ISPRA
Istituto Superiore per la Protezione e la Ricerca Ambientale

Sistema Nazionale per la Protezione dell'Ambiente

Report on Waste from Economic Activities 2023 Summary data

RAPPORTI
390bis / 2023

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The Report confirms ISPRA's commitment to ensure that information and knowledge relating to an important sector, such as that of waste, are available to all.

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The design, coordination and final drafting of this Report was carried out by Valeria FRITTELLONI, Director of the Department for Environmental Assessment, Monitoring and Sustainability.

CHAPTER 1
GENERATION OF WASTE FROM ECONOMIC ACTIVITIES

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CHAPTER 2
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1 Generation of waste from economic activities

At national level the generation of waste from economic activities (in short EAW) is quantified from the information contained in the mandatory declarations (called MUD). MUD is annually submitted by the subjects obliged to declare quantities of waste generated, transported, and recovered or disposed of during the year that preceded the declaration, pursuant to art. 189 of Legislative Decree no. 152/2006.

The latest data available on EAW are extracted from the declarations submitted in 2022 and cover the year 2021. Data and information from MUD are integrated with the quantities estimated by ISPRA for those manufacture sectors that are fully or partially exempted from the mandatory declarations (e.g., the construction and demolition sector), in accordance with the current legislation.

In 2021, the total amount of EAW generated nationally has been 165 million tonnes. Between 2020 and 2021 waste generation increased by 4.5%, approximately 18 million tonnes (Table 1.1).

Comparison with 2020 data cannot be considered representative of an ordinary situation, considering the health emergency that has affected the socio-economic context, with-repercussions on the national production system and consumption. Compared to 2019, the pre-pandemic year, the increase recorded is more moderate, equal to 7.1% (+11 million tonnes).

The year 2021 saw a general upturn in economic activity. In fact, industrial and manufacturing production is characterised by the gradual re-establishment of trade, which is essential-in the supply chains of raw materials and semi-finished products, despite some sectors are still negatively affected by the emergency period.

Non-hazardous wastes, representing 93,5% of the total wastes generated, increased by almost 17.1 million tonnes (+12.5%), while hazardous wastes by 820 thousand tonnes (+8.3%).

The increase in the generation of non-hazardous waste is mainly due to the amount of construction and demolition waste (+19.2%, corresponding to 12.4 million tonnes). The construction sector, in fact, recorded a significant recovery after the pandemic crisis, thanks to the resumption and/or opening of construction sites for infrastructures and public works, housing and commercial buildings. It should also be noted that this sector has been the subject, in recent years, of incentives provided by the government for the renovation of buildings aimed at energy efficiency upgrading.

It is worth mentioning that waste production data can be influenced, even considerably, by possibly reintroducing material flows into industrial cycles and using production residues as by-products in production chains that may be different from the one from which they originated, promoting industrial symbiosis and the so-called 'circular districts'.

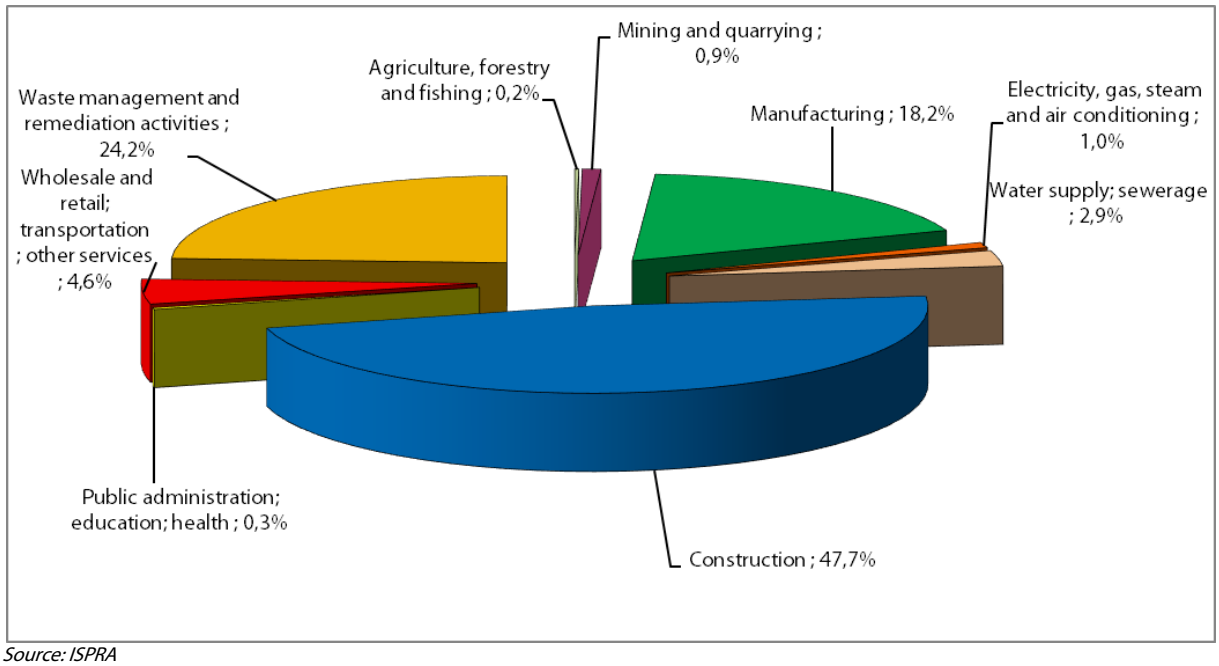
Table 1.1 – National generation of waste from economic activities, years 2019 – 2021

Type of waste	Quantity (tonnes)		
	2019	2020	2021
Non-hazardous wastes excluding construction and demolition waste	75 484 906	72 342 320	77 036 232
Construction and demolition wastes	68 334 771	64 793 200	77 217 926
Total of non-hazardous wastes (NH)	**143 819 677**	**137 135 520**	**154 254 158**
Hazardous wastes excluding end-of-life vehicles	8 616 601	8 381 523	9 130 205
End-of-life vehicles	1 538 046	1 466 693	1 537 681
Total of hazardous wastes (H)	**10 154 647**	**9 848 216**	**10 667 886**
Total of wastes from economic activities	**153 974 324**	**146 983 736**	**164 922 044**

*Quantities of wastes deriving from the treatment of municipal waste are included.
Source: ISPRA

The largest contribution to the total generation of EAW is given by the construction and demolition sector (NACE1rev.2 Sector F - Construction) and accounts for 47.7% of the total amount, with over 78.7 million tonnes (Figure 1.1). This quantity includes wastes from construction and demolition operations and other wastes produced by these activities (packaging wastes, spent oils, etc.). Waste treatment and environmental remediation activities (NACErev.2 Sector E - Water supply; sewerage; waste management and remediation activities) account for 24.2% of the total waste generation (39.9 million tonnes), while all manufacturing activities (NACErev.2 Sector C - Manufacturing) represent 18.2% (approximately 30.1 million tonnes). The remaining economic sectors contribute, overall, to 9.9% (16.2 million tonnes).

Figure 1.1 – Percentage distribution of total waste generation, by sector of economic activity, year 2021



Source: ISPRA

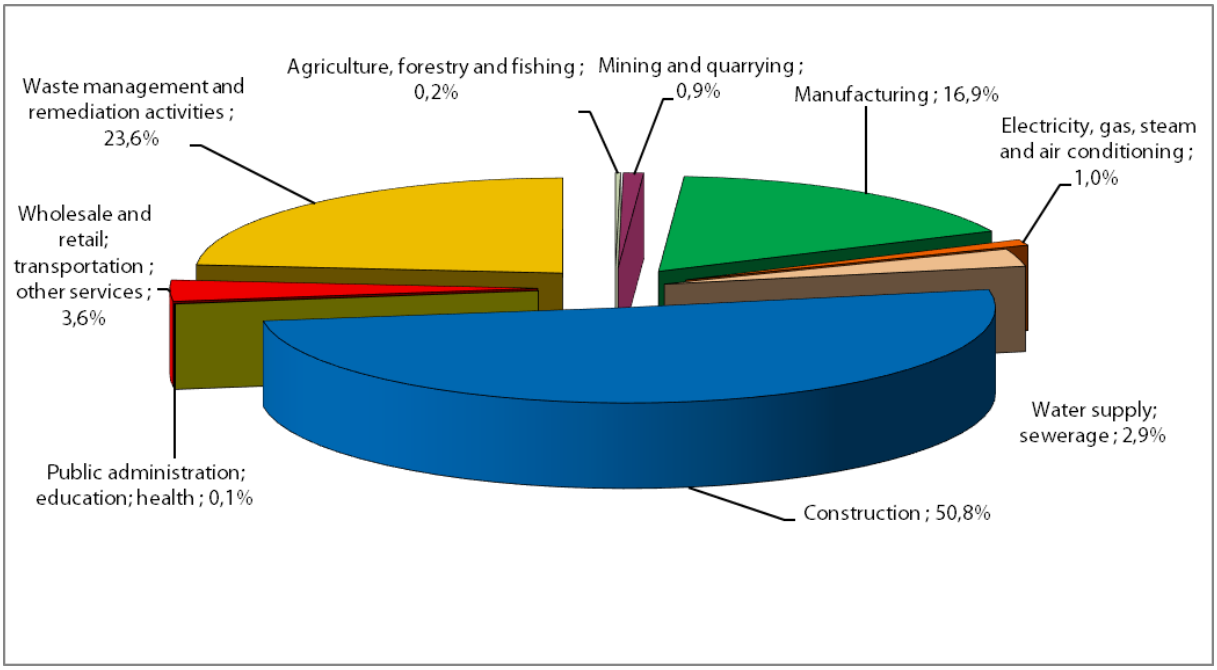
Percentage distribution of non-hazardous wastes generation between the various sectors of economic activities (Figure 1.2) reflects the distribution of the total wastes generation in consideration of the high incidence of this type of waste on the total of wastes produced (93,5% of the total quantity).

A share of 50.8% of the total non-hazardous wastes generated, corresponding to 78.3 million tonnes, comes from the construction and demolition activities ($NACE_{rev.2}$ Sector F), followed by activities of waste treatment and remediation (23.6% - $NACE_{rev.2}$ Sector E) and the manufacturing sector (16.9%- $NACE_{rev.2}$ Sector C), corresponding respectively, to 36.4 million tonnes (this amount includes the quantities of waste deriving from the treatment of municipal waste) and almost 26.1 million tonnes. The remaining sectors, together, account for 8.7% of the total amount of non-hazardous wastes generated (approximately 13.4 million tonnes).

Data analysis by type of non-hazardous waste generated shows that wastes from construction and demolition operations (LoW[2] 17) constitute 50.1% of the total, those produced by treatment of wastes and wastewater (LoW 19) correspond to 26.2%, followed by wastes produced by thermal processes (LoW 10), representing 6,3%, and wastes not otherwise specified in the European List of Waste (LoW 16), 3.8% (Figure 1.3).

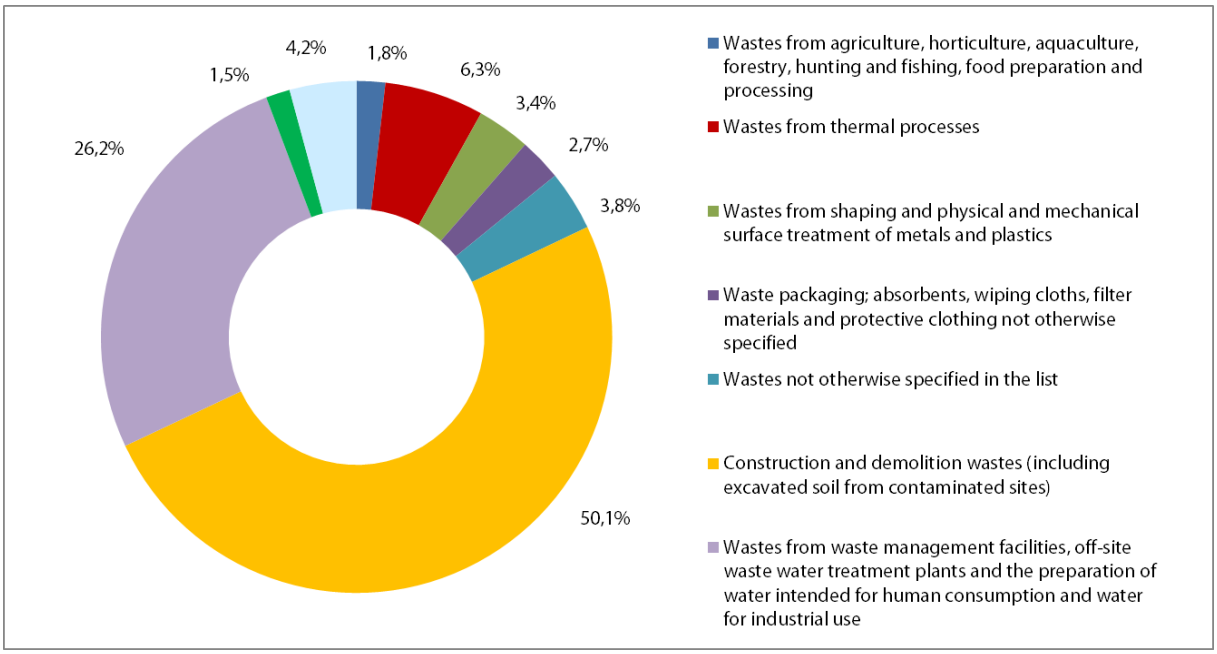
[1] NACE Rev. 2: Statistical classification of economic activities in the European Community, Rev. 2
[2] European List of Waste.

Figure 1.2 – Percentage distribution of non-hazardous wastes generation, by sector of economic activity, year 2021



Source: ISPRA

Figure 1.3 – Percentage distribution of non-hazardous wastes generation, by type of waste, year 2021



Source: ISPRA

The manufacturing sector produces 37% of the total hazardous wastes, corresponding to almost 3.9 million tonnes (Figure 1.4). Waste treatment and environmental remediation sector is accountable for 33.1 % of the total hazardous wastes generated, for 3.5 million tonnes. Wholesale and Retail -Transportation - Other services activities sectors ($NACE_{rev.2}$ Sector G, H and others), generated 19.7% of the total, about 2.1 million tonnes, of which over 1,5 million tonnes of end-of-life vehicles. The remaining activities, taken together, account for 10.2% (almost 1.1 million tonnes) of the total hazardous waste generated.

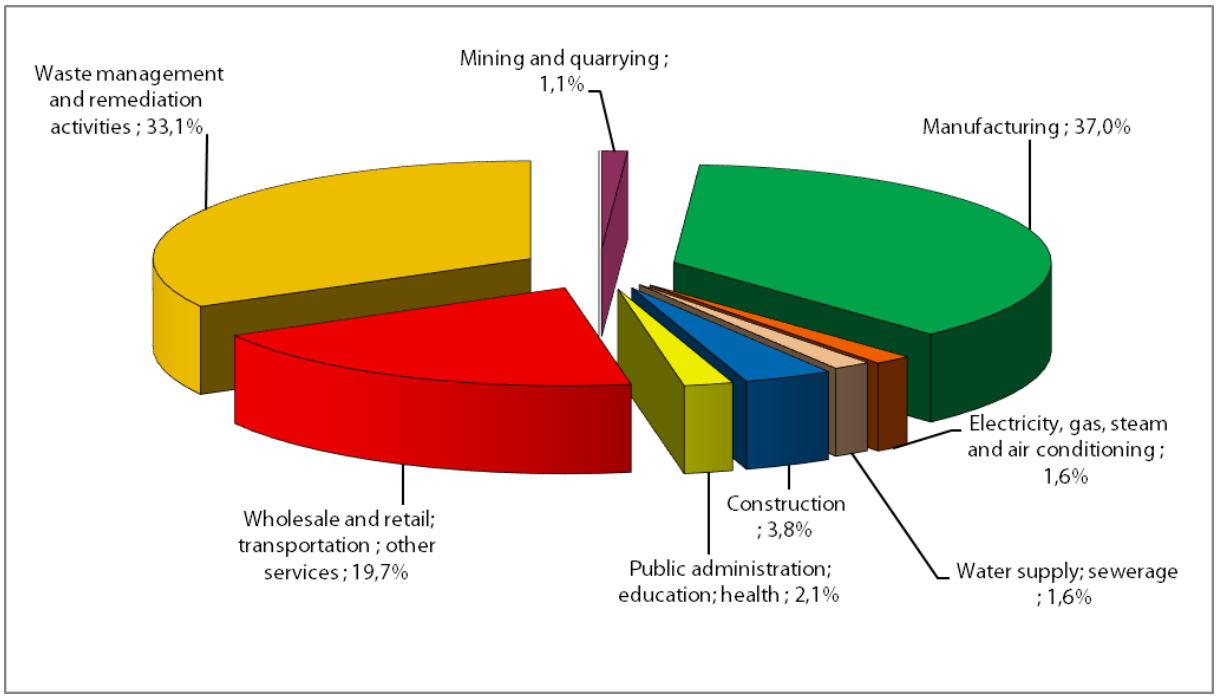
Among the manufacturing sectors, the manufacture of coke and products deriving from petroleum refining ($NACE_{rev.2}$ Sector C19), the manufacture of chemical and pharmaceutical products ($NACE_{rev.2}$ Sector C20 - C21) and the manufacture of rubber articles and plastics ($NACE_{rev.2}$ Sector C22), together accounted for 43.5% (over 1.7 million tonnes) of the total hazardous wastes produced by the whole manufacturing sector.

Metallurgical sector ($NACE_{rev.2}$ Sector C24 - Manufacture of basic metals), produced almost 1.1 million tonnes of hazardous wastes (26.7% of the whole sector), while the manufacture of metal products, excluding machinery and equipment ($NACE_{rev.2}$ Sector C25), produces 445 thousand tonnes of hazardous wastes (11.3%).

Data analysis by type of hazardous waste generated in 2021 shows that 24.9% of the total, consists of wastes produced by treatment of wastes and wastewater (LoW 19), while 22,7% are wastes not otherwise specified in the European List of Waste (LoW 16) including end-of-life vehicles (ELV), electrical and electronic equipment (WEEE), batteries and accumulators (Figure 1.5).

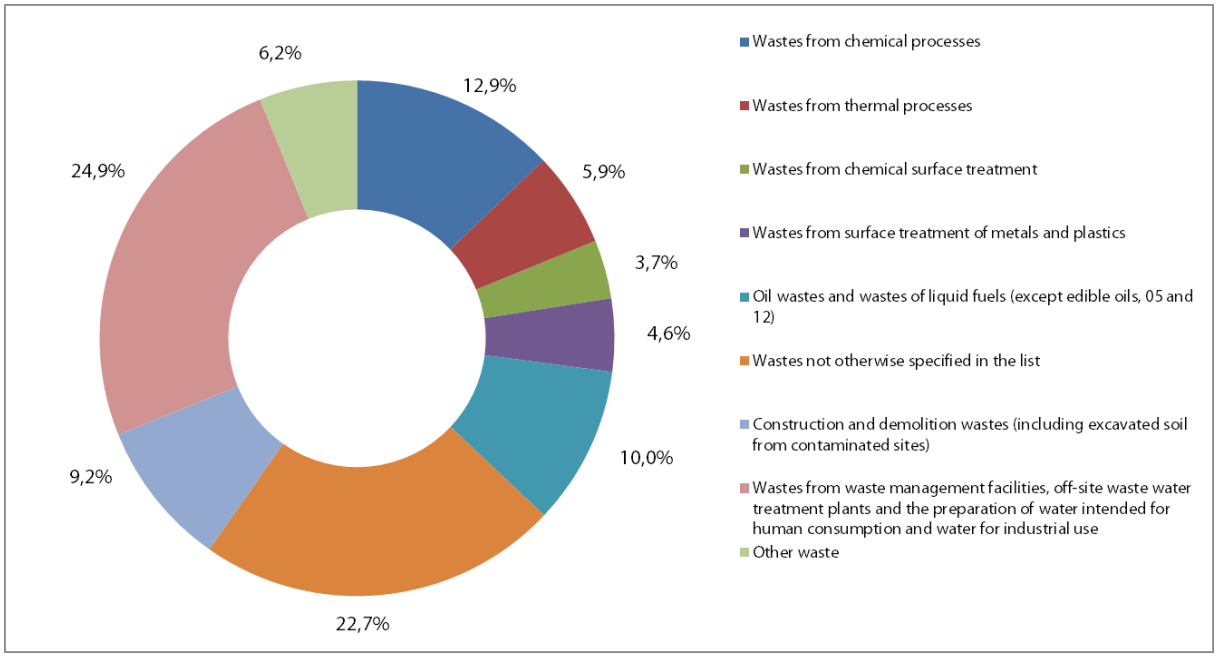
Wastes from inorganic and organic chemical processes (LoW 06 and LoW 07) together represent 12.9% of the total amount of hazardous waste generated, while oil wastes and wastes of liquid fuels (LoW 13) and wastes deriving from construction and demolition operations (LoW 17) are respectively 10% and 9,2% of the total. Wastes from thermal processes (LoW 10) amount to 5.6% and wastes from the surface processing of metals and plastics (LoW 11) to 4.6%.

Figure 1.4 – Percentage distribution of hazardous waste generation, by sector of economic activity, year 2021



Source: ISPRA

Figure 1.5 – Percentage distribution of hazardous wastes generation, by type of waste, year 2021



Source: ISPRA

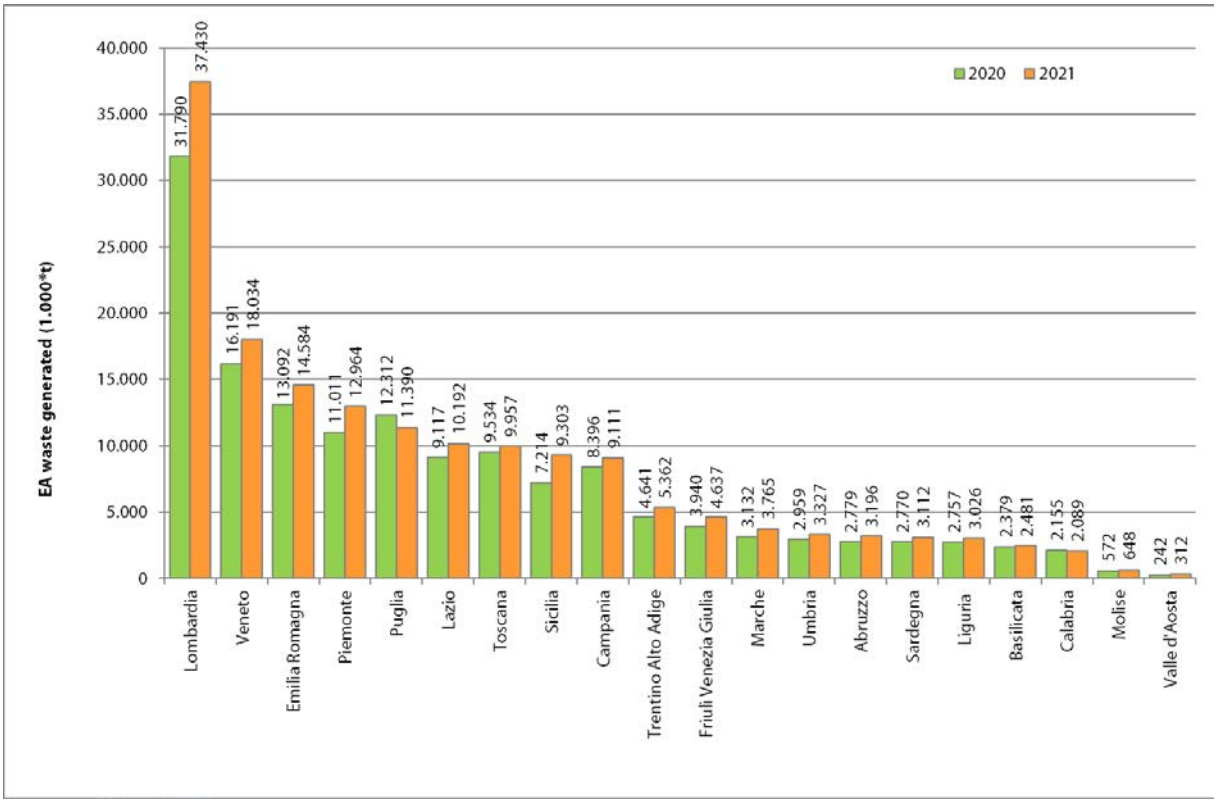
Economic activities localized in specific territories influence the type and quantity of waste generated. At macro-area level, EAW generation is concentrated in northern Italy where the number of industries is highest, reaching almost 96.4 million tonnes (58.4% of the overall national data). Waste generation in central Italy stands at 27.2 million tonnes (16.5% of the total), while in southern Italy stands at 41.3 million tonnes (25.1%).

At regional level (Figures 1.6, 1.7, 1.8), Lombardia produces 38.8% of the total waste generated in northern Italy with 37.4 million tonnes, followed by Veneto with 18 million tonnes (18.7%), Emilia-Romagna with almost 14.6 million tonnes (15.1%) and Piemonte with almost 13 million tonnes (13.5%).

Among the regions of central Italy, Lazio with 10.2 million tonnes (37.4%), and Toscana with about 10 million tonnes (36.6%) have the highest amounts of waste generated in the macro-area.

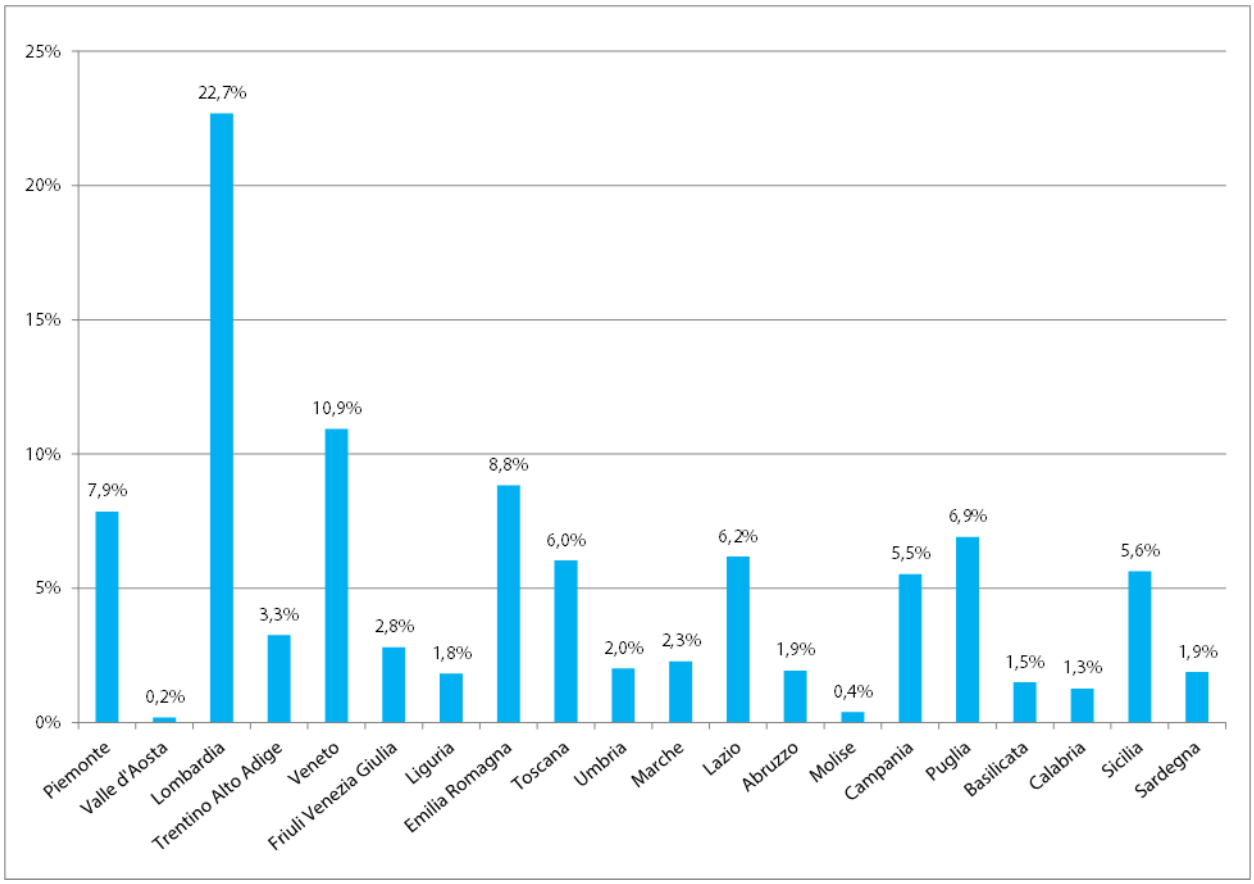
In southern Italy, Puglia with an overall production of EAW of almost 11.4 million tonnes, represents 27.6% of the total of the macro-area, followed by Sicilia with 9.3 million tonnes (22.5%) and Campania (9.1 million tonnes, 22%).

Figure 1.6 – Total generation of waste from economic activities at regional level, years 2020 – 2021



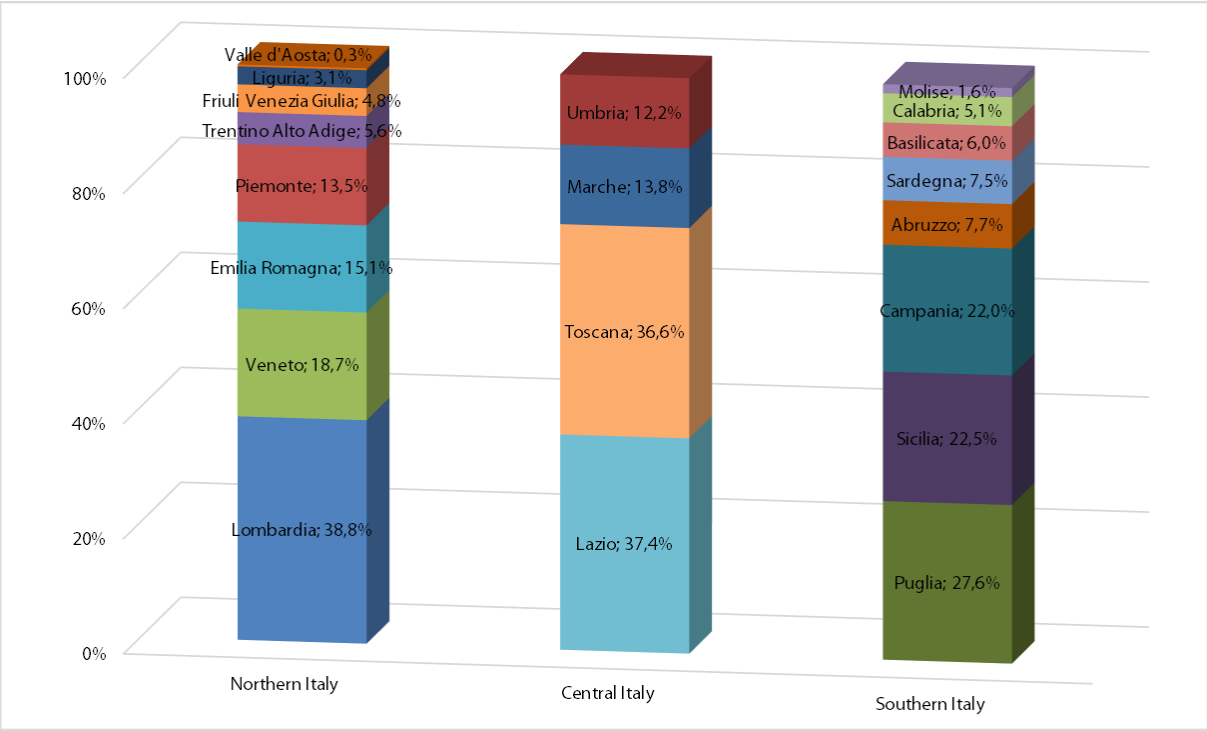
Source: ISPRA

Figure 1.7 – Incidence rates of regional waste generation related to total national value, year 2021



Source: ISPRA

Figure 1.8 – Incidence rates of regional waste generation related to total macro-area value, year 2021



Source: ISPRA

2 Management of waste from economic activities

The total amount of EAW managed in Italy (by recovery or disposal operations) is 178.1million tonnes, of which 168 million tonnes (94.4% of the total) are non-hazardous and the remaining 10 million tonnes (5,6% of the total) are hazardous waste. The total amount includes 18.7 million tonnes of waste in storage at plants and producers at the date of 31/12/2021.

Compared to 2020 (159.8 million tonnes), the total amount increased by 11.4% (+18.3 million tonnes)

In 2021, waste undergoing forms of recovery amounted to 147.8 million tonnes (83% of the total managed), while waste sent for disposal amounted to 30.2 million tonnes (17% of the total managed; Table 2.1).

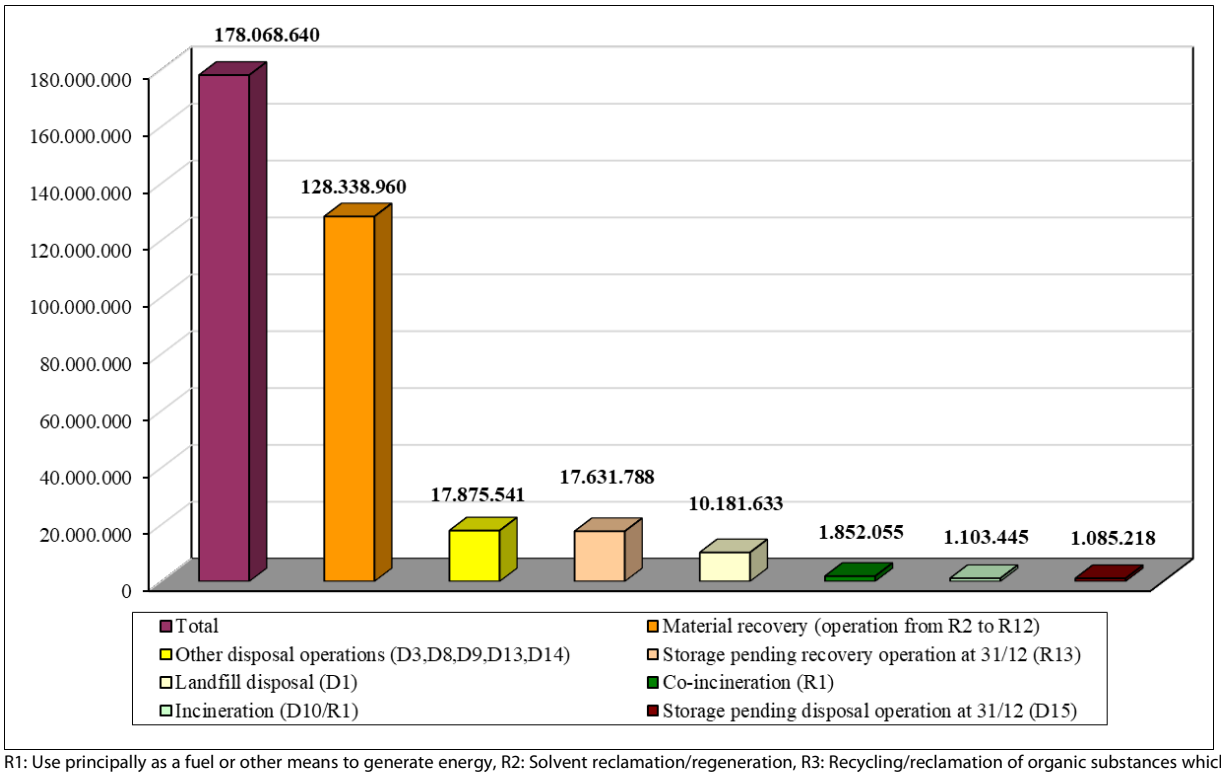
Table 2.1 - Management of hazardous and non-hazardous waste recovered and disposed of (tonnes), year 2021

	Waste recovered	Waste disposed of	Total waste treated	Variation % 2020-2021	Rate of recovery (%)	Rate of disposal (%)
Non-Hazardous	142 922 448	25 108 516	168 030 964	11.76%	80.26%	14.10%
Hazardous	4 900 355	5 137 321	10 037 676	6.34%	2.75%	2.89%
Total	**147 822 803**	**30 245 837**	**178 068 640**	**11.44%**	**83.01%**	**16.99%**

The main form of treatment is material recovery (operations *R2 to R12*) accounting for 72.1% of the total waste treated (128.3 million tonnes), followed by other disposal operations (*D3, D8, D9, D13, D14*) with 10% (17.9 million tonnes) and landfill disposal (*D1*) with 5.7% (10.2 million tonnes). Waste quantities sent for co-incineration[3] (*R1*; 1,9 million tonnes) and incineration (*D10/R1* 1,1 million tonnes) are marginal at 1,1% and 0,8% respectively (Figures 2.1 and 2.2).

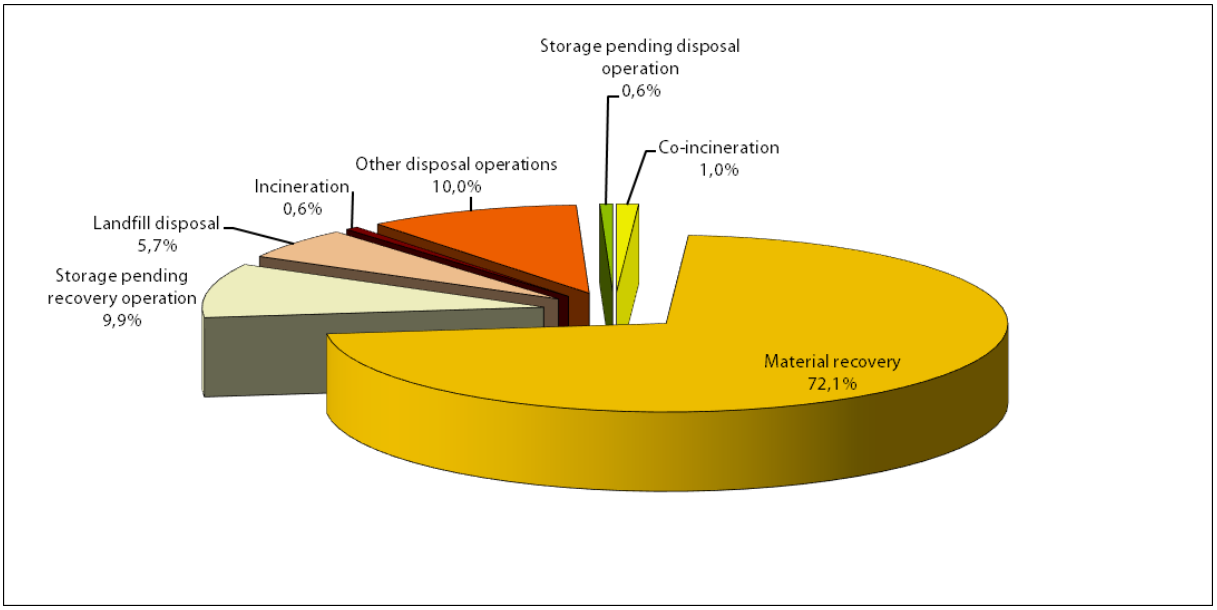
[3] "co-incineration": the use of wastes as a regular or additional fuel in a co-incineration plant or the thermal treatment of waste for the purpose of disposal in a co-incineration plant; "co-incineration plant": any stationary or mobile plant whose main purpose is the generation of energy or production of material products, and (a) which uses wastes as a regular or additional fuel; or (b) in which waste is thermally treated for the purpose of disposal.

Figure 2.1 – Waste from economic activities treated (tonnes), year 2021



R1: Use principally as a fuel or other means to generate energy, R2: Solvent reclamation/regeneration, R3: Recycling/reclamation of organic substances which are not used as solvents (including composting and other biological transformation processes), R4: Recycling/reclamation of metals and metal compounds, R5: Recycling/reclamation of other inorganic materials, R6: Regeneration of acids or bases, R7: Recovery of components used for pollution abatement, R8: Recovery of components from catalysts, R9: Oil re-refining or other reuses of oil, R10: Land treatment resulting in benefit to agriculture or ecological improvement, R11: Use of waste obtained from any of the operations numbered R 1 to R 10, R12: Exchange of waste for submission to any of the operations numbered R 1 to R 11, R13: Storage of waste pending any of the operations numbered R 1 to R 12 (excluding temporary storage, pending collection, on the site where the waste is produced).
D1: Deposit into or on to land (e.g. landfill, etc.), D3: Deep injection (e.g. injection of pumpable discards into wells, salt domes or naturally occurring repositories, etc.), D8: Biological treatment not specified elsewhere in this Annex which results in final compounds or mixtures which are discarded by means of any of the operations numbered D 1 to D 12, D9: Physical-chemical treatment not specified elsewhere in this Annex which results in final compounds or mixtures which are discarded by means of any of the operations numbered D 1 to D 12 (e.g. evaporation, drying, calcination, etc.), D10: Incineration on land, D13: Blending or mixing prior to submission to any of the operations numbered D 1 to D 12, D14: Repackaging prior to submission to any of the operations numbered D 1 to D 13, D15: Storage pending any of the operations numbered D 1 to D 14 (excluding temporary storage, pending collection, on the site where the waste is produced).
Note: Incineration includes quantities of hazardous waste treated in incineration plants with energy recovery dedicated predominantly to the treatment of municipal waste and classified R1 according to Annex II of Directive 2008/98/EC.
Source: ISPRA

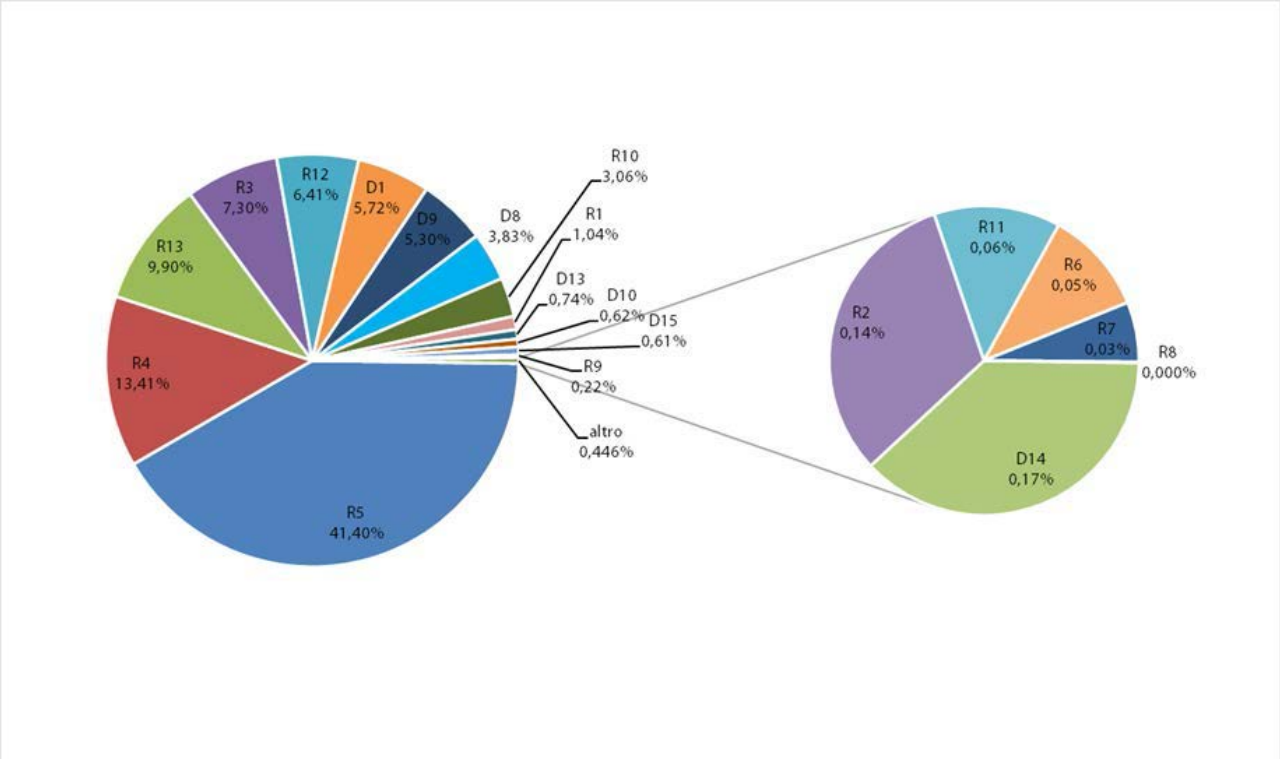
Figure 2.2 – Percentage distribution of waste from economic activities, by type of treatment operation, year 2021



Note: Incineration includes quantities of waste treated in incineration plants with energy recovery dedicated, predominantly, to the treatment of municipal waste and classified R1 according to Annex II of Directive 2008/98/EC.
Source: ISPRA

Among the most used treatment operations are those aimed at waste recovery, especially the recycling/recovery of inorganic substances (*R5*) representing 41.4% of the total waste treated (73.3 million tonnes). There was an increase of 10 million tonnes (+15.7%) compared to 2020. Wastes subjected to *R5* operation are mostly those from C&D activities (LoW code 17; 64.7 million tonnes) and are generally recovered in road embankments and road foundations (Figure 2.3).

Figure 2.3 – Percentage distribution of waste from economic activities, by specific treatment operation, year 2021



Source: ISPRA

The recovery of metals and metal compounds (*R4*) amounts to 23.9 million tonnes (13.4% of the total) and is mostly carried out in steel mills in northern Italy. This quantity increased by 3.1 million tonnes (+14.7%) compared to 2020.

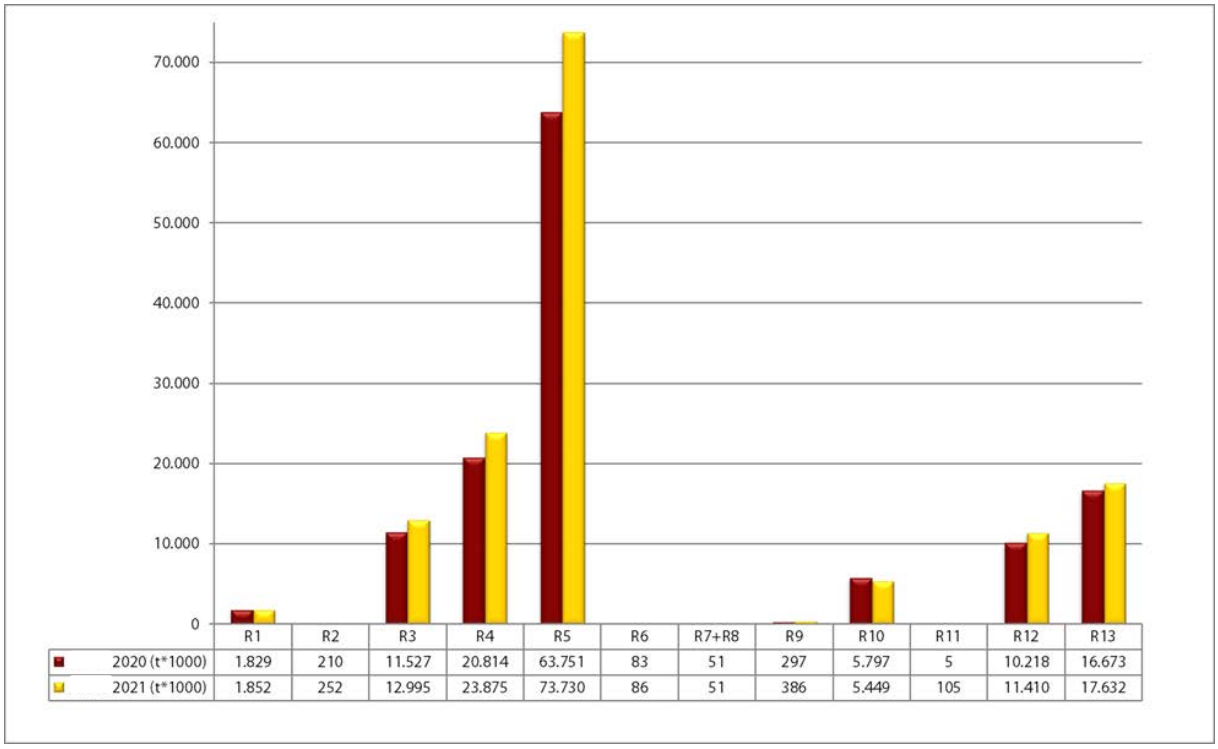
The recovery of organic substances (*R3*) represents 7.3% of the total (13 million tonnes) and mainly concerns, paper, cardboard, and wood; increasing, compared to 2020, by 1.5 million tonnes (+12.7%). In contrast, land treatment for the benefit of agriculture and ecology (*R10*), at 5.4 million tonnes, shows a decrease of 6%.

Landfilling (*D1*) is the main form of disposal (5.3 % of the total managed) with 9,4 million tonnes, registering a reduction, compared to 2019, of 17,7% (2 million tonnes). Waste undergoing physical-chemical treatment (*D9*) accounts for 5.3% of the total managed (9.4 million tonnes) and shows an increase of 705 thousand tonnes (+8.1%). The waste treated with D9 operations are mostly aqueous liquid wastes (LoW 1610**) and landfill leachate (LoW 1907**).

The quantities of wastes sent for biological treatment (*D8*) are also significant, amounting to 3.8% of the total (6.8 million tonnes); showing an increase of 741 thousand tonnes (+12.2%) compared to 2020. These are, mainly, landfill leachate, septic tank sludge and sludge produced by urban wastewater treatment.

Figures 2.4 and 2.5 show details of the quantities of waste from economic activities sent for recovery and disposal operations in 2020 and 2021.

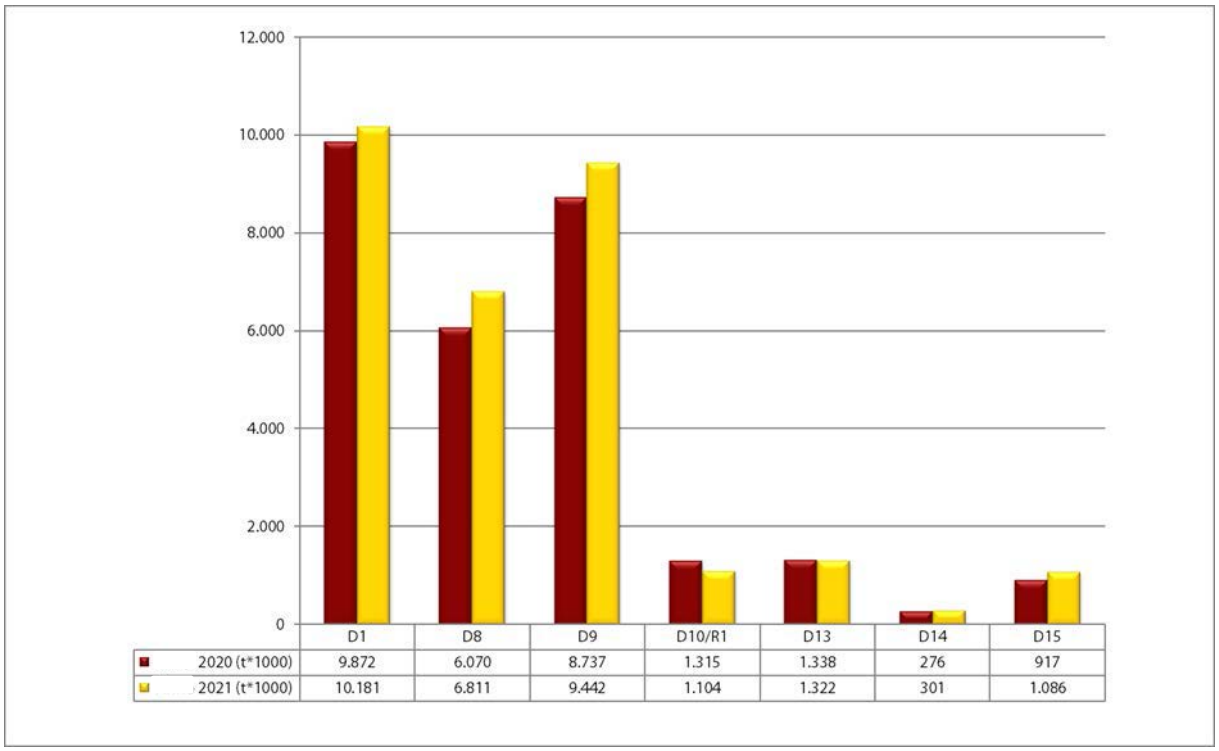
Figure 2.4 – Waste sent for recovery operations (tonnes*1.000), years 2020 - 2021



	R1	R2	R3	R4	R5	R6	R7+R8	R9	R10	R11	R12	R13
2020 (t*1000)	1.829	210	11.527	20.814	63.751	83	51	297	5.797	5	10.218	16.673
2021 (t*1000)	1.852	252	12.995	23.875	73.730	86	51	386	5.449	105	11.410	17.632

Source: ISPRA

Figure 2.5 – Waste sent for disposal operations (tonnes*1.000), years 2020 - 2021

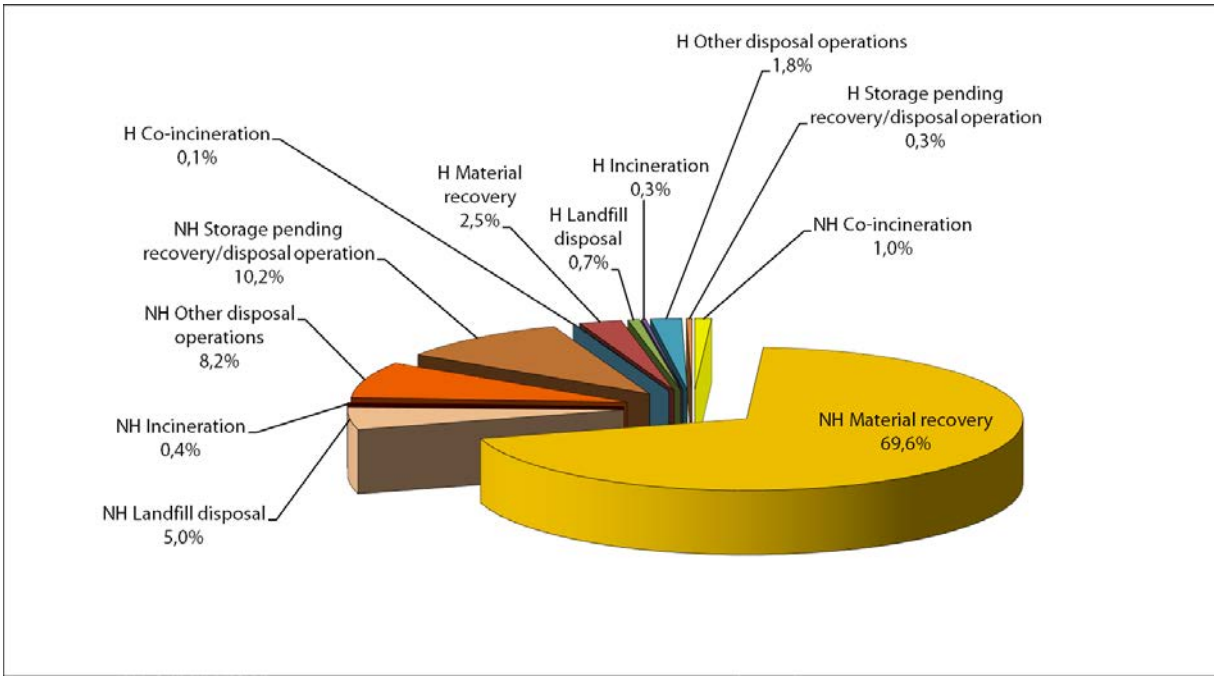


	D1	D8	D9	D10/R1	D13	D14	D15
2020 (t*1000)	9.872	6.070	8.737	1.315	1.338	276	917
2021 (t*1000)	10.181	6.811	9.442	1.104	1.322	301	1.086

Note: D10 includes quantities of hazardous waste treated in incineration plants with energy recovery dedicated predominantly to the treatment of municipal waste and classified R1 according to Annex II of Directive 2008/98/EC.
Source: ISPRA

The total amount of non-hazardous waste treated in 2021 is 168 million tonnes, of which 142.9 million tonnes are sent for recovery operations (+12.7% compared to 2020), while 25.1 million tonnes are destined for disposal operations (+6.8% compared to 2020). Non-hazardous waste accounts for over 94.4% of the total waste managed, so the distribution in management type is consistent with that already described for total waste management, with the prevalence of material recovery (69.6% of the total non-hazardous waste – Figure 2.6).

Figure 2.6 – Percentage distribution of non-hazardous waste from economic activities, by type of treatment operation, year 2021

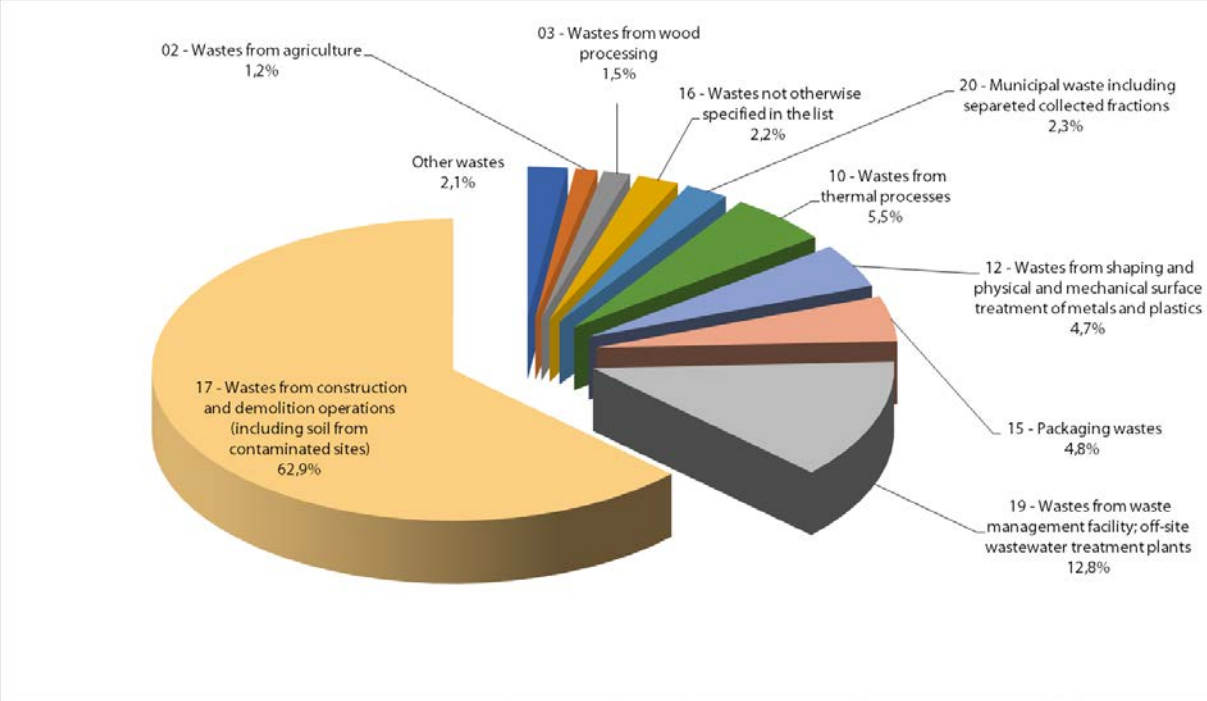


Note: Incineration includes quantities of waste treated in incineration plants with energy recovery dedicated, predominantly, to the treatment of municipal waste and classified R1 according to Annex II of Directive 2008/98/EC.
Source: ISPRA

Construction and demolition waste accounts for the largest quantities recovered (Figure 2.7) while those most disposed of are waste from treatment waste and wastewater (Figure 2.8).

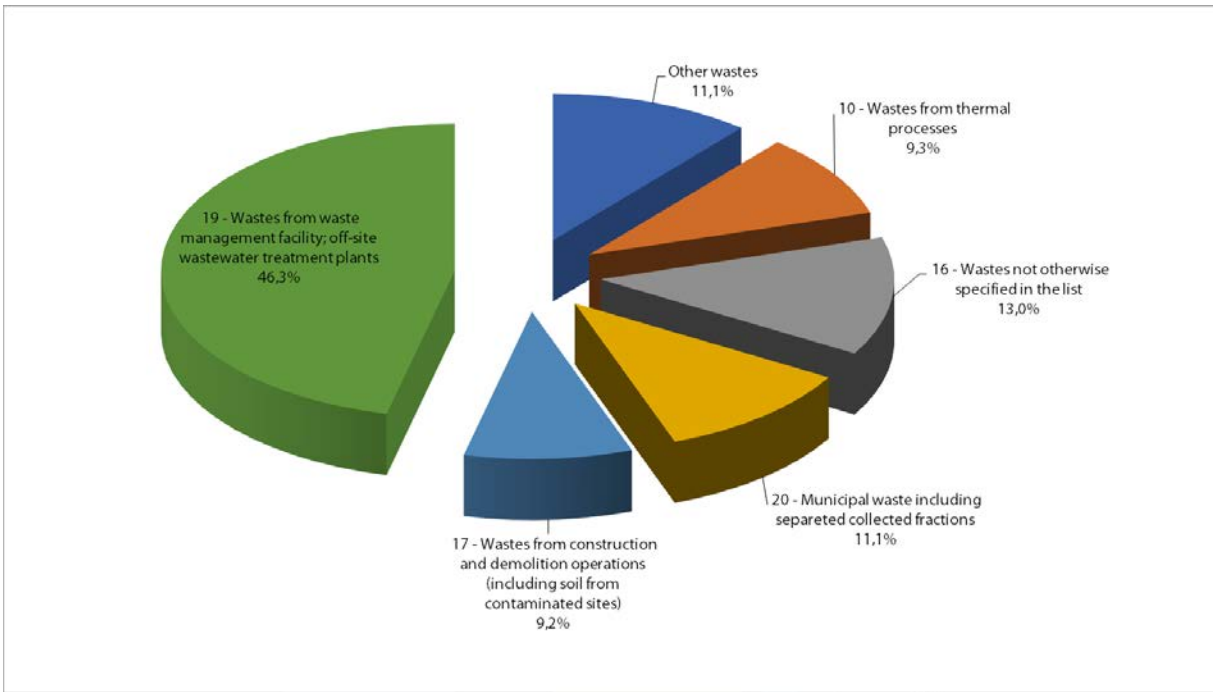
Figure 2.9 shows the forms of management for non-hazardous waste broken down by code of European list of waste. The predominant form of management is, as shown, material recovery.

Figure 2.7 – Percentage distribution of types of hazardous waste recovered, year 2021



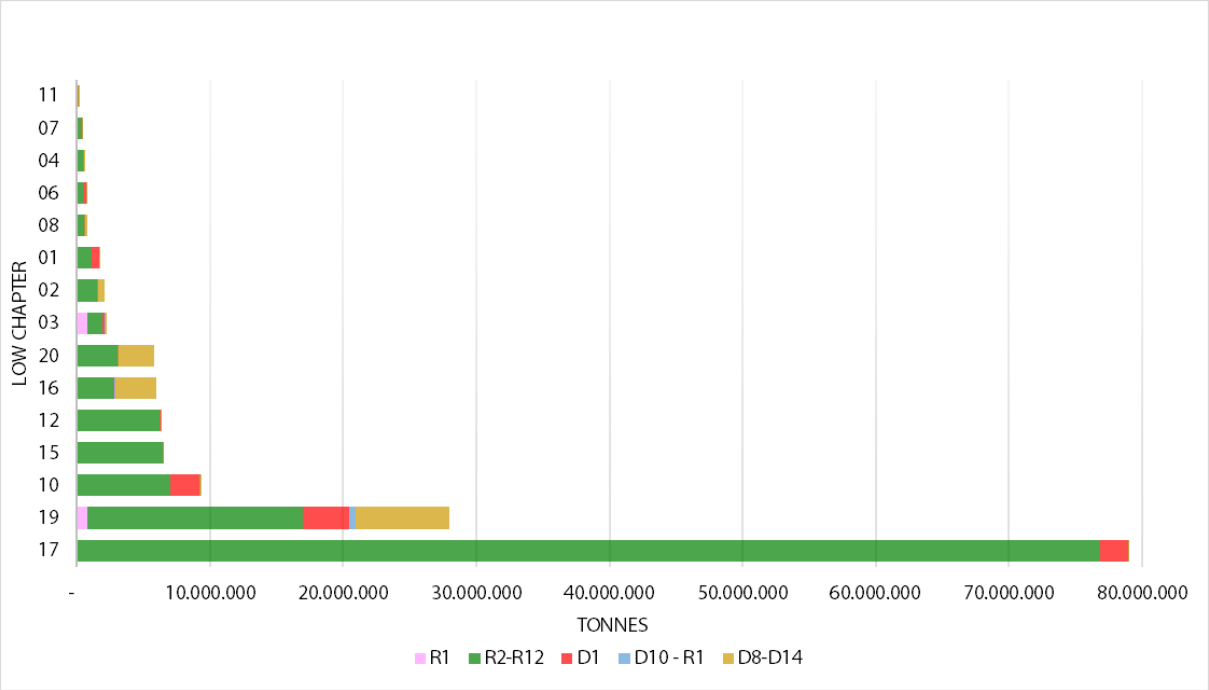
Source: ISPRA

Figure 2.8 – Percentage distribution of types of hazardous waste disposed of, year 2021



Source: ISPRA

Figure 2.9 – Non-hazardous waste management methods according to the main LoW chapters, year 2021



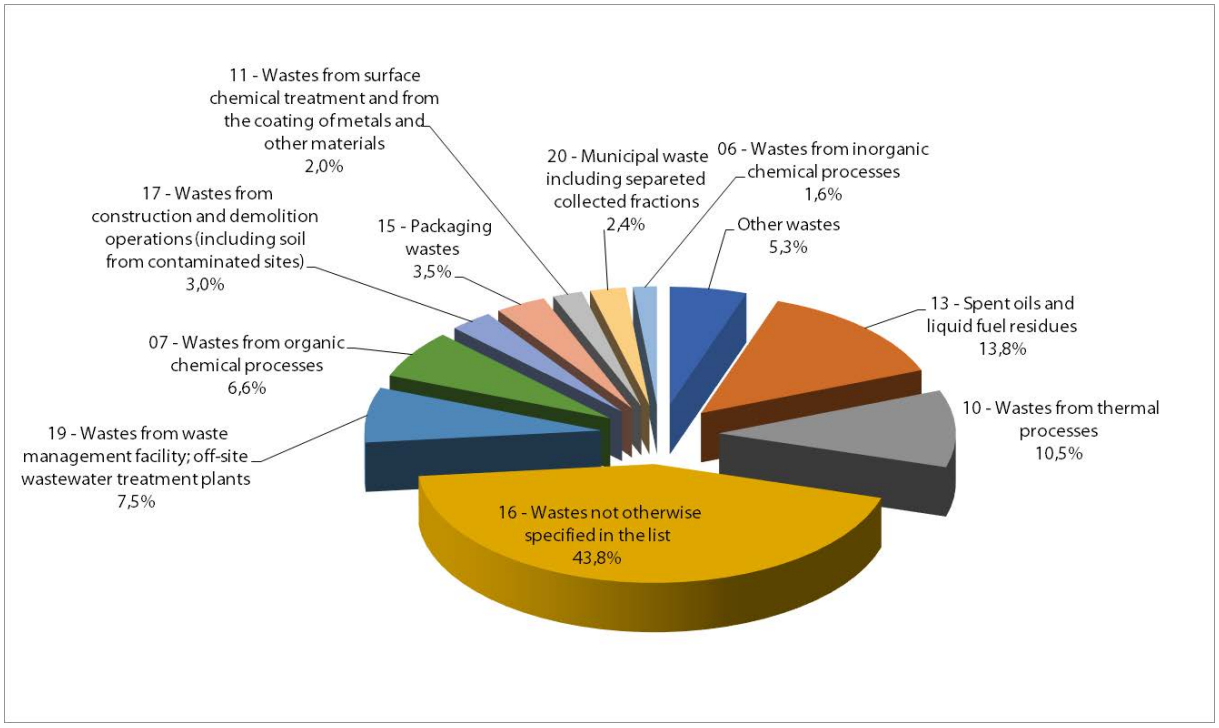
Source: ISPRA

Hazardous waste treated were 10 million tonnes, of which 4.4 million tonnes sent for material recovery (2.5% of the total waste treated). Recycling/recovery of metals or metal compounds (*R4*) amounts to 1,5 million tonnes, and waste treated with *R12* operations are 1,7 million tonnes. These quantities include more than 1.5 million tonnes of end-of-life vehicles, corresponding to 47.8% of the total hazardous waste managed through these operations. (Figure 2.12).

Intermediate disposal operations (*D8, D9, D13, D14*) involved 3.2 million tonnes of hazardous waste, among these, chemical-physical treatment (*D9*) is the most common operation with 2.3 million tonnes. Landfilling (*D1*), with about 1.2 million tonnes, decreased by 7,4% (-97thousand tonnes).

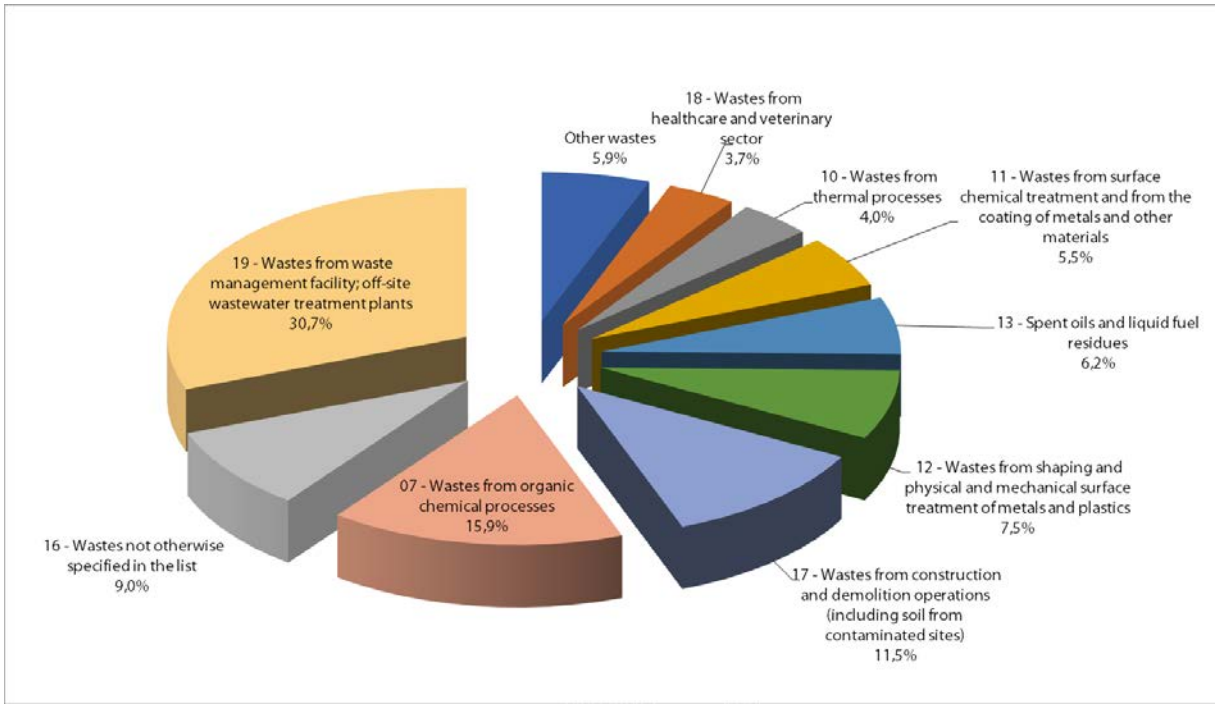
Figures 2.10 and 2.11 show the types of hazardous waste most frequently recovered and disposed of, while Figure 2.12 highlights the forms of management to which they are subjected. While hazardous construction and demolition waste is predominantly sent to landfill, waste not otherwise specified in Chapter 16 of the European LoW (including end-of-life vehicles) are mainly recovered.

Figure 2.10 – Percentage distribution of types of hazardous waste recovered, year 2021



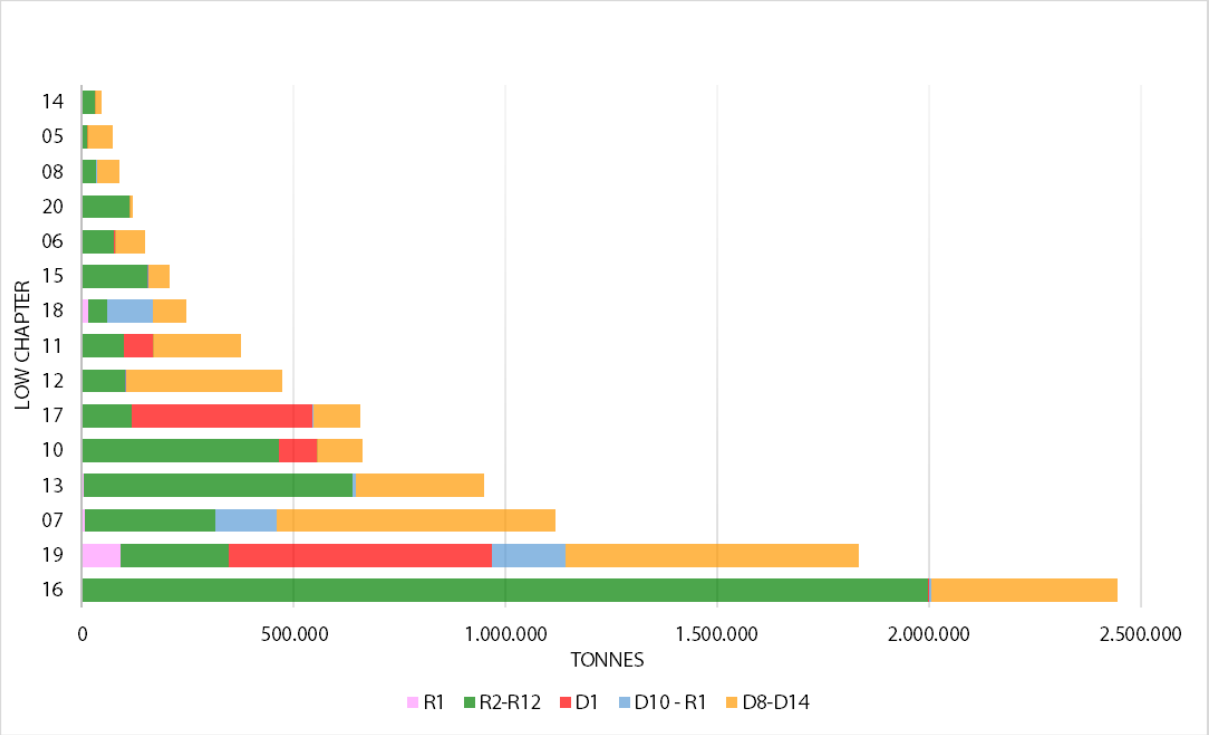
Source: ISPRA

Figure 2.11 – Percentage distribution of types of hazardous waste disposed of, year 2021



Source: ISPRA

Figure 2.12– Hazardous waste management methods according to the main LoW chapters, year 2021



Source: ISPRA

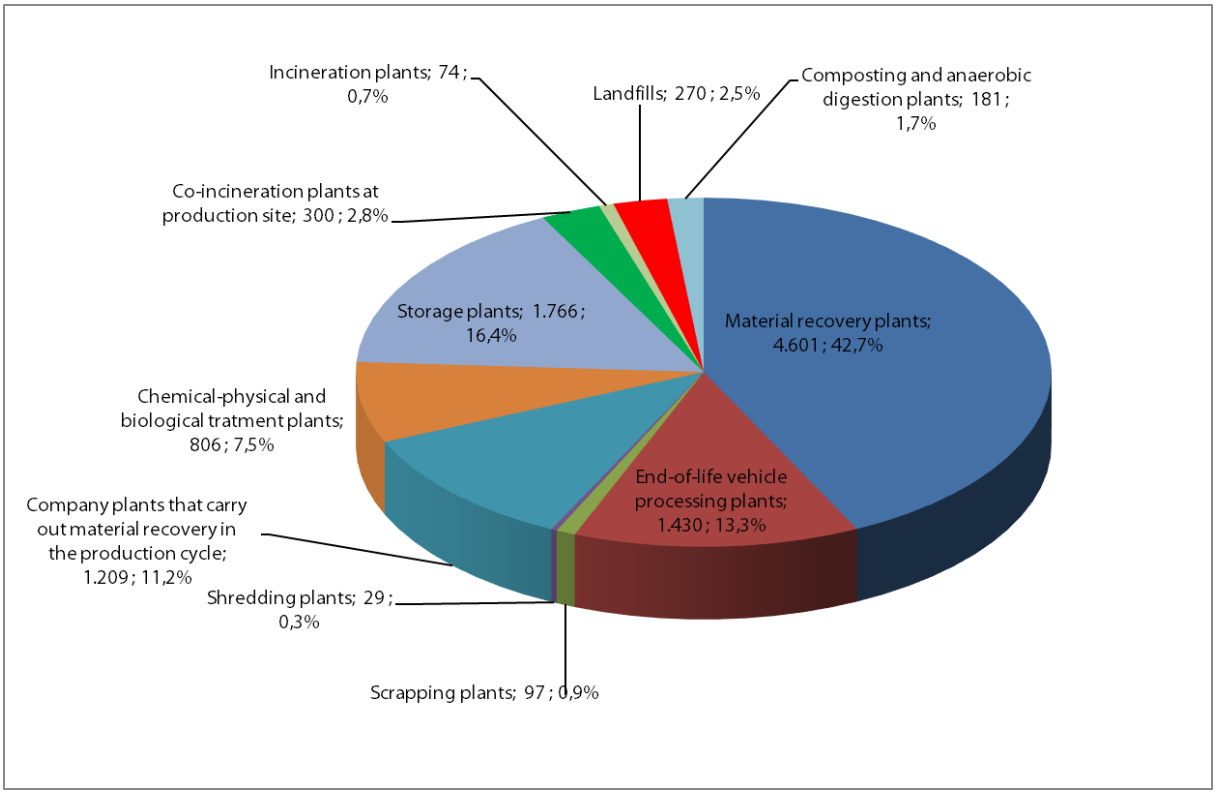
Material recovery plants, amounting to 4,601, represent 42.7% of the total. Facilities exclusively dedicated to the storage of waste before recovery/disposal operations, are 1,766 (16.4% of the total); end-of-life vehicle processing plants represent 13.3% of the total, (1,430 plants); industrial plants that perform material recovery within their production cycle, amounting to 1,209, represent 11.2 % of the total (Table 2.1 and Figure 2.13).

Table 2.1 – Number of plants grouped by type and by macro area, year 2021

Type of facility	North	Centre	South	Italy
Material recovery plants	2 579	717	1 305	4 601
End-of-life vehicle processing plants	613	217	600	1 430
Scrapping plants	59	28	10	97
Shredding plants	16	6	7	29
Industry plants that carry out material recovery in their production cycle	743	238	228	1 209
Chemical-physical and biological treatment and reconditioning plants	410	199	197	806
Storage plants	1 003	355	408	1 766
Co-incineration plants at production sites	197	62	41	300
Incineration plants	46	7	21	74
Landfills	152	43	75	270
Composting and anaerobic digestion plants *	110	27	44	181
Total	**5 928**	**1 899**	**2 936**	**10 763**

* Composting and anaerobic digestion plants dedicated to the biological treatment of municipal waste, which also recover waste from economic activities (sludge and agro-industrial residues).
Source: ISPRA

Figure 2.13 – Number of treatment plants by type and incidence rate, year 2021



Source: ISPRA

2.1 Co-incineration of waste from economic activities

There are 302 production plants co-incinerating waste in Italy, of which 255 processing more than 100 tonnes/year of waste. The other 47 plants process small quantities of waste exclusively for the recovery of thermal/electric energy for their own production cycle. Total amount of EAW co-incinerated is approximately 1,9 million tonnes showing a slight increase of 23 thousand tonnes compared to the year 2020 (+1.3%), attributable to the gradual resumption of production activities at the end of the Covid-19 health emergency.

Non-hazardous waste, over 1.7 million tonnes (93.5% of the total), showed a slight increase of 0.9% compared to 2020. Hazardous waste, 121 thousand tonnes (6.5% of the total), showed an increase of 7.6%.

Northern Italy recovers the largest quantities (75.9% of the total), followed by southern (13.4%) and central Italy (10.7%). As for the regions, Lombardia recovered 533 thousand tonnes (28.8% of the total), Emilia Romagna more than 310 thousand tonnes (16.8%), Veneto almost 230 thousand tonnes (12.4%), Friuli Venezia Giulia about 169 thousand tonnes (9.1%), Umbria almost 168 thousand tonnes (9%), Piemonte about 110 thousand tonnes (5.9%) and Puglia 61 thousand tonnes (3.3%) (Table 2.1.1).

Table 2.1.1 - Waste from economic activities co-incinerated (tonnes), year 2021

Region	N. of plants	Hazardous waste	Non-hazardous waste	Total waste	(%) on total of co-incinerated wastes
Piemonte	34	7 765	101 790	109 555	5.9
Lombardia	57	14 952	518 076	533 028	28.8
Trentino-Alto Adige	6	-	29 401	29 401	1.6
Veneto	44	-	229 623	229 623	12.4
Friuli-Venezia Giulia	15	19 620	148 934	168 554	9.1
Liguria	3		25 406	25 406	1.4
Emilia-Romagna	40	48 860	261 581	310 441	16.8
Northern Italy	**199**	**91 197**	**1 314 811**	**1 406 008**	**75.9**
Toscana	13	-	31 927	31 927	1.7
Umbria	13	-	167 593	167 593	9
Marche	28	-	34 703	34 703	1.9
Lazio	8	-	14 321	14 321	0.8
Central Italy	**62**	**-**	**248 544**	**248 544**	**13.4**
Abruzzo	2	-	583	583	0
Molise	5	-	23 563	23 563	1.3
Campania	4	-	3 709	3 709	0.2
Puglia	15	-	60 918	60 918	3.3
Basilicata	-	-	-	-	0
Calabria	5	23 999	18 559	42 558	2.3
Sicilia	6	-	56 138	56 138	3
Sardegna	4	5 848	4 184	10 032	0.5
Southern Italy	**41**	**29 847**	**167 654**	**197 501**	**10.7**
Total	**302**	**121 044**	**1 731 009**	**1 852 053**	**100**

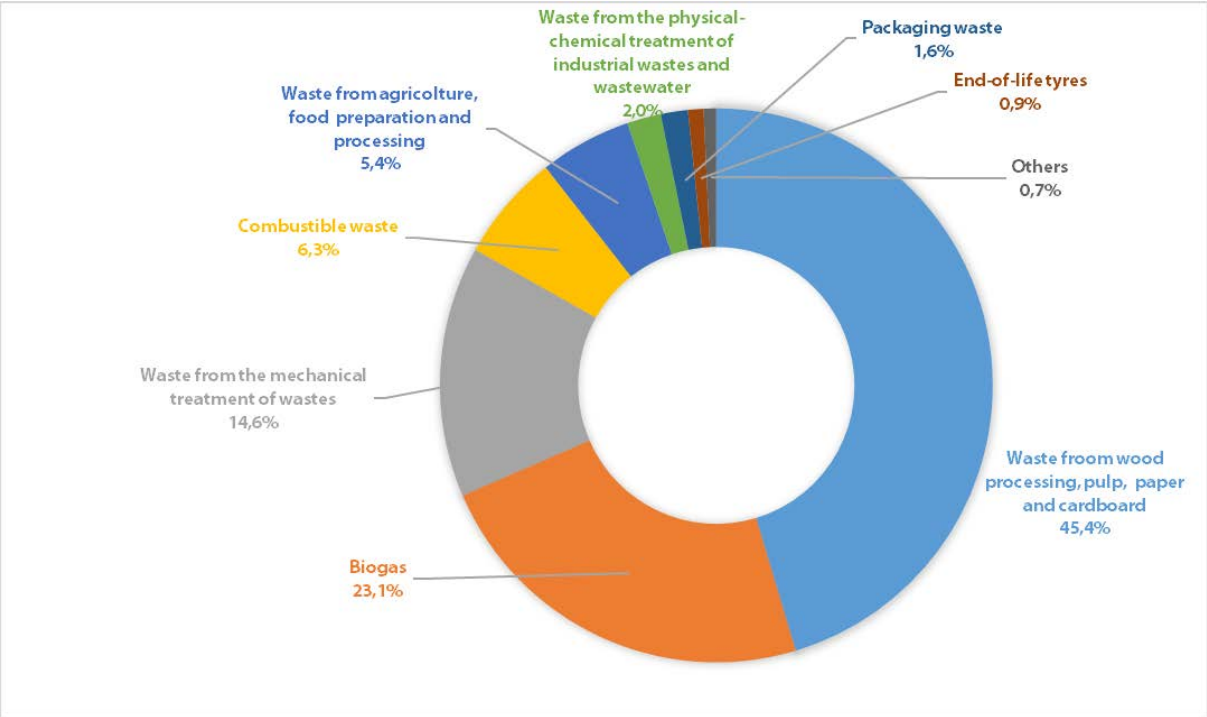
Source: ISPRA

The largest amount of non-hazardous waste co-incinerated result from the following types of waste: wastes from wood processing, paper, and related products (LoW 03**), with almost 786 thousand tonnes (45.5%), biogas (LoW 190699), with over 401 thousand tonnes (23.2%) and wastes from mechanical treatment of waste (LoW 1912**), with near 253 thousand tonnes (14.6%) (Figure 2.1.1) .

As for hazardous waste co-incinerated, the largest amount comes from the following types of waste: wastes from physical/chemical treatments of waste (LoW 1902**) and wastes from wastewater treatment plants (LoW 1908**), with 71 thousand tonnes (58.7%), waste from the mechanical treatment of waste (LoW 1912**), with about 19 thousand tonnes (15.5%), wastes from the healthcare sector (LoW 18**) with approximately 15

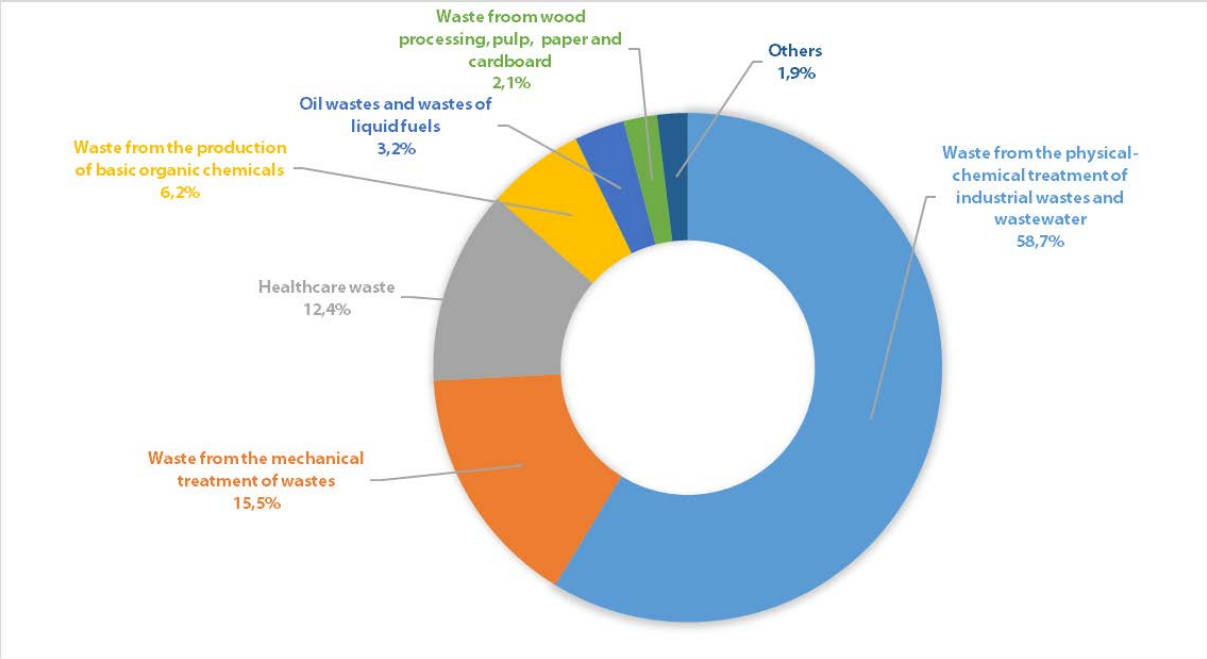
thousand tonnes (12.4%) and waste from the production of basic organic chemicals (LoW 07**) with over 7 thousand tonnes (6.2%).(Figure 2.1.2).

Figure 2.1.1 - Percentage distribution of types of non-hazardous waste sent for co-incineration, year 2021



Source: ISPRA

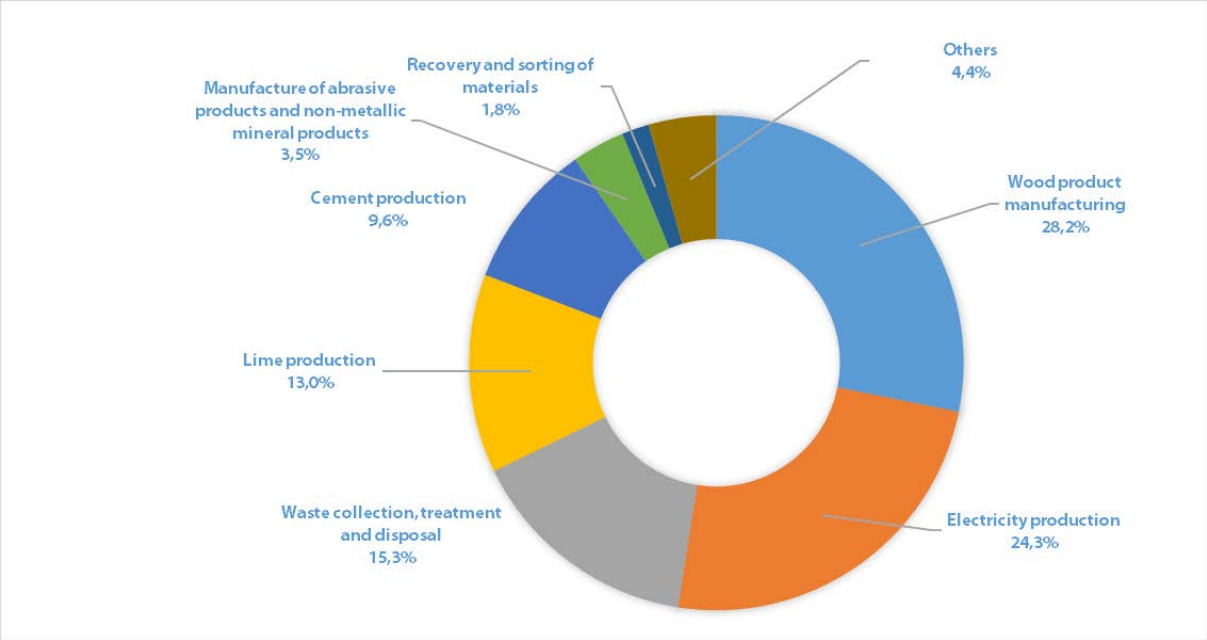
Figure 2.1.2 - Percentage distribution of types of hazardous waste sent for co-incineration, year 2021



Source: ISPRA

The industrial sectors that in 2021 used the largest quantities of waste as a substitute for conventional fuels were: the wood products manufacturing sector ($NACE_{REV.2}$ Sector C.16), with 522 thousand tonnes (28.2%), followed by the electricity production sector ($NACE_{REV.2}$ Sector D.35), with almost 450 thousand tonnes (24.3%), the waste collection, treatment and disposal sector with ($NACE_{REV.2}$ Section E.38) over 284 thousand tonnes (15.3%), and the lime production sector ($NACE_{REV.2}$ Sector C.23.52) with over 240 thousand tonnes (13%; Figure 2.1.3).

Figure 2.1.3 – Percentage distribution of co-incinerated waste, by industrial sector, (tonnes) anno 2021



Source: ISPRA

2.2 Incineration of waste from economic activities

In 2021 approximately 1,1 million tonnes of EAW were incinerated, of which 653 thousand tonnes (59.2% of the total) were non-hazardous and 450 thousand tonnes (40.8% of the total) were hazardous. These quantities are treated both in incineration plants dedicated to EAW and plants dedicated, for the most part, to the treatment of municipal waste and authorised by the competent authorities as disposal plants (*D10*) and/or as energy recovery plants (*R1*) (pursuant Note 4 of Annex C of Legislative Decree 152/06). Specifically, 574 thousand tonnes were incinerated with the *R1* recovery operation and almost 530 thousand tonnes with *D10* operation.

Compared to 2020, there was a decrease of 16.1% in the amount of EAW incinerated, equal to 212 thousand tonnes.

Of the 74 operative incineration plants treating EAW, 46 are located in northern Italy, 7 in central Italy and 21 in southern Italy.

In line with the distribution of the plants, data analysis shows that wastes are mainly incinerated in the plants located in the North (81.7% of the total, almost 900 thousand tonnes), then the South with 15.7% (173 thousand tonnes) and Centre with 2.6% (29 thousand tonnes).

Table 2.2.1 - Number of plants and amount of waste from economic activities incinerated (tonnes), year 2021

Region	Number of Plants	Hazardous waste	Non-hazardous waste	Total	% on total wastes incinerated
Piemonte	3	31 535	4 358	35 893	3.3
Lombardia	26	355 836	196 811	552 647	50.1
Trentino-Alto Adige	1	33 476	-	33 476	3.0
Veneto	6	14 445	46 766	61 211	5.5
Friuli-Venezia Giulia	2	27 038	-	27 038	2.5
Emilia-Romagna	8	116 768	74 074	190 842	17.3
Northern Italy	**46**	**579 098**	**322 009**	**901 107**	**82**
Toscana	6	21 096	4 678	25 774	2.3
Lazio	1	-	3 324	3 324	0.3
Central Italy	**7**	**21 096**	**8 002**	**29 098**	**3**
Abruzzo	2	24	22 711	22 735	2.06
Molise	1	-	4 728	4 728	0.43
Campania	2	337	14 377	14 714	1.33
Puglia	7	11 960	7 442	19 402	1.76
Basilicata	1	22 052	23 287	45 339	4.11
Calabria	2	1 467	2 927	4 394	0.40
Sicilia	4	9 398	39 152	48 550	4.40
Sardegna	2	8 148	5 229	13 377	1.21
Southern Italy	**21**	**53 386**	**119 853**	**173 239**	**15.70**
Total	**74**	**653 580**	**449 864**	**1 103 444**	**100**

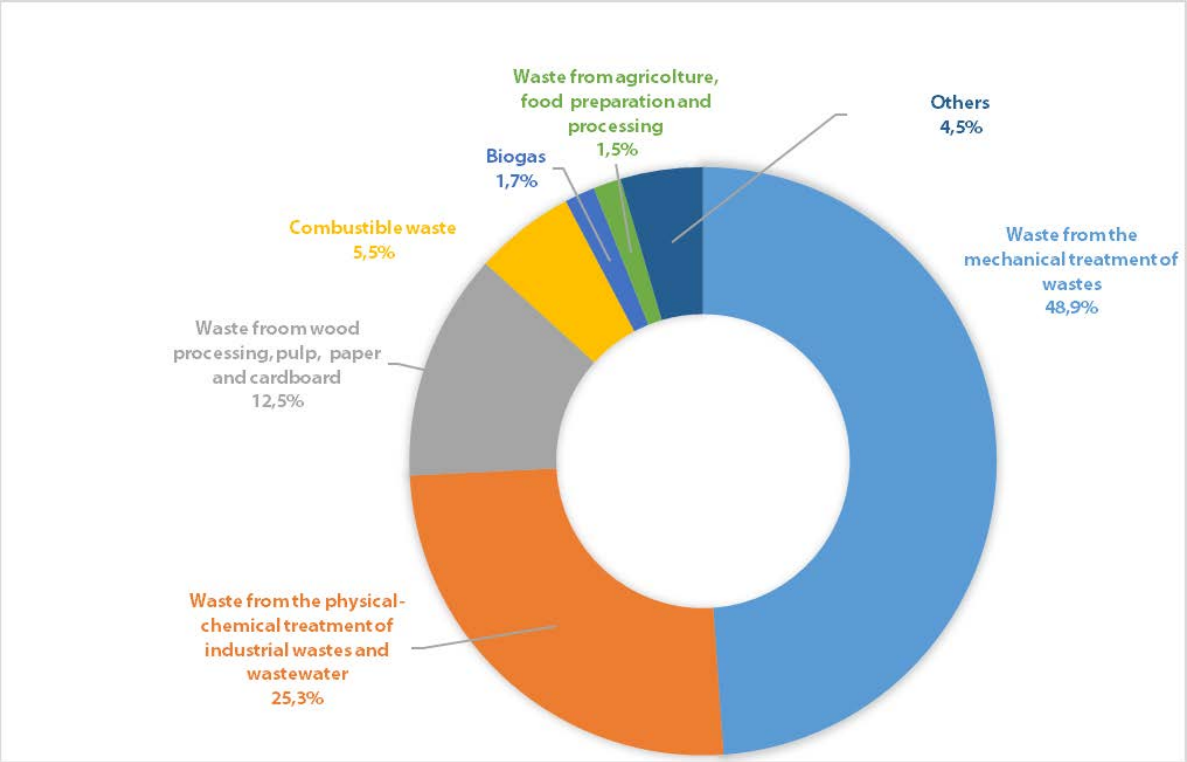
Source: ISPRA

The largest quantity of non-hazardous waste incinerated (Figure 2.2.1) are: wastes from the mechanical treatment of waste (LoW 1912**), with a quantity of almost 320 thousand tonnes (28.9%), wastes from physical/chemical treatments of waste (LoW 1902**) and wastes from wastewater treatment plants (LoW 1908**), with over 165 thousand tonnes (15%), waste from wood processing, paper and related products (LoW 03**) with almost 82 thousand tonnes (7.4%) and combustible waste (LoW 191210) with 36 thousand tonnes (3.3%).

As for hazardous waste, incineration mainly concerns wastes from physical/chemical treatments of waste (LoW 1902**) and wastes from wastewater treatment plants (LoW 1908**) with 129 thousand tonnes (11.7%), wastes from the healthcare sector (LoW 18**) with 108 thousand tonnes (9.8%) wastes from the production of basic organic chemicals (LoW 07**) with almost 105 thousand tonnes (9.5%), wastes from the mechanical treatment

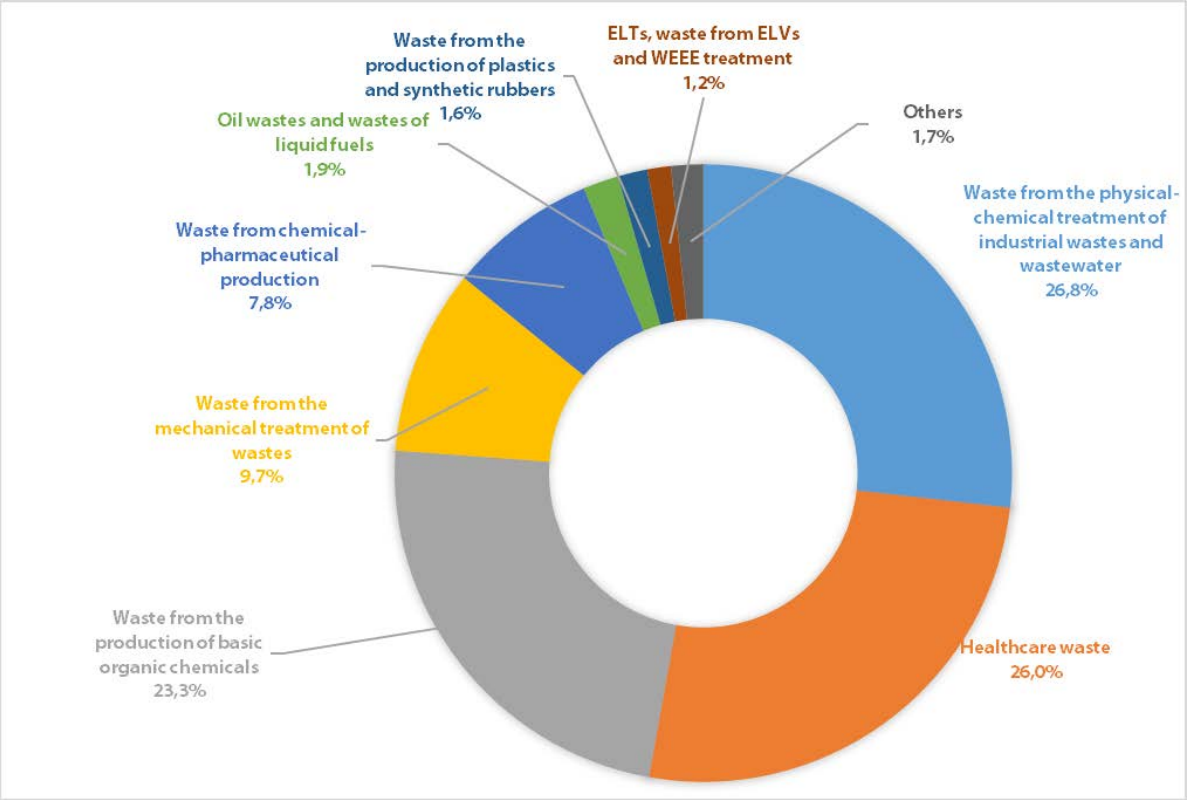
of waste (LoW 1912**) with 44 thousand tonnes (4%), waste from chemical-pharmaceutical production (LoW 0705) with 35 thousand tonnes (3.2%) and oil wastes (LoW 13**) with more than 8 thousand tonnes (0.8%) (Figure 2.2.2).

Figure 2.2.1 - Percentage distribution of types of non-hazardous waste sent for incineration, year 2021



Source: ISPRA

Figure 2.2.2 - Percentage distribution of types of hazardous waste sent for incineration, year 2021



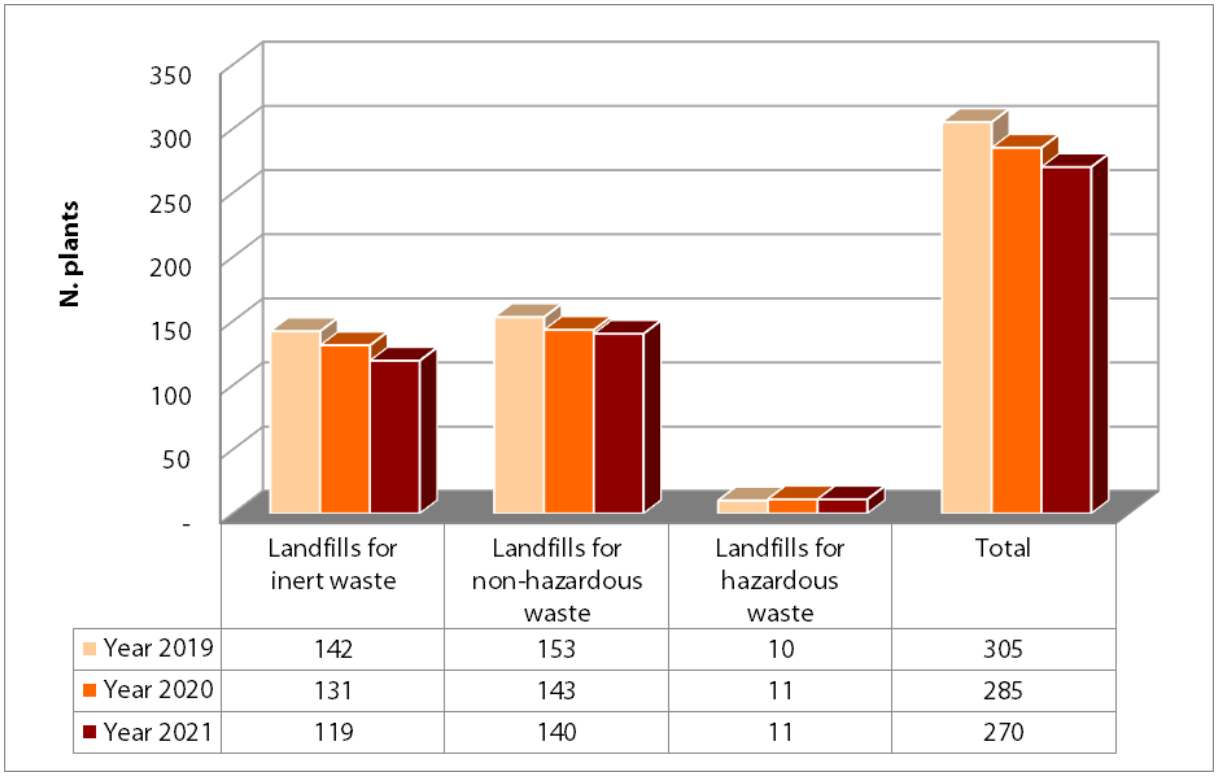
Source: ISPRA

2.3 Landfill disposal of waste from economic activities

Total number of operational landfills in Italy is 270; 119 are landfills for inert waste (44% of the total operating plants), 140 are landfills for non-hazardous waste (52% of the total), and 11 are landfills for hazardous waste (4% of the total).

The analysis of the three-year period 2019 - 2021 shows a progressive decrease in the total number of operational landfills from 305 in 2019, to 285 in 2020 and to 270 in 2021 (Figure 2.3.1).

Figure 2.3.1 - Number of landfills for the disposal of waste from economic activities, divided by landfill categories, years 2019 - 2021



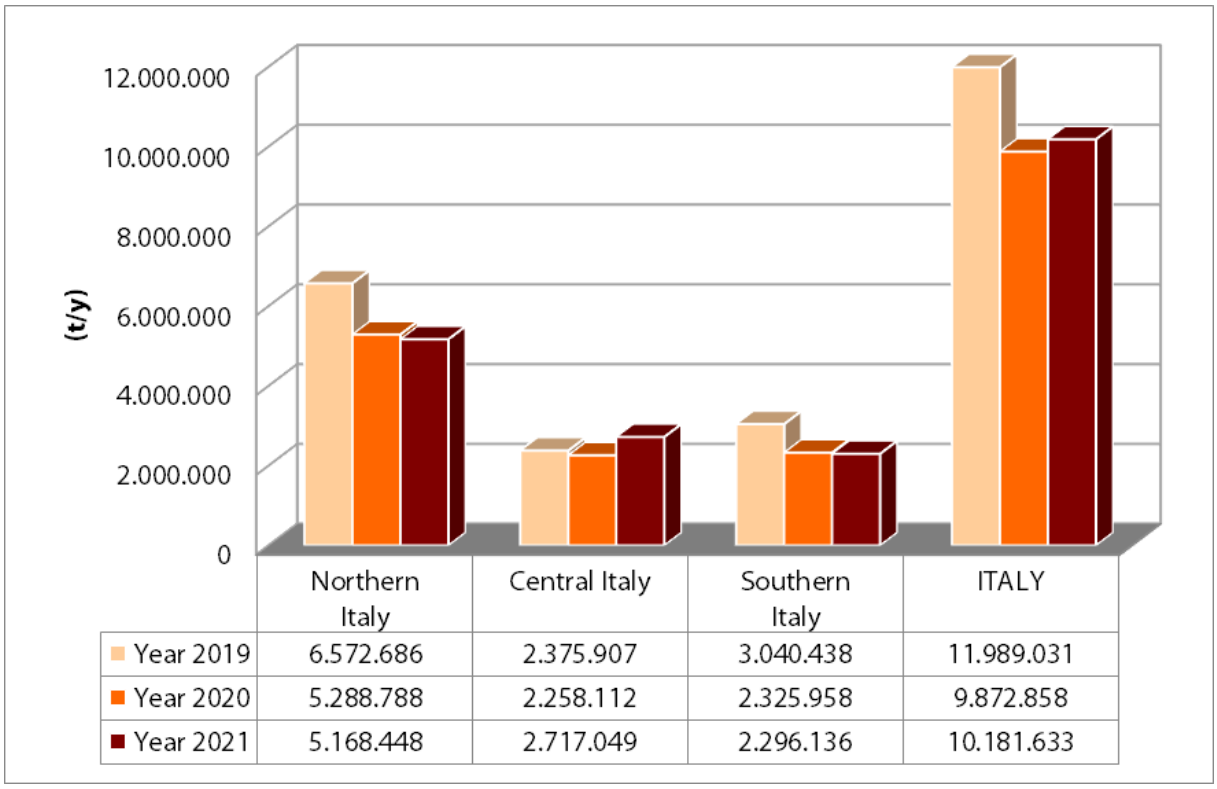
Source: ISPRA

Most of the landfills are located in northern Italy where there are 152 plants; 43 landfills are in central Italy and 75 in southern Italy.

Overall quantities of EAW disposed of in landfills amount to approximately 10.2 million tonnes, 5.7% of the quantity of EAW managed at national level (about 178 million tonnes). Comparison with 2020, shows an increase of 309 thousand tonnes (+3.1%) while compared to 2019 the decrease is of 1.8 million tonnes (-15%).

Landfills in northern Italy dispose of 50.8% of the total waste, near 5,2 million tonnes, with a decrease of -2.3% (about 120 thousand tonnes), compared to 2020. Landfills in central Italy dispose of 26.7% with an increase of +20.3% (+459 thousand tonnes); the amount of waste landfilled went, in fact, from 2,3 million tonnes in 2020 to about 2,7 million tonnes in 2021. In southern Italy, 22.5% of the national total is disposed of, with a decrease of 1.3% (-30 thousand tonnes), (Figure 2.3.2).

Figure 2.3.2 - Disposal in landfills of waste from economic activities, by geographical macro-area (tonnes), years 2019 - 2021



Source: ISPRA

The analysis of the amount of EAW disposed of in the different landfill categories, shows the following distribution: approximately 3,8 million tonnes are allocated in landfills for inert wastes (36,4% of total waste disposed of), 5,3 million tonnes in landfills for non-hazardous wastes (52%), and over 1.1 million tonnes in landfills for hazardous waste (11.1%).

Lombardia region dispose the largest quantities of waste (2,5 million tonnes equal to 49.1% of northern Italy and 24.9% of the national total), followed by Toscana (1,1 million tonnes, 41,6% of central Italy and 11.1% of the national total), Veneto (1,1 million tonnes, 20.8% of northern Italy and 10.6% of the national total) and Sardegna (942 thousand tonnes, 41% of the southern Italy and 9.2% of the national total). (Table 2.3.1).

Table 2.3.1 - Waste disposal in landfills, by region, by landfill category and type of waste (tonnes), year 2021

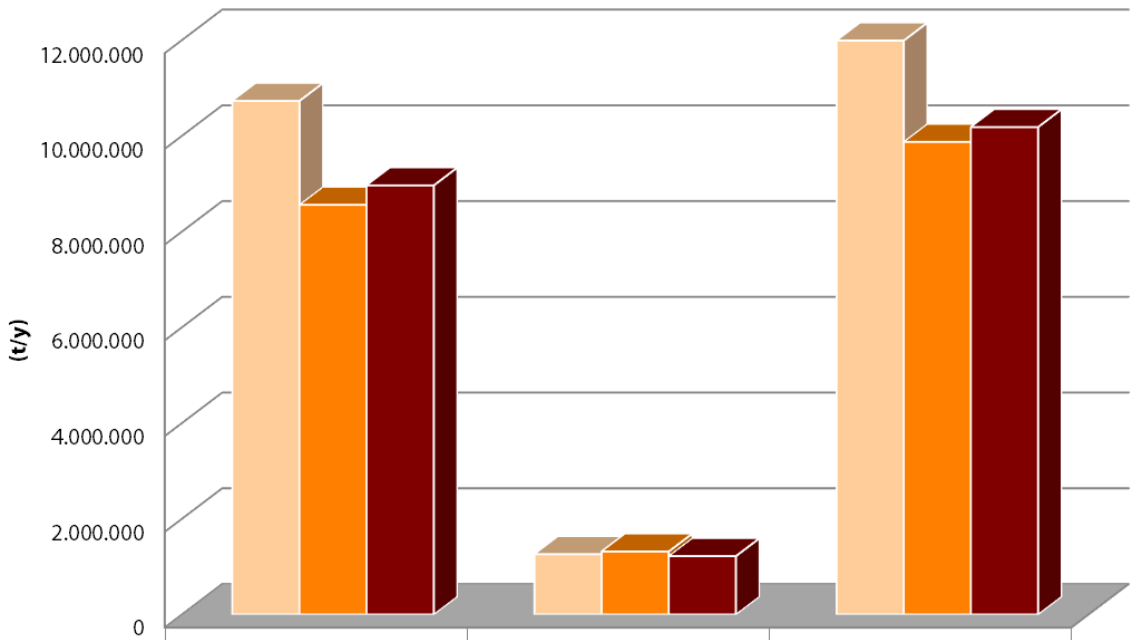
Region	Landfills for inert waste (t/y)			Landfills for non-hazardous waste (t/y)			Landfills for hazardous waste (t/y)			ITALY (t/y)		
	NH	H	Total	NH	H	Total	NH	H	Total	NH	H	Total
Piemonte	5 242	0	5 242	189 655	0	189 655	576	153 729	154 305	195 473	153 729	349 202
Valle d'Aosta	40 022	0	40 022	51 839	1	51 840	0	0	0	91 861	1	91 862
Lombardia	1 729 394	0	1 729 394	441 570	176 472	618 042	106 541	84 174	190 715	2 277 505	260 646	2 538 151
Trentino-Alto Adige	6 675	0	6 675	39 071	238	39 309	0	0	0	45 746	238	45 984
Veneto	484 736	0	484 736	531 707	60 869	592 576	0	0	0	1 016 443	60 869	1 077 312
Friuli-Venezia Giulia	119 082	0	119 082	47 382	168 070	215 452	0	0	0	166 464	168 070	334 534
Liguria	148 335	0	148 335	347 617	0	347 617	0	0	0	495 952	0	495 952
Emilia-Romagna	0	0	0	217 415	18 036	235 451	0	0	0	217 415	18 036	235 451
Northern Italy	**2 533 486**	**0**	**2 533 486**	**1 866 256**	**423 686**	**2 289 942**	**107 117**	**237 903**	**345 020**	**4 506 859**	**661 589**	**5 168 448**
Toscana	0	0	0	1 015 446	9 793	1 025 239	10 840	94 933	105 773	1 026 286	104 726	1 131 012
Umbria	0	0	0	34 782	0	34 782	379 152	80 854	460 006	413 934	80 854	494 788
Marche	0	0	0	175 979	0	175 979	0	29 428	29 428	175 979	29 428	205 407
Lazio	751 001	0	751 001	37 241	0	37 241	97 600	0	97 600	885 842	0	885 842
Central Italy	**751 001**	**0**	**751 001**	**1 263 448**	**9 793**	**1 273 241**	**487 592**	**205 215**	**692 807**	**2 502 041**	**215 008**	**2 717 049**
Abruzzo	0	0	0	0	814	814	0	0	0	0	814	814
Molise	12	0	12	33 319	0	33 319	0	0	0	33 331	0	33 331
Campania	0	0	0	0	0	0	0	0	0	0	0	0
Puglia	191 614	0	191 614	699 526	0	699 526	5 606	436	6 042	896 746	436	897 182
Basilicata	17 781	0	17 781	29 421	0	29 421	0	20 427	20 427	47 202	20 427	67 629
Calabria	0	0	0	3 769	0	3 769	142	67 106	67 248	3 911	67 106	71 017
Sicilia	20 510	0	20 510	217 830	46 121	263 951	0	0	0	238 340	46 121	284 461
Sardegna	244 041	0	244 041	490 817	206 844	697 661	0	0	0	734 858	206 844	941 702
Southern Italy	**473 958**	**0**	**473 958**	**1 474 682**	**253 779**	**1 728 461**	**5 748**	**87 969**	**93 717**	**1 954 388**	**341 748**	**2 296 136**
TOTAL	**3 758 445**	**0**	**3 758 445**	**4 604 386**	**687 258**	**5 291 644**	**600 457**	**531 087**	**1 131 544**	**8 963 288**	**1 218 345**	**10 181 633**

NH: non-hazardous; H: hazardous

Source: ISPRA

Non-hazardous wastes disposed of in landfills are 9 million tonnes representing 88% of the total amount disposed of in landfills; over 1,2 million tonnes are, instead, hazardous waste (12% of the total, Figure 2.3.3). Data analysis for the two-year period 2020 - 2021 shows a +4.7%, increase in non-hazardous waste, from 8.6 million tonnes in 2020 to 9 million tonnes in 2021 (approximately 406 thousand tonnes), while for hazardous waste, there is a -7.4% reduction (approximately 97 thousand tonnes)

Figure 2.3.3 - Disposal in landfills of waste from economic activities, by type, years 2019 - 2021



	Non-hazardous	Hazardous	Total
Year 2019	10.729.286	1.259.745	11.989.031
Year 2020	8.557.483	1.315.375	9.872.858
Year 2021	8.963.288	1.218.345	10.181.633

Source: ISPRA

About 38.9% of the waste landfilled are "wastes produced by waste treatment operations" (LoW 19), 24.7% are produced by thermal processes (LoW 10), 23.4% from construction and demolition operations (LoW 17) and 6.2% are wastes from prospecting, mining, quarrying, physical and chemical processing of minerals (LoW 01). Other wastes (including mixed materials) from mechanical treatment of waste (LoW code 191212), account for the largest share, amounting to 1.5 million tonnes (16.9% of total non-hazardous waste); followed by waste soil and rock (LoW code 170504), amounting to 1.2 million tonnes (13.9% of total non-hazardous waste).

Hazardous wastes are mainly (51%) "waste from waste treatment operations" (LoW 19), 35.2% are from construction and demolition operations (LoW 17), 7.4% from thermal processes (LoW 10) and 5.7% from chemical surface treatment and coating of metals and other materials and waste from non-ferrous hydrometallurgy (LoW 11). In particular, partially stabilised waste (LoW code 190304*) accounts for the largest share (589 thousand tonnes, i.e., 48.3% of the total hazardous waste); followed by construction materials containing asbestos (EER code 170605*), amounting to about 328 thousand tonnes or 26.9% of the total.

Waste containing asbestos disposed of in the 17 dedicated landfills amounts to about 331 thousand tonnes and represents 3.2% of the total amount sent to landfills and 27.1% of the share of hazardous waste. 89.7% of the total amount of waste containing asbestos in 2021 is disposed of in the North (about 297 thousand tonnes), 2.5% in the Centre (8 thousand tonnes), and 7.8% in the South (about 26 thousand tonnes).

These quantities are almost entirely consisting of construction materials containing asbestos (LoW code 170605*), approximately 328 thousand tonnes (99.1% of the total disposed). The remaining 0.9% (about 3 thousand tonnes) is made up of other types of waste identified by LoW 160111* (1 tonne), LoW 160212* (12 tonnes) and LoW 170601* (2,968 tonnes).

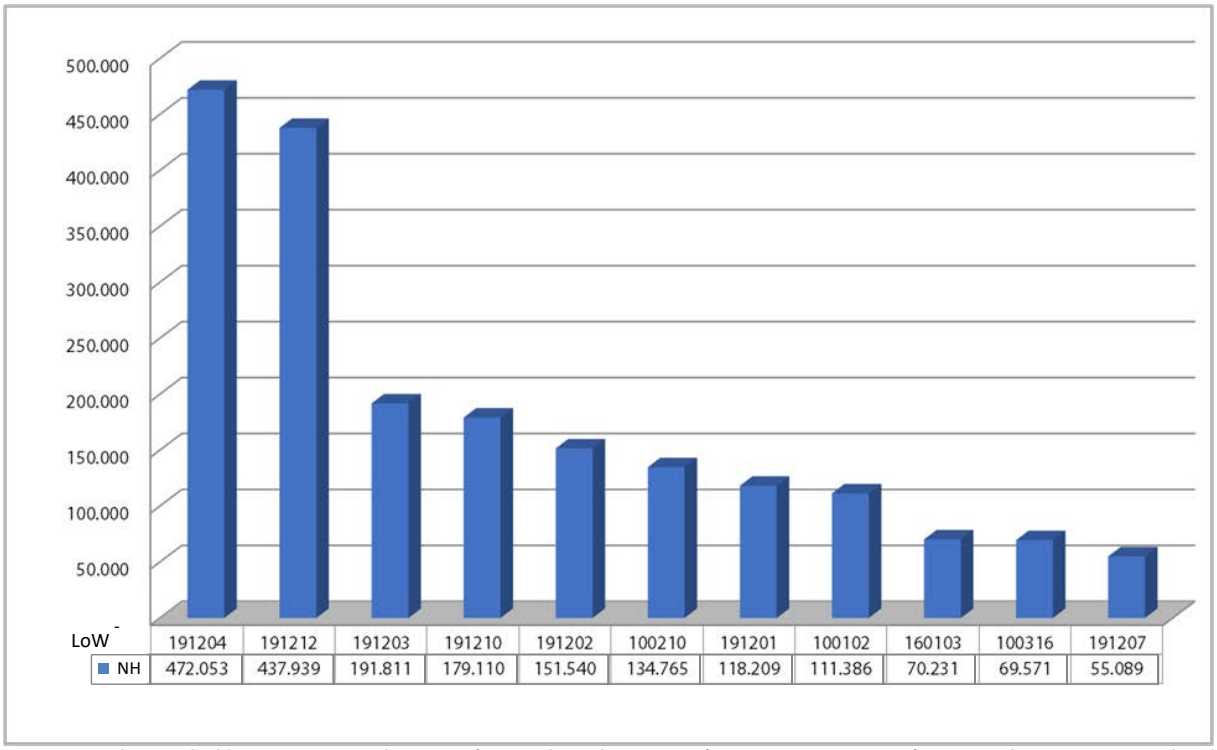
2.4 Import and export of waste from economic activities

The total amount of exported EAW is over 3,9 million tonnes, while the imported amount is over 7,4 million tonnes. Exported waste consists for 66% of non-hazardous waste (2,6 million tonnes) and for the remaining 33% (1,3 million tonnes) of hazardous waste.

Compared to 2020, the total quantity exported shows a 7.6% increase. non-hazardous waste increased by 215 thousand tonnes (+9%), while; hazardous waste, on the other hand, increased by 59 thousand tonnes (+4.7%).

The most exported non-hazardous waste (67,5% of non-hazardous waste) amounting to 1,6 million tonnes is waste produced by waste treatment plants (LoW 19*). Specifically, 472 thousand tonnes are plastic and rubber, exported mainly to Türkiye and Austria, 438 thousand tonnes of mixed waste from waste treatment, exported mainly to Austria and Hungary, about 192 thousand tonnes of non-ferrous metals exported mainly to Germany and China (Figure 2.4.1).

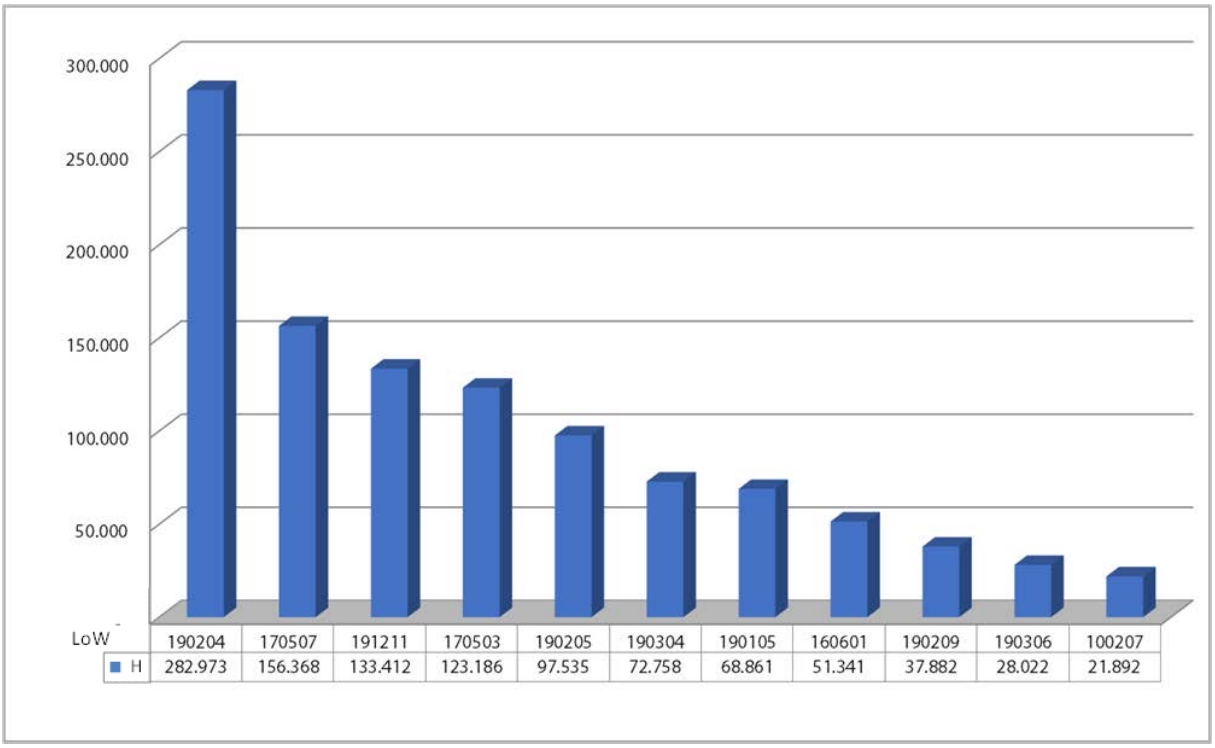
Figure 2.4.1 - Main types of non-hazardous waste from economic activities exported (tonnes), 2021



LoW 191204: plastic and rubber; LoW 191212: other wastes from mechanical treatment of waste; LoW 191203: non-ferrous metals; LoW 191210: combustible waste; LoW 191202: ferrous metal; Low 100210: mill scales; LoW 191201: paper and cardboard; LoW 100102: coal fly ash; LoW 160103: end-of-life tyres; LoW 100316: skimmings. LoW 191207: wood.
Source: ISPRA

About 61.4% of the exported hazardous waste, 795 thousand tonnes, is waste generated by waste treatment plants; among these, premixed wastes composed of at least one hazardous waste are prevalent, with more than 283 thousand tonnes, followed by wastes from treatment of waste, with 133 thousand tonnes. An amount of 336 thousand tonnes (26%) is waste deriving from construction and demolition operations and mostly consists of track ballast (156 thousand tonnes; Figure 2.4.2).

Figure 2.4.2 – Main types of hazardous waste from economic activities exported (tonnes), year 2021



LoW 190204*: premixed wastes containing at least one hazardous waste; LoW 170507*: track ballast; LoW 191211*: other wastes from mechanical treatment of waste; LoW 170503*: soil and stones; LoW 190205*: sludges from physical-chemical treatments; LoW 190304*: wastes marked as hazardous partially stabilised; LoW 190105*: filter cake from gas treatment; LoW 160601*: lead batteries; LoW 190209*: solid combustible wastes; LoW 190306*: wastes marked as hazardous, solidified; LoW 100207*: solid wastes from gas treatment containing hazardous substances.
Source: ISPRA

Overall, 75.9% of exported non-hazardous waste is destined for material recovery (2 million tonnes), 21.4% for energy recovery and 2.7% for disposal.

The largest quantity exported, amounting to 831 thousand tonnes, is sent to Germany, which receives mainly hazardous waste for a total of 582 thousand tonnes, of which 270 thousand tonnes from waste treatment plants and 266 thousand tonnes from construction and demolition operations.

Imported EAW amounts to more than 7.4 million tonnes and consists almost exclusively of non-hazardous waste; hazardous waste accounts for 1.3% of the total imported.

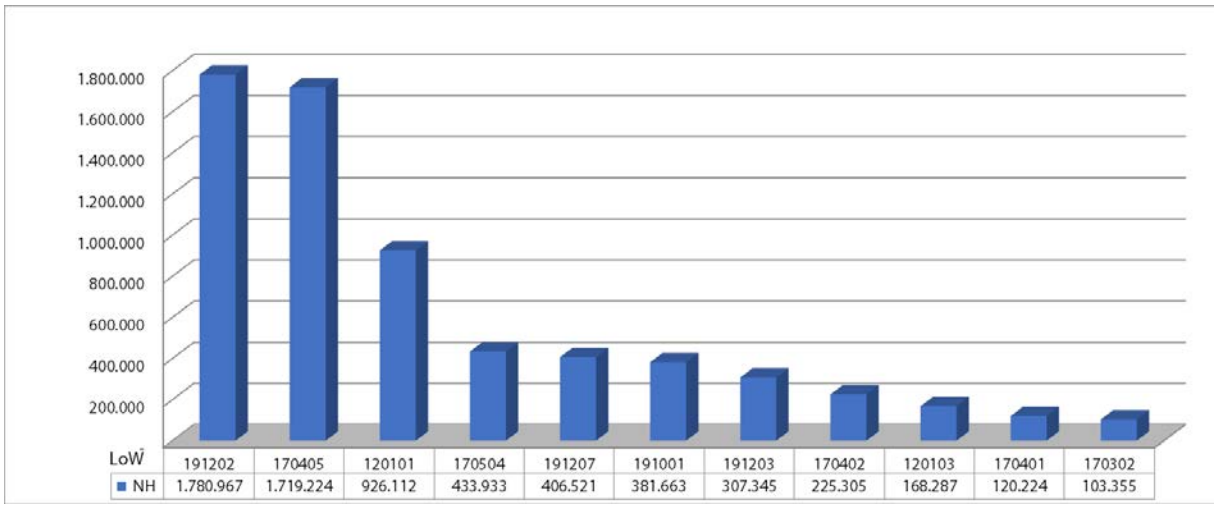
A share of 37.2% of the non-hazardous EAW imported are construction and demolition waste (2.7 million tonnes), mainly iron and steel waste (1.7 million tonnes). Wastes produced from waste treatment plants represents 41.7% (3 million tonnes), with ferrous metals predominating (1.8 million tonnes, Figure 2.4.3). These wastes are destined for recovering in industrial plants located in Friuli-Venezia Giulia, Lombardia and Veneto.

Wastes produced by thermal processes represent 70.1% of the total imported hazardous EAW and are mainly consisting of solid wastes produced from gas treatment (67 thousand tonnes), recovered in Sardegna at a metallurgical industrial site (Figure 2.4.4).

Overall, 99.9% of EAW waste imported is destined for material recovery.

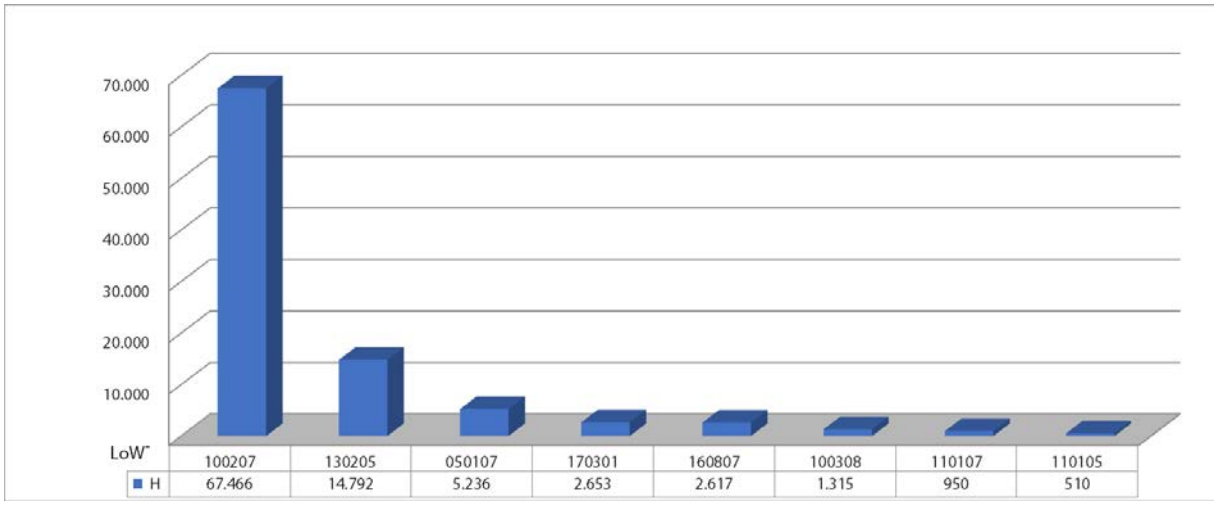
The largest quantity of imported waste comes from Germany, about 2 million tonnes, 95.7% of which is metal waste. Significant quantities of EAW also come from France (1.1 million tonnes), Switzerland (1 million tonnes) and Austria (783 thousand tonnes). Metal and wood wastes are mainly imported from France, soil and stones destined for environmental restoration in Lombardia are primarily imported from Switzerland.

Figure 2.4.3 – Main types of non-hazardous waste from economic activities imported (tonnes), year 2021



LoW 191202: ferrous metals; LoW 170405: iron and steel; LoW 120101: ferrous metals filings and turnings; LoW 170504: soil and stones; LoW 191207: wood; LoW 191001: iron and steel waste; LoW 191203: non-ferrous metals; LoW 170402: Aluminium; LoW 120103: non-ferrous metals filings and turnings; LoW 170401: copper, bronze, brass; LoW 170302: bituminous mixtures.
Source: ISPRA

Figure 2.4.4 – Main types of hazardous waste from economic activities imported (tonnes), year 2021



LoW 100207*: solid waste from gas treatment; LoW 130205*: mineral-based non chlorinated; engine, gear and lubricating oils; LoW 050107*: acid tars; LoW 170301* bituminous mixtures containing coal tar; Low 160807*: spent catalyst contaminated with hazardous substances; LoW 100308*: salt slags from secondary production; LoW 110107*: pickling bases; LoW 110105 pickling acids.
Source: ISPRA

3 Monitoring of specific waste streams

3.1 Waste containing asbestos

In 2021 asbestos-containing waste produced in Italy amounted to 339 thousand tonnes, 97.1% of which consisted of construction materials, 2.2% of insulation materials, and 0.7% of metal packaging, brake pads and discarded equipment containing free asbestos.

Northern Italy produced 81.2% of the total asbestos-containing waste generated nationwide, while Central Italy and Southern Italy produce 10.8% and 8% respectively.

Friuli Venezia Giulia is the region with the largest amount of asbestos-containing waste produced in 2021 with 101 thousand tonnes which represents 29.9% of the national total. (Table 3.1.1).

Table 3.1.1 - Production of waste containing asbestos by LoW code (tonnes), year 2021

REGION	150111*	160111*	160212*	170601*	170605*	TOTAL
Piemonte	65	1	26	902	18 879	19 873
Valle d'Aosta	-	-	-	-	43	43
Lombardia	437	5	74	3 050	64 224	67 790
Trentino-Alto Adige	70	-	153	20	2 919	3 162
Veneto	380	4	24	867	48 406	49 681
Friuli-Venezia Giulia	28	1	4	237	101 093	101 363
Liguria	17	-	30	630	1 778	2 455
Emilia-Romagna	200	2	5	110	30 650	30 967
Northern Italy	**1 197**	**13**	**316**	**5 816**	**267 992**	**275 334**
Toscana	129	7	1	224	13 099	13 460
Umbria	37	-	1	14	6 464	6 516
Marche	54	-	-	57	5 587	5 698
Lazio	80	2	10	365	10 420	10 877
Central Italy	**300**	**9**	**12**	**660**	**35 570**	**36 551**
Abruzzo	47	-	-	30	4 277	4 354
Molise	2	-	-	-	214	216
Campania	96		1	470	3 400	3 967
Puglia	42	1	13	78	5 131	5 265
Basilicata	5	-	-	7	314	326
Calabria	8	-	57	80	2 176	2 321
Sicilia	14	-	5	166	6 168	6 353
Sardegna	15	6	1	309	4 243	4 574
Southern Italy	**229**	**7**	**77**	**1 140**	**25 923**	**27 376**
TOTAL	**1 726**	**29**	**405**	**7 616**	**329 485**	**339 261**

LoW 150111: metal packaging containing hazardous solid porous matrix (for example. asbestos) including empty pressure containers; LoW 160111: brake pads containing asbestos; LoW 160212: discarded equipment containing free asbestos; LoW 170601: insulation materials containing asbestos; LoW 170605: construction materials containing asbestos.
Source: ISPRA

The management of asbestos-containing waste involved 358 thousand tonnes and 98% of it were construction materials, about 351 thousand tonnes.

The predominant form of management is landfill, where, in fact, 92.3% of this waste (331 thousand tonnes) was disposed of. The remaining quantity was sent for preliminary treatment and preliminary storage (about 28 thousand tonnes).

Italy exported in 2021 about 16 thousand tonnes of waste containing asbestos, which are sent almost entirely to Germany (11,596 tonnes) and to a lesser extent to Spain (3,107 tonnes) and France (630 tonnes). These exported wastes are essentially construction materials, around 13 thousand tonnes, destined for disposal (Table 3.1.2).

Table 3.1.2 – Comparison of production, treatment, and export by type of waste containing asbestos (tonnes), year 2021

LoW	Waste produced	Waste managed						Export
		D1	D9	D13	D14	D15 at 31/12	Total	
150111*	1 726	-	203	106	1 562	559	2 430	-
160111*	29	1	-	6	-	2	9	-
160212*	405	12	49	3	320	48	432	9
170601*	7 616	2 968	102	568	378	813	4 829	3 900
170605*	329 485	327 677	6	3 264	5 118	14 654	350 719	12 649
TOTAL	**339 261**	**330 658**	**360**	**3 947**	**7 378**	**16 076**	**358 419**	**16 558**

D1: Deposit into or on to land (e.g. landfill, etc.); D9: Physical-chemical treatment not specified elsewhere in this Annex which results in final compounds or mixtures which are discarded by means of any of the operations numbered D1 to D12 (e.g. evaporation, drying, calcination, etc.); D13: Blending or mixing prior to submission to any of the operations numbered D1 to D12, D14: Repackaging prior to submission to any of the operations numbered D1 to D13, D15: Storage pending any of the operations numbered D1 to D14 (excluding temporary storage, pending collection, on the site where the waste is produced).
Source: ISPRA

3.2 End-of-life vehicles

The analysis of the information collected on the treatment of end-of-life vehicles showed that, between 2020 and 2021, the number of operational ELV processing plants increased from 1,417 to 1,430, of which 613 are in northern Italy (443% of the total), 217 in central Italy (15%) and 600 in southern Italy (42%) (Table 3.2.1).

In total, over 1.4 million tonnes of vehicles were treated in the ELV processing plants, about 187 thousand tonnes more than in 2020 (+15.3%).

Table 3.2.1 - End-of-life vehicle processing plants by geographical area, years 2019-2021

	2019		2020		2021	
	N. plants	End-of-life vehicle treated (t/y)	N. plants	End-of-life vehicle treated (t/y)	N. plants	End-of-life vehicle treated (t/y)
Northern Italy	635	605 550	626	575 791	613	638 254
Central Italy	236	234 094	212	215 242	217	253 090
Southern Italy	591	453 150	579	426 482	600	512 810
TOTAL	**1 462**	**1 292 754**	**1 417**	**1 217 515**	**1 430**	**1 404 154**

Source: ISPRA

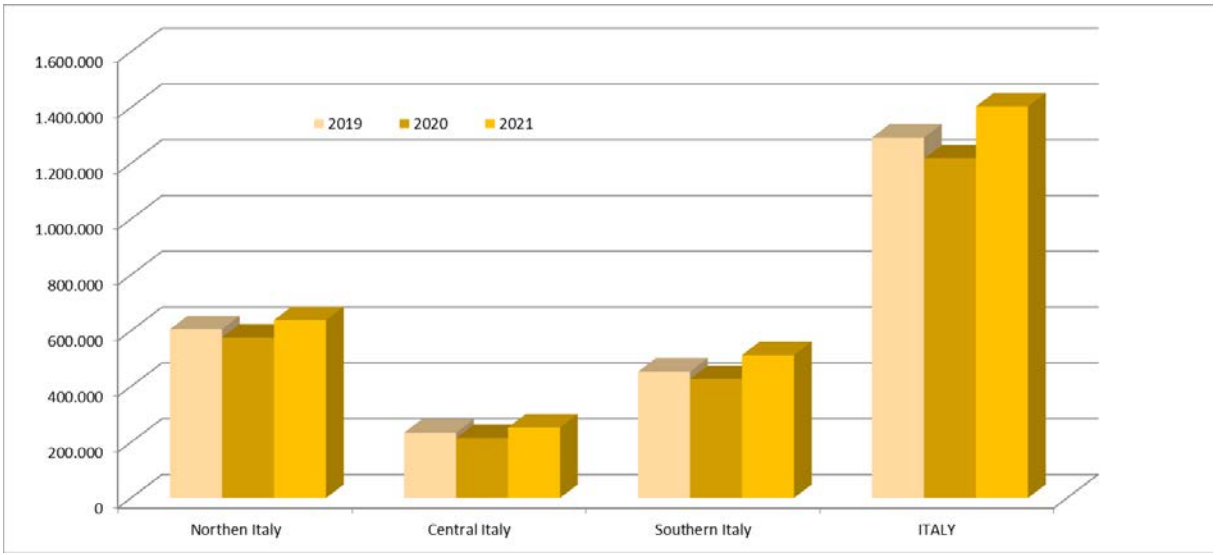
The distribution by geographical macro-area of the quantities of processed vehicles shows a widespread increase across the country: with +20%, compared to 2020, southern Italy presents the largest increase. Northern Italy had an increase of +11%, while central Italy of +18% (Figure 3.2.1).

The North is still the geographical area where the most significant quantities of ELV were processed, over 638 thousand tonnes, while 253 thousand tonnes were processed in central Italy and 513 thousand tonnes in the South.

Scrapping plants, which do not carry out safety operations but only treatment (demolition and dismantling) to promote recycling, represent an intermediate stage in the ELV management cycle. In 2021, there were 97 active plants and they received 98 thousand tonnes of de-polluted vehicles or vehicle components (Table 3.2.5).

The shredding plants, which represent the last link in the end-of-life vehicle management chain, are not widespread throughout the territory, but are concentrated in some territorial areas near the industrial scrap iron recovery plants and in areas where there are more industrial plants (Table 3.2.6 and Figure 3.2.2). Almost all of the material recovered in these plants is, in fact, scrap metal for steel mills. In 2021, 29 plants were operational, of which 16 in the North, 6 in the Centre and 7 in the South.

Figure 3.2.1 - End-of-life vehicles treated in processing plants (tonnes), years 2019 - 2021



Source: ISPRA

Table 3.2.2 – Number of end-of-life vehicle scrapping plants by geographical area and quantities recovered (tonnes), year 2021

	N. plants	R4	R12	Storage of waste pending recovery operation at 31/12
Northern Italy	59	16 634	23 720	6 105
Central Italy	28	7 174	6 191	1 799
Southern Italy	10	20 169	16 163	434
TOTAL	**97**	**43 977**	**46 074**	**8 338**

R4: Recycling/reclamation of metals and metal compounds; R12: Exchange of waste for submission to any of the operations numbered R 1 to R 11
Source: ISPRA

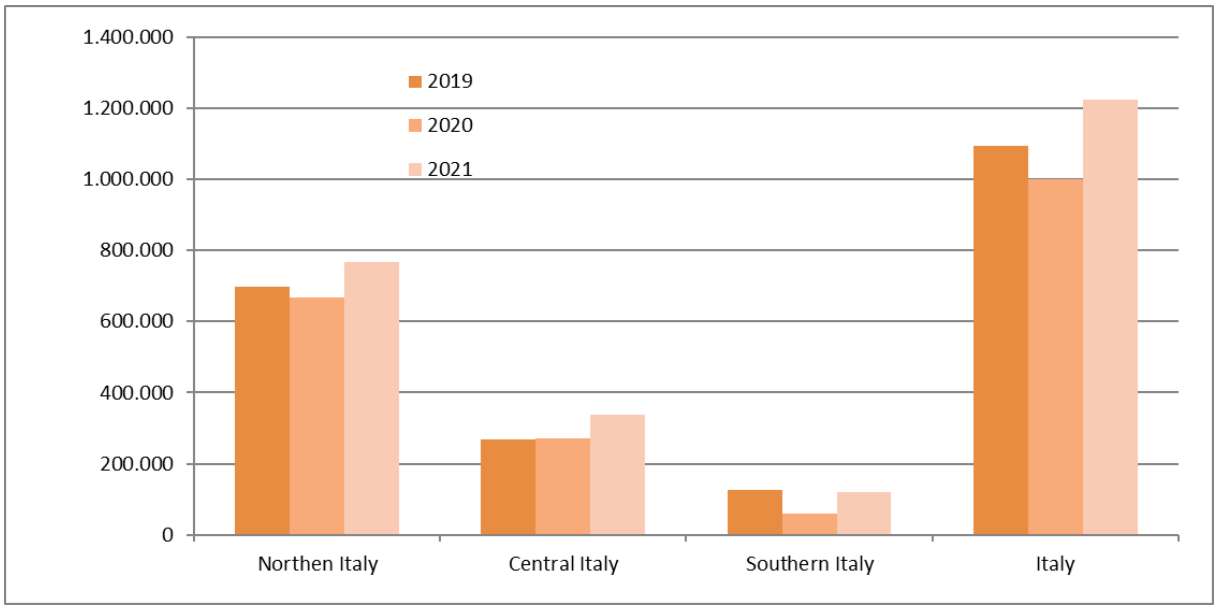
Table 3.2.3 –Number of shredding plants by geographical area and quantities recovered (tonnes), year 2021

Region	Province	Municipality	R4	R12	Waste stored pending recovery operation at 31/12	Storage of waste pending disposal operation at 31/12
	AT	Costigliole d'Asti	29 633	-	254	-
	TO	Settimo Torinese	28 178	-	258	-
	VB	Verbania	45 242	202	36	-
Piemonte			**103 053**	**202**	**548**	**0**
	BG	Ciserano	245	-	-	-
	BG	Comun Nuovo	6 037	-	56	-
	BG	Costa Volpino	2 416	1 146	302	118
	BS	Polpenazze del Garda	163 905	-	-	-
	LC	Dolzago	3 326	-	-	58
	MI	Bollate	103 128	-	7,717	-
	MI	Lainate	142 724	-	8,017	-
Lombardia			**421 780**	**1 146**	**16,092**	**176**
	VR	Castelnuovo del Garda	129 276	-	8,879	-
	VR	Villafranca di Verona	813	-	-	-
Veneto			**130 089**	**0**	**8,879**	**0**
	BO	Valsamoggia	82 037	18	754	-
	FC	Cesena	65	776	230	-
	FC	Longiano	131	-	48	-
Emilia-Romagna			**82 233**	**794**	**1,032**	**0**
	FI	Empoli	76	1 991	97	-
	PI	Pontedera	170 037	-	3,079	-
Toscana			**170 113**	**1 991**	**3,176**	**0**

Region	Province	Municipality	R4	R12	Waste stored pending recovery operation at 31/12	Storage of waste pending disposal operation at 31/12
	LT	Cisterna di Latina	3 183	-	279	-
	LT	Cisterna di Latina	2 874	2 877	117	-
	LT	Pontinia	285	499	-	-
	RM	Roma	146 976	2	4,457	-
Lazio			**153 318**	**3 377**	**4,853**	**0**
	AV	Atripalda	3 194	251	30	-
Campania			**3 194**	**251**	**30**	**0**
	LE	Maglie	37 895	8	1,217	-
Puglia			**37 895**	**8**	**1,217**	**0**
	CT	Catania	67 481	-	2,970	-
	SR	Augusta	1 511	150	-	-
	SR	Floridia	1 302	105	3,115	-
Sicilia			**70 294**	**255**	**6,085**	**0**
	CA	Uta	743	-	-	-
Sardegna			**743**	**0**	**0**	**0**
ITALY			**1,172,712**	**8,025**	**41 912**	**177**

R4: Recycling/reclamation of metals and metal compounds; R12: Exchange of waste for submission to any of the operations numbered R 1 to R 11
Source: ISPRA

Figure 3.2.2 – Amount of ELV recovered in shredding plants by geographical area (tonnes), years 2019 - 2021



Source: ISPRA

Table 3.2.4 shows the national data related to the different operations of ELV treatment in 2021. Analysis shows recycling/recovery levels slightly decreasing compared to those observed in 2020. Overall, the reuse and recycling percentage is 84.3% of the average vehicle weight, slightly below the 85% target set for 2015 by art. 7 paragraph 2 of Legislative Decree no. 209/2003. Similarly, total recovery stands at 84,3%; with the 95% target set by law far from being reached.

The recovery rate shows how the absence of energy recovery plants compromises the possibility of achieving the overall recovery target.

Fluff produced by the shredding plants (219 thousand tonnes) is almost entirely sent for disposal. The difficulty of finding valid uses for this waste is one of the biggest problems of the entire supply chain. It should be

emphasised that proper de-pollution of vehicles, given the high calorific value that characterises fluff (consisting essentially of organic materials), would also enable its effective energy recovery.

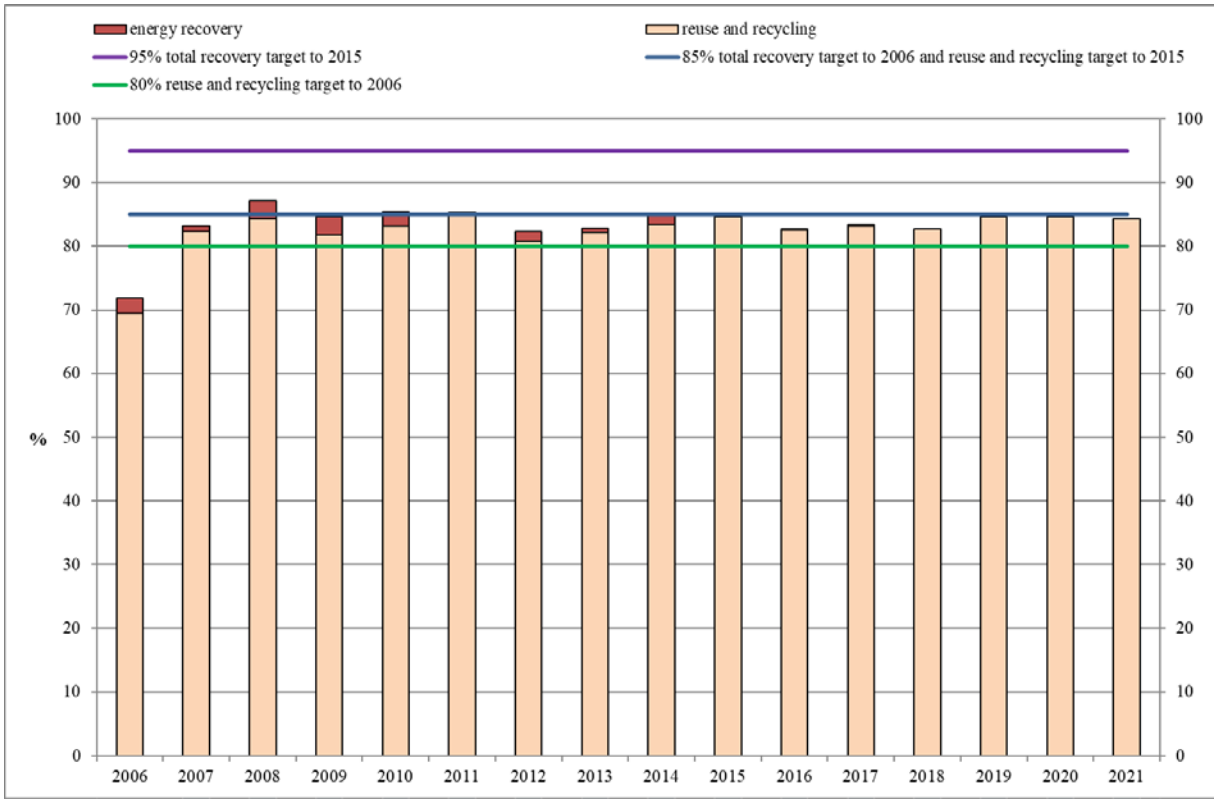
Table 3.2.4 - End point of waste from de-pollution and demolition of end-of-life vehicles (tonnes), year 2021

Reuse (t)	Recycling (t)	Energy recovery (t)	Total recovery (t)	Disposal (t)
132 379	**1 051 942**	**0**	**1 184 321**	**219 834**

Source: ISPRA

The analysis of reuse, recycling and recovery rates since 2006 (the first year of monitoring by ISPRA) shows a static situation in recent years, after an initial improvement, perhaps due to a positive response of the sector to what was then new legislation and new European targets, as well as a phase of adaptation to the reporting method. The structural deficiencies previously recorded have thus perpetuated over the years and there has still been no progress, specifically in energy recovery, which is widely used in other Member States. (Figure 3.2.3).

Figure 3.2.3 – Percentage distribution of end-of-life vehicle recovery, years 2006 - 2021



Source: ISPRA

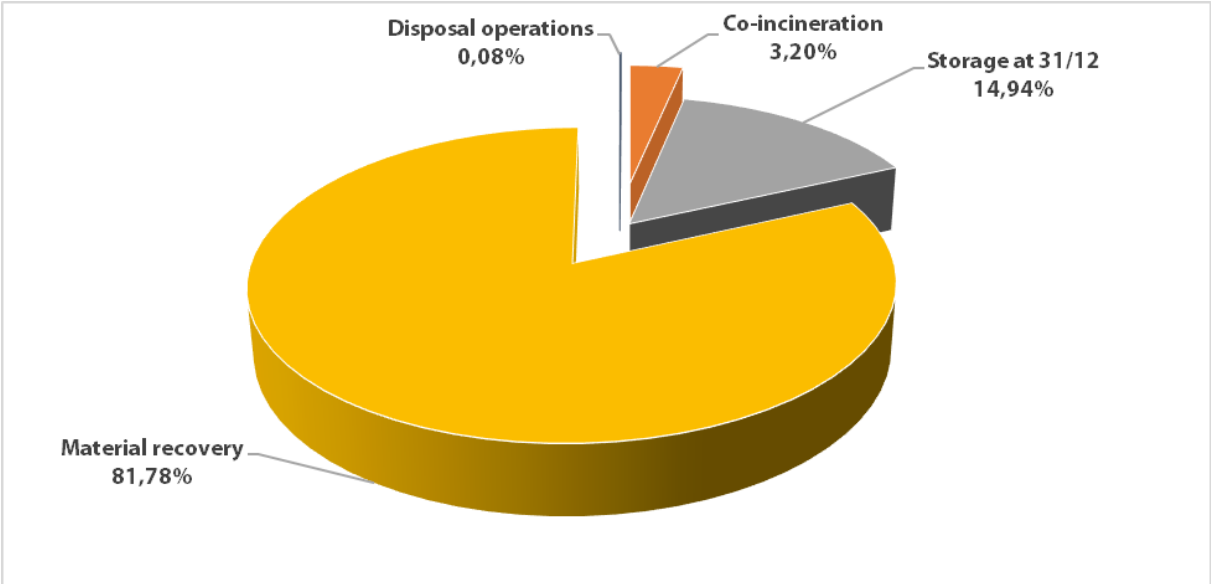
3.3 End-of-life tyres

In Italy, 492 thousand tonnes of End-of-Life Tyres (ELTs) were produced in 2021.

The amounts of ELTs managed is over 488 thousand tonnes (+10.5% compared to 2020), plus 70 thousand tonnes exported. ELTs treated are mainly destined for recovery operations (over 399 thousand tonnes). Disposal involves a residual quantity of 395 tonnes (Figure 3.3.1). At the end of the year there were approximately 73 thousand tonnes in storage, 14.9% of the total managed.

An analysis of the data shows that 81.8% of the ELTs, 399 thousand tonnes, went to material recovery and 3.2%, 16 thousand tonnes, were sent to production plants to generate energy.

Figure 3.3.1 – Treatment operation for end-of-life tyres, year 2021



Source: ISPRA

Of the 70 thousand tonnes exported, 37 thousand tonnes are sent for material recovery abroad (52.8% of the total exported) and 33 thousand tonnes were recovered as waste-to-energy (46.8%); a marginal portion, amounting to 313 tonnes, was subjected to disposal operations (0,4%).

Türkiye and Germany received each about 31 thousand tonnes and 21 thousand tonnes of ELTs. Quantities sent to Türkiye are used for energy recovery, while those sent to Germany are destined almost entirely to material recovery (97.6%).

3.4 Sludge from treatment of urban wastewater

The quantity of sludge from urban wastewater treatment (LoW code 190805) generated on the national territory amounts to 3.2 million tonnes, with a decrease of -4.5% compared to 2020, due to the decrease in the centre-south of Italy. (Table 3.4.1).

Table 3.4.1 – Generation of sludge from treatment of urban wastewater, year 2021

Region	Generation of sludges from treatment of urban wastewater (LoW code 190805) (t)		
	2019	2020	2021
Piemonte	301 897	303 653	324 823
Valle d'Aosta	4 470	4 998	8 563
Lombardia	466 295	468 784	487 371
Trentino	140 393	135 646	142 246
Veneto	399 958	409 896	409 500
Friuli-Venezia Giulia	82 618	83 293	81 218
Liguria	41 926	46 859	48 990
Emilia-Romagna	439 492	406 294	372 871
North	**1 877 049**	**1 859 423**	**1 875 582**
Toscana	303 135	288 954	277 290
Umbria	43 380	44 788	40 838
Marche	79 357	80 908	86 063
Lazio	409 997	332 347	234 775
Centre	**835 869**	**746 997**	**638 966**
Abruzzo	60 862	73 502	72 974
Molise	3 004	2 437	3 085
Campania	180 099	228 321	217 555
Puglia	299 814	2 330	1 858
Basilicata	4 391	334 526	267 465
Calabria	34 072	31 695	29 838
Sicilia	30 575	29 809	56 424
Sardegna	90 668	81 327	74 394
South	**703 485**	**783 947**	**723 593**
TOTAL	**3 416 403**	**3 390 368**	**3 238 141**

Note: quantities are reported according to the physical state declared on the MUD (liquid, palatable, sludgy, solid).
Source: ISPRA

Of the 3 million tonnes of sludge managed, 52.3% was sent to disposal operations and 45.6% to recovery operations (Table 3.4.2). The total amount of urban wastewater sludge sent to recovery/disposal shows a slight decrease compared to the 2020 of about 141 thousand tonnes (-4.6%).

In detail, quantities sent for recovery operations decreased by 1.2% (-16.6 thousand tonnes), those sent for disposal by 6.8% (-111 thousand tonnes) (Table 3.4.2).

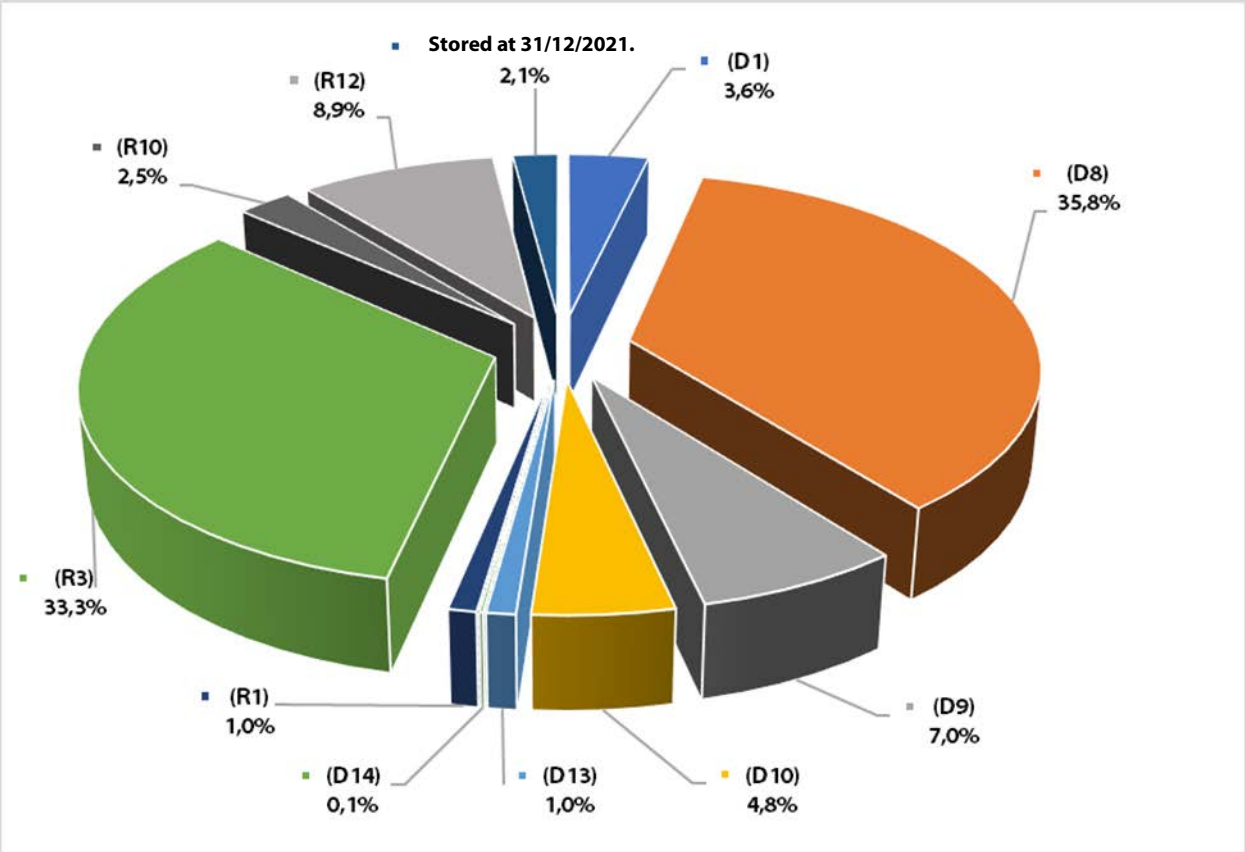
Table 3.4.2 – Treatment of sludge from urban wastewater, LoW code 190805 (tonnes), years 2019 - 2021

Disposal/recovery operation	Quantity (t/y)		
	2019	2020	2021
Deposit into or on to land (e.g., landfill, etc.) (D1)	231 839	253 462	106 058
Biological treatment (D8)	1 028 890	1 014 869	1 041 786
Physical-chemical treatment (D9)	261 247	178 515	202 813
Incineration on land (D10)	135 147	119 184	138 602
Blending or mixing prior to submission to any of the operations numbered D 1 to D 12 (D13)	90 824	62 638	28 741
Repackaging prior to submission to any of the operations numbered D 1 to D 13 (D14)	2 140	3 954	3 540
A) Total disposal (D1-D14)	1 750 087	1 632 622	1 521 540
Use principally as a fuel or other means to generate energy (R1)	26 895	25 593	27 916
Recycling/reclamation of organic substances which are not used as solvents (R3)	875 373	995 563	967 835
Recycling/reclamation of other inorganic materials (R5)	215	3 056	0
Land treatment resulting in benefit to agriculture or ecological improvement (R10)	90 323	87 367	72 691
Exchange of waste for submission to any of the operations numbered R 1 to R 11(R12)	296 163	232 593	259 111
B) Total recovered (R1-R12)	1 288 969	1 344 172	1 327 553
C) Total Stored at 31/12 (R13/D15)	91 421	72 801	59 538
Total Treated (A+B+C)	**3 130 477**	**3 049 595**	**2 908 631**

Source: ISPRA

Among the disposal operations, the largest quantity, about 1 million tonnes (35.8%), is sent to biological treatment (*D8*), followed by physical-chemical treatment with 203 thousand tonnes (7%). The predominant recovery operation is the recycling/recovery of organic substances not used as solvents (*R3*), with over 968 thousand tonnes (33.3%) followed by *R12* with over 259 thousand tonnes (8.9%). (Figure 3.4.1).

Figure 3.4.1 – Percentage distribution of treatment operations for urban wastewater sludge (LoW code 190805), year 2021



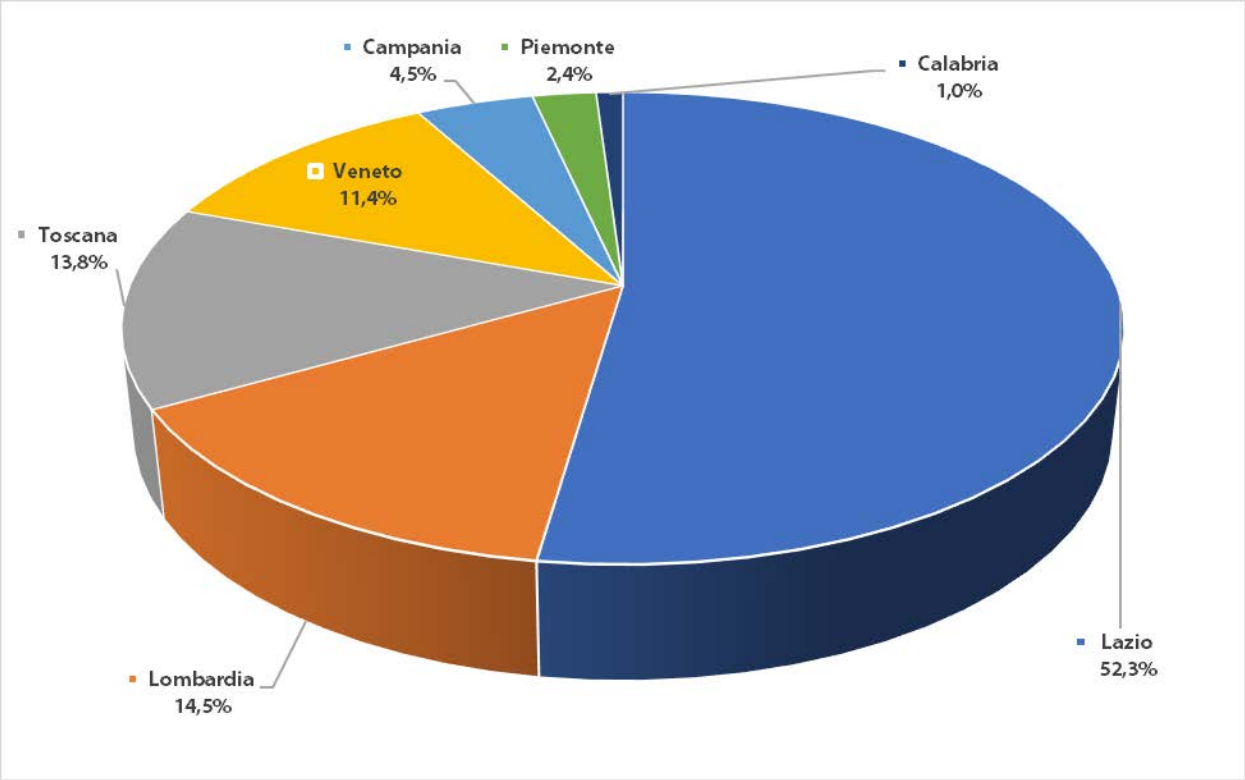
D1: Deposit into or on to land (e.g. landfill, etc.), D8: Biological treatment not specified elsewhere in this Annex which results in final compounds or mixtures which are discarded by means of any of the operations numbered D 1 to D 12, D9: Physical-chemical treatment not specified elsewhere in this Annex which results in final compounds or mixtures which are discarded by means of any of the operations numbered D 1 to D 12 (e.g. evaporation, drying, calcination, etc.), D10: Incineration on land, D13: Blending or mixing prior to submission to any of the operations numbered D 1 to D 12, D14: Repackaging prior to submission to any of the operations numbered D 1 to D 13

R1: Use principally as a fuel or other means to generate energy, R3: Recycling/reclamation of organic substances which are not used as solvents (including composting and other biological transformation processes), R10: Land treatment resulting in benefit to agriculture or ecological improvement, R12: Exchange of waste for submission to any of the operations numbered R 1 to R 11.

Source: ISPRA

Almost 49 thousand tonnes of sludge were exported abroad, mainly destined for material recovery (47.7%), Lazio is the Region that exported the largest quantity (Figure 3.4.2). Compared to 2020, the quantity of sludge exported decreased by more than 11,600 tonnes (-19.3%).

Figure 3.4.2 – Export of sludge produced by urban wastewater treatment, by region (LoW code 190805) tonnes, year 2021



Source: ISPRA

Sludge plasters, i.e., calcium and magnesium correctives obtained from the hydrolysis (and possible enzymatic attack) of sewage sludge (as defined by Legislative Decree no. 99 of 27 January 1992 implementing directive 86/278/CEE) are 447 thousand tonnes, produced mainly in Lombardia, Trentino, Veneto and Lazio. By comparing the information deduced from MUD database with the information on land use from ISTAT (National Institute of Statistics), it can be deduced that defecation plasters from sludge are, in 2021, about 84% of the total amount of correctives produced, equal to over 530 thousand tonnes.

3.5 Construction and demolition wastes

Construction sector, through its intensive use of natural resources, generates strong impacts on land and a progressive depletion of raw materials.

Waste from construction and demolition operations are, quantitatively, the largest EA waste stream generated, at both European and national level.

In 2021, in fact, the largest contribution to overall EA waste generation comes from the construction and demolition sector, accounting for 47.7 per cent of the total, corresponding to 78.7 million tonnes, including waste from construction and demolition operations and other waste from these activities (e.g., packaging waste, waste oil, etc.).

In order to move towards a European recycling society with a high level of resource efficiency, the European Commission has made it a priority to monitor the flow of C&D wastes and in Article 11 of Directive 2008/98/EC on waste set a target of 70% preparation for reuse, recycling, and other material recovery by 2020, including backfilling operations using waste as a substitute for other materials. The calculation methods for monitoring the achievement of the target were identified in Decision 2011/753/EC.

Excluded from monitoring are soils and rocks (LoW code 170504) and dredging materials (LoW code 170506), amounting to 17.7 million tonnes and 93,000 tonnes respectively.

After the significant drop recorded in 2019-2020 due to the health, economic and social crisis linked to the Covid-19 pandemic, which led to the closure of construction sites for infrastructure works and a reduction in the maintenance/construction of buildings, the trend was reversed in 2021. Analysis of the data shows, in fact, an upturn in activity in the construction sector, also due to government incentives in recent years aimed at the energy upgrading of buildings. These construction/renovation activities, as well as the continuation or new start of public construction works, have led to significant environmental impacts in terms of greater quantities of waste produced.

The national production of construction and demolition waste, excluding soil and stones and dredging spoil (LoW 1705**), stands at approximately 59.4 million tonnes (+18.4% compared to 2020, corresponding to 9.2 million tonnes). Material recovery reaches 47.6 million tonnes, with a increase of +21.7% (8.5 million tonnes). For the mineral part of C&D waste, the main form of recovery is transformation into fine or coarse aggregates that can be used in the production of concrete or asphalt or in road construction.

The percentage of recovery of demolition and construction waste is 80.1% in 2021, therefore above the 70% target set by Directive 2008/98/EC for 2020 (Figure 3.5.1).

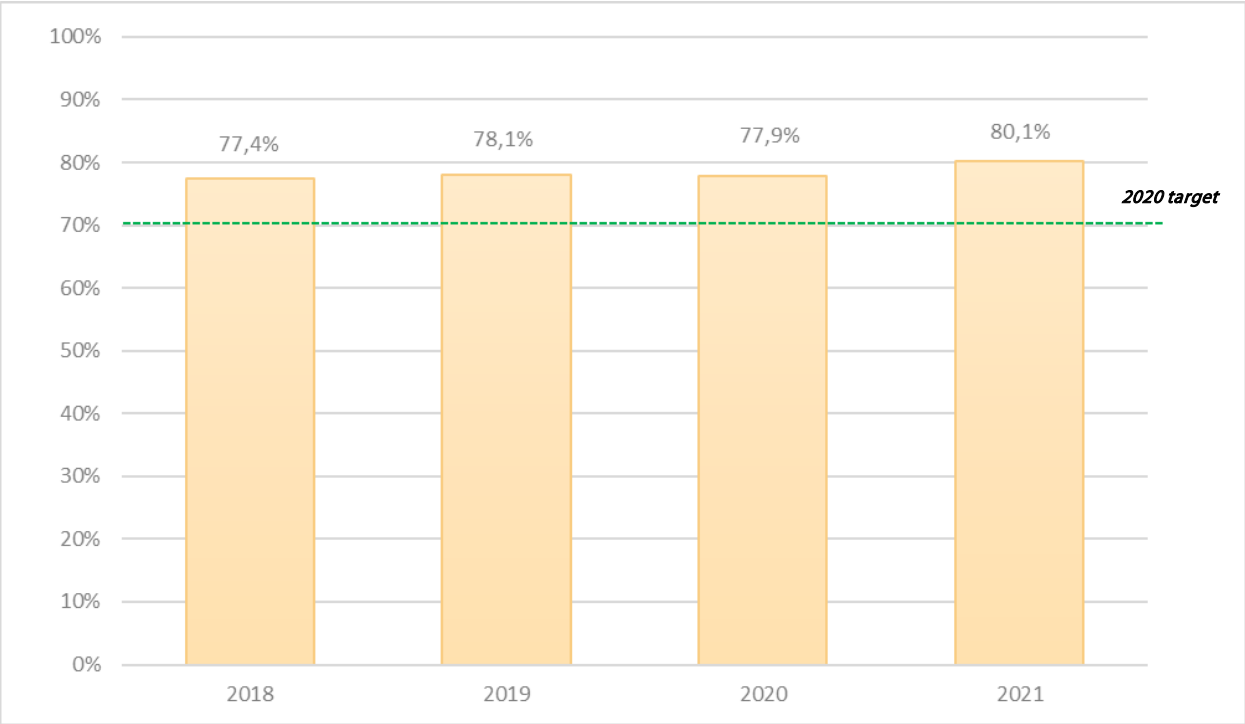
The amount of waste used as backfilling stands at approximately 375 thousand tonnes. Including these quantities, the recovery rate would reach 80.7%.

Table 3.5.1 – Generation, preparation for re-use/recycling and other forms of material recovery, of C&D waste (excluding soil and rock and dredging sludge) - year 2021

Aggregates list of waste categories from Annex 1, Section 2 of Regulation (EC) No 2150/2002 (LoW code 17)		Aggregation of economic activities according to the NACE Rev. 2 classification in Regulation (EC) No 1893/2006 (F: Construction)	
		Generation	Preparation for re-use/recycling
Code	Description	tonnes	tonnes
6.1	Ferrous metal waste and scrap	4 952 316	4 411 731
6.2	Non-ferrous metal waste and scrap	423 660	314 966
6.3	Mixed metal wastes	228 023	179 798
7.1	Glass wastes	104 216	91 430
7.4	Plastic wastes	53 985	38 392
7.5	Wood wastes	293 117	264 428
12.1	Construction and demolition wastes	53 340 326	42 270 588
Total		**59 395 643**	**47 571 333**

Source: ISPRA

Figure 3.5.1 – Trends in the rate of preparation for re-use, recycling and other material recovery, excluding backfilling, of construction and demolition waste, years 2018 – 2021



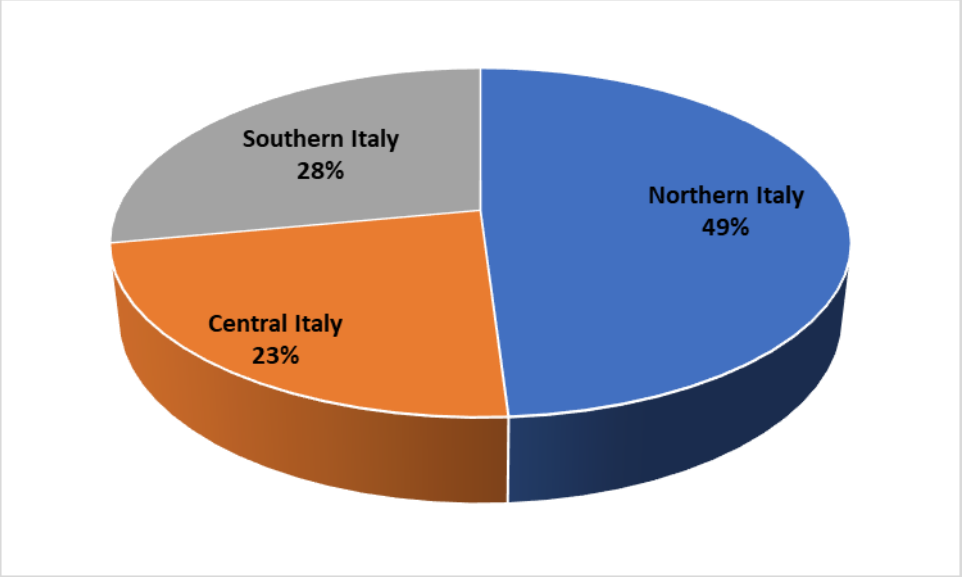
Source: ISPRA

3.6 Wastes from human or animal health care and/or related research (LoW 18)

In 2021, healthcare waste generation increased by 13.4% compared to 2020, the year the SARS-COV2 pandemic started. Wastes from human or animal health care and/or related research, in short healthcare waste (LoW 18) produced in Italy amounts to about 265 thousand tonnes, of which about 26 thousand tonnes are non-hazardous and over 239 thousand tonnes are hazardous wastes.

As for hazardous healthcare waste, summary information referring to macro-areas (Figure 3.6.1) shows that production in Northern Italy is 47% of the total with over 114 thousand tonnes. In southern Italy production is about 73 thousand tonnes (31% of the total) and in the Centre about 52 thousand tonnes, 22% of the total.

Figure 3.6.1 - Healthcare waste (LoW 18) produced, by macro-area, year 2021

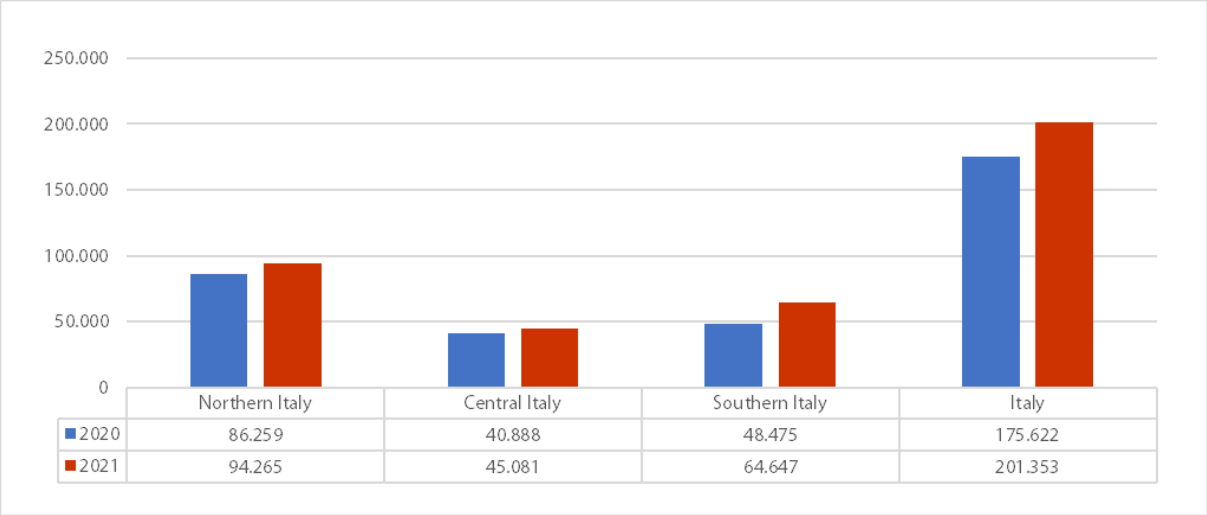


Source: ISPRA

Most of the hazardous waste produced consists of wastes whose collection and disposal is subject to special requirements in order to prevent infection (LoW code 180103*), amounting to 201 thousand tonnes, with a 14.6% increase compared to 2020.

The increase in the South is 27.2%, with over 13 thousand tonnes more, while in the North production rose from just over 86 thousand tonnes in 2020 to almost 95 thousand tonnes in 2021 (+9.7%). Finally, in the Centre the increase was of 10.2% (over 4,000 tonnes).

Figure 3.6.2 - Generation of hazardous medical waste with a risk of infection (which must be collected and disposed of using special precautions to avoid infection - LoW Code 180103*), by geographical macro-area, years 2020-2021

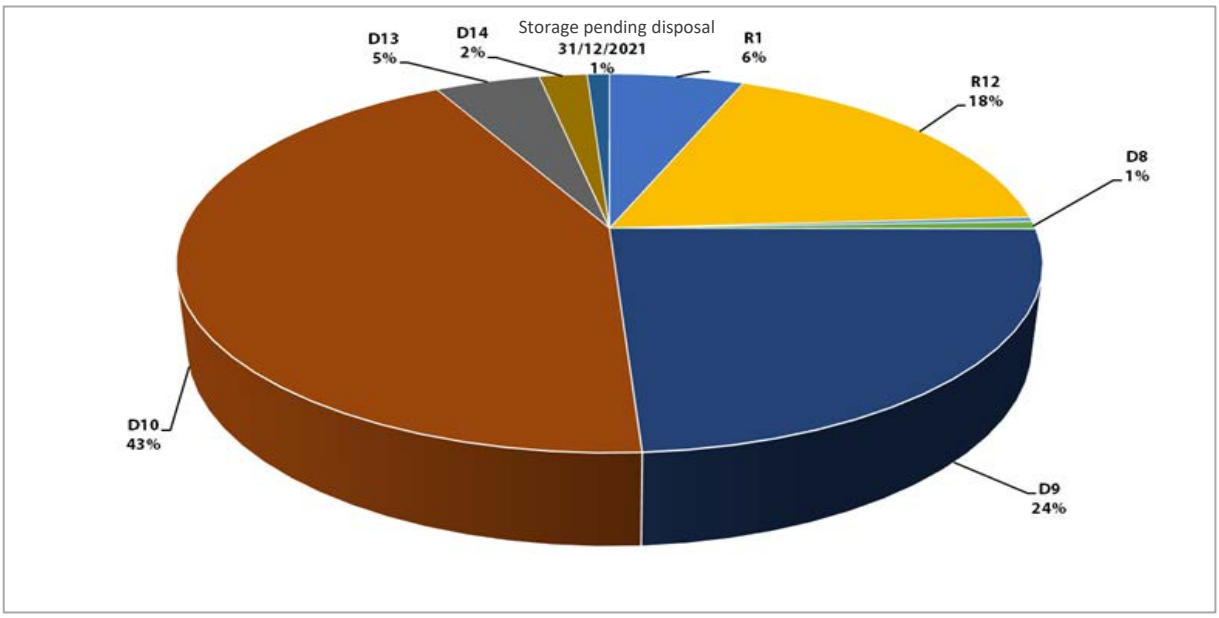


	Northern Italy	Central Italy	Southern Italy	Italy
2020	86.259	40.888	48.475	175.622
2021	94.265	45.081	64.647	201.353

Source: ISPRA

The healthcare waste treated are over 277 thousand tonnes, of which just over 26 thousand tonnes are non-hazardous wastes and about 251 thousand tonnes are hazardous wastes, with an increase, for the latter of 14.8% compared to the year 2020, in which more than 218 thousand tonnes of hazardous medical waste were treated. Figure 3.6.3 shows the incidence rates of the different hazardous waste treatment operations, in relation to the total treated at national level. Waste disposal operations, accounting for 75% of the total, are the most common management operations. Specifically, with 43% of the total managed, incineration (*D10*) is the prevalent option, followed by physical-chemical treatment with 25% of the total.

Figure 3.6.3 - Management of hazardous medical waste, by single operation, year 2021



Source: ISPRA

Wastes whose collection and disposal are subjected to special requirements in order to prevent infection (LoW code 180103*) accounts for 84.4% (almost 212 thousand tonnes) of the total hazardous healthcare waste treated.

The following analysis focus on the two main forms of treatment for hazardous healthcare waste: sterilisation and incineration. Table 3.6.1 shows that over 92 thousand tonnes of hazardous healthcare waste are treated at sterilisation plants, while just over 108 thousand tonnes are sent for incineration. Overall, the amount of hazardous healthcare waste incinerated or sterilised was 201 thousand tonnes, of which over 95.6% (192 thousand tonnes) was hazardous healthcare waste with infectious risks (LoW code 180103*). 102 thousand tonnes of these hazardous healthcare waste were sent to incineration and more than 89 thousand to sterilisation.

There are 17 sterilisation plants operating on the national territory, with a total treatment capacity of 166 thousand tonnes. Wastes treated with sterilisation are subsequently sent to waste-to-energy plant or landfill.

There are 24 plants authorised to incinerate this category of waste, of which two did not treat waste with LoW code 180103* in the year 2021.The total authorised capacity for this type of treatment amount to 273 thousand tonnes. Total sterilisation and incineration capacity is about 439 thousand tonnes.

Table 3.6.1 – Amount of hazardous healthcare waste incinerated or sterilised (tonnes), year 2021

Management option	Number of plants	Authorised capacity (tonnes)	Amount of hazardous healthcare waste treated (tonnes)	Amount of waste with LoW code 180103* treated (tonnes)
Incineration	24*	272 930***	108 382	102 462
Sterilization	17**	165 983***	92 221	89 286
Total	**41**	**438 913**	**200 603**	**191 748**

* Two facilities did not treat wastes whose collection and disposal is subject to special requirements in order to prevent infection (LoW Code 180103*),
** This figure includes two facilities located in port areas and one facility equipped with two sterilisation chambers,
*** This figure may be overestimated since the total authorised treatment capacity of hazardous waste, and not only hazardous medical waste, was calculated for some plants,
Source: ISPRA

Table 3,6,2 shows, in the year 2021, an increase in the amount of hazardous medical waste sent for sterilisation by 13,8% (over 11 thousand tonnes), and in the amount of waste sent for incineration by 13,7%, 13 thousand tonnes more than the previous year,

For hazardous medical waste (infectious risk) treated in incineration and sterilisation plants, there was a +14,2% increase (over 23,7 thousand tonnes), compared to 2020,

Table 3,6,2 - Hazardous medical waste sent for incineration and sterilisation (tonnes), years 2020-2021

Management option	Amount of hazardous healthcare waste treated (tonnes)		Percentage variation	Amount of waste with LoW code 180103* treated (tonnes)		Percentage variation
	2020	2021	%	2020	2021	%
Incineration	95 321	108 382	13.7%	90 389	102 462	13.4%
Sterilization	81 041	92 221	13.8%	77 582	89 286	15.1%
Total	**176 362**	**200 603**	**13.7%**	**167 971**	**191 748**	**14.2%**

Source: ISPRA

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