WASTE MANAGEMENT AND REMEDIATION IN LOMBARDY REGION

Plan “Toward the Circular Economy”

Extension booklet

Sostenibilità in Lombardia

Regione Lombardia

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Milan, September 2022

Sustainability and Circular Economy in Lombardy

By **Raffaele Cattaneo**
Councillor for Environment and Climate, Lombardy Region

Lombardy Region is moving quickly and taking concrete action to reach the sustainability goals set by the United Nations 2030 Agenda, the Green Deal, the European Strategies, and the National Strategy for Sustainable Development. In this path, the Region plays a key role, in conjunction with the national strategy and the territory by giving concrete form to these policies and by linking the goals to the resources.

One of the pillars of sustainability is precisely the circular economy, in which our region is at the forefront, and which takes further expression in **the new Regional Waste Management Programme**, including the Programme for Polluted Areas which we wanted to significantly title: “toward the circular economy”. It is a **planning tool in which policies are defined for prevention**, **recycling**, **recovery,** and **disposal of waste**, as well as for the management of **polluted sites to be reclaimed**.

We are going through an era of cultural change: **everything must be considered a resource** and possibly the word “waste” must be deleted. For this reason, it is important that a circular approach is adopted in each area, by revisiting the function of the entire supply chain involved in each production cycle: from design, to production, to consumption, to end-of-life destination. The goal that Lombardy sets is **the ‘zero waste to landfill’**: This method of disposal must be used only in residual form for those fractions that cannot be reused and recovered either as matter or as energy in our waste to energy plants.

The same applies to **the reclamation system**, an area in which Lombardy Region has been able to outline a picture of the critical issues in the area, proposing actions aimed at making sure and improving the execution of reclamation procedures and pursuing more effectively **the general objective of eliminating, containing or reducing pollutants so as to prevent and limit the risks to health and the environment** from soil contamination, by returning **to new uses and functions** portions of territory currently affected.

All of this is possible thanks to the alliance between the institutions, the citizens, and the entrepreneurial system. An alliance fostered by the choices made by the Lombardy Region and the local institutional system geared to maximum realism and balance, without ideological excesses and in the awareness that responsible decisions are needed even when they are not simple, for it is only with courage and responsibility that genuine sustainability can be made concrete.

Lombardy is already today the Italy’s driving force and one of the most advanced regions in the Europe toward the circular economy. By implementing this programme, which sets even more ambitious goals, it will confirm and strengthen its leadership position in order to become a further player on the path to sustainable development.

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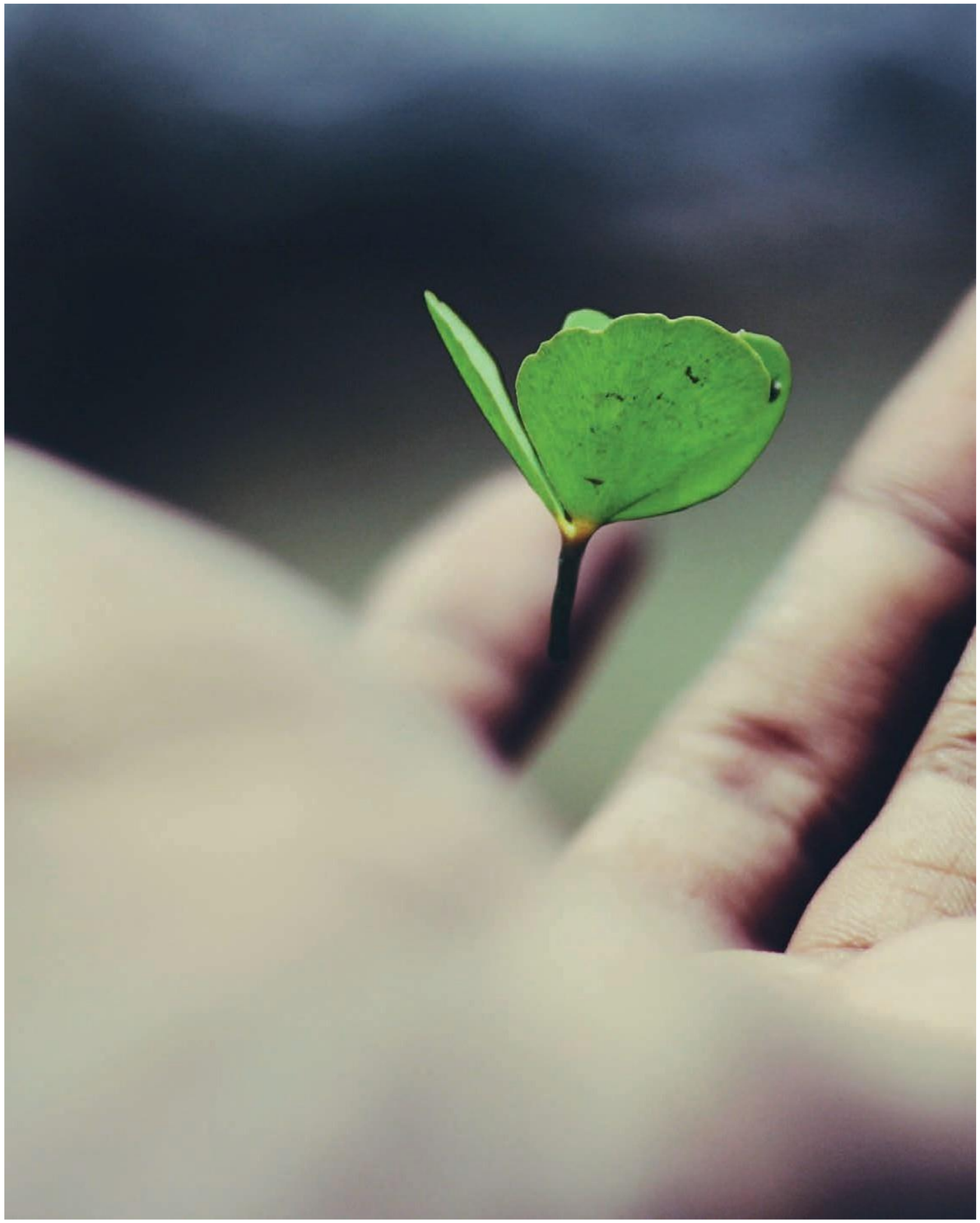

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The Regional planning update path

Since 2005, Lombardy Region has established a Regional Waste Management Programme, including the Regional Programme for Polluted Areas Remediation (Programma Regionale di Gestione dei Rifiuti – Programma Regionale delle Bonifiche, PRGR-PRB), consistent with the relevant regulatory provisions. The previous PRGR was **approved by Regional Council Resolution No. 1990 of 20 June 2014 and thereafter monitored biennially in 2017 and 2019**. Under the current rules, the PRGR-PRB must be reassessed after six years and must therefore be subject to updates.

> **With Regional Council Resolution No. 6408 of 23/05/2022, the update of the Regional Waste Management Program (PRGR), including the Programme for Polluted Areas Remediation (PRB), was approved.**

The programme contributes to **the implementation of Community sustainable development strategies**, as well as being the programming instrument through which Lombardy Region defines in an integrated way **policies on the prevention, recycling, recovery and disposal of waste**, **and the management of polluted sites to be cleaned** up.

The update of the waste programme is in line with the directives referred to in the **Circular Economy Package**, transposed in Italy in September 2020 with a series of rules that amended the Consolidated Environmental Law (Italian Legislative Decree no.152/2006 and subsequent amendments and supplements). This path is part of a broader European strategy that aims to bring about a significant change in production and consumption patterns under the new Circular Economy. The PRGR contains **evolution scenarios for 2027** for both municipal and special waste, with specific objectives and implementation tools aimed at fostering effective recycling processes and limiting the creation of new volumetric capacity of landfill.

Regional planning includes, in addition to planning for urban and special waste, actions for the specific management of particular categories of waste, such as Biodegradable Municipal Waste, sewage sludge, packaging waste, waste containing asbestos and equipment containing polluting substances such as polychlorinated biphenyls (PCBs).

> **The Regional Programme for Polluted Areas Remediation, an integral part of the PRGR, aims to draw up an up-to-date picture of the critical issues in Lombardy based on an analysis of the territory, and to propose a comprehensive set of actions to be implemented in the short and medium term aimed at improving the execution of the remediation procedures and pursuing more effectively the general objective of eliminating, containing or reducing pollutants to prevent and/or limit risks posed to human health and the environment from soil contamination, by returning portions of lands that are currently affected to their legitimate uses and functions.**

This document contains **a reasoned and informative summary of the main elements of the new regional planning**, starting from the mapping of the existing situation, up to the presentation of its main strategies, objectives and implementing instruments, until 2027, which are applied to the different sectoral plans.

02

What is Waste?

THE NEW DEFINITIONS

MUNICIPAL WASTE IS

NDU: NON-DOMESTIC USER / HW: HOUSEHOLD WASTE

MUNICIPAL WASTE IS NOT

- WASTE FROM PRODUCTION
- WASTE FROM SEPTICS TANKS, SEWERAGE SYSTEMS AND WASTEWATER
- VEHICLES OUT OF USE
- WASTE FROM AGRICOLTURE, FORESTRY AND FISHERIES
- WASTE FROM CONSTRUCTION AND DEMOLITION (C&D)

Figure 1. Breakdown of types of waste

Waste is what remains like scraps or remains from a wide variety of human activities

More specifically, European Directive 2008/98/EC, transposed in Italy in the Consolidated Environmental Law, defines waste as *"any substance or object which the holder discards or intends or is required to discard"*.

> **Waste is mainly divided into two categories: "urban waste" and "special waste".**

Italian legislative decree No 116/2020 has recently amended the definition of urban waste, providing that such is not only the mixed and separate waste produced in citizens houses (household waste) but also the waste from non-household users (non-household waste) similar in nature and composition to household waste. This means that under this new definition, a lot of special waste has become urban by law.

Moreover, urban waste includes waste from **the street sweeping**, waste **on roads** and **public areas, and vegetable waste** from the management of **green areas**, such as parks and gardens.

Special waste, on the other hand, is generated by **production activities**, **agriculture**, **forestry**, **fishing**, and **septic tanks**, sewerage **systems** and **wastewater treatment plants**, including **sewage sludge**; other special waste include **end-of-life vehicles** or **construction and demolition waste**.

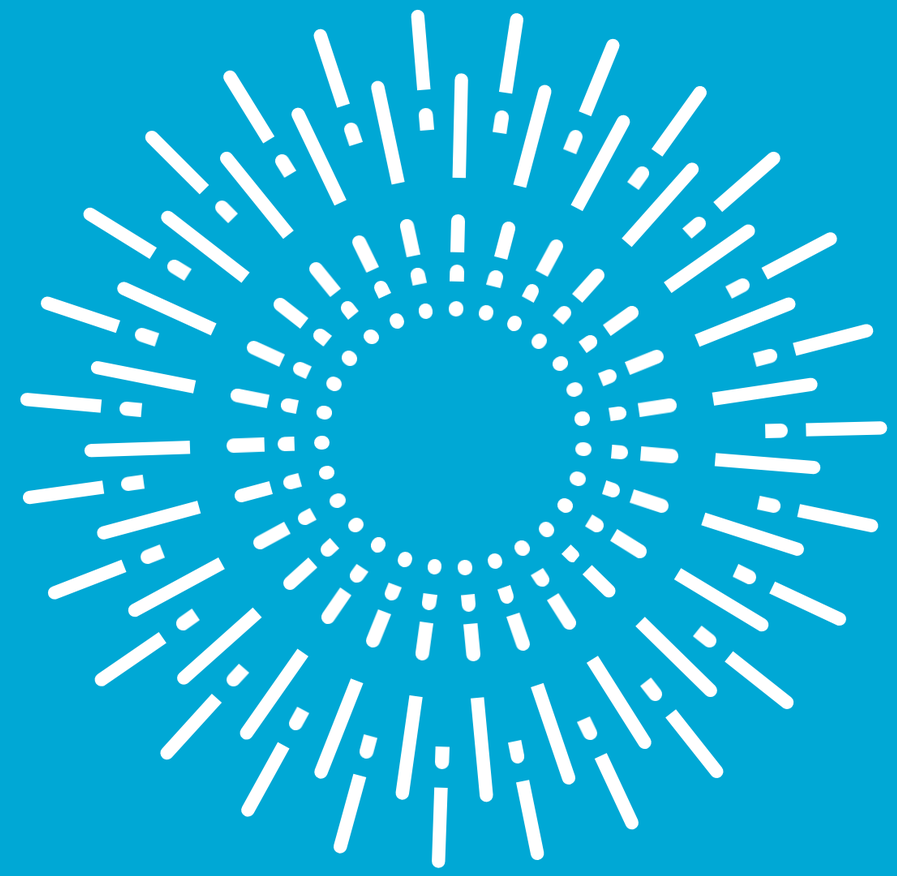
These two waste categories are subject to a different management.

THE MANAGEMENT OF URBAN AND SPECIAL WASTE

For urban waste, the principle of regional self-sufficiency applies, i.e., they are managed and disposed within the same region where they are produced, through a proper network of plants.
For special waste, it is slightly different: since for the characteristic they are subject to free movement rules such as goods, they can therefore be recovered and disposed even in plants located outside the region.

03

Our starting point



3.1 What Goals for Waste Management

Existing EU legislation on waste management is the European Council and EU Council Directive **No. 2008/98/EC** of 19 November 2008.
On 14 June 2018, the so-called **Circular Economy Package** was published in the Official Journal of the European Union, consisting of the following four directives:

Directive 2018/851/EU of the Framework **Directive on waste(2008/98/EC)**

Directive 2018/850/EU amending **the Directive on the landfill of waste (1999/31/EC)**

Directive 2018/852/EU amending **the Directive on Packaging (1994/62/EC)**

Directive 2018/849/EU amending **Directives on end-of-life vehicles (2000/53/EC), batteries and accumulators (2006/66/EC)** and **waste electrical and electronic equipment – WEEE (2012/19/EU)**.

The Circular Economy Package Directives have been in force since 4 July 2018.

> **The package of new directives forms part of a broader European strategy that aims to bring about a significant change in production and consumption patterns, in line with the new vision of the so-called "Circular economy". with the aim of reducing and increasing the efficiency of the collection and use of natural resources and making the system's economic development more competitive and sustainable.**

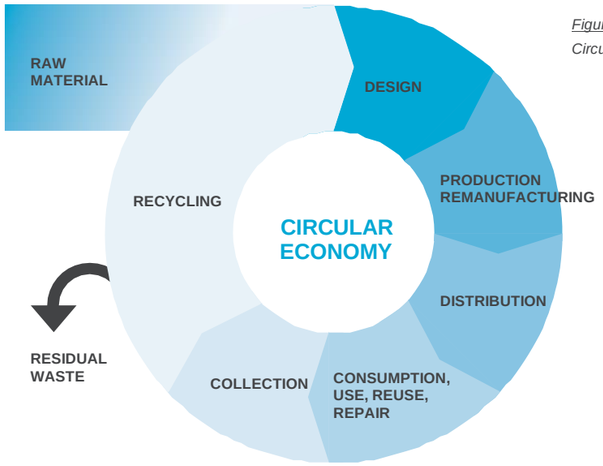


Figure 2. Diagram of the Circular Economy model

The key concept behind the development of EU waste legislation is **the waste hierarchy of**, defined as a priority order in waste prevention and management legislation and policy. It is characterized by the following stages:

⟶ prevention ⟶ preparation for reuse ⟶ recycling ⟶ other recovery, e.g., energy recovery ⟶ disposal.

> Implementation of the Circular Economy Package

The implementation of the Circular Economy Package in Italy provides for four decrees:
1 — D.Lgs. of 3/9/2020 no 116 on waste
2 — D.Lgs. of 3/9/2020 no 118, on batteries and accumulators and waste batteries and accumulators, and on waste electrical and electronic equipment
3 — D.Lgs. 3/9/2020 no 119, concerning end-of-life vehicles
4 — D.Lgs. 3/9/2020 no 121, establishing a new organic framework for the delivery of waste to landfill, with a ban on the disposal to landfill, from 2030, all waste which is resulting suitable for recycling or other forms of recovery.

Figure 3. Priority criteria in waste management

THE WASTE HIERARCHY

The waste hierarchy can be represented by an inverted pyramid leading from the best to the worst choice: at the top are the prevention and minimization of waste generation, which can be tackled for example by intervening "upstream" in the design of goods and packaging (so-called eco-design), the production processes and their energy consumption can be improved, and their recyclability and re-use can be improved. Secondly, there are the options for the material recovery and energy, while only at the last level is considered the disposal.

> National Goals

The goals set out in the European Directives have therefore been transposed at national level, including:

> **by 2020, the preparation for reuse and recycling of waste such as paper, metals, plastics and glass from households and possibly from other sources, if such streams are similar to household waste, shall be at least 50% by weight;**

- **by 2020, preparation for reuse and recycling and other types of material recovery (including filling operations using waste as a substitute for other materials), of non-hazardous construction and demolition waste (other than soil and rock for excavation, CER 170504) must be at least 70% by weight;**
- **preparation for reuse and recycling of urban waste, in terms of weight, shall be: at least 55% by 2025, at least 60% by 2030, at least 65% by 2035;**
- **from 31 December 2021 bio-waste must be separated and recycled at source (by self-composting or community composting) or collected separately, without mixing it with other types of waste. Waste, including packaging, having similar biodegradable and compostable properties to organic waste, shall be collected, and recycled together with the latter, where it complies with the European reference standards (EN 13432 and 14995);**
- **from 1 January 2022, textile waste must be collected in a separate manner.**

> European goals

With regard to the European goals for reducing the delivery of biodegradable waste to landfills, the following timetable is established at national level, valid for the Italian *Ambito Territoriale Ottimale* (local administrative areas for the integrated public services organization) or, if this has not been established, as in the case of the Lombardy Region, at provincial level:

- **by 28 December 2020 biodegradable urban waste landfilled shall be less than 173 kg/year per inhabitant;**
- **by 28 December 2023 biodegradable urban waste landfilled shall be less than 115 kg/year per inhabitant;**
- **by 28 December 2030 biodegradable urban waste landfilled shall be less than 81 kg/year per inhabitant.**

In line with the general objectives of Directive 2018/850/EU on the reduction of landfilled waste, two paragraphs are introduced in Article 5 of Legislative Decree No 36/2003:

- **paragraph 4-bis provides that from 2030 onwards, the disposal of all waste suitable for recycling or other recovery, in particular form municipal waste, to landfills shall be prohibited, with the exception of waste for which landfill disposal is the best environmental result;**
- **paragraph 4-ter States that by 2035, the amount of municipal waste collected in landfill must be reduced to 10% or less of the total amount by weight of urban waste generated.**

3.2 How much waste we produce

According to data from the ARPA Lombardia's 2020 Waste Registry, in 2020 in Lombardy region, we produced a total of 4,677,223 tons of urban waste.

Each citizen generated an average of 469.3 kilograms of waste, with a reduction of 2.1% compared to 2019 (479.1 kg/ab*year), a trend that must however be assessed considering the exceptional dynamics linked to the COVID-19 pandemic.

In particular, in recent years we have witnessed the gradual and significant decrease in the residual urban waste (i.e., the dry mixed waste) up to a value of 124.4 kg/inhabitant in 2020 (it was equal to 220.8 kg/inhabitant in 2010 and to 249.2 kg/inhabitant in 2005), and in parallel with the increase in separate collection.

FRACTION	QUANTITIES COLLECTED (T)	QUANTITIES HARVESTED (KG/INHAB/YEAR)
RESIDUAL URBAN WASTE	1,239,694	124.4
BULKY	236,659	23.7
STREET SWEEPING	115,261	11.6
PAPER AND CARDBOARD	557,029	55.9
PLASTIC	216,290	21.7
GLASS	334,822	33.6
FORSU	770,934	77.3
GREEN	458,096	46.0
WOOD	213,976	21.5
METALS	58,200	5.8
WEEE	53,924	5.4

Figure 4.
Main fractions: Quantity collected, total and per capita in Lombardy (data from 2020, Regional Waste Register - ARPA Lombardia)

The most significant **increase** in differentiated fractions concerns **the humid waste fraction**, which was reduced to 77.4 kg/inhabitant in 2020, and recyclable plastic, glass, and multi-material fractions, which have reached a level similar to that of bio-waste. The multi-material waste is typically collected in two ways: in some municipalities it includes plastic packaging, plastic-coated paper, and cans (so-called *multileggero*) and in others it includes glass and cans (so-called *multipesante)*. By dividing the quantities by type of material, in 2020 the total amount of **plastic** reaches **21.7 kg/inhabitant** and **glass 33.6 kg/inhabitant**.

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3.3 The current percentage of separate collection we do

In 2016, a new national method for the percentage of separate collection was introduced by Ministerial Decree (DM 26/05/2016 “Guidelines for the Calculation of the Percentage of Separate Collection of Municipal Waste”), this results in values higher than the previous methodology by more than 7 percentage points according to the 2011 Regional Council resolution.

This new method makes it possible to make the results achieved on all national levels comparable.

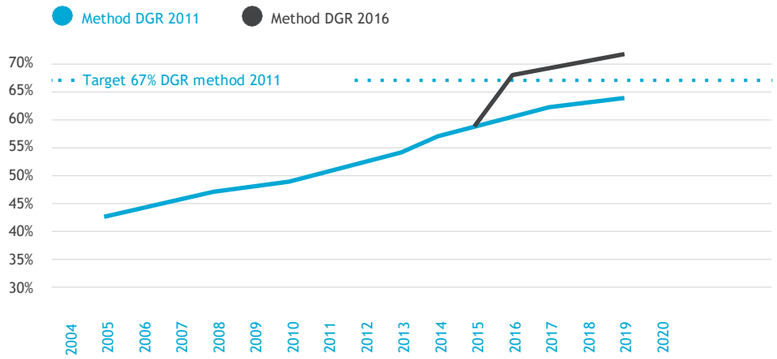

Figure 5. Trend in separate collection in Lombardy with the two calculation methods in force in recent years.

In 2020, separate collection in Lombardy reached a regional average of 73.3% (calculation method DM 2016), with peaks of virtuous municipal that stand permanently above 80%.

Compared to other Italian regions, Lombardy is in fourth position, after Veneto, Sardinia, and Trentino Alto Adige.

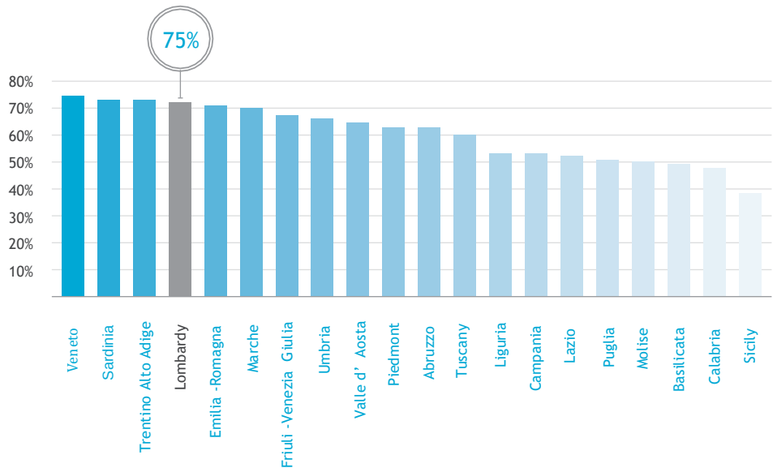

Figure 6. Separate collection, ISPRA data for 2019, calculation method DM 2016.

The percentage of separate collection at municipal level has been steadily increasing over the last ten years, also with reference to the previous calculating method DGR 2011, as it is evident from the map below.

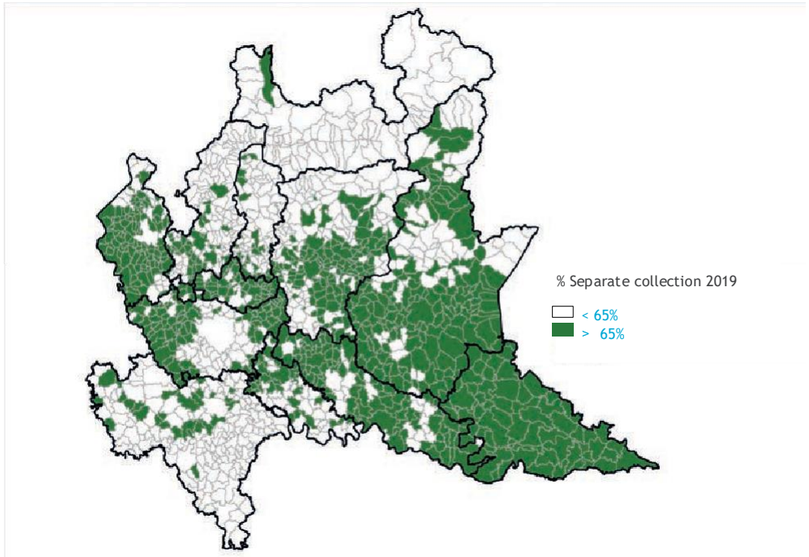

Figure 7. Territorial distribution of municipalities with better separate collection results.

While the separate collection rate represents the collected waste streams separately from the total waste collected to facilitate its specific treatment, the recycling rate refers to the amounts of waste actually sent to recovery and preparation for re-use operations, without the selection scraps, to obtain products, materials, or substances to be used for their original function or for other purposes.

The level of recycling achieved in 2019 in Lombardy is 54.9%, which is interesting as it anticipates by six years the achievement of the national target set out by the review of Directive 2008/98/EC (55% in 2025, 60% in 2030 and 65% in 2035).

3.4 The current management of our urban waste

In Lombardy in recent years, the significant efficiency achieved in collection services, has allowed important objectives to be achieved, such as the reduction and stabilization of per capita waste production and the simultaneous increase in the percentage of separate collection.

The collection model that has led to these results is the door-to-door model (extended to over 80% of Lombard municipalities) which, in some contexts, has set up a system for warning of deliveries with the priority of making citizens aware of their level of waste generation; this monitoring system is also necessary and precludes the possible implementation of the one-off tariff based on the core concept of the European environmental Policy “Polluter Pays” (declined in PAYT – Pay As You Throw).

The Lombard waste collection system shall pursue the optimization, cost containment and customization of the service to users through, for example:

- **the variation of collection frequencies according to the needs for the territory, up to, for example, the reduction of the frequency of collection of residual urban waste to once a month in particularly advanced separated collection contexts**
- **the activation of services dedicated to particular territories or categories of users, such as the experiences of activating the collection of diapers/sanitary pads for families with infants or elderly people, door-to-door collection of specific waste streams for non-domestic users, itinerant collection points for historic centres (where there are problems with storage space) or other areas lacking in close collection centres, collection points with controlled access for tourists, etc.**

As regards the treatment of collected waste, **Lombardy has a large number of plant-based sectors, which are constantly evolving** both to ensure a constantly lower environmental impact of waste management activities and to adapt the management to treatment needs, which vary over time, to market demands and technological innovations.

The main active municipal waste treatment plants in Lombardy are:

12 incineration installations with recovery of electricity/ thermal energy	8 anaerobic digestion plants	9 Landfill for non-hazardous waste from urban waste
7 mechanical-biological treatment plants	7 integrated treatment plants anaerobic/ aerobic	9 plants for recovery of the sweepings
3 selecting plants dealing predominantly with (residual urban waste)	65 Composting plants for the treatment of bio fraction from urban solid waste (FORSU), green and sludge	100 Platforms of the CONAI system for the recovery of fractions

98.1% of urban waste had as its first destiny a Lombard plant.

In recent years, the Lombard plant complex has largely guaranteed self-sufficiency in the treatment of urban waste: only 1.9% of urban waste had as its first destiny a plant located outside the Region.

As regards to the residual urban waste in particular, the Lombard plants have ensured treatment full self-sufficiency. **In addition, 87% of the total residual urban waste was treated within the production province** in full compliance with the proximity principle.

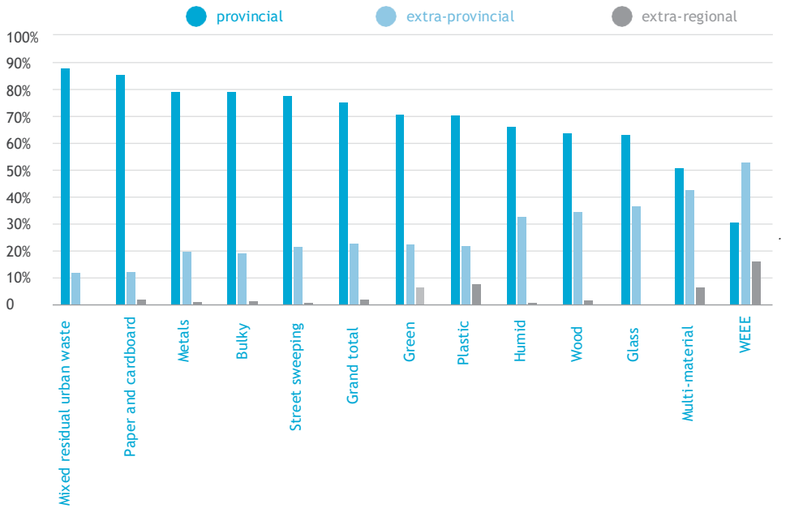

Figure 8. First destination for the main municipal waste fractions collected in 2019

> Current destination of Lombard waste:

Separate collections → the individual flows of the separate collections, which together account for more than 63% of the urban waste, are sent for recycling, after separating the extraneous fraction. This extraneous fraction, together with undifferentiated waste, is sent to energy recovery or final disposal. In 2020, 63.4% of municipal waste and 21.6% of energy recovery were undertaken, with a combined recovery of 85%.

Mixed waste → 80 % of the residual urban waste is incinerated in Lombard plants; the resulting waste (about 20 % of the treated material) is recovered and a limited amount of hazardous light ash is destined for disposal.

The remaining 20% is sent to mechanical biological treatment (MBT) or to selecting (SEL) plants in Lombardy; these generate outbound waste that largely feeds incinerators and only marginally are sent to co-incineration plants such as cement plants.

Bulky waste → almost all the bulky waste is taken over by recovery plants, but only about 25% of the treated waste is subsequently sent to material recovery.

Although the waste management and treatment system has already achieved good performance levels, it should aim for further optimization to:

- **maximising an effective material recovery**
- **where material recovery is not possible, maximize the initiation of energy recovery;**
- **make full use of the selection potential of MBT/SEL plants by enhancing their role, including with regard to the large production of special waste, for the material recovery, if any, and for the production of waste solid secondary fuel to be initiated in Lombard co-incineration plants as a replacement for conventional fuel (petroleum coke);**
- **encourage research and development of new plant-based technologies for material/energy recovery from waste;**
- **to minimize landfill deliveries by effectively reducing them to waste flows only which, due to their chemical and physical characteristics and their commodity category, are otherwise unrecoverable.**

3.5 How much special waste we produce

In 2019 (the latest available data from ARPA Lombardia's Regional Register for Special Waste) 1 8,869,786 tons of special waste were generated, of which 84.5% is cost-effective from non-hazardous waste and the remaining 15.5% from hazardous waste. Overall, special waste accounts for around **80% of total Lombard waste production**.
This quantity must be added to the non-hazardous inert waste, for which (ISPRA estimate), also **for 2019, there was a production of 13.2 million tons**, corresponding to about 42% of the total special waste produced, an increase of 4.6 compared to 2010 millions of tons. **The total of special waste including inert is about 32 million tons.**

In the PRGR, the available data were analysed in the period 2010-2018, during which the special waste produced in Lombardy increased by +12%.

With regard to this period, an initial upward trend was observed, followed by a slight decline in the number of special wastes produced in 2016 and a subsequent recovery in 2017 (+6.8% compared to 2016) and 2018 (+2.6% compared to 2017).

Special waste produced in Lombardy accounts for **21.7% of national production** (which in 2019 amounted to 154.0 million tons) and **37.8%** of the figure **for Northern Italy** (which in 2018 amounted to 88.6 million tons). These figures include C&D waste, the quantity of which (14.6 million tons in Lombardy, 38.4 million tons in North Italy, 68.3 million tons nationally) is estimated by ISPRA as there is no obligation to declare data.

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Figure 9. Comparison of the development of the production of special waste in Lombardy with national and northern Italy data, 2010- 2018. Source: Processing ISPRA estimates.

Special waste production trend in Italy, Northern Italy and Lombardy

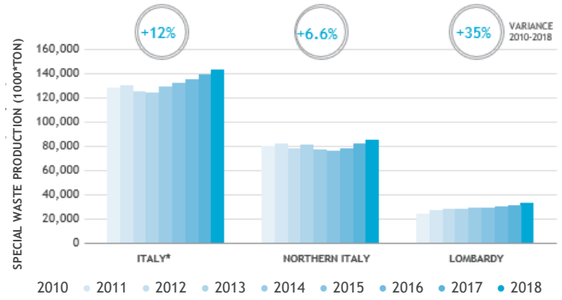

Figure 10. Comparison of trends in the generation of non-hazardous special waste report (excl. Cap 17 and 19) per unit of GDP and verification of the goals of the prevention programme in Lombardy with national and Northern Italy data, 2010-2018. Source: Estimating ISPRA and ISTAT for GDP.

Trend comparison percentage change in non-hazardous special waste output ratio (excl 17 and 19)/GDP, compared to 2010 (2011-2018)

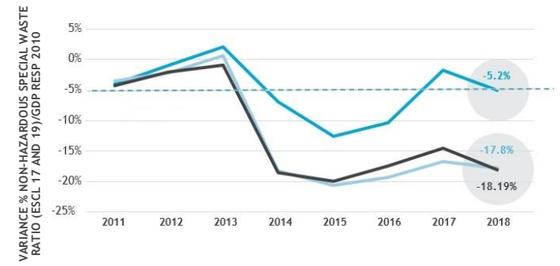

Figure 11. Comparison of trends in the generation of special hazardous waste report (excl. Cap 17 and 19) per unit of GDP and verification of the goals of the prevention programme in Lombardy with national and Northern Italy data, 2010-2018. Source: Estimating ISPRA and ISTAT for GDP

Trend comparison percentage change in special hazardous waste output ratio (excl 17 and 19)/GDP, compared to 2010

The main special waste produced in Lombardy are:

- **Construction and Demolition (C&D) waste, which contributes 13 million tons or about 40 % of total production (in 2018)**
- **Wastes from waste management and water waste treatment plants, which contribute 9.5 million tons to 29 % of the total production**
- **Wastes from the processing and physical and mechanical superficial treatment of metals and plastics, which contribute 1.9 million tons which accounts for 5.8% of total production.**

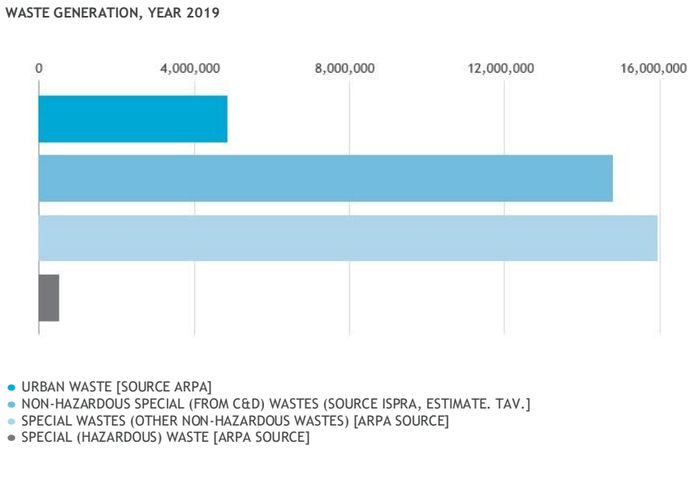

Figure 12. Production of special waste in the Lombardy Region, year 2019. Source: ISPRA, ARPA data processing

3.6 The current management of our special waste

The economic activities that largely generate the special waste are related to the following: waste collection, treatment and disposal activities and material recovery (29%) and rehabilitation activities and other waste management services (3.5%), metallurgy and manufacturing of metal (12.7% and 6.3% of the total), construction (10.8%) and to a lesser extent manufacturing and trade activities.

The current management of special waste takes place for 81% through the material recovery, for 3% through energy recovery and for the remaining 16% through disposal activities.

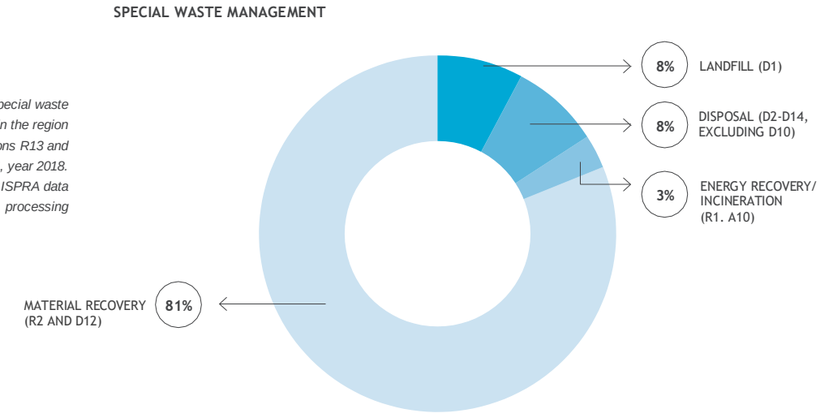

Figure 13. Special waste management in the region (excluding operations R13 and D15), year 2018. Source: ISPRA data processing

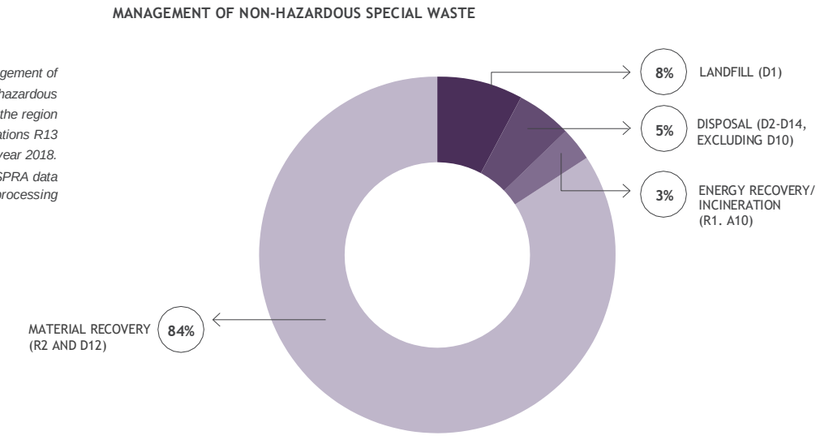

Figure 14. Management of special non-hazardous waste in the region (excluding operations R13 and D15), year 2018. Source: ISPRA data processing

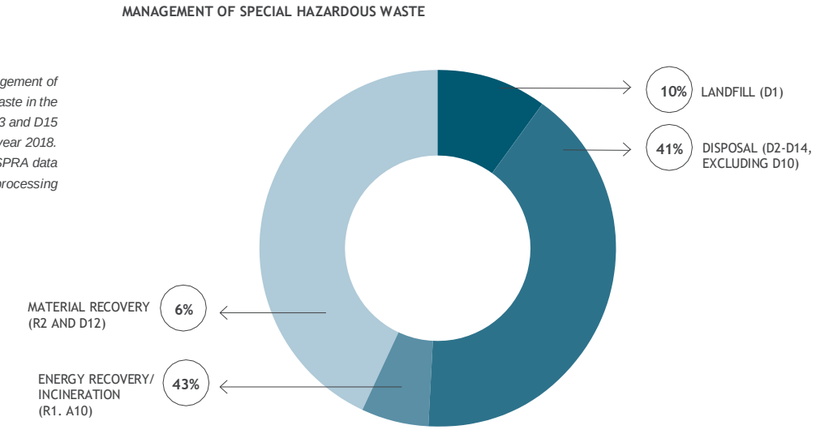

Figure 15. Management of special hazardous waste in the region (excluding R13 and D15 operations), year 2018. Source: ISPRA data processing

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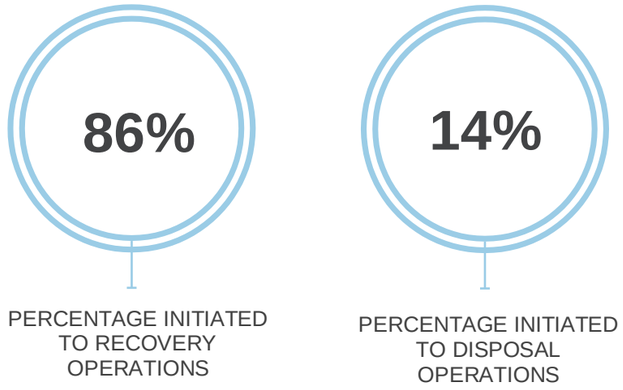
Disposal activities include: treatment operations to facilitate disposal such as, for example, preliminary grouping and reprocessing; final disposal operations such as landfill (D1) or incineration (D10).

The management of special waste, in terms of both recovery and disposal, has a clear increasing trend: +47.6% from 2010 to 2019, with an increase in the quantities treated both by recovery operations (+57.8%) and by disposal operations (+6.6%).

The overall estimate of special waste management in 2019 is 46.4 million tons, of which: 39.7 million tons (86%) are initiated to recovery operations, 6.7 million tons (14%) are disposal operations.



Predominant recovery operations: Recovery of inorganic material (37% of total recovered in 2019) **/** Metal recovery (21%) **/** Recovery of organic material (14%) **/** Land treatment (3.8%) **/** Energy recovery (7.8%).

Disposal operations: Landfill disposal (48% of total special waste disposed in 2019) / chemical-physical treatment (26%) / incineration of special waste (3%) / biological treatment (13%)*.

The regional plant network manages, in addition to the Lombard special waste streams (about 70% of the total received), also waste from outside the region (about 20%) and from abroad (about 10%).

Most of them are initiated into a real **recovery under the Circular Economy**. Only 14.5% of the special waste produced in Lombardy are instead sent out to the region and only 4% abroad.

** NOTE: The data below were rewritten using the values from the ARPA report, which also considers Category 19 waste (from urban wastes). In the PRGR, tables 6.11 and 6.12 they were not considered.*

3.7 How do we prevent this in Lombardy?

In implementation of the Lombard Waste Management Programme 2014-2020, Lombardy Region has implemented important waste prevention initiatives for food and non-food areas, in continuity with the actions activated with the **PARR (Action Plan for Waste Reduction)**, and with the policies promoted at Expo 2015.

> Food Area

- **In 2015-2016**, the project called ***L'ABC dello Spreco Alimentare (The basics of food waste)*** was carried out to support schools in the fight against food waste, in collaboration with the Regional Table for Environmental Education, schools and the Regional Educational Department.
- **In 2015-2017**, it developed the project called "***Reti territoriali virtuose contro lo spreco alimentare"*** **(Virtuous Territorial Networks against Food Waste)** to network GDO, non-profit organisations and Municipalities, to quantify the de- volution of food surpluses for social purposes and promote it by using the waste tariff as an instrument for guiding management policies and not just for covering costs.

Distribution of purchases in a G.A.S. (Ethical Purchasing Group), 2022. Photo © Silvia Colombo

Malnate Reuse Centre, 2022. Photo © Silvia Colombo

Other actions such as additional project outputs:

- **Made available** the ***Linee guida igienico-sanitarie regionali per il recupero del cibo al fine di solidarietà sociale*** **(Regional Health and Hygiene Guidelines for Food Recovery for social solidarity purposes)**, which provide operational guidance to facilitate food recovery and distribution for social solidarity purposes.
- **Promoted 2 calls** for funding for **non-profit organisations involved in the donation of food supplies** and a call for non-repayable funding to public bodies for the realisation, the enlargement, and the reinforcement of HUBS or *Empori Solidali* (Solidarity One-stop-shops) for the recovery and distribution of surplus food for social solidarity purposes.
- **Development of the two-year intervention plans 2017-2018 and 2019-2020** to consolidate and promote **the distribution of food surpluses** throughout the Regional Law no 34/2015 ***Legge di riconoscimento, tutela e promozione del diritto al cibo*** (Law of recognition, protection, and promotion of the right to food)

> Non-Food Area

In 2014, 2017 and 2022, Lombardy Region promoted two calls for funding for **the creation of 'reuse centres'**, facilities goods in good/very good conditions, which the holders wish to dispose of and not turn into waste, because of their still high value of use. A total **of 39 Municipalities were supported by the Region** in the activation of a reuse centre, available to about **559,000 Lombard citizens**.

Since 2019, Lombardy Region has **been a partner of the European Interreg Plasteco Project**, which promotes circular policies for the management plastic and its wastes, through the exchange of **experience** and **good practices** at EU level.

In 2020, Lombardy Region made sustainable the food and beverage areas of *Palazzo Lombardia*: thirty food and beverage areas were equipped with dispensers for **the free distribution of purified, still, and sparkling drinkable water**, and some glass bottles with hermetic cap and logo were donated to the employees. At the same time, in the spaces of the Region's *Palazzo*, huge "immersive" installations were positioned to create an unconventional artistic and photographic exhibition, entitled ***Amare contaminazioni***. The aim of **the exhibition** is to trigger emotional impact needed to achieve personal commitment and **sharing** of the initiative through social media.

> Special Waste

The National Programme for Waste Prevention provides the following goals for the reduction of special waste:

- **5% reduction in the production of non-hazardous special waste per unit of GDP**
- **10% reduction in the production of special hazardous waste per unit of GDP.**

While **the goal for non-hazardous special waste has been achieved** at regional level and even more so at national level, for hazardous waste there has been a deviation from the prevention goals both at national level and even more so at regional level. In fact, this situation may have been helped by **a better formulation over the years of the definition of waste as hazardous** (e.g., the change in the classification of hazardous waste following Law No 116 of 11 of August 2014, which converted the D.L. no 91 of 24 June 2014).

04

The future of our waste: Planning

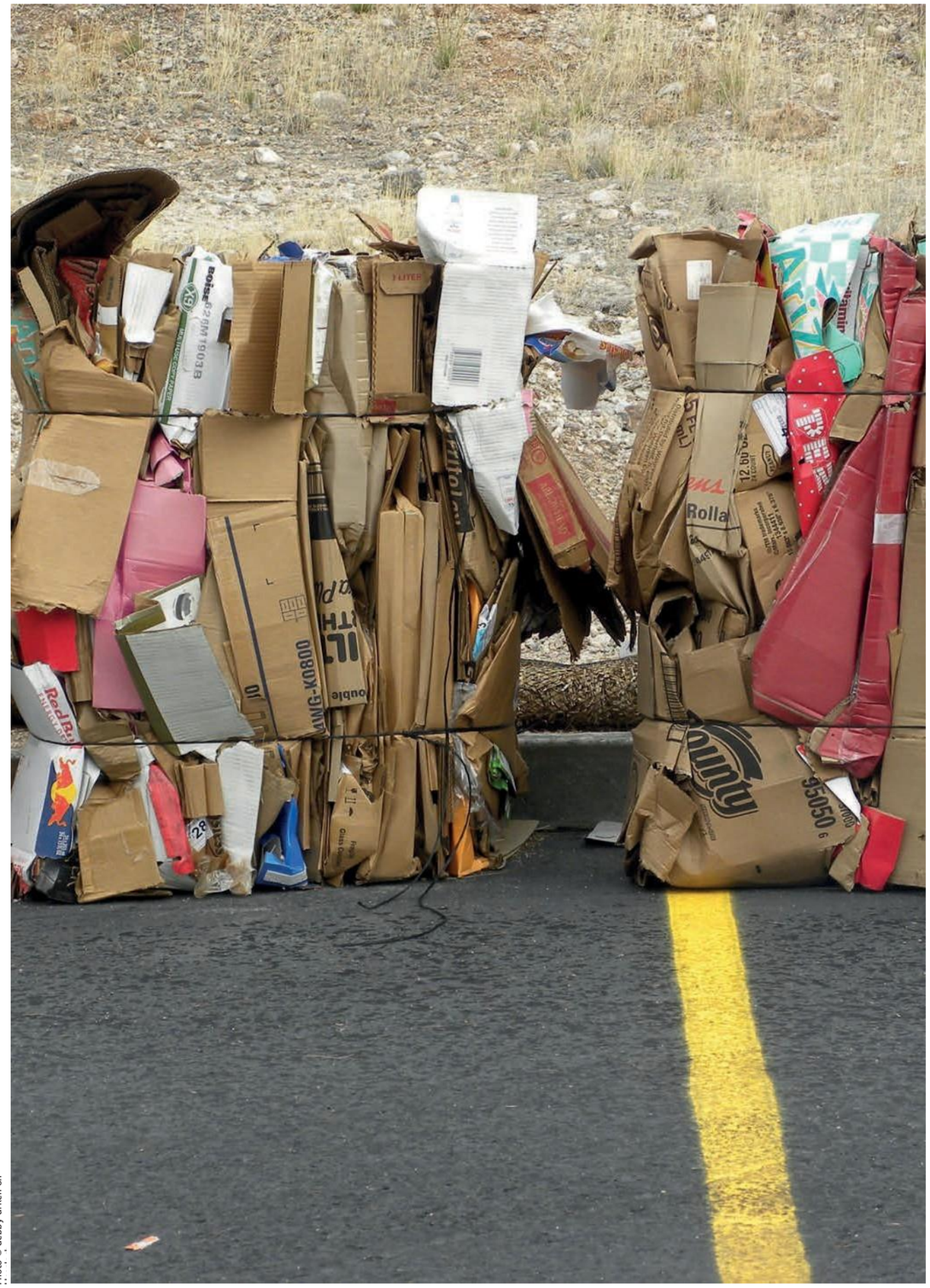


Photo © debby-urken on

Figure 16. Schematic of the homogeneous harvesting model Of the PRGR

4.1 The goals of the update of the PRGR (2022-2027)

To represent the evolution framework of municipal waste management, the PRGR has provided **for three waste generation scenarios until 2027**: the inertial scenario, which considers the "natural" development of the system, in accordance with sectoral legislation; the target scenario, which considers the development in accordance with the more ambitious objectives introduced by the recent regulatory change; **the optimized scenario, which will lead to the development of the system more driven toward 'excellence' performance**. The latter which is the most challenging also from the plant point of view, has been chosen as **the programme scenario**. With the monitoring of the programme, scheduled every 3 years, it will be possible to verify any deviation of the PRGR from the chosen scenario and identify any necessary adjustments of the programme goals and actions.

Urban Waste

The previous PRGR set the objective of extending a "homogeneous model" for urban waste collection at least for the main fractions (Residual municipal waste, Urban solid waste organic fraction, paper, glass, plastic) **in 80% of municipalities by 2020**. This model is based on door-to-door collection.

FRACTION	CONTAINER	MODE AND HARVEST
URBAN SOLID WASTE ORGANIC FRACTION		**KERBSIDE, TWICE / WEEK.** WEEKLY IN THE WINTER PERIOD, IF APPLICABLE
PAPER, CARDBOARD, TETRAPACK		KERBSIDE, WEEKLY
PLASTIC PACKAGING		KERBSIDE, WEEKLY
LIGHTWEIGHT MULTI-MATERIAL (PLASTIC AND METAL PACKAGING)		KERBSIDE, WEEKLY
GLASS AND METALS OR GLASS (IF MULTI-MATERIAL LIGHT METAL SEPARATE COLLECTION IS ACTIVE)		KERBSIDE, WEEKLY
MIXED		KERBSIDE, WEEKLY
GREEN WASTE (GRASS, PRUNING AND BRANCHES)	TRUCK 120 LITERS AND ABOVE	KERBSIDE, SEASONAL, ON REQUEST AND ON PAYMENT ONLY FOR THOSE PARTICIPATING IN THE SERVICE
CERTIFIED AND BRANDED COMPOSTABLES PACKAGING (PLATES, GLASSES, FORKS)	TOGETHER WITH URBAN SOLID WASTE ORGANIC FRACTION AFTER VERIFICATION WITH COMPOSTING SYSTEM	LIKE URBAN SOLID WASTE ORGANIC FRACTION

The update of the PRGR has the following new goals:

Completion of the extension of the homogeneous door-to-door collection model to all Municipalities, with the following possible variants:

- **Alternative collection models only if they ensure a level of efficiency in terms of separate collection and commodity quality of all the fractions comparable to that of door-to-door collection.**
- **Models which minimize the frequency at which undifferentiated waste is collected.**
- **Models with proximity collections in territorial situations where the implementation of door-to-door collection is more complex, always safeguarding the high-quality goals of recycling.**

- **Urban solid waste organic fraction collection in all municipalities, reaching at least 60 kg/inhabitant*year of interception, understood as the sum of mixed collection and domestic or community composting.**
- **Collection of textiles in all municipalities.**
- **Encouragement of the collection of vegetable and mineral waste oils.**
- **Collection of waste from personal absorbent hygiene products in case of reduction of residual municipal waste collection to values below once a week; the separate collection of personal absorbent hygiene products can be activated in experimental mode with a dedicated circuit if there is a plant that allows the recycling of these fractions.**

83.3%

SEPARATE COLLECTION BY 2027

Over time the level of separate collection has increased in all municipalities, though at variable "speeds", and the future goal is now **to** achieve high values of effective recycling, a concept that is different from the simple separated collection, as already mentioned.

Special Waste

Special waste, unlike municipal waste, is not subject to a planning to achieve self-sufficiency in disposal and it is not subject to any handling restrictions on national territory. In spite of this context, the Regional Programme sets out a framework of needs to ensure that the regional system for managing urban and special waste from a perspective self-sufficiency.

The strategies set out in the PRGR for the management of special waste provide for:

- **Respect for the hierarchy of correct waste management, encouraging prevention and recovery, considering landfill disposal as the residual solution to all other treatments.**
- **Regional self-sufficiency in management in compliance with the proximity principle.**

The programme also sets out some **priority goals**, expressed in specific flows (with the exception of sewage sludge, reclamation waste and asbestos, which are subject to specific programmes), in particular:

- **Good management and prevention of special waste actions, as described in the Prevention Plan.**
- **Advanced implementation of the by-products regulation.**
- **Evolution in the legislation on End-of-waste and its enforcement.**
- **Plant improvement to achieve the recycling regulatory goals.**

In this way, regional planning aims **to fully comply with the latest legal requirements** which by 2030 prohibit the landfilling of recoverable waste, "*with the exception of waste for which landfilling would result in the best overall environmental outcome.*"

4.2 Composting and anaerobic digestion plants

The so-called **humid waste**, consisting mostly of kitchen waste or scrap, is sent to special treatment plants **using anaerobic and/or composting processes** which **transform** this waste, enriched with garden waste, consisting of mowing and pruning, **into biological fertilizer,** by means of **a completely natural biological process**.

Anaerobic digestion is a biological process that takes place in the absence of oxygen, by means of which the organic substance, under the action of certain groups of microorganisms, is transformed into biogas consisting mainly of methane and carbon dioxide.

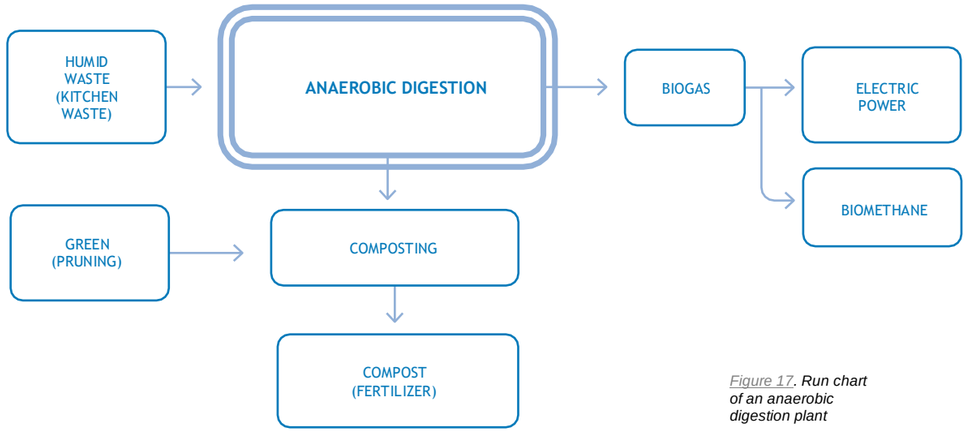


Figure 17. Run chart of an anaerobic digestion plant

In plants where there is an anaerobic digestion section (in the absence of oxygen), the process also generates biogas with high methane concentration. This gas is used to produce renewable power or biomethane for road transport.

The simultaneous **material recovery and energy**, which can be achieved through **the integration of anaerobic digestion and composting**, is at the top of the waste management hierarchy and achieves excellent integration between supply chains. This process allows the material (a composted soil improver and a fuel represented by biogas) and energy recovery together (obtained from the possible use of biogas for power and/or heat generation).

The treatment potential of the current Lombard plants is large if compared to the expected flow of organic waste production and the PRGR does not therefore cover the need for new plants, without prejudice to the development of specific initiatives in terrestrial contexts which are particularly lacking; this is also in order to comply with the principle of territorial proximity, according to which the disposal of municipal waste must take place “in one of the closest appropriate plants to the place of production or collection, in order to reduce the movement of waste” (art. 182-bis of Legislative Decree No 152/2006).

With a view to improving overall waste management and achieving the regulatory goals, **the PRGR include the possibility to take action to increase the effectiveness of pre-treatment and recovery processes with a reduction in waste production.** Here too, the next desirable technological development will play a key role both in the pre-selection phase of the material to be recovered and in the actual recovery phase.

> **In addition, the PRGR envisages an increase in initiating urban solid waste organic fraction to anaerobic digestion, with a view to maximising energy recovery as well as material recovery.**

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4.3 Selecting and recovery facilities

> Glass, paper, plastic, metals and multi-material

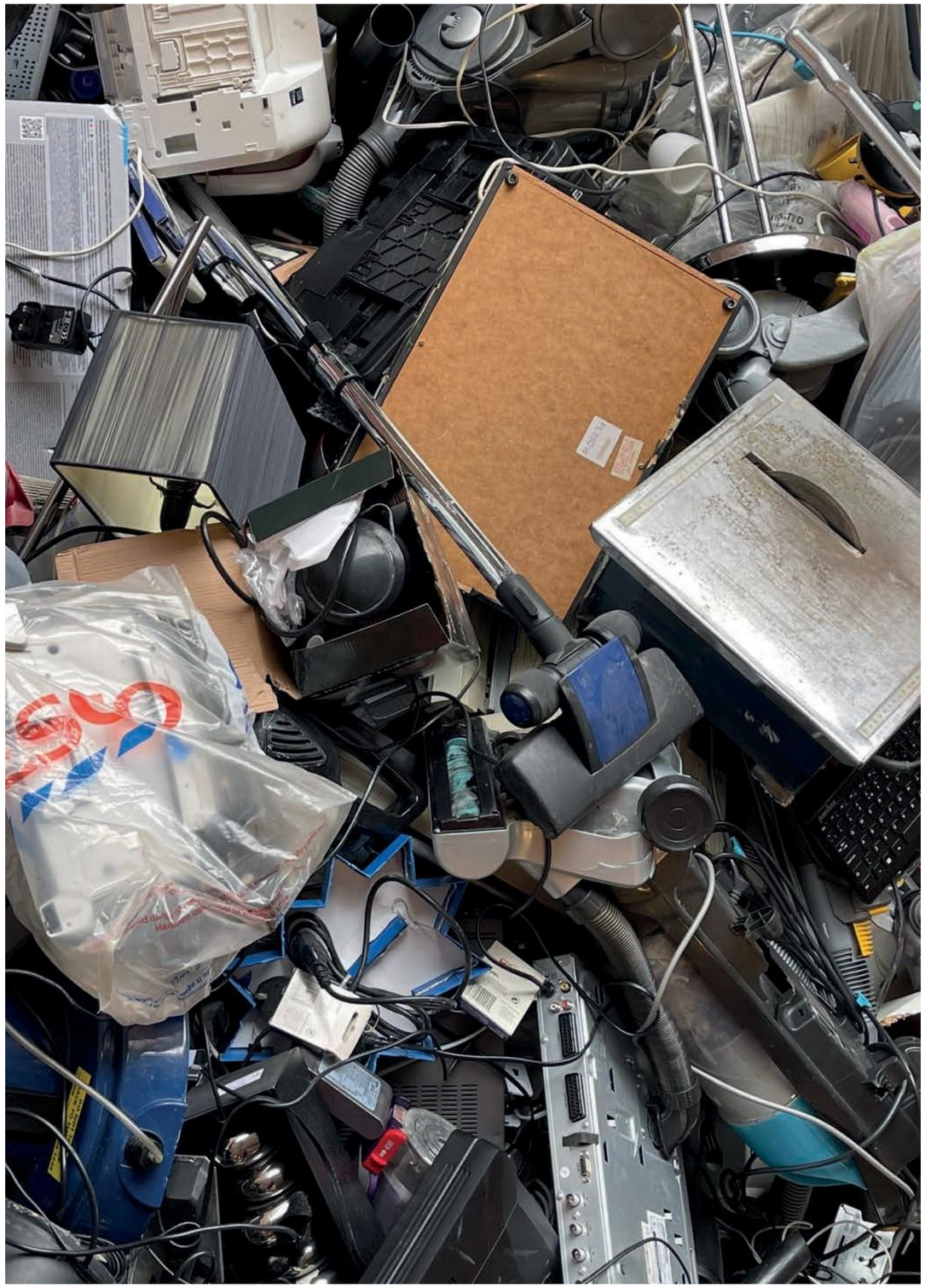
The Lombard territory has always had material recovery facilities, a true reference point especially for small towns. Paper and metal scraps recovery facilities are among the most striking examples of the attention to waste recovery that has transformed a need for resource savings (since the war) into a developed recycling industry (nowadays).

In the last 20 years, the strong development of separate collection has allowed a proliferation of a large number of businesses, located throughout the region and specialized in recovering most of the waste collected separately, thus guaranteeing in Lombardy the treatment of all separated fractions intended for the material recovery.

> **Selecting and pressing plants for paper, selecting, and pressing plants for plastics, glass processing and multi-material selecting plants form an “army” of hundreds of small businesses that live thanks to the efforts of citizens and that revive what once goes to landfill.**

THANKS TO THESE IMPLANTS

we obtain both materials that are very similar to raw materials, which are used in the production cycles of new goods, and waste that is to be used in a different way, for example by means of energy recovery.



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> Waste electrical and electronic equipment (WEEE)

> **The WEEE treatment plants shall recover the metal, plastic and glass fractions that make up them and make the safe disposal of the hazardous substances that may be contained therein.**

This type of treatment can achieve different levels of complexity in terms of the specific WEEE being treated, the recovery efficiencies to be achieved and the types of materials to be recovered. The most applied treatments today are of a mechanical type and are able to reduce the main metal fractions, such as iron, **copper, and aluminium**, with good efficiency. **Precious metals and rare earth elements are currently recovered in small quantities.**

According to the WEEE Coordination Centre, the collection rate of domestic WEEE in Italy in 2019, calculated on the basis of the amount released for consumption in the previous three years, was around 37%, 28 percentage points below the minimum collection rate as of 1 January 2019 as defined by the European Directive. However, according to the data reported by the WEEE Coordination Centre, there is a large gap between the macro-areas of Central and Southern Italy and that of Northern Italy, where in 2019 there was a per capita collection of domestic WEEE of an average of 7.39 kg/inhabitant. Lombardy region in particular, with a collection of 5.14 kg/inhabitant/year in 2019, appears to be in line with the national average estimate of 5.68 kg/inhabitant /year.

In relation to the EU and national sectoral goals and the identified challenges, the PRGR identifies a number of implementing actions for the management of WEEE:

- **Communication actions to ensure that citizens are properly informed about the collection, delivery of WEEE and the need to separate lithium batteries from them.**
- **the promotion of agreements with large-scale retailers and specialist shops to set some rules on the ways in which goods can be landfilled even in case that are not in connection with new purchases.**
- **Promotion of the “mobile collection service” on the territory.**
- **Creating and/or connecting a network of reuse centres.**

LITHIUM BATTERIES

Issues related to the fractions of WEEE relate to the wide presence of lithium batteries, which generate combustion phenomena, cause potential for the operation of treatment plants resulting thus in higher operating costs.

> The Bulky Waste

The Bulky waste, together with sweepings, make an important contribution to the material recovery that can be used in different processes instead of raw materials, which would otherwise have to be extracted and processed in another way. It is possible to recover wood and several kinds of metal from bulky waste such as furniture and mattresses.

> Selecting and Recovery Facilities: the Sweepings

The sweepings, collected during road cleaning, are transported to complex plants from which up to 70% of incoming waste can be recovered as material.

The following materials are obtained from the treatment process for recovery and/or disposal:

- **gravel (2-10 mm, 10-20 mm, 20-120 mm)**
- **coarse material (diameter 20-120 mm)**
- **ferrous metals destined for recovery in metallurgical plants**
- **waste to be sent to authorized disposal facilities such as landfills and waste to energy plant.**

The methods of separating extraneous fractions from the final product make it possible to obtain **sand and gravel that meet quality standards** (ISO quality standards for use in the construction field).

In view of the current wide treatment potential and the expected unchanged levels of waste generation from sweeping, **the PRGR does not include the need for new plant construction**, but with a view to improving overall waste management and meeting regulatory goals, it pursues efficient recovery processes with a reduction in waste production.

In Lombardy, there are 9 specific treatment plants on this type of waste and about 134,000 tons of waste from sweeping, collected and initiated to recovery, representing 2.9% of the total urban waste.

> **The amounts recovered in the Lombard plants are varied and range from 20% to 67% of the quantities of waste in the process.**

> Selecting and Recovery Facilities: What does the PRGR provide for

The numerous facilities for treating differentiated fractions in Lombardy **are active both in the selection phase** of the collected waste, with the aim of isolating extraneous fractions or separating the different types of waste collected together, **and in the actual recycling phase**.

Both of these operations are particularly **delicate** as improper treatment can completely frustrate the efforts made in the waste collection phase. Therefore, in order to improve overall waste management and achieve the regulatory recycling goals, **the PR-GR envisages the efficiency of selecting and recycling processes with a reduction in the associated waste output**. In this process, the next desirable technological development will play a key role, both in **the field of material selection** and in the field of effective **recycling**.

Where necessary, it will also be possible **to envisage new plants for urban and special waste treatment**, focusing in particular on technological innovation and high efficiency of material recovery**, with a view to an ever more present Circular Economy**.

4.4 MBT/SEL. Mechanical Biological Treatment and Selecting Plants

Mechanical Biological waste treatment (MBT) is a process for cold management (no combustion is involved) of mixed waste and/or residues after separated collection, using a combination of mechanical and biological techniques.

> **Thanks to this process it is possible to recover some of the dry recyclable materials still contained in certain waste streams (urban or special), to reduce the volume of waste and to produce SSF (solid secondary fuel) that can be initiated to energy recovery.**

In the MBT, two treatment lines can be created: that of **the predominantly inorganic material (over-sieve)**, which can be used for the production of SSF, and that of **the organic material (under-sieve)** which will be used for biological treatment, so that only stabilised waste can be landfilled, **which has lower environmental impacts associated with the production of biogas and leachate**.

The PRGR provides for the review of the role of MBT or SEL facilities (previously used mostly for the treatment of mixed urban waste) as special waste selection facilities **to carry out material recovery, where technically and economically feasible,** and the production of SSF to be used for energy recovery in the regional co-incinerator plant. In this way, this plant, **as a supplement** to the plant already operating in the regional area dedicated to the treatment of special waste, will help to exploit the current flow of waste for disposal by maximising the initiation to recovery.

IT WILL THEREFORE BE ESSENTIAL TO RETHINK, RECONSTRUCT AND ENHANCE THE EXISTING PLANTS WITHOUT THE NEED OF IMPLEMENTING NEW PLANTS DEVOTED TO WASTE SELECTION.

In this process, the next desirable technological development will play a key role both in the field of material selection and in the field of actual recovery.

Although MBT plants are receptors of marginal streams of mixed waste, **will have to prioritize the treatment of special waste streams suitable for use in both material recovery and fuel production**.

4.5 Incineration and Co-incineration plants

In incinerators, residual urban waste, containing the non-re-cyclable fractions, is treated by returning heat, used for the production of electricity and, in some cases, also for district heating (waste to energy plants).

Waste is also produced in the incineration process: slag and ash. **Slag**, which accounts for about 15-25% of the weight of the waste fed, represents the combustible part of the waste and can **be reused** in other sectors (construction, road subgrades) after appropriate treatment. **Ash** comes from the treatment processes flue gas of the incinerator and following a process of inertisation, it is mainly sent to **disposal** or **to landfill** or **recovery in mines**.

In **2019**, in the Lombardy Region, about 2.4 million tons of waste were treated in **the 12 main Lombard incinerators,** of which about 63% is co-constituted by urban waste (or coming from the urban waste treatment) and the remaining by special waste. Slag and ash production in 2019 was 425,000 tons, of which more than 90 % were non-hazardous slags (source: ISPRA Report on Waste). This slag is almost **completely recovered**, while **light ash and other waste** from the purification of fumes, which are classified as hazardous, is mainly disposed of **(about 80%)** and the remainder is **recovered (about 20%**).

> **The most common incinerators in Lombardy are those with a grate furnace. By using the heat generated by combustion and resulting from the waste intrinsic features, they can play a fundamental role in waste management.**

NEW PLANTS?

Based on the current situation and the forecasts for the programme time frame for 2027, there is no need for a new dedicated incineration plant in Lombardy, whereas it seems useful to make full use of the treatment capacities of the co-incineration plants, by submitting proposals and authorisation requests (if necessary), for the existing industrial activities that could use more alternative fuels as a replacement for fossil fuels.

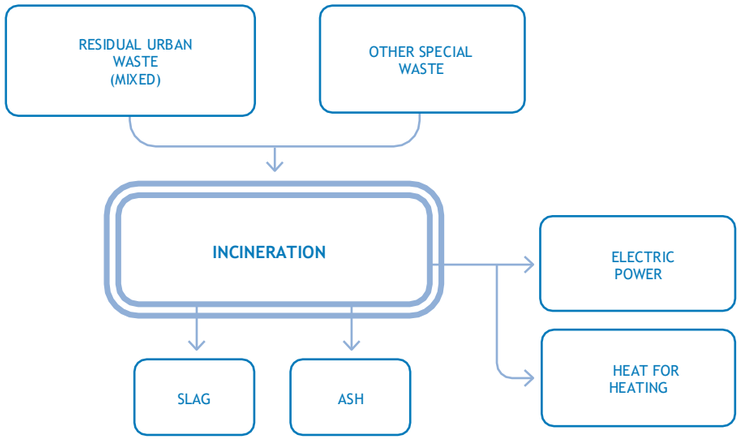

Figure 18. Diagram of the operations of an incinerator

The process steps transform the present heat into electric or thermal energy by means of heat exchangers which, from the steam production to its input into a turbine, produce of electric energy.

The Milan waste to energy plant "Silla2", which has been active since 2001, produces on average 345 GWh of electricity and 375 GWh of thermal energy per year, capable of heating, at full capacity, over 30,000 houses connected to the district heating network.

The Brescia waste to energy plant, which has been active since 1998, produces on average 610 GWh of electricity and 820 GWh of heat per year, serving over 60,000 apartments connected to the district heating network.

> Incineration Plant Engineering

According to the analyses carried out in the PRGR, the incineration potential of plants already in Lombardy, is **sufficient to meet the need for treatment until 2027**.

It will therefore not be necessary to build new dedicated incineration plants, but rather **to make full use of existing treatment capacities**, to maintain regional self-sufficiency in the residual urban waste treatment.

MUNICIPALITY	
A2A AMBIENTE	BRESCIA (BS)
NEUTALIA S.P.A.	BUSTO ARSIZIO (VA)
ACSM-AGAM AMBIENTE S.P.A.	COMO (CO)
AEM GESTIONI S.R.L.	CREMONA (CR)
REA DALMINE S.P.A.	DALMINE (BG)
BRIANZA ENERGIA AMBIENTE B.E.A. S.P.A.	DESIO (MB)
A2A AMBIENTE SILLA DUE	MILAN (MI)
LOMELLINA ENERGIA	PARONA (PV)
PRIMA SRL	TREZZO SULL'ADDA (MI)
SILEA SPA	VALMADRERA (LC)

Figure 19. Incineration plants

4.6 Disposal Plants – Landfills

In line with the European hierarchy, Lombardy has set the goal of minimizing, tending to zero, the transfer to landfill: this form of disposal must be used only in residual form for **those fractions that cannot be recovered as material and energy**.

In recent years, Lombardy has experienced a gradual decline in the **direct municipal waste transfer to landfill**, which is now practically **non-existent**; **with regard to special waste**, **the increase,** that occurred between 2010 and 2018, was mainly **due** to increases in the quantities disposed of in landfills for **inert waste**.

Based on the projection of the produced waste quantities, the PRGR estimated the cumulative requirements for landfill volume up to 2027, considering the different scenario hypotheses and the actions envisaged in the plan itself. Such requirements relate to the optimized scenario, **which envisages a landfill use reduction.** The data analysis shows that the landfill residual volume for inert waste is sufficient to cover the disposal needs of this type of waste, while the residual volumes of other types of landfills seem to be lower than the disposal requirements. However, the actual need for new landfill volumes will have to be assessed during the programme period, considering the developments in the monitoring indicators and the progressive consumption of available landfill volumes.

In keeping with these provisions, authorizations for new landfill volumes should be limited to the needs estimated by the PRGR.

05

Programme for the prevention of municipal and special waste

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Prevention of Municipal Waste

The Regional Programme for Waste Prevention focuses its action on 5 areas of intervention, which Lombardy Region considers strategic and in line with the recent evolution of the EU and national regulatory framework, with a view to structural waste prevention that is consistent with the Circular Economy horizon.

- **WASTE PREVENTION FOOD** — Promotion of the short supply chain also through support for the development of ‘ethical purchasing groups’, guidelines for collective catering under CAM, environmental education in schools, support for food donation
- **PROMOTING REUSE** — through calls for financing for implementation and management optimisation
- **PREVENTING DISPOSABLES**
- **PREVENTING MICRO-PLASTICS**
- **EXTENDING THE ACTUAL TARIFFS** — with the aim of achieving the 20% of the Lombard municipalities with actual tariffs by 2027

The prevention actions for the 5 areas will be developed in collaboration with the regional prevention stakeholders, so as to realise, strengthen and create a network of innovative actions that can be used throughout Lombardy.

A **Good Practices and re-use practices for reuse and prevention Portal** will be prepared by Lombardy Region containing also dedicated applications to:

— Ensuring quick reporting of good practices promoted by the region and regional stakeholders.

— Monitoring the developments.

— Mapping the developments.

— Conveying the main communication campaigns that will be promoted for the 5 areas of intervention.

The Regional Prevention Plan on Food Waste 2022-27

The amendment of the *Testo Unico Ambientale* (Consolidated Law on the Environment – TUA) induced by D.Lgs no 116/20, transposing the European package for the Circular Economy (article 199 of TUA), provides that the Regional Programme for Waste Prevention contains a special section on the prevention of food waste throughout the entire production, processing, distribution, catering and consumption chain, given the significant impact that it entails. In line with the legal provisions, the European *Farm to Fork* strategy *and* the UN Sustainable Development Goals, which set out the objective of halving food waste by 2030 compared to 2014, the prevention activities implemented by Lombardy Region in 2022-27 period in the food area will be oriented toward the **structural** prevention of food waste along the whole food supply chain, with:

- **Measures to support the short supply chain, such as the promotion of products that do not comply with aesthetic requirements and Ethical purchasing groups (GAS) to public and private entities with several employees.**
- **Communication campaigns on the food social and ecological values, on sustainable nutrition, on the correct meaning of terms on the preservation and shelf life of food.**
- **Education campaigns according to the Green Schools Guidelines to reduce food waste in school canteens and to contract the canteen service according to the Minimum Environmental Criteria (CAM).**
- **Working tables with the large-scale retail trade to structurally prevent food surpluses, and to give back quality as well as reporting food surpluses that cannot be prevented on purpose.**
- **Promotion of neighbourhood hubs, extending donation also to drugs and cosmetics.**

Photo © wang-kenan on Unsplash

The Prevention of Special Waste

The PRGR highlighted **the virtuosity of the Lombard waste management system**, which was largely reliant on material and energy recovery operations for the treatment of special waste, but the system needs **to evolve further in order to fully comply with the principles of Circular Economy**. Through the programme, therefore, Lombardy Region favours the evolution toward an economic system that “closes the cycle”, through the following special waste prevention actions:

- **Promoting products eco-design to reduce waste and ensure their reusability/recoverability/end-of-life regeneration.**
- **Awareness-raising, communication, and training projects among related-sectors businesses.**
- **The enhancement and large-scale use of by-products which are merely a process’ waste that can be usefully reused in other production processes, thanks to an easier exchange through on-line platforms and industrial symbiosis systems.**
- **Adoption of programme agreements to promote research/experimentation and improve overall the waste prevention.**

THE GASES

According to the ISPRA study “Food waste: A systemic path for prevention and structural reduction” of 2018, in primary agricultural production GASES reduce waste by 8 times compared to agro-industrial systems, in the disbursement of 7% against 55% of large-scale retail systems, since they mark to consumers products just picked up and in the quantities pre-noticed by them, without surplus at the distribution stage and in consumption up to 1:10 % to those who use only conventional channels.

06

Sludge management programme

Photo © glenn-carstens-peters on Unsplash

Sewage Sludge Management Programme from Wastewater Treatment

LEGISLATION

The Italian National legislation (legislative Decree 152/06) and European legislation (**Directive 98/2008/EC**) see minimization of production and **material recovery** as the options to be pursued as a priority, making energy recovery and, ultimately, landfill disposal subordinate to this.

The current national Italian legislation is still constituted by **D.Lgs. 99/92** (implementation of Council Directive 86/278/EEC on the protection of the environment).

In the Lombardy Region the national standard is **supplemented** by the d.g.r. no 2031/2014, updated with the provisions of d.g.r no 1777/2019.

Other regional rules are **d.g.r. no** 5269/2016 , technical document for integration with the d.g.r. 2031/2014 drafted with the aim of ensuring the efficient use of sludge from an agronomic point of view, according to the criterion of **"good agricultural practice"**, while at the same time preventing the possibility of **olfactory harassment** resulting from this activity. The **d.g.r. amendment no 7076/2021** defines new parameters on which analyses are to be carried out for the purpose of spreading of sludges for the benefit of agriculture, and their **concentration limits**, as well as **updating** the characterization and eligibility protocols under the new parameters added and updating the suggested methods for sludge analysis.

The Sewage Sludge Management Programme, resulting from wastewater treatment, supports sludges reduction trends, including through innovative technologies which, in addition to ensuring the minimization of sludge production, allow for the simultaneous material recovery and, where this is not possible, for energy recovery from sludge, in full coherence with the principles of the Circular Economy and the waste management hierarchy.

Sludge accounts for **a small percentage** of the total mass of waste produced in Lombardy Region (about 3%), of which the dry mass, which is about a quarter of the humid waste mass after dehydration operations, accounts for less than 1%.

The main production of sludge other than that from urban wastewater purification is concentrated in the provinces **of Lodi, Mantua and Brescia** and largely derives from **the purification of process water of the agri-food industry**.

Sludge production was around 771 thousand tons (2018) and showed a general trend with a slight increase (Figure 20). This trend is due to the opposite effects, on the one hand, to the sludge reduction due to the application of innovative technologies and, on the other hand, to the improvement of the purification processes performance, which, by increasing the retention of solids, also increases the amount of sludge.

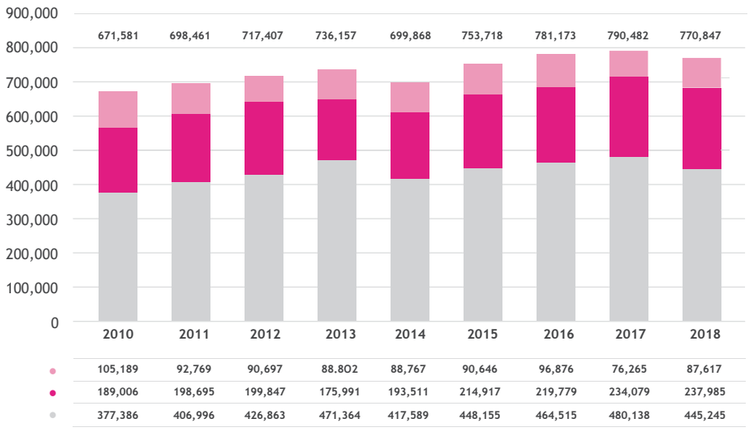

Figure 20. Sludge production trend in Lombardy region (ton)

The sludge produced by the urban wastewater treatment process has long **been used in agriculture**, thanks to the content of organic substances and nutrients such as nitrogen, phosphorus, and potassium, which are essential for plant fertility. **Its use in agriculture is the traditional solution to the problem of sludge disposal and is of interest for its agronomic and economic effectiveness because it can integrate either chemical or organic fertilizers.**

On the other hand, since sludge comes from water purification processes, it contains high concentrations of organic molecules that are not completely degraded as well as inorganic pollutants, which, in addition to the presence of heavy metals, are added to harmful organic compounds and pathogenic micro-organisms.

T**o reduce the environmental impact** of the use of sludge in agriculture, due to the presence of such harmful residues, the following treatments may be considered:

- **composting**
- **anaerobic co-digestion**
- **production of correctives (gypsum and carbonates)**

which allow **the material recovery** (organic material, nitrogen, and phosphorus for spreads on agricultural soils, soil improvers, fertilized such as bio-sulphate, digestate) and **energy recovery** (electricity in the case of anaerobic co-digestion)

Sewage sludge which, on the other hand, cannot reused in the agricultural industry, for regulatory, logistical or market reasons, may be subjected to thermal treatment such **as incineration**, pyrolysis, gasification, hydrothermal carbonization, which allow energy (thermal, in the form of steam, and electrical) and material recovery (flying ash, slag and phosphorus).

Among these, the most mature in Europe, are: mono-incineration and co-incineration. The first is the combustion of sludge alone and produces ash of 30% by weight of the dry mass, from which phosphorus and inert can be recovered. The average phosphorus content in sludge ash in Lombardy is about 6%. Co-incineration instead, consists of the combined combustion of sludge and other combustible waste.

The plan therefore provides for certain general criteria for the sludge management:

1 — Agronomic use should preferably be used for high-quality sludge.

2 — The destinations must be diversified so as to give flexibility to the sludge management system.

3 — The principles of proximity and treatment self-sufficiency must lead to, where possible and cost-effective, the processing of sludge for the material recovery and energy at production sites.

4 — Emerging technologies must enable treatment innovation.

Based on these guidelines, solutions for the enhancement of sludge must consider:

- **Qualitative and quantitative features of the sludge produced in the territory**
- **Features of the territory**
- **Opportunities for synergies with other waste treatment, such as organic waste**
- **Logistical and proximity criteria such as proximity of other purifiers, transport feasibility, integration into urban areas.**

07

Packaging Waste Management Programme

On packaging and packaging waste, the European legislation (Directive 94/62/EC amended by 2018/852/EU) gives the Member States the following addresses:

Avoid or reduce the environmental impacts of packaging and packaging waste.

Ensure the functioning of the internal market and prevent distortions and restrictions of competition in the Union.

In transposition of the Directive, the Italian national standard sets the following quantitative goals:

1– percentage of packaging by weight to be recycled:

2– minimum recycling targets in terms of weight for the individual materials contained in packaging waste:

MATERIAL	2017	2018
STEEL	73.6%	78.6%
ALUMINUM	66.2%	86.6%
PAPER	87.7%	88.8%
WOOD	62.8%	65.8%
PLASTIC	81.8%	87.5%
GLASS	72.8%	76.3%
TOTAL	77.6%	80.6%

Figure 21. Percentage of total recovery on material placed on the market by commodity fraction, years 2017-2018. Source: CONAI

Packaging developers and users shall be obliged to manage packaging and packaging waste.

They are responsible for the correct and effective environmental management of waste related to their products, defined in proportion to the quantity of packaging placed on the national market. **Producers are also required to label packaging** in accordance with the applicable technical ISO standards and in accordance with the determinations adopted by the European Union Commission, to facilitate packaging collection and reuse, recovery and recycling and the provision of adequate information to consumers about the final destinations of packaging.

OBLIGATION TO LABEL PACKAGES

in order to facilitate the collection, reutilization, recovery and recycling of packaging and to provide consumers with the correct information on the final destinations of the packages.

> **Directive 2019/904/EU "Reduction of environmental impact of certain plastic products, reduction of disposable plastic" is a further part of the European strategy for plastics. The Directive has been transposed into Italian law by legislative Decree no. 196/2021 effective January 14, 2022.**

The main indications introduced by the Directive, not only concerning packaging waste but also concerning plastics in general, are as follows:

Banning single-use plastic products for which there are alternatives on the market, such as cotton sticks, cutlery, dishes, food containers and expanded polystyrene bowls.

Measures to reduce the consumption of plastic for food containers and beverage cups and specific labelling of products.

Requirements for the production of disposable plastic products with plastic covers and caps: such goods may be placed on the market only if caps and lids remain attached to the containers for the purpose of the intended use of the product (obligation to be transposed by the Member States by 3 July 2024).

Photo © markus-spiske on Unsplash

Requirements for the production of beverage bottles with a capacity of up to 3 litres:

• From 2025 “PET bottles” shall contain at least 25% recycled plastic.

• From 2030 “PET bottles” shall contain at least 30% recycled plastic.

Measures necessary to ensure separate collection for recycle:

• by 2025, a quantity of 77% in the weight of disposable plastic products such as beverage bottles with a capacity of up to 3 litres (including caps and lids) will be discarded, in the weight, of such disposable plastic products put on the market in one year or more.

• by 2029, a quantity of 90 % by weight of disposable plastic products such as beverage bottles with a capacity of up to 3 litres (including caps and lids), of such disposable plastic products placed on the market in a final year.

Marking requirements for certain single-use plastic products (absorbents, tampons, tobacco products, humid waste wipes, beverage cups and cups).

An analysis of the CONAI data contained in the “2019 Municipal Waste Report”, prepared by ISPRA, shows that the national recovery and recycling goals for the whole package waste were achieved in 2018.

In 2020, according to the most recent CONAI report, 73% recycling of packaging waste was achieved at the national average level and, as a result, the 65% recycling target set by the legislation for 2025 is already achieved.

CONAI

(Italian National Packaging Consortium) was established by law in 1997 as a non-profit organization. It is responsible for the recovery and recycling of used packaging, separated in our homes or during our activities and then collected by the collection managers in our cities. Within *CONAI* there are several supply chain consortia dealing with the different subjects: *Corepla* (plastic), Rilegno (wood), *Coreve* (glass), *Comieco* (paper), *Ricrea* (steel) and *Cial* (Aluminium).

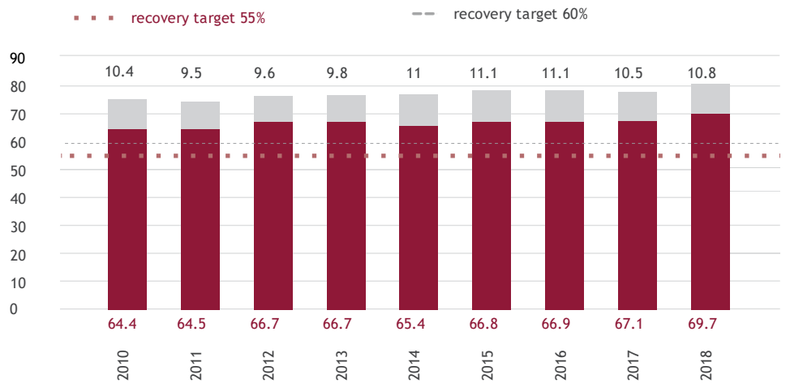

Figure 22. Percentage of recovery and recycling of packaging waste years 2010-2018. Source: ISPRA processing on CONAI data and supply chain consortia.

MATERIAL	2017	2018
STEEL	73.6%	78.6%
ALUMINUM	66.2%	86.6%
PAPER	87.7%	88.8%
WOOD	62.8%	65.8%
PLASTIC	81.8%	87.5%
GLASS	72.8%	76.3%
TOTAL	77.6%	80.6%

Figure 23. Percentage of total recovery on material placed on the market by commodity fraction, years 2017-2018. Source: CONAI.

At regional level, among the prevention goals, based on the waste hierarchy, identified in the relevant legislation, the Programme includes:

- **Implementing the independent packaging waste prevention actions set out in the Waste Prevention Programme.**
- **Producing reusable packaging**
- **Promoting the reuse of secondary and tertiary packaging (e.g., pallets, cardboard packaging, etc.).**

In addition, the construction of new plants for waste recycle will not be necessary, also considering the expected increase in the collection of separate municipal waste. Interventions will be carried out in the existing plants to increase the efficiency of selecting and recycling processes with a reduced waste production. The next desirable technological development will play a key role in this, both in the field of material selection and in the field of effective recycling.

In addition, work will be done to improve the management of waste resulting from selecting and recycling activities by prioritizing **the recovery of waste for the production of waste fuel** (where such fractions are not furtherly recoverable as material) and direct energy recovery.

HOW MANY TYPES OF PACKAGING ARE THERE?

Primary packaging is for protect the integrity of the product from a chemical, bacteriological, thermal, and mechanic point of view.

Secondary packaging: has a function of mechanical protection and rationalization of spaces, allowing goods to be moved without damage, to be stored and then displayed in the most rational way.

Tertiary packaging is for the transport of goods. This is the case for “packaging per unit of load”, which is suitable for optimizing mechanical storage and movement from the production unit to the point of sale.

Among the actions that will be implemented to achieve the recycling targets for packaging waste are:

- support for **the most backward areas** from the point of view of separate collection**;**
- collaboration with CONAI and the supply chain consortia for **the correct delivery of packaging** in separate collection and for monitoring;
- update of **the eco-tax criteria** to favour plants with less waste production;
- promoting **Memorandum of Understanding/agreements** for the implementation of the waste prevention programme;
- dissemination of **environmental certifications** to companies and to waste treatment and disposal facilities;
- **communication and awareness-raising initiatives** on the reduction, reuse, and collection of packaging waste;
- identification for the monitoring of future national regulatory targets on **single use plastics**
- **agreements with the large-scale retail trade** to reduce plastic packaging;
- **collaboration with collection managers** in identifying the best modal aggregation rates of fractions in multi-material collection;
- **monitoring of the efficiency of selecting and recycling facilities**, including appropriate product campaigns, to improve the yield of selection and final recycling facilities in terms of material recovery and less waste production;
- initiatives for **the collection of hard plastic** at platforms;
- Assessment of the appropriateness of **widespread collection of PETS in the regional territory;**
- promoting **eco-design;**
- promotion of calls for proposals for the **development of innovative technologies for the recovery** of packaging waste;
- promotion and monitoring **of new plastics “chemical recycling” technologies** to minimize the launch for disposal;
- development of tools for **the better placement on the market of fraction recycling** (e.g., mixed plastics) which are currently facing the greatest difficulties.

ECO-TAX FOR LANDFILL DISPOSAL

The eco-tax is an economic instrument introduced at national level by Law no 549 of 1995, to disincentivise landfill disposal. In Lombardy, it is modulated with rewarding criteria that encourage recovery: plants that benefit from the reduced rate of 20 % benefit from the rate dispose composting rejects in the compliance with minimum recovery and maximum waste values as indicated in d.g.r. no 4274 of 25 October 2012.

To stimulate the proximity treatment plants, waste from out the region plants pays an ecotax increased by 50%

08

Asbestos-containing Waste Management Plan

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Asbestos is a fibrous material, consisting of natural mineral fibres belonging to silicates and mineralogical series of serpentine (white asbestos) and amphiboles (blue asbestos).

Asbestos has found widespread use primary as an insulator or insulator and, secondary, as a reinforcement and support material for other synthetic products (protective devices and heat-resistant overalls).

The use is currently prohibited by law, but the release of asbestos fibres from existing structural elements within buildings may occur due to slow deterioration of materials containing them, or due to direct damage to them by the occupants or for maintenance work.

> **Asbestos is usually found in compact form, embedded in a concrete matrix (concrete asbestos in roofing, flues, etc.) or other matrices (linoleum floors, walls, panels, etc.), but it can also be found in a crumbly, more dangerous form, when used as soundproofing or insulating material on suspended ceilings and/or walls. Since it is carcinogen, exposure is to be avoided, even at low concentration levels since minimal exposure is sufficient to sustain adverse effects and to clean up and dispose existing products.**

The management plan for asbestos-containing waste, like the whole PRGR, has as its horizon to the year 2027, the year by which **it foresees the removal of about 40 km2 of cement asbestos in Lombardy, equal to about 1,350,000 m3**, with the strategic objective of the complete elimination of asbestos from the regional territory.

40
km²

OF CEMENT ASBESTOS IS EXPECTED TO BE REMOVED BETWEEN 2018 AND 2027 IN LOMBARDY

The regional plan provides for the removal of approximately 40 km2 of asbestos cement in Lombardy, with the aim of eliminating it by 2027.

MAPPING OF ASBESTOS IN LOMBARDY

Within the activities included in the 2005 visionary Regional Plan for Asbestos (PRAL), Arpa Lombardia realised a mapping of the concrete-asbestos covers in Lombardy to determine the extent of this problem. To reach such goal, a sampling technique was used, whereby the most representative regional areas were identified based on their anthropisation level and the diffused presence of factory sites that pre-date 1994. Whitin PRAL, in 2007 Arpa Lombardia realised a mapping using airborne sensing techniques on a surface of over 2000 km^2 . Thanks to the results, an estimate of 2800000 m^3 is the amount concrete asbestos present in Lombardy which was found as of that date; eventually, an update of the mapping in 2012 allowed to estimate at 27% the percentage of covers that were removed from 2007 to 2012. In 2020, Arpa Lombardia realised a further mapping of the concrete asbestos covers existing in Lombardy to integrate, update, and extend the information already obtained, by using the best currently available Earth observation techniques. Thanks to this update, a coverage of surveyed area equal to approximately 3700 Km^2 was made, corresponding to 16% of the entire regional surface and to 34% of the surface of plain. Over the total surveyed area, a total surface of over 5,3 km^2 with concrete asbestos covers was mapped. Besides the concrete asbestos covers mapped by ARPA, asbestos can be also found in some residential and industrial insulations that mapped surveyed by Lombardy Region, thanks to communications by the Health Protection Agencies (Agenzie per la Protezione della Salute, ATS) or restoration companies that were managed by the electronic portal “Gestione Manufatti in Amianto” (Ge.M.A.) which has been active since 2013.

The average annual quantity to be initiated for disposal, given a complete removal by 2027, is therefore indicatively estimated at 200,000-250,000 m^3.

The plants currently operating in the regional sector will be able to meet the needs of the short term, but to achieve the overall needs by 2027, **an estimate of 550,000 m^3 will be needed to have additional stock space**. In view of the timing for the identification of one or more suitable sites, the authorization procedures, and the implementation thereof, it is essential to **seek new spaces to ensure the correct management of this specific waste stream**.

Finally, friable asbestos, accounting for about 1% of total waste produced, will continue to be disposed of through the use of facilities located outside the regional territory. There are no suitable disposal facilities in the region, nor is it justified to set them up in view of the small quantities involved.

09

Regional Programme for Polluted Areas Remediation (PRB)

9.1 The Contaminated Sites and Reclamation in Lombardy

The Lombard territory is characterized by **a long tradition of economic activities** that, over time, have led to different situations of pollution of land and groundwater. The incidents are most frequently associated with ongoing or past industrial activities, storage and sale of automotive fuels, fuel leaks from underground tanks, accidental (e.g., road accidents involving overturns of tankers, etc.) or fraudulent substances releases, uncontrolled and abusive landfills. **The most complex contaminated sites are mainly due to historical contamination events dating back decades when no environmental protection legislation had yet been enacted in Italy.**

The possible historical contamination of a site (pollution of soil and groundwater) is often not evident and can **accidentally emerge**, for example, during construction excavations, maintenance works on underground plants or tanks, renovation works, or after specific controls to examine local anomalies in groundwater quality.

> **A close connection to the type of activity that led to the contamination was also found in the most frequently encountered pollutants, that are: metals, hydrocarbons, aromatic compounds (BTEXS) and polycyclic aromatic hydrocarbons (PAH) are the most common ones in soils, whereas chlorinated solvents are the most significant ones in groundwater.**

In accordance with the Polluter Pays Principle**, all the costs of clearing a contaminated site are borne by the polluter** (or sometimes, in the case of a previous contaminations before the current owner of the site as an interested party, who can turn to the polluter to recoup the loss). In all cases where the person responsible cannot be identified or is in default, it is the Public Administration which, with a substitute intervention, within the limits of the availability of the public budget, must cope with the reclamation.

The Regional Programme for Polluted Areas Remediation (PRB) is the key instrument for preventing, containing, and remediating soil and groundwater degradation. From **the collection** and **organization of information** on polluted areas in the territory and studies carried out in past years, the PRB outlines the action lines to be taken for remediation actions, **defines regional intervention priorities** for polluted and potentially polluted sites on the basis of the relative risk assessment, reviews the funding granted so far and makes an initial estimate of the costs of land reclamation.

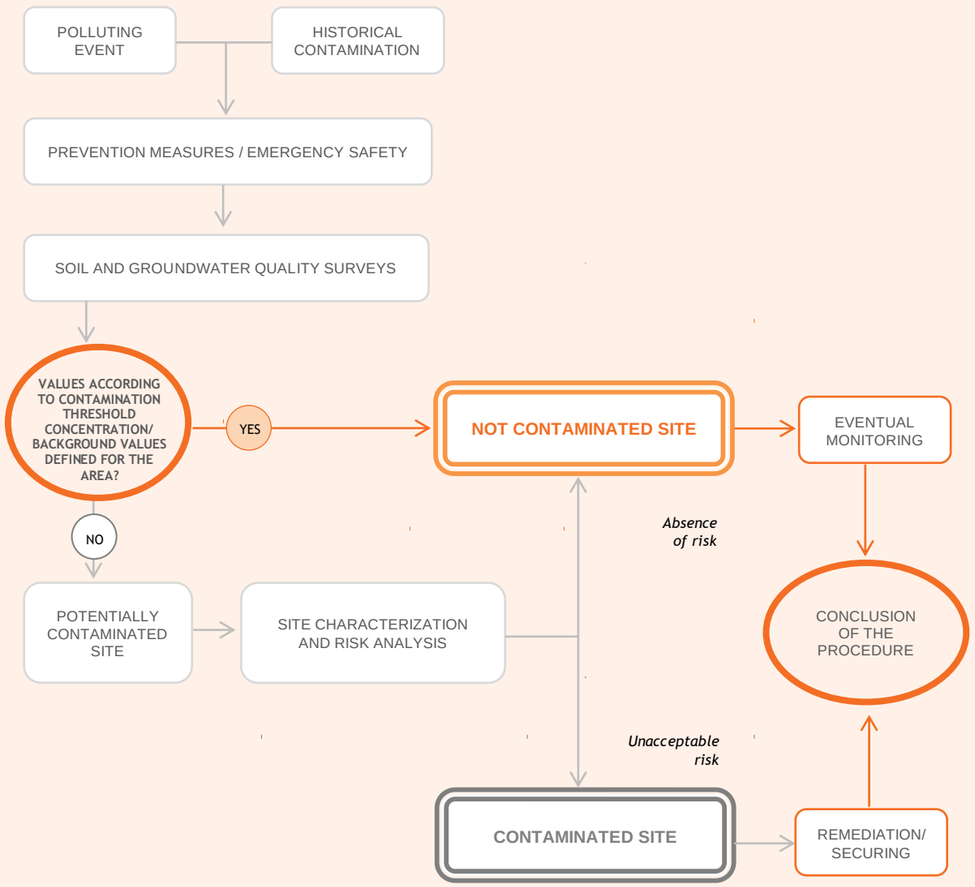
The updating of regional land reclamation planning, in synergy with the regional policy for reducing land consumption, also devotes a large amount of attention to the environmental, urban, and territorial development of the areas to be reclaimed.

Due to the impact on the individual remediation procedures and on the management of the excavated material (see box), specific actions are also taken for **the mapping of the background values of metals and semi-metals on the regional territory**, starting with areas that due to their soil and geological with higher soil-based concentrations and pollution situations not attributable to a single source (“diffuse pollution”), whose management requires specific discipline within regional planning.

What does it mean to clean up a polluted site?

The term “contaminated site” refers **to all areas where**, due to past or ongoing human activities, **it has been established that since the quality characteristics of environmental matrices of soils, subsoils, and groundwater have changed, it is likely to pose a risk to human health and the environment**. The remediation of contaminated sites includes all actions aimed at eliminating sources of risk and reducing concentrations of pollutants within the limits required by law.

The final goal of reclamation is therefore to protect the environment and public health and to recover and redevelop compromised areas, contributing to the reduction of soil consumption.



The remediation procedure, as shown in the diagram below, involves a **first phase of the evaluation** of the state of the land and/or groundwater ("characterization") to look for pollutants in concentrations above the regulatory limits (contamination threshold concentrations) or background values for those substances that may also have a natural origin.

If there is a pollution situation with contamination threshold concentration exceedances, the area is defined as a “potentially contaminated” site.

The next step is site-specific risk analysis, which is a tool to assess whether the detected risk in the area may result in a potential risk to the health of citizens and/or the environment. The site-specific risk analysis also allows the definition of **the maximum concentrations of each admittable compound in the area**, the so-called risk threshold concentrations, depending on the characteristics and use of the area itself (for example, the standard provides for more precautionary limits in the presence of residential areas compared to industrial areas).

In case the concentrations at the “potentially contaminated” site are lower than the risk threshold concentrations determined by site-specific risk analysis, the procedure is deemed to be completed and the site is declared “non-contagious following site-specific risk analysis”. Otherwise, the site is classified as a 'contaminated site' and remediation measures such as:

- **Environmental remediation and restoration, with the aim of reducing the levels of on-site present pollutants; the intervention may be in situ, i.e., directly on the ex-situ area, with the removal of polluted materials from site treatment (on-site remediation) or off-site, in authorized treatment facilities or in landfills (off-site remediation).**
- **Permanently safeguarding, to isolate, in cases where remediation is not technically and economically feasible, sources of pollution from the surrounding environment, at all times, to protect people and the environment.**
- **Operating safety measures, i.e., mitigation and containment of contamination to minimize risks to health and the environment in the active productive areas using techniques compatible with the continuation of the activities carried out. In these cases, sites, however adequately manned and managed, remain classified as contaminated until the final remediation and/or permanent safety activities are completed, when the production activities cease**.

Finally, the “reclamation sites” are all the areas for which the interventions to rehabilitate the soil and groundwater have been concluded and certified by the Provinces, returning legitimate uses of “clean” areas.

Reclamation in Lombardy

The state of remediation measures as of 2021 shows the dynamism of a sector in continuous development, with intense activity, both by the public Administration and by private operators, aimed at achieving the environmental remediation goals.

> **The analysis of the territorial context shows, indeed, an increase in the number of reclaimed sites. In absolute terms, the number of reclaimed sites as of December 2021 has more than doubled compared to the figure in the Regional Programme for Polluted Areas Remediation (PRB) in 2014 (2,829 reclaimed sites in 2021, compared to 1,396 in the 2014 PRB).**

In addition, around **1,200 sites procedures were closed due to non-contamination**, non-exceeding of the regulatory values for the specific purpose of use or due to site-specific risk analysis.

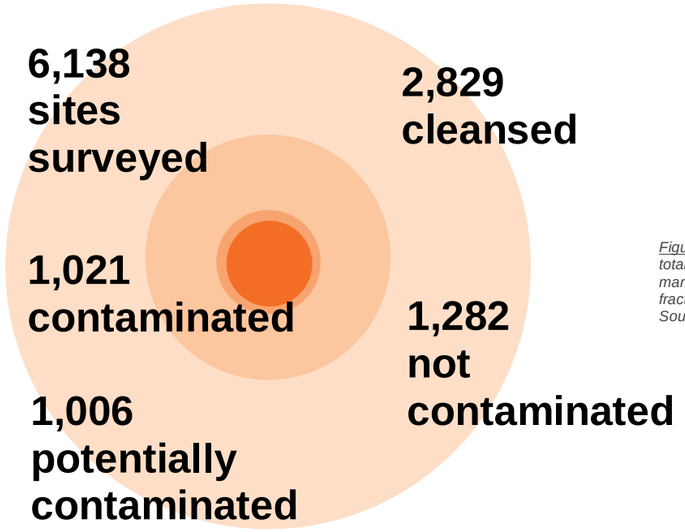


Figure 24. Percentage of total recovery put on market by commodity fraction, years 2017-2018. Source: CONAI

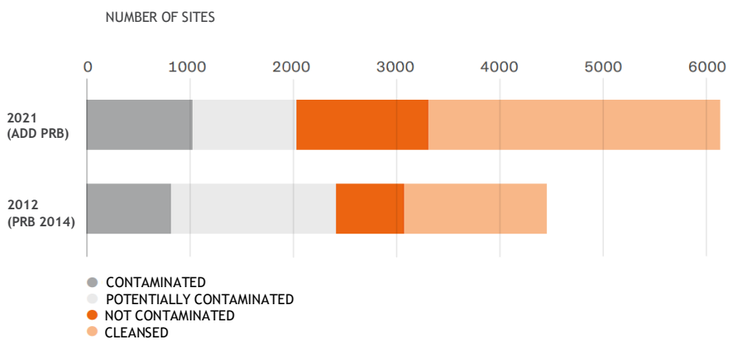
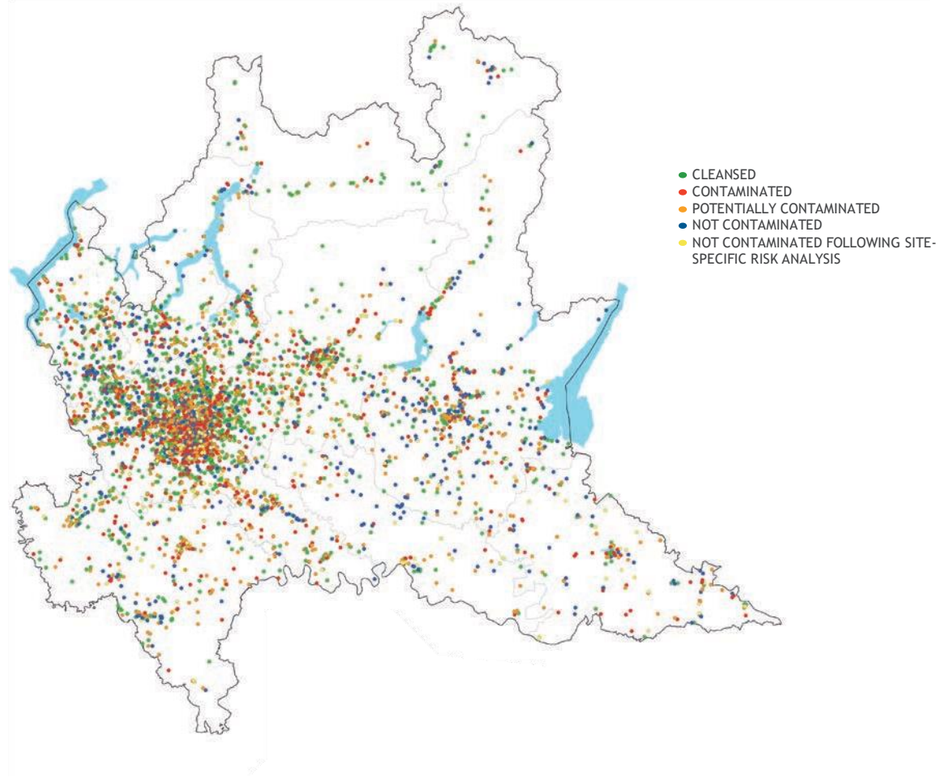


Figure 25. Sites as of 2021 compared to 2012. Source: I act, 2021

The territorial distribution of the certified interventions (remediation completed) confirms **the intense activity in the territory of the Metropolitan City of Milan**, which alone covers about **57% of the procedures concluded** by years and by number and about 52% total area remediated. The figure for the Milan area shows the importance of the redevelopment activities that have affected the territory of the Milan Province in recent years.



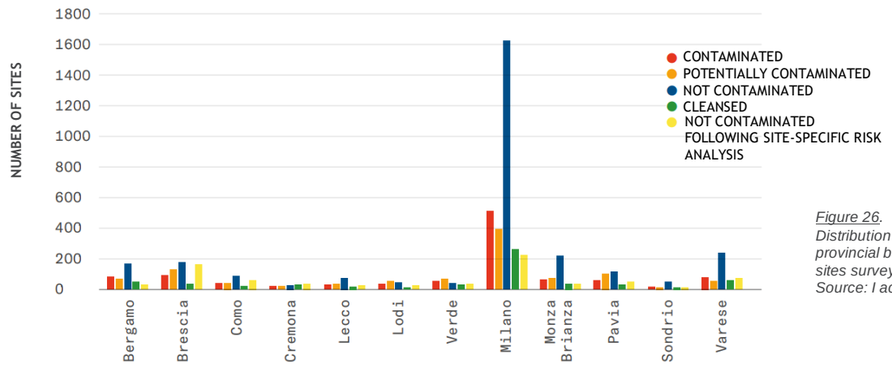
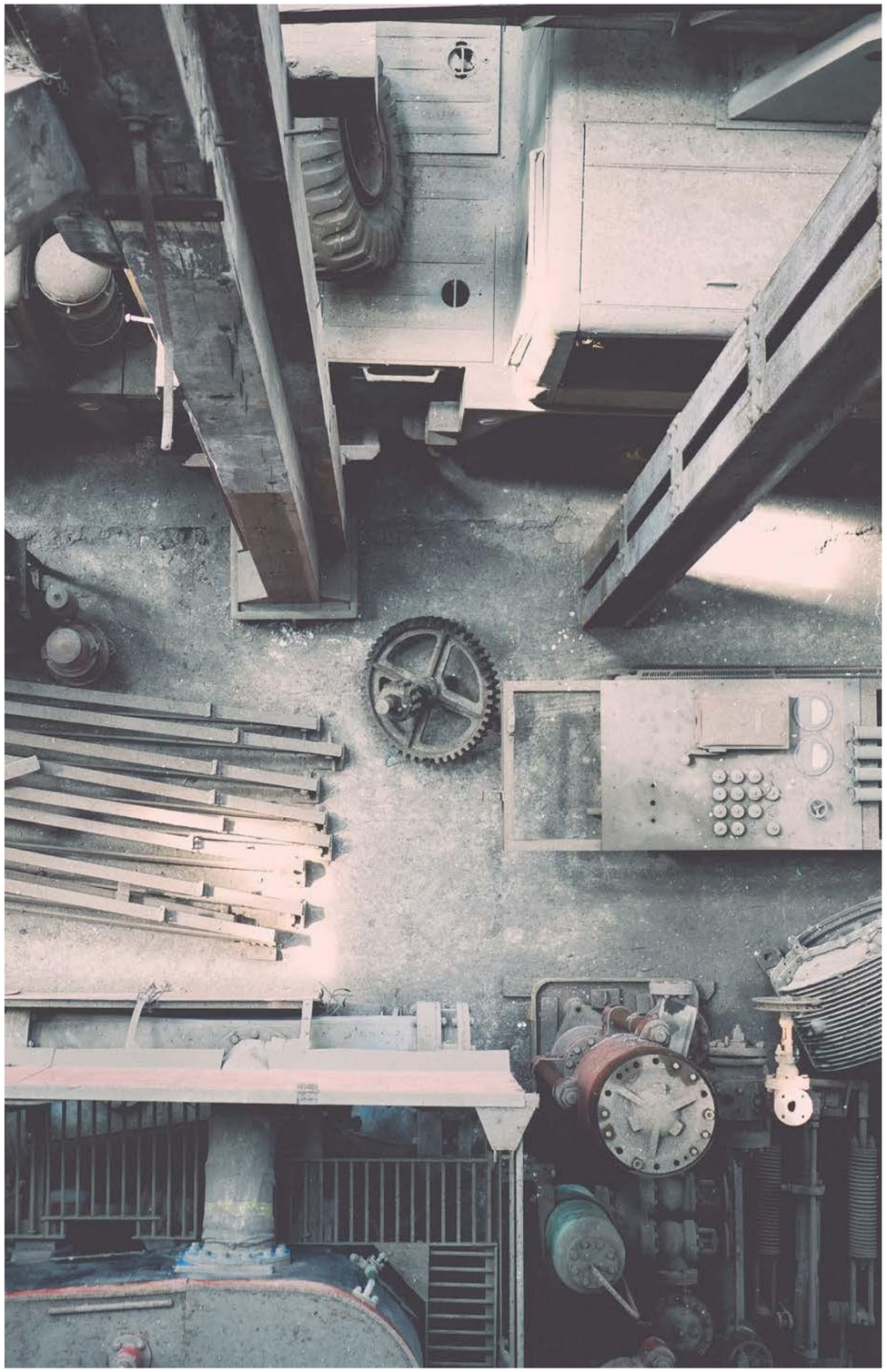


Figure 26. Distribution on a provincial basis of sites surveyed. Source: I act, 2021



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However, the number of contaminated sites on the regional territory is still high, at 1,021, and the number of potentially contaminated sites is still high, although compared to PRB 2014 is decreasing, from around 1,500 sites to 1,006 sites.

By analysing the provincial distribution of the sites to be reclaimed, it is noted that the most industrialized provinces (Milan in the lead, followed by Brescia and Varese) are those that still have the highest number of contaminated and potentially contaminated sites.

Among the sites to be reclaimed in Lombardy are 5 of the current 42 Sites of National Interest, under the responsibility of the Italian Ministry for the Ecological Transition: *Broni, Brescia Caffaro, Sesto San Giovanni, Laghi di Mantova* and *Polo Chimico*, *Pioltello* and *Rodano*. A portion of the regional territory included in the perimeter of the Site of National Interest di Pieve Vergonte in Piedmont is also added to this territory.

The administrative management of the other proceedings is carried out by the municipal administrations, with the exception of sites that extend over the territory of several municipalities, whose territory is part of the Lombardy Region, called sites of regional interest which, as of 2021, comprise 51 areas with ongoing proceedings.

In terms of extension, the total number of sites surveyed accounts for about 0.4% of the regional land, of which over 40% are associated with Sites of National Interest and Sites of Regional Interest.

> **As regards to the reclamation techniques, in Lombardy, very diversified technologies are used overall, although the use of off-site excavation and disposal of land is still the most widespread intervention compared to the installation of other more environmentally sustainable technologies (without off-site material handling) but they have longer and more uncertain timing than intervention, but a better profile in terms of sustainability, above all for interventions at larger sites.**

At present **, the impact of the remediation procedures concluded on the territory is around 63% on average in relation to the total number of sites surveyed**; The total number of ongoing proceedings in the region is still significant and, as can be seen in Figure 25, spread over the whole territory, albeit with a prevalence in the metropolitan area of *Milan* and in the provinces of *Brescia*, *Pavia*, *Bergamo*, *Varese*, *Monza*, and *Brianza*. Significant is also the number of proceedings initiated, which in the last 5 years was about 150-200 new proceedings per year.

> **All these elements are indicative of intensive remediation, both in the re-sanction/return to legitimate use of parts of contaminated territory with the completion of the interventions, and in the progressive evolution of the procedure.**

As regards to the **reclamation techniques**, in Lombardy, very diverse technologies are used overall, although the use of off-site excavation and land disposal is still the most widespread intervention compared to the use of other in-situ or on-site technologies, they have generally longer and uncertain response times, but a better profile in terms of sustainability, especially for interventions at larger sites.

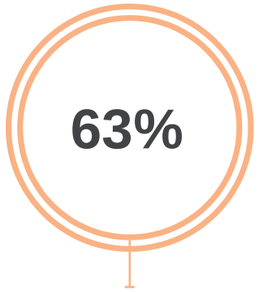
By analysing the provincial distribution of the sites to be reclaimed, it is noted that the most industrial provinces (Milan in the lead, followed by Brescia and Varese) are those that still have the highest number of contaminated and potentially mine-counting sites.

Among the sites to be reclaimed in Lombardy there are 5 of the current 42 sites of National interest, under the responsibility of the Ministry of ecological transition: *Broni, Brescia Caffaro* (industrial areas and their landfills to be reclaimed), *Sesto San Giovanni* (industrial areas and their landfills), *Laghi di Mantova* and *Pole Chimico*, *Pioltello* and *Rodano*. To these is also added a portion of the regional territory included in the perimeter of SIN di Pieve Vergonte in Piedmont.

The administrative management of the other proceedings is carried out by the Community administrations, with the exception of sites that extend over the territory of several municipalities, whose territory is part of the Lombardy Region, called sites of regional interest which, as of 2021, comprise 51 areas with ongoing proceedings.

In terms of extension, the total number of sites surveyed represents about 0.4% of the regional territory, of which over 40% are associated with Sites of National Interest and Sites of Regional Interest.

At present, the impact of the remediation procedures concluded on the regional territory in relation to the total number of sites surveyed is on average around 63%; the number of ongoing procedures managed in the region remains significant and, as noted in Fig. 10-19, distributed throughout the territory, albeit with a prevalence in the metropolitan area of Milan and in the provinces of Brescia, Pavia, Bergamo, Varese and Monza and Brianza. Furthermore, the number of proceedings initiated is significant, with approximately 150-200 new proceedings per year in the last 5 years.



Remediation procedures concluded in relation to the total number of sites surveyed

New proceedings initiated annually in the last 5 years

9.2 Goals and Actions of Regional Planning

The main priority of the regional remediation plan 2022-2027, in line with the previous planning, is the identification of the main challenges present in the territory and their consequent remediation to ensure the protection of the environment and with it the protection of the health of the citizens, while promoting at the same time, in addition to reclamation, the regeneration of degraded areas with the aim of helping to limit the consumption of clean soil.

On the basis of the analysis of the state of play and of the operational and administrative problems encountered in the implementation of the 2014 PRB, regional reclamation actions shall be directed toward the following primary objectives:

① Establishment of regional intervention priorities and effective management of land reclamation procedures

Given the need to provide a constantly updated picture of the situation in the face of a continuous evolution of the environmental remediation processes of the sites, the Remediation Programme identifies, with the support of ARPA Lombardia, the intervention priorities to be remedied falling within the regional territory through a relative risk assessment procedure. **The procedure applied gives the contaminated/potentially contaminated sites investigated an index of potential criticality depending on the degree of contamination and the vulnerability/sensitivity of the territorial/environmental context** (e.g. considering the presence of abandoned waste or tooth tanks/tanks, the type and hazard class of the pollutants encountered, the population in the vicinity of the site, the proximity of the site to agricultural areas, water wells or protected/restricted areas, etc.).

These sites represent the regional intervention priorities for the financing of inter- twenty remediation, security, and characterization, including through direct interventions by the Public Administration in place of the defaulting responsible for pollution. **Between 2014 and 2021, more than 45 million euros were financed by Lombardy Region**.

The PRB introduces interventions in favour of municipal administrations, especially small and medium-sized municipalities, which intervene ex officio, through regional economic- co-financial planning and support for administrative-procedural and legal aspects.

In addition, in order to facilitate the efficient management of the various procedures in the area, **the Region establishes and coordinates permanent institutional discussion tables with the technical and control bodies** (Provinces, ARPA and ATS) and within the framework of the regional observatory for Circular Economy, in addition to carrying out training and dissemination of information on technical and administrative tools for the remediation of contaminated sites.

② Regeneration of decommissioned, underutilized and degraded contaminated areas

The gradual changes in production patterns in relation to technological progress and the change in the financial and economic landscape since the 70s have had a major impact on the regional territory, sometimes leading to the crisis of entire industrial districts and the relocation of production processes in favour of service activities, other processes of abandonment of areas and structures, which today represent both a territorial and economic problem, with implications for urban and social security, but also a potential resource for the community. **The regional territorial governance law (L.R. no 12/2005) acknowledges, indeed, the key role of the compromised areas for the re-valorisation of the Lombard territory, drawing attention to the importance of an optimal use of territorial resources and the consequent minimization of free land consumption**. The Regional Territorial Plan (RTP), starting from the principles of sustainable development and environmental sustainability, has also focused on minimizing the use of new land, through better use of already urbanized areas and the recovery of disused and degraded areas, with priority over all other forms of construction.

Regarding abandoned contaminated sites and old landfills, the PRB, in compliance with regional spatial planning**, aims to encourage not only their reclamation but also the simultaneous redevelopment from the urban, environmental, and social points of view**, by introducing tools to support municipalities and non-polluting individuals who are interested in rehabilitating and rehabilitating these areas, facilitating better coordination between reclamation and urban regeneration procedures.

It is also expected that **decommissioned contaminated areas** that are less attractive for urban regeneration interventions will be considered, depending on the territorial context in which they are inserted, for the installation of new installations for the production of energy from renewable sources and/or for the re-naturalization and re-connection of regional ecological networks to protect biodiversity.

③ Improvement of waste management generated during remediation interventions/sustainability of remediation interventions

In accordance with the principle of sustainability and in connection with the objectives of the Circular Economy, actions are planned to reduce overall the generation of waste resulting from reclamation activities, through the promotion of in-situ technological solutions with a lower environmental impact and the promotion of the reuse of clean fractions produced during safety and/or remediation measures. Sending for disposal, in accordance with the hierarchy provided for by the sectoral rules, also for remediation, must be considered as a residual activity and only in the event of economic and/or technical impossibility to proceed otherwise.

④ Contamination prevention

Strengthening actions to **avoid the risk of environmental pollution** or in any case **to prevent harmful effects** on health and eco-systems, with particular reference to new works and installations falling within the environmental impact assessment (EIA) frameworks, **the Integrated environmental authorization** (AIA) and **the Single environmental authorization** (AUA) and **monitoring** of existing works and installations. A second line of regional action for the prevention of **contamination and management of public health or hygiene emergencies** arising from risks or phenomena of environmental pollution concerns, pursuant to the L.R. no 26/2003, waste management activities in operation or unauthorized activities, such as **renunciation** (art. 17a) and **landfills before the related law was established**, shut down, under operational/post-operational management or with post-operational management terminated (art. 17b). **Financing provided pursuant to art. 17bis and 17ter from 2014 to 2021, more than 41 million euros were made**.

⑤ Protection of groundwater against pollution

with regard to **the measures on contamination plums**, but also to the strategies for managing situations of widespread pollution, which require **a complex co-arrangement of the actions of public and private entities,** in various ways, affected by the problems linked to the extension of contamination.

⑥ Soil background values

With the aim of **completing the knowledge framework** and **the study of the characteristic nature content of metals/metalloids** in the soil of the regional territory, especially for those substances, such as arsenic, which locally have levels above regulatory threshold values, in order to better demarcate the areas affected by high background values.

10

Conclusions

Lombardy is one of the most advanced regions in Europe for the circular economy and acts as a locomotive for the rest of Italy. With the new Regional Waste Management Programme and the Regional Programme for Polluted Areas Remediation plan "Toward the Circular Economy", approved by the Lombard Region Executive, the aim is to consolidate this leadership position, not only at national level but also at European level.

The new programme will increase the already **high-quality standards** of separate collection, as well as **providing integrated guidance on** policies on **prevention**, **recycling**, **recovery**, **waste disposal** and the management **of polluted sites to be remediated**.

By guarantying that waste is to be re-used and recycled as a second raw material, **it will be possible to turn waste into** resources.

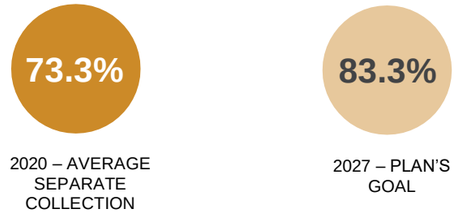
The update of the PRGR-PRB for the period 2022-2027, contributes to **the implementation of the Eu sustainable development strategies, in particular the 2030 Agenda**, and is the programming instrument through which Lombardy Region aligns to the directives of the "Circular Economy Package".

The PRGR provides for specific programmes according to the individual policy areas: The Waste Prevention Programme, the Packaging Waste Management Programme, the Biodegradable Municipal Waste Reduction Programme, the Sludge Management Programme, the Asbestos Waste Management Programme, the Polychlorinated Biphenyls Programme.

The PRGR forecasts are based on objective and verifiable numbers and analyses, with monitoring that will continue over time. **Among the evolutionary scenarios hypothesized in 2027, Lombardy Region has chosen the most challenging one**, defining objectives and implementing instruments, which aim to favour effective recycling processes and to reduce landfill contributions even more.

As regards to municipal waste, 4.7 million tons were produced in 2020. The goal of the 2027 PRGR is to reduce them by 9%.

> **Separate waste collection in Lombardy averaged 73.3%, with 20% of local municipalities producing it above 80%, thanks mainly to the door-to-door collection (carried out by more than 80% of the municipalities): through the PRGR the goal is to reach 83.3% in 2027.**

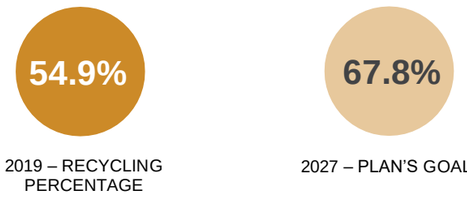


It is therefore necessary **to continue with efforts along this path, improving the quality of our separate collections**, further reducing food waste, and targeted prevention actions, by continuing to choose products that are poorly packed or made from recovered or more easily recoverable materials and always paying attention to the collection of other municipal waste such as WEEE, oils, batteries, medicines, etc...

In order to achieve these challenging goals, the PRGR plans to complete, in the coming years, the extension of the homogeneous door-to-door collection model or other equally performing systems to allow all municipalities to achieve at least 65% separate collection and a good quality of separately collected waste fractions. In all the municipalities, where they are not yet present, the collections of the organic fraction and textile waste to be used for recovery should be activated, alongside the collections already active for the reuse of clothing in good condition.

According to 2019 data, the actual recycling rate, estimated for the first time in this RRP, in Lombardy is 54.9% and **has anticipated of six years the achievement of the national target set for 2025** by the revision of Directive 2008/98/EC.

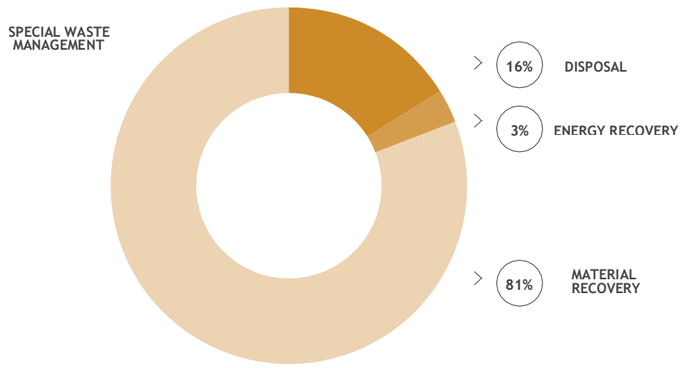
> **The measures provided for in the PRGR will achieve a regional effective recycling rate of 67.8% in 2027, which is higher than the European targets.**



On **the plant front**: the existing plants allow to reach **high levels of Material and energy recovery** by allocating very low percentage of waste to landfill, which will in any case be further reduced with a view to moving toward the 'zero' landfill target within the EU's time limits, while at the same time guaranteeing the self-sufficiency already achieved.

Lombardy also manages to comply with **the principle of proximity**: 87% of the residual urban waste has been treated within the province of production. There are no critical issues or the need for new incineration facilities for non-hazardous municipal and special waste, but rather to continue **to act toward optimization and plant innovation to ensure maximum recycling and material recovery and energy**.

The PRGR focuses not only on municipal waste, but also on waste generated by productive, agricultural, and commercial processes, namely special waste, which is much more than municipal waste and accounts for about 87% of the overall waste production: in 2019, 33.5 million tons were produced, of which about 15 tons were from construction and demolition.



The current management of special waste takes place 81% through the material recovery, 3% through energy recovery and the remaining 16% through disposal activities. **14.5% of the special waste produced in Lombardy is sent out of the region**.

> **The regional plant network then not only manages the Lombard special waste flows (about 70% of the received total amount), but also waste from outside the region (about 20%) and from abroad (about 10%)**.

However, this waste is mainly used according to the Circular Economy, as a second raw material (metals, wood) for new productions.

And as to regards recycling, the programme provides for process efficiency, supports innovation and the development of more effective recovery technologies and for the most difficult fractions, sets out precise criteria for the location of new plants and for modifications of existing ones.

Lombardy Region has also set the target of freeing its territory from asbestos by 2027, while **for sewage sludge future scenarios are emerging, including both the use of high-quality sludge** in agriculture and the recovery of phosphorus, which is essential to fertilize the fields and that currently comes almost completely from outside Europe. This recovery can take place after dedicated incineration of the lower quality sludge.

The programme includes **the Regional Programme for Polluted Areas Remediation**. Starting from the analysis of the territorial context, **the Programme outlines an up-to-date picture of the critical issues in Lombardy and proposes a comprehensive set of actions to be implemented in the short and medium term to ensure and improve the conduct of remediation procedures** and to pursue more effectively **the general objective of eliminating, containing or reducing pollutants in soil and groundwater** so as to prevent and/or **limit the risks posed to human health and to the health of the soil** by returning to the legitimate uses and functions of the land currently affected.

The PRB strongly encourages **the regeneration and environmental rehabilitation of disused and degraded industrial areas** in synergy with land-use planning. It pays particular attention to reclamation technologies, aiming at a sustainable management of interventions with a reduction of environmental impacts and waste generated.

> **The aim is to promote the sustainable management of materials and waste generated during the interventions of reclamation in full compliance with the principles of the Circular Economy.**

The results so far obtained by the Lombard waste management and remediation system were only possible thanks to the interventions carried out by the municipalities in those years and by the business system present in the territory that invested and believed in innovation.

The ambitious objectives of the programme will therefore only be attainable thanks to the active cooperation of all the actors involved.

PRGR - PRB

The PRGR-PRB can be consulted and downloaded on the website of Lombardy Region in the section Environment and Energy/Waste

Glossary

PRGR Glossary

Electrical and electronic equipment (EEE)
Equipment dependent on electric currents or electro-magnetic fields for proper operation and generation equipment, transfer and measurement of these currents and fields and designed to be used with a voltage not exceeding 1000 volts for alternating current and 1500 volts for direct current

Georeferenced Waste Register
Register managed by ARPA Lombardia and updated by the Provinces, providing geo-localized information on Lombard waste treatment plants

Collection centre
Area manned and set up, with no new or increased burden on public finances, for the collection activity of municipal waste by grouping separately homogeneous fractions delivered by holders for transport to recovery and treatment facilities. The rules governing collection centres were adopted by DM of 8/04/2008, as was amended by DM of 13/05/2009

Secondary Solid Fuel (SSF)
Solid fuel produced from waste which meets the characteristics of classification and specification identified in the UNI CEN/TS 15359 technical standards with subsequent amendments and integrations; without prejudice to the application of Article 184ter, secondary solid fuel shall be classified as special waste (EER 191210).

Community composting
Composting by several domestic and non-domestic users of the organic fraction of the municipal waste generated by them, in order to use the compost produced by the users who delivered the waste

Domestic composting
Composting of organic waste from own municipal waste from domestic and non-domestic users for the purpose of on-site use of the material

Quality compost
Product, obtained from the composting of collected organic waste which complies with the requirements and characteristics laid down in Annex 2 to legislative Decree No 196/2003 of 29 April 2010 75, and subsequent amendments

Consorzio Italiano Compostatori (CIC)
A non-profit structure with a national importance. It brings together compost-producing companies and public and private bodies as well as other organizations which are interested in composting activities (machinery and equipment manufacturers, fertilizers manufacturers, research organizations, etc.)

Urban Solid Waste Organic Fraction
Otherwise called “humid waste”. Residues of food or food preparations and comparable fractions, like separately collected used food paper waste (part of “Organic waste”)

Eco-design
The process of conceiving and designing products or services with the aim of minimizing the environmental impact during their life cycle, from study to production to market sale

European list of waste (Elenco europeo dei rifiuti - EER)
New descriptions on the basis of the corrigendum to Decision 2014/955/EU, published in the Official Gazette of the European Union on 06/4/2018, amending decision 2000/532/EC on the list of waste pursuant to Directive 2008/98/EC

Stabilized Organic Fraction (SOF)
Fraction out of MBT, encoded as EER 190503. It is the organic - stabilized interaction by aerobic process and transformed into an out-of-specification compost precisely called SOF. If it does not meet the stability criteria for eligibility in landfill, it is not SOF but EER 190501

Management
The collection, transport, recovery, and disposal of waste, including the monitoring of such operations and intra- 20 after the closure of the disposal sites, as well as the operations undertaken as a trader or intermediary.

Integrated waste management
The whole range of activities, including the ‘clean-up of waste’, is designed to optimize waste management

Selecting facilities (SEL)
facilities performing selecting operations for undifferentiated waste. They differ from mechanical biological treatment (MBT) plants because they do not have the bio stabilisation section but only screening and other types of product classification

Rate Method
Tariff method for calculating the efficient costs of the urban hygiene service, as determined by ARERA

Used oils
Any industrial or lubricating oil, whether mineral or synthetic, which has become non-compliant for its initial use, such as waste oils for combustion engines and transfusion systems, as well as oils for turbines and hydraulic controls

Financial Economic Plan
Financial plan to be prepared for ARERA according to the rate methodology

Preparing for re-use
The control, cleaning, dismantling and repair operations by which products or components of products which have become waste are prepared in such a way that they can be reused without any other pre-treatment

Prevention
Measures taken before a substance, material or product becomes waste which reduce: (1) the quantity of waste, including through the reuse of products or the extension of their life cycle; (2) the negative impacts of waste on the environment and human health. (3) The content of dangerous substances in materials and products

Waste producer
The person whose activity produces waste and the person to whom the production is legally related (original producer) or any person who carries out pre-treatment, blending or three operations that have changed the nature or composition of the waste (new producer)

Collection
The collection of waste, including pre-collection and the preliminary storage, including the operation of “collection centres”, with a view to its transport to a treatment facility

Separate collection
Collection in which a waste stream is kept separate according to the type and nature of the waste in order to facilitate its specific treatment

Recovery
Any operation the principal result of which is to allow waste to play a useful role by replacing other materials which would otherwise have been used to fulfil a specific function or to prepare it for that function, either within the plant or in the economy in general. Annex C to Part IV of legislative Decree no. 152/2006 is a non-exhaustive list of recovery options

Recycling
Any recovery operation involving the waste treatment to obtain waste produced, materials or substances to be used for their original function or for other purposes. It includes the treatment of organic material but not energy recovery or reprocessing of materials to be used as fuels or in filling operations

Waste electrical and electronic equipment (WEEE)
Electrical or electronic equipment which is waste under Article 183(1)(a) of legislative Decree No 196/2003 of 3 April 2006 152, including all components, sub-components and consumables which are an integral part of the product at the point in time in which the holder disposes of it, intends, or is required to dispose of it

Waste
Any substance or object which the holder discards or intends or is obliged to discard

Biodegradable waste
any waste which by nature undergoes aerobic or anaerobic decomposition processes, such as food waste, garden waste, paper and cardboard waste

Bio stabilised waste
Waste obtained from the biological aerobic or anaerobic treatment of unselected waste, with code EER 190503

Asbestos- containing waste
A group of various waste with EER-code referring to the presence of asbestos, almost all of which are hazardous: in this plan, EER 150111, 170601, 170605, 101309, 101310,060701, 061304, 160212, 160111 were considered

Organic rejection
Biodegradable gardens and parks waste, food and kitchen waste from households, restaurants, catering services and retail outlets and similar waste from the food industry collected in a differentiated manner

Dangerous waste
Waste with one or more characteristics listed in Annex I to Part four of legislative Decree no.156/2006

Special Waste
Under Art. 184 paragraph 3 of legislative Decree no., are special wastes:

A – Waste generated in the agricultural, agro-industrial and forestry activities, according to Art. 2135 of the Italian Civil Code, and under Fisheries Codes.

B – Waste generated by the co-construction and demolition activities, as well as waste resulting from the activities of excavation, without prejudice to Article 184-bis.

C – Waste generated under industrial waste if other than that referred to in paragraph 2 (municipal waste).

D – waste generated in the context of the craft sector if other than that referred to in paragraph 2 (municipal waste).

E – waste generated as part of commercial activities if other from those referred to in paragraph 2 (municipal waste).

F – waste generated as part of service activities if other than those referred to in paragraph 2 (municipal waste).

G – waste from the waste recovery and disposal, sludge from water potabilization and other water treatment and wastewater de-purification, as well as waste from fume abatement, septic tanks and sewerage systems.

H – waste arising from health-care activities if different from those in Article 183(1)(b).

I – End of life vehicles

Urban waste
According to Art. 183 paragraph 1, urban waste is:

1 – mixed household waste and waste from separate collection, including paper and cardboard, glass, metals, plastics, bio-waste, wood, textiles, packaging, waste electrical and electronic equipment, waste batteries and accumulators and bulky waste, including mattresses and furniture.

2 - mixed waste and separated collection waste from other sources which are similar in nature and composition to household waste, generated by production activities.

3 - waste from the sweeping of roads and the emptying of waste bins.

4 – waste of any kind or provenance, on roads and public areas or on roads and public areas subject to public use, or on sea and lake beaches and on the banks of watercourses.

5 - waste from public green maintenance, such as leaves, grass flakes and tree pruning, as well as waste from market cleaning.

6 - waste from terrestrial areas, exhumations, as well as other waste from cemetery facilities other than those referred to in points 3, 4 and 5

Hazardous Urban waste
Urban waste that has one or more of the characteristics listed in Annex I of Part four of legislative Decree no156/2006.

Residual Urban waste
undifferentiated urban waste not a separate collection stream

Regeneration of waste oils any recycling operation which allows the production of base oils by refining waste oils, involving in particular the separation of contaminants, oxidation products and additives contained in these oils

Reuse
Any operation through which any product or component which is not waste shall be reused for the same purpose for which it was intended

Industrial symbiosis
cross-border operation used to maximize the re-use of resources normally used for waste. These resources include material (waste and products), energy, water, services, and expertise. Waste (waste and by-products) generated by one company can be used by another company to replace production inputs or to be turn into new products destined for the final market. Industrial symbiosis is now considered one of the main strategies for the transition to the Circular Economy

Disposal
Any operation other than recovery, even if the operation has the secondary effect of recovering substances or energy. B Annex to Part IV of legislative Decree no. 152/2006 contains a non-exhaustive list of disposal operations

By-product
Any substance or object that meets the conditions laid down in Article 184 bis, paragraph 1 of legislative Decree no. 152/2006, or meets the basic criteria according to article 184 bis paragraph 2

Undercover
Fine fraction resulting from the crushing operations of the residual urban waste, with a high content of organic fraction

Composting reject
Coarse fraction resulting from the crushing operations of the residual urban waste, with a low content of organic fraction. It is typically EER 191212

Road sweeping
A way for the collection of waste by road, public areas and private areas for public use cleaning excluding operations to clear snow from the roadside and its pertinent areas, carried out for the sole purpose of ensuring their usability and the security of transit

Storage
The disposal activities consisting of waste disposal operations referred to in point D15 of Annex B to part four of legislative Decree no.
no. 152/2006, as well as the recovery activities consisting of the placing in reserve of waste referred to in point R13 of Annex C to that fourth paragraph

Treatment
Recovery or disposal operations, including preparation prior to recovery or disposal

Mechanical biological treatment (MBT)
Plants that carry out a selection of the residual urban waste by screening and following bio stabilization of the organic fraction, with the aim of reducing fermentability before discharge, and for the production of CDR or SSF

Green
Otherwise known as “flakes and branches”. Biodegradable waste from gardens and parks collected in a separated manner (it is part of “organic waste”)

PRB Glossary

Site specific health and environmental risk analysis
Site-specific analysis of the effects on human health resulting from prolonged exposure to the action of substances present in contaminated environmental matrices, conducted according to the criteria in Annex 1 to part four of legislative Decree no. 152/06

Remediation
All measures to reduce pollution sources and pollutants or to reduce their concentrations in soil, subsoil and groundwater to a level equal to or below the risk threshold concentrations

Contamination Threshold concentrations
The contamination levels of environmental matrices that constitute values above which site-specific characteristics and site-specific risk analysis are required, as identified in Annex 5 to part four of legislative Decree no. 152/06. Where the potentially contaminated site is located in an a- rea affected by human or natural phenomena that have resulted in the passing of one or more threshold contamination concentrations, these concentrations shall be assumed to be equal to the existing background value for all exceeded parameters

Risk Threshold concentrations
The contamination levels of the environmental matrices, to be determined on a case-by-case basis by the application of site-specific risk analysis procedure if I agree with the principles set out in Annex 1 to Part four of legislative Decree no. 152/06 and on the basis of the results of the ca- ration plan, the completion of which requires safety and certification. The definite concentration levels constitute the acceptability levels for the site

Emergency conditions
Events at the occurrence of which the execution of emergency interventions has ceased, such as:

- current concentrations or potential of vapours in confined spaces close to explosive levels or likely to cause acute adverse health effects.
- the presence of significant quantities of the product in separate phase on the ground, or in superficial watercourses or in the water table.
- contamination of wells for drinkable water or for agricultural purposes.
- fire and explosion hazard

Diffuse pollution
The contamination or the chemical, physical or biological alterations of environmental matrices from diffuse sources and not attributable to a single source

Emergency safety
Any immediate or short-term intervention, to be implemented in the emergency conditions (see glossary item) in the event of a sudden contamination of any kind, to contain the spread of primary sources of contamination, to prevent contact with other matrices on site and to remove them, waiting for any further remediation or operational or permanent safety operation

Operational safety
All the work carried out at a site with running activities that ensure an adequate level of safety for people and the environment, pending further permanent safety or remediation work to be carried out upon cessation of the activity. They also include contamination containment measures to be implemented on a transitional basis until remediation or permanent safety is carried out, until the spread of the country within the same matrix or between different matrices is avoided. In such cases, appropriate monitoring and control plans shall be in place to verify the effectiveness of the measures taken

Permanent Safety
All measures to definitively isolate pollutant sources from the surrounding environmental matrices and to ensure that a high and definitive level of safety for people and the environment shall be permanently secured. In such cases, monitoring and control plans and limitations on use with respect to the pre-construction of urban planning instruments must be provided for

Prevention measures
Actions to counter an event, act or omission that has created an imminent threat to health or the environment, understood as a sufficiently probable risk that health or environmental damage will occur in the near future, to prevent or minimize the realization of this threat

Repair measures
Any action or combination of actions, including mitigation or interim measures to repair, rehabilitate or replace damaged natural resources and/or natural services, or to provide an equivalent alternative to such resources or services

Environmental restoration and restoration
the environmental and landscape redevelopment measures, including those that complement the measures of continuous safety, which allow the site to be restored to its actual and definitive usability for the intended use in accordance with the urban development tools

Sites of National Interest
Sites of national interest, for the purposes of remediation, can be identified in relation to the characteristics of the site, the quantities and dangers of the pollutants present, the impact on the surrounding environment in terms of health and ecological risk, and the damage for cultural and environmental heritage. Sites of national interest shall be identified by decree of the Minister for the Environment and the Protection of the Territory, in agreement with the regions concerned, according to the following principles and guiding criteria:

- reclamation operations must re- look at areas and territories, including water bodies, of particular environmental value.
- the reclamation must cover areas and territories protected under decree no 42 22 of January 2004.
- the health and environmental risk arising from the detected exceedance of the threshold risk concentrations must be particularly high due to the density of the population or the extent of the affected areas.
- the socio-economic impact caused by the pollution of the area must be significant.
- contamination must pose a risk to goods of national historical interest and of cultural importance.
- the measures to be implemented must re- look at sites within the territory of several regions.

In any case, sites of asbestos production and extraction sites are identified as sites of national interest for the purposes of reclamation.

The procedure for the reclamation of the sites of national interest is attributed to the Italian Ministry for the Environment and for the Protection of the Territory

Sites of Regional interest
Site for which the Region maintains the right of procedure for reclamation/security, pursuant to the L.R. no 30/2006, in the event of a pollution condition in more municipalities emerges to the detriment of environmental matrices

Site
A geographically defined and determined area or part of the territory, understood in the different environmental matrices (soil, subsoil and groundwater) and including any existing building and plant structures

Site with running activities
A site where productive activities are running, both industrial and commercial, as well as the relevant areas and those used for economic activities, including the maintenance and protection of the heritage, with a view to the subsequent resumption of activities.

Contaminated site
A site where the values of the risk threshold concentrations determined by the application of the risk analysis procedure set out in Annex 1 to part four of Legislative Decree no. 152/06 on the basis of the results of the recovery plan is outdated

Brownfield site
A site where production has stopped

Not contaminated site
A site where the contamination re-raised in the environmental matrix is less than the contamination threshold concentration values, or whichever is greater, however, it is less than the risk threshold concentration values determined following the site-specific health and environmental risk analysis

Potentially contaminated site
A site at which one or more concentration values of pollutants in environmental matrices are above the concentration thresholds for contamination, pending the performance of site-specific health and environmental risk characterization and analysis, to determine the contamination status or non-contamination on the basis of the threshold concentrations of risk

BTEX substances (benzene, toluene, ethylbenzene, and xylene) these substances, known for their soil and groundwater contamination, are part of the volatile organic compounds (VOCs) found in petroleum products such as gasoline. Toluene, ethylbenzene, and xylene have negative effects on the central nervous system

PAHs (polycyclic aromatic hydrocarbons)
The term IPA includes different organic compounds with two or more aromatic rings condensed together. Even if there are over 100 polycyclic products, only some of them can be harmful to humans and animals

Reclamation technologies
A set of possible techniques for the treatment of contaminated environment matrices. The following are distinguished:

in situ technologies: Contaminated treatment methods that come on the environmental matrices contaminated directly in their natural site (soil, subsoil, groundwater), so as to not request any movement of the contaminated matrices.

ex situ/on-site technologies: These remediation measures require the movement of the contaminated environmental matrix, but use plants located in the contaminated site itself, encouraging the reuse of the restored matrices.

ex situ/off-Site Technologies: Remediation methods involving the movement of the contaminated matrix from its original location (e.g., land excavation and pumping of groundwater) and its subsequent treatment in plants located outside the site of contamination, such as authorized external handling facilities or landfills.

Background value
Samples taken from areas adjacent to the site where there is certainty of absence of contamination from the site and other human activities are referred to as natural background samples. Used for the determination of the concentration values of the polluting agents for each of the relevant environmental factors for the site under investigation

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