult to manage or finance from public sources, risk sharing with a private partner, predictability of total investments and / or operating costs. Disadvantages of PPP are complex and expensive project preparation, complicate project approval procedure and higher project cost.

The precise structure of financing, i.e., sources of financing will be defined depending on the specific project. Each project will have its own construction of funding, which will be defined after the feasibility studies have been prepared.

In the Action Plan for the implementation of the Program, the required financial resources will be presented, according to the sources of financing, by years for each measure.

7.3. Measure Effect Analysis

The effects of the implementation of the waste directives are reflected in the benefits that result from improving the quality of the environment, improving the health of the

population and reducing costs for health services, increasing the market value of land and other socio-economic benefits.

The main benefits of implementing waste directives are:

• Less pollution of groundwater and surface water due to leaks of unprotected landfills and, as a result, lower risks of contamination of aquifers of groundwater and surface water, i.e., reduced risk of contamination of drinking water.

• Lower health and explosion risks as well as less impact on global warming as landfill methane emissions are collected and used for energy production (economic benefits). Existing landfills are being upgraded or closed in accordance with special standards. Illegal landfills are also being closed in accordance with regulations.

• Benefits for ecosystems and other environmental resources. Harmful emissions (resulting from waste management activities) into the air, water and land are reduced, while energy recovery is increased.

• Increased efficiency in the use of materials and reduced production (extraction) of primary resources as a result of higher levels of recycling. This is a result of the implementation of the Packaging and Packaging Waste Directive as well as the achievement of the objectives of the Landfill Directive.

• Lower costs of waste collection, treatment and disposal, because less waste will be generated.

• Better management and monitoring of waste streams through the implementation of the Waste Framework Directive.

• Pollution of air, soil and water (particles, dioxins, heavy metals from sewage sludge, waste oil) and environmental risks from municipal and hazardous waste treatment sites.

• Reduction of respiratory diseases and other risks to the health of the local population from polluted air and contaminated soil (economic benefits due to reduced medical treatment costs of the population).

Socio-economic benefits are also reflected in the following:

• **Increase in employment** in the eco-industry through increased investment and more developed infrastructure (which is further associated with a larger volume of work activities and maintenance activities). Sectors such as construction and the provision of capital goods will also benefit, as the demand required by eco-industry activities necessarily requires inputs from these sectors;

• **The eco-efficiency of the industry** will increase with the introduction of new processes, while existing activities, where relevant, become more sustainable - this will lead to a reduction in resource intensity in production processes, i.e., improvements in energy and water use per unit of GDP or per unit of added value can be expected (i.e. at both national and sectoral levels). Also, with the increasing prevalence of reuse, recycling practices and pricing policies that highlight organic products, a reduction in the amount of use of primary raw materials in the production process can be expected. From the existing statistical data, it is clear that the eco-efficiency of many industries in the Republic of Serbia lags far behind those in many EU member states;

• Improving eco-efficiency will undoubtedly have a positive impact on the **competitiveness** of many companies in the Republic of Serbia and facilitate their entry and survival in the competitive market of the EU. This will not only support economic growth and

development, but will also have a positive impact on employment and adjusting the national balance of payments;

• In addition to the above, there will obviously be some progress in **the development of corporate organizational cultures** that can lead to certain economic benefits and avoided costs;

• **Reduction of pollution intensity** in production processes - one could expect a reduction in the number of pollutants (e.g., CO2, NOX, COX, discharges of hazardous substances into water, waste generated) related to GDP or added value of the economy as a whole and individual sectors in particular. As with the intensity of resource use, the intensity of pollution per unit of product is higher in the Republic of Serbia than in most EU member states. The implementation of EU directives in the waste management sector will lead to social benefits arising from human health benefits. It is less clear whether energy use, natural resource use and pollution levels per capita will increase or decrease. The intensity for a given consumption would decrease, but this will be partially (if not completely) compensated by changes in consumption patterns.

The economic benefits of implementing EU directives on waste will have a significant effect on employment as one of the most important macroeconomic indicators. Recycling and reuse of materials that used to end up in waste will lead to a reduction in demand for primary production, which will, to the extent that these materials were previously imported, stimulate increased local competitiveness. This will further create employment opportunities, related to the collection and recycling of secondary materials. The implementation of the Program will also create opportunities for the employment of informal collectors, which will affect their standard of living. Also, encouraging the use of the best available techniques in the industry to comply with directives stimulates local technology markets which in turn have the potential to increase employment and competitiveness in the long run.

The following table shows the potential increase in employment resulting from the implementation of the Waste Management Program in the Republic of Serbia.

Table 7.10. *Change in employment (2022-2032)*

	Total investments (million euros)	**Percentage of investment that generates employment**	**Part of the investment that generates employment (million euros)**	**Average gross earnings (euros)**	**Number of employees in total (2022-2032)**
Minimum scenario	939,605	16,50%	155,035	765	202.660
Maximum scenario	939,605	34,80%	326,983	765	427.428

Macroeconomic analysis shows that compliance with EU waste directives in accordance with this Program can generate employment in the period 2022-2031 ranging from 202,660 to 427,428 employees. It is very important to emphasize that the displayed numbers of employees do not imply the number of new employees, but the number of jobs that will be created. In other words, this means that in addition to hiring new workers, there will also be a redistribution of employees between sectors. For example, while an increase in recycling leads to an increase in employment, in the production of primary materials there will be a decrease in employment which will further lead to a redistribution of employees between these sectors. In the end, net employment will certainly be positive, because the Republic of Serbia also has significant imports of primary raw materials, so that the decrease in employment in the production of primary materials will be less than the increase in employment related to the

collection, processing and production of secondary materials. The reduction of imports of primary materials will have a positive impact on the Republic of Serbia's balance of payments.

Based on the mentioned change in the number of employees, potential public revenues based on taxes and contributions on salaries will increase in the mentioned period in the interval from 4,263,458 to 8,992,021 euros.

Compliance with the waste directives will lead to a reduction in the amount of generated waste, which will further have wider economic benefits in terms of reducing the requirement for additional capacity for its disposal. The implementation of these directives reduces the need to increase landfill capacity, which creates additional economic benefits due to more profitable land use. In addition, the closure of unsanitary and illegal landfills will lead to an increase in the value of land. The conducted economic analysis shows that the value of land in Serbia located near unsanitary landfills that are planned to be closed in the period 2022-2031 will increase by a total of 1,477,500 euros (undiscounted value).

In addition to increasing the value of land, reducing the need for additional capacity could lead to significant savings in investment costs for the construction of waste treatment plants.

Reducing diseases and other risks to the health of the local population from polluted air and contaminated land creates economic benefits due to reduced medical treatment costs of the population. Economic analysis shows that the total potential economic savings on this basis amount to 39,404,246 euros (undiscounted value).

Economic savings also arise from the reduction of CO2 emissions. These benefits are reflected both in the reduction of environmental damage caused by gas emissions and in the increase of the potential competitive advantage of the industry due to the reduction of the carbon footprint in the production process. Calculated economic benefits resulting from the implementation of this Program in the period 2022-2031 amount to a total of 1,107,467,881 euros (undiscounted value).

The total economic benefits (undiscounted and discounted values at a discount rate of 5%) that can be expressed in monetary terms and that will arise from the implementation of this Program in the period 2022-2031 are given in the following table.

Table 7.11. *Total economic benefits 2022-2031 (in euros, constant prices from 2021)*

Benefits and costs	Undiscounted values	Discounted values
Change in land value	1.477.500	1.140.886
Savings on health care costs	39.404.246	29.637.921
Savings by reducing CO2 emissions	1.107.467.881	831.014.855
Total economic benefits	1.148.349.627	861.793.662
Total investment	939.605.144	759.970.119
Benefit / cost ratio		1,13

Economic analysis has shown that the implementation of EU waste directives in Serbia in the period 2022-2031 generates greater economic benefits than costs. The ratio between economic benefits and costs is 1.13 (calculated according to discounted values). In addition to the economic benefits that can be expressed in monetary terms, the implementation of these directives will have a positive net impact on employment (which will change in the range of 202,600 to 427,428 jobs). Other effects include a potential increase in public revenues based on taxes and contributions which would increase in the range from 4,263,458 to 8,992,021 euros, as well as an increase in competitiveness of domestic companies and a positive impact on balancing the country's foreign trade balance.

8. WASTE MANAGEMENT ORGANIZATION

The program regulates the management of various types of waste in the territory of the Republic of Serbia, from generation to final disposal, with the main goal of establishing a comprehensive waste management system that will be organized in accordance with national and EU requirements and standards.

The waste management system will be organized integrally, with all participants in the system at the national, provincial and local levels, in accordance with the competencies.

The waste management system in the Republic of Serbia is decentralized, while the Ministry is the designated national body for the overall establishment of waste management policy, strategic, legal framework (transposition) and regulatory framework of the Directive; Competences for issuing permits are divided between the national level (Ministry), provincial (AP Vojvodina) and local (LSU) bodies; the waste management information system (monitoring and reporting) is the responsibility of the Environmental Protection Agency, while the responsibilities for monitoring and control of implementation are also divided vertically, including: Ministry (Sector for Environmental Monitoring and Precaution), Provincial Secretariat for Urbanism and Environmental Protection (Sector for Inspection Affairs) and Local Self-Government (Inspection for Environmental Protection). The vertical division of competencies for issuing control permits is done on a geographical basis, and the delegation of competencies considers the types of activities / waste.

In accordance with the regulations, the regional approach to waste management implies that two or more local self-government units adopt a waste management plan that defines common goals in waste management. The preparation and adoption of the regional waste management plan is regulated by an agreement of the assemblies of local self-government units. The regional waste management plan is approved by the Ministry, i.e., the competent authority of the autonomous province on its territory.

The function of organizing municipal waste management can be attributed to the responsibilities of the public sector, and according to the Law on Waste Management, Article 20, that is the competence of the local self-government unit. While the management of waste from industry and commercial activities is the responsibility of producers and entities engaged in economic activities, public authorities determine the essential requirements relating to worker safety, environmental protection and human health from pollution caused by waste management. Each economic entity and public authority, in accordance with these requirements, may choose the most appropriate methods or means of waste management.

One of the most important aspects is the principle of producer responsibility for the impact of products on the environment, because the manufacturer has the greatest influence on the formation of this effect when making important decisions in the stages of product design and production. However, consumers also play a major role in waste management systems. It is necessary to analyze the entire life cycle of products and the main participants, producers and consumers, when developing a waste management system for certain types of waste.

Another important aspect is ensuring the financial sustainability of the system. The costs of waste management in accordance with the polluter pays principle are borne by the owner of the waste and / or the producer or importer of materials and items that later become waste.

The national level provides guidelines for the introduction of inter-municipal agreements on cooperation based on the experience of already operational regions in the Republic of Serbia. Based on the experience so far, the early introduction of professional

assistance to regional waste management companies, before the company starts providing public service, is necessary for the successful establishment of regional waste management structures.

The level of necessary changes in institutions in the Republic of Serbia in a relatively short time is recognized as one of the biggest challenges for the successful implementation of the Directives related to waste management.

The application of modern waste management standards requires a significantly higher level of technical, administrative, and managerial skills of all entities involved in an integrated waste management system. Without them, capital and operating costs may increase beyond the level acceptable to the citizens of the Republic of Serbia.

Cooperation between the public and private sectors in the field of development and management of waste management services has already been established in the Republic of Serbia. Greater participation of private companies is more likely if the sector requires higher standards or greater efficiency. Financing investments through public-private partnerships is especially possible for the construction of regional warehouses, facilities for physical and chemical treatment and incineration of hazardous waste. Specialized service providers can bring technology, expertise and efficiency that are not available to existing public utility companies. One of the greatest benefits may be overcoming existing obstacles to reforming public service institutions.

8.1. Public Sector

In the field of waste management, the public sector generally performs a regulatory and control function. However, local self-government units must also ensure the organization and implementation of municipal waste management, i.e., to organize a municipal waste management system on their territory.

Republic level

State administration bodies, primarily the Ministry, are in charge of harmonization with EU standards and lead this process through the transposition of the acquis Communautaire into national regulations, the development of national policy and its implementation. The Ministry's Strategic Planning Framework aligns national resources and institutional capacities with international assistance in support of local authorities and in cooperation with other state institutions such as the Ministry of Finance and the Ministry of European Integration. Effective and efficient waste management depends on an adequate distribution of responsibilities, competencies, and revenues between central, regional, and local governments.

Coordination of inter-institutional cooperation is also an activity of the Ministry. Integrated waste management services deal with different waste streams (medical, agricultural, sewage sludge, hazardous household waste, etc.) under the jurisdiction of several institutions at each level.

Provincial level

At the level of the Autonomous Province, the competent secretariat performs all delegated competencies of the Ministry in its territory.

Regional level

The regional approach to waste management includes the establishment of cooperation and grouping of local governments in the regions to establish a sustainable waste management system and rationalize implementation costs. To promote the regional approach,

the existing political, legal, and administrative framework that guides the work of local self-government bodies should ensure the existence of an adequate basis for inter-municipal cooperation, as well as sufficient capacity to develop and implement waste management policies. The competent ministry at the national level has the task of supporting the regional waste management system.

The establishment of regional entities to support waste management systems will only work properly if inter-municipal agreements are respected.

Local level

Local self-government units are the main entity that organizes the management of municipal waste generated in a certain territory. They are responsible for arranging, developing and administering municipal waste management systems in their territories. The local self-government approves the local waste management plan and other regulations on municipal waste management that regulate the municipal waste management system. The rules are binding for all natural and legal persons located in the municipality, and for other persons participating in relevant activities. The application of provisions and requirements must ensure rational management of municipal waste, proper execution of public management tasks and financial obligations.

All waste owners must reimburse the costs of waste management and adhere to established waste management requirements, and all waste must be managed in accordance with the law. High priority in the coming period will be given to municipal waste management, which represents a large share of total waste. The cost of disposing of household waste should not exceed 1%[11] of average family income. Social policy must be implemented through social programs, which are supported by waste management companies.

The main task of local self-government units is to offer a public service of municipal waste management (collection, transport, and treatment) to all residents and economic entities (companies, institutions, and organizations) to ensure that the service meets technical, economic, hygienic, and environmental requirements, to be convenient and accessible to users.

To implement the measures envisaged by the Program, each level of institutions must have general skills in areas such as strategic planning, financial management, procurement, project implementation, monitoring and control. For the development of local waste treatment services and for the implementation of major projects, local authorities are required to improve skills to ensure modern standards related to data collection and delivery, analysis of waste composition and generation, modeling future changes, specification of necessary equipment, monitoring, evaluation, and revision of internal and external contracts.

When opportunities for cooperation with the private sector are sought (in cases where own resources or experience and expertise are insufficient), but it is not intended to completely give up public sector oversight of services provided, the public sector has two additional alternatives for organizing waste management:

1. contracting a public-private partnership - to obtain the necessary resources from the private sector on the basis of a contract (directly or through an entity controlled by local self-government), e.g., concession and other contracts;

[11][11] The maximum affordability for households required to cover OPEX costs in the waste subsector is defined at 1% of average household income.

2. institutional public-private partnership - establishment of a joint venture, together with a private investor, directly or through an entity controlled by the local self-government.

It is recommended that local self-government institutions for municipal waste management establish regional companies, transfer their self-government functions in the field of waste management, but to ensure constant control over the functions they perform through management bodies. The provision of waste management services and the construction and operation of the necessary infrastructure should be ensured in public procurement procedures, contractual or institutional public-private partnerships.

8.2. Obliged entities in accordance with the Law

Responsibility for the management of other waste from industry and commercial activities rests with the private sector.

Management of other waste from industry and commercial activities includes organizational and technical measures implemented by operators involved in the generation, collection, transport and treatment of waste. This includes, but is not limited to, companies/industries that have an integrated permit for pollution prevention and control, or participate in the emissions trading system, but also economic entities that are active in waste management, establishing procedures in accordance with national waste legislation. Relevant waste streams are not necessarily managed in municipal waste management systems organized by local self-government units (public sector).

Industrial and commercial waste includes both non-hazardous and hazardous waste and may contain a wide range of different types of waste, such as biodegradable waste, construction and demolition waste, medical and pharmaceutical waste, sludge and other waste. Management of other waste from industry and commercial activities is regulated at the state level by environmental and other normative documents, regulations on the management of special waste streams, permits issued for certain activities and the operation of the plant. It is the obligation of economic operators to ensure that other waste from industry and commercial activities is adequately managed and in accordance with the requirements and principles of the general waste management system.

Waste owners and/or operators are responsible for the collection, sorting, packaging, marking, billing, storage and transport of waste from industry and trade in accordance with the polluter pays principle. The waste owner must cover all waste management costs, except those costs covered by the extended liability of the producer that are determined for certain waste/materials (such as packaging).

Management of waste from industry and commercial should be organized by a company in accordance with the procedure specified in the permits for the operation of the plant. Priorities for proper waste management will also be considered, including all possible and cost-effective waste reduction measures, preparation of environmental action plans, introduction of cleaner production principles and low-waste technologies.

Companies that are not obliged to obtain a permit for their activities or operation of equipment for organizing waste management from industry and commercial activities must also adhere to the priority order of prevention and management of waste (if necessary) in accordance with environmental requirements and other legal regulations.

To apply the principle of extended producer responsibility, manufacturers and importers are responsible for the products and packaging they place on the internal market

throughout the life cycle of those products, from production to safe waste management, including:

1) organization and/or financing of collection, transport, recycling, reuse and disposal systems;
2) achieving the goals set for the management of production and packaging waste;
3) providing information on products, packaging and waste management to users of such products and waste management operators; and
4) acceptance and management of returned products and waste resulting from their use and financial responsibility for such activities.

The principle of extended producer responsibility is applied in the management of packaging waste, waste tires, accumulators, batteries, fuel for engines with internal combustion, , air filters, hydraulic (oil) shock absorbers of vehicles, electrical and electronic equipment and motor vehicles. An assessment will be made as to whether special streams, such as waste oil, pharmaceutical waste, waste rubber, will be covered by the principle of extended producer responsibility.

Manufacturers and importers of packaged products can fulfill their legally established obligations by transferring their obligations to the operator for packaging waste management or independently with a permit for independent management of packaging waste).

In order to collectively organize the management of production and packaging waste subject to the principle of extended producer responsibility, non-profit public legal entities are established at the initiative of producers and importers (and licensed organizations of producers and importers) to meet established obligations and goals.

The program defines the different responsibilities of waste stream management, which are shown in Table 8.1.

Table 8.1. *Financial responsibility of the public and private sector for different types of waste*

Types of waste		**Responsibility of the private sector for financing**	**Responsibility of the public sector for financing**
Municipal waste	Household waste		√
	Commercial non-hazardous waste		√
	Sludge from WWTP		√
Industrial waste	Waste from the titanium dioxide industry	√	
	Mining and energy waste	√	√
	Waste containing hazardous waste	√	
	Waste from construction and demolition	√	
	Waste contaminated with POPs (POPs waste)	√	
	Other hazardous waste	√	

Waste from institutions and agriculture	Agricultural waste	√	√
	Animal waste	√	√
	Medical waste	√	√
Waste products	Waste fluorescent tubes with mercury	√	
	Waste from electrical and electronic equipment	√	
	Waste vehicles	√	
	Waste tires	√	
	Waste oils	√	
	Used batteries and accumulators	√	
	Packaging waste	√	

As stated in Table 8.1, responsibilities in waste stream management are as follows:

1) all types of municipal waste, such as household waste, commercial waste (similar to household waste), WWTP sludge, are managed by local governments and municipal services in charge of these activities;
2) industrial and commercial waste that should be managed according to the polluter pays principle is currently focused on financing from the private sector, more precisely from the manufacturing industry;
3) waste products, which are managed on the principle of extended producer responsibility, are fully covered by private operational and financial responsibility;
4) construction waste is under private responsibility;
5) waste from institutions such as hospitals (medical waste) and agriculture, e.g., agricultural and animal waste, has a transitional status: when under public administration, it is financed from public funds, and when privately owned, waste management is under private liability.

9. MONITORING THE IMPLEMENTATION OF THE PROGRAM AND METHOD OF REPORTING

The Ministry is in charge of monitoring the progress in the implementation of the Program. The Ministry provides support to other bodies, services and organizations in the implementation of activities within their scope. Also, the Ministry communicates with partners and the public regarding the implementation of the Program.

Reports on the progress in the implementation of the action plan are prepared by the Ministry based on reports submitted by all bodies and organizations responsible for the implementation of measures and activities through the Unified Information System for Planning, Implementation Monitoring, Policy Coordination and Reporting (UIS) and in accordance with the Law on the Planning System of the Republic of Serbia and bylaws which regulate the manner of reporting and mandatory elements of the report.

Data on the achieved values of performance indicators, which in accordance with its competencies are monitored by the Environmental Protection Agency, are submitted to the

Environmental Protection Agency through (UIS) for the purposes of preparing annual reports on the implementation of the action plan. In addition to annual reporting, the Environmental Protection Agency submits the necessary data to the Ministry at its request.

Competent bodies and organizations, as bodies and organizations that are recognized as partners in the implementation of measures and activities, have the obligation to report to the Ministry annually on the progress in implementation, as well as on any issues in achieving the intended results. Based on that, the Ministry has a basis for assessing the progress in the implementation of the Program and identifying current problems and potential risks and the need to adjust activities in accordance with them and make timely decisions to achieve the expected results.

The preparation of the report on the implementation of the action plan and its submission to the Government will be carried out in accordance with the deadlines set by the Law on the Planning System.

The Ministry will prepare a report on the results in achieving the established objectives of the Program based on an *ex-post* analysis of the effects, after every three years of the Program implementation, within which it may propose a possible revision of the Program. The final report will be submitted to the Government for adoption after the expiration of the Program. Evaluation of the Program performance is done by analyzing whether and to what extent the achieved effects are in line with the impact indicators at the level of the general objective, the outcome indicators at the level of specific objectives and the result indicators at the level of individual measures.

10. CONSULTATIONS WITH THE INTERESTED PARTIES

The development of a new public policy document in the field of waste management began in 2017, with the support of the EU TWINNING project SR13 / IPA / EN / 04 16 "Support to the development of a strategic framework in the field of waste management". The project was implemented in cooperation with the Ministry, the Swedish Environmental Protection Agency and the Lithuanian Environmental Project Management Agency. The implementing agency was the Austrian Environmental Agency.

A special working group was formed to draft the document, by the Decision of the Minister of Environmental Protection of July 30, 2018. The members of the Working Group are representatives of the Ministry (Sector for Planning and Management, Sector for Waste and Wastewater Management, Sector for Supervision and Precaution in the Environment, Sector for Financial Management and Control), Provincial Secretariat for Urbanism and Environmental Protection, the City of Belgrade-Secretariat for Environmental Protection, the Environmental Protection Agency, the Standing Conference of Towns and Municipalities and the Serbian Chamber of Commerce. By 2020, through working meetings, workshops and electronic communication, cooperation was established to exchange experiences with experts from EU member states, Romania, Sweden, Lithuania, Germany, and Poland.

Within the project, in addition to consultations between institutions, which were realized during the preparation of the necessary analyzes and the text of the document, communication was also realized with civil society organizations. Information on document development activities was available to stakeholders and the public on the project website.

At the beginning of the drafting, the document was called "National Waste Management Strategy with National Plan", and after the Law on Planning System came into force, the drafting continued under the name "Program", in order to comply with new regulations governing the planning system in Serbia.

The draft program was made available to the public in the period from September 16 to October 5, 2021, and online presentations of the document were held as part of public consultations. Comments and suggestions of stakeholders and state administration bodies, sent during the consultations, mostly referred to the need to update the data in the analysis of the situation, to show reliable and up-to-date available data. Additional comments were made regarding the need to plan amendments to regulations to ensure the separation of food waste from municipal waste, in relation to special waste streams, as well as suggestions to harmonize the structure and content of the document with the regulations governing the planning system. Based on the received suggestions and comments, the text of the Program was improved, and the comments were mostly accepted. The public debate on the Program Proposal was conducted in the period from December 23, 2021 to January 11, 2022.

11. RISK ANALYSIS

The risks for the implementation of the Program are as follows:

1) changes to the timetable for the implementation of the Program as a result of negotiations with the EU on Chapter 27
2) lack of financial resources;
3) problems with obtaining assistance from EU IPA funds;
4) issues with obtaining loans from international financial institutions;
5) delay in harmonization of regulations with EU directives;
6) insufficient administrative capacity of the Ministry, the Autonomous Province and local governments to implement the measures;
7) insufficient capacity of institutions to control the implementation of measures;
8) lack of professional staff for the establishment of waste management systems in local and regional systems
9) significant delay in the preparation of technical documentation for infrastructure construction;
10) collection of fees for waste management services lower than expected;
11) insufficiently developed consciousness of citizens.

Risks can be mitigated by regular monitoring of the implementation of the Program and timely response and by taking measures to mitigate the risks.

12. ACTION PLAN

The adoption of the action plan is planned within 90 days from the adoption of the Program. The Action Plan will define specific activities that will be undertaken to ensure the conditions for the realization of the objectives of the Program, certain actors, and partners for the implementation of these measures and activities, define their indicators, as well as deadlines and means for their implementation.

The first action plan is adopted for the period from 2022 to 2024, for the implementation of the Waste Management Program in the Republic of Serbia for the period 2022-2031.

13. LIST OF REGULATIONS TO BE AMENDED OR ADOPTED IN ORDER TO IMPLEMENT THE PROGRAM

The corresponding differences between the legislation on waste in the Republic of Serbia and the acquis Communautaire are listed in Chapters 2.1. and 2.2. of this Program. Also, the constant development of the legal framework to support the circular economy in the EU

requires additional adjustment of the legislation of the Republic of Serbia on waste in the process of approaching the EU.

The key regulations that need to be amended in order to implement the Program are in particular:

- Law on Waste Management;
- Law on Packaging and Packaging Waste;
- Law on Fees for the Use of Public Goods
- Law on Integrated Prevention and Control of Environmental Pollution;
- Regulation on Waste Disposal in Landfills;
- Decree on the plan for the reduction of packaging waste for 2025-2030
- Regulation on Construction and Demolition Waste Management;
- Regulation on minimum requirements for extended producer responsibility programs for certain specific waste streams;
- Regulation on Waste from Mercury and Mercury Compounds;
- Decree on Criteria for Selection of Waste Management Infrastructure Locations;
- Decree on the amount and conditions for the allocation of incentive funds
- Rulebook on categories, testing and classification of waste;
- Rulebook on the treatment of devices and waste containing (PCB);
- Rulebook on the list of electrical and electronic products, measures to prohibit and restrict the use of electrical and electronic equipment containing hazardous substances, methods and procedures for the disposal of waste from electrical and electronic equipment;
- Rulebook on the manner and procedures of managing used batteries and accumulators;
- Rulebook on the manner and procedure of waste vehicle management;
- Rulebook on the content of the request for entry in the Register of by-products and the Register of waste that has ceased to be waste;
- Rulebook on technical requirements and other special criteria for certain types of waste that cease to be waste;

- Rulebook on the manner and procedure of waste tire management;

- Rulebook on the manner and procedure of waste oil management;

- Rulebook on technical and other requirements for plastic bags with additives for oxidative degradation and biodegradation, on conformity assessment and conditions to be met by the notified body.
- Rulebook on technical and other requirements for plastic carrying bags and on conformity assessment;
- and other regulations arising from the obligation to comply with EU regulations.

The list will be revised as necessary and through action plans, in line with possible changes to EU regulations.

14. FINAL PROVISIONS

This Program shall be published on the Government's website, the website of the Ministry of Environmental Protection and the e-Government portal, within seven working days from the day of its adoption.

Publish this program in the "Official Gazette of the Republic of Serbia".
05 Number 353-/588/2022-1
Belgrade, 28 January 2022

GOVERNMENT

PRIME MINISTER
Ana Brnabic