

View of Italian legislation on sewage sludge management

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Legislation on water

Part III of D. Lgs. 152/06

- ⇒ Art. 78 of D. Lgs. 152/06 establishes that the water protection plans foresee instruments for reaching quality standards for hazardous substances, also with reference of sewage sludge management.
- ⇒ Art. 110 establishes that the treatment of liquid wastes in an urban wastewater treatment plant (WWTP) must never be a prejudice for re-use of water after treatment or for sludge utilization in agriculture.
- ⇒ According to art. 127, after treatment in the WWTP sludge are subjected to the waste legislation.
Sewage sludge must be preferentially used, whenever it is suitable.
Sewage sludge disposal in surface and salty waters is strictly forbidden.

Legislation on wastes

Part IV of D. Lgs. 152/06

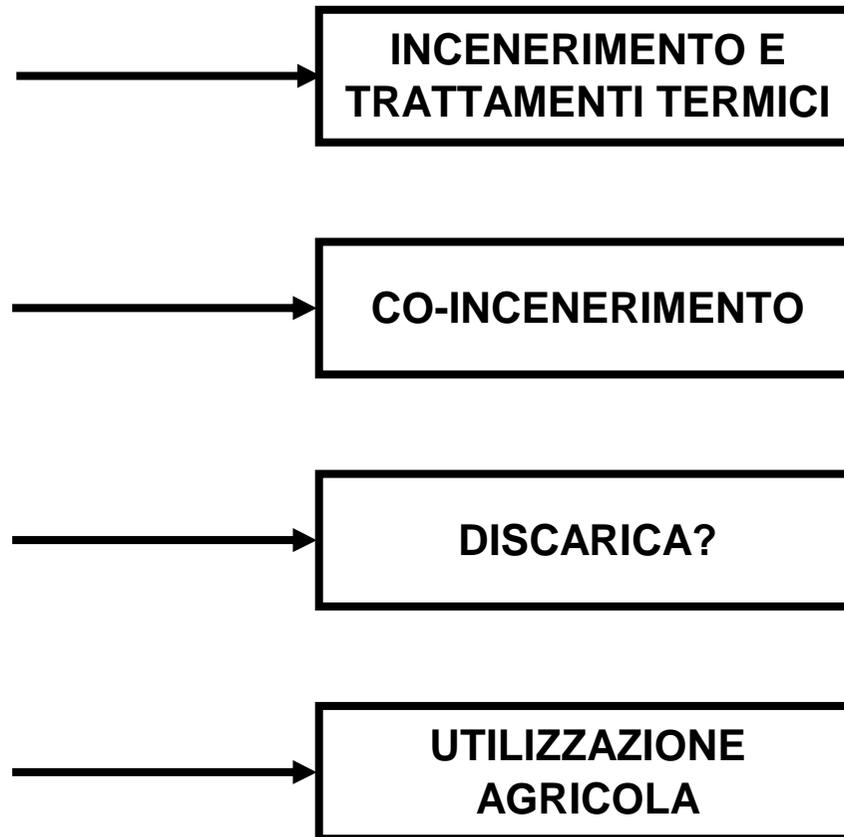
- ⇒ The waste code of sewage sludge is 19 08 05, i.e. sludges from treatment of urban waste water.
- ⇒ Some doubts can arise when sewage sludge contain hazardous substances in concentration higher than limits for classifying an hazardous waste.
- ⇒ The major problems can arise when sludge contain Zn.
- ⇒ ZnO is classified as a very toxic substance for the aquatic organisms and therefore it has to be taken into account for classification of a waste as hazardous for ecotoxicity at concentration higher than 0,25%.
- ⇒ A second problem is relevant to pH. According to the official advice of the Italian Superior Institute of Health a waste with pH lower than 2 or higher than 11,5, during a prolonged period of time, has to be classified as hazardous being irritant.

Integrated pollution prevention and control (IPPC) legislation

- ⇒ The following waste management activities are subjected to an integrated environmental permit (AIA):
- ✧ Plants for elimination or recovery of hazardous wastes (all the disposal operation and any use for fuel application or for energy production).
 - ✧ Incineration plants for domestic and commercial wastes with capacity higher than 3 t/h (i.e. 72 t/d).
 - ✧ Plants for elimination or recovery of non hazardous wastes for the operation D8 (biological treatment not specified elsewhere in this Annex which results in final compounds or mixtures which are discarded) and D9 (physico-chemical treatment not specified elsewhere in this Annex which results in final compounds or mixtures which are discarded) with capacity higher than 50 t/d.
 - ✧ Landfill sites which receive more than 10 t/d and with a total capacity higher than 25.000 t (landfills sites for inert wastes are excluded).

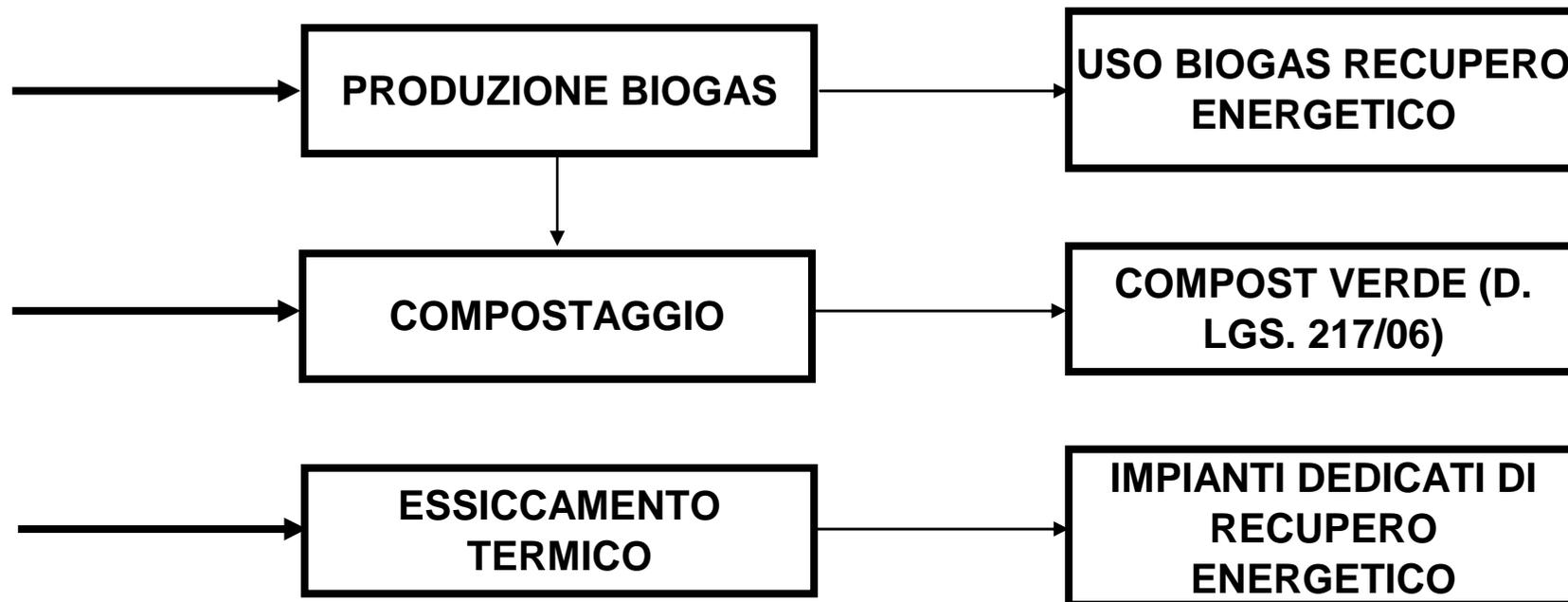
Sewage sludge disposal by ordinary procedure

REGIME ORDINARIO



Sewage sludge disposal by simplified procedure

PROCEDURE SEMPLIFICATE



Incineration and co-incineration (D. Lgs. 133/05)

- ⇒ Art. 182 of the D. Lgs. 152/06 establishes that building and management of new plants can be permitted only whether the process allows to recover energy to a minimum extent of the calorific content of the waste to be incinerated.
- ⇒ The plants must be managed in a way to have a combustion as much completed as possible, adopting, if necessary, suitable pretreatment techniques. The incombustibles matter in slag and bottom ashes, as total organic carbon or as volatile solids, must not overcome 3% or 5%, respectively, in weight.
- ⇒ Each incineration line must be equipped with at least one auxiliary burner to be used during start up or for switching off for guarantying the increase and maintaining of the minimum temperature. The burner must work automatically when the exhaust gas temperature after the last air injection lowers down the minimum allowed temperature (850°C). This burner must not be fed with fuels which can cause higher emissions than those deriving from diesel oil, liquid gas or natural gas.

General prescriptions of incineration or co-incineration plants

- ⇒ The plants must be designed, built, equipped and managed in such a way that the exhaust gas will remain for at least 2 s at a temperature of at least 850°C ~~after~~ after the last air injection. For hazardous waste incineration with a concentration of organic halogenated substances higher than 1% the temperature must be at least 1.100°C.
- ⇒ The plants must be equipped with automatic systems which prevent the waste feeding during starting-up, when the temperature is lower than the minimum one, and when the limit values at the emissions are not respected due to the monitoring by process instrumentation.
- ⇒ The heat should be recovered as much as possible;
- ⇒ The flue gas should be emitted in a controlled way through a chimney of suitable height and with a velocity and enthalpic content high enough to favour the good dispersion for the safeguard of human health and the environment.
- ⇒ The chimney must be equipped with continuous instrumentation for monitoring the flue gas for the following parameters: CO, NO_x, SO₂, total dust, TOC, HCl, HF, O₂ (on a volume basis), temperature, pressure, moisture content, and volumetric flow rate.

Mixing relationship for coincineration plants

$$C = \frac{V_{rifiuti} \times C_{rifiuti} + V_{processo} \times C_{processo}}{V_{rifiuti} + V_{processo}}$$

Emission limits (mg/Nm³)

	Parameter	Daily average	Semi hourly average	
			Maximum limit	97° percentile
			A	B
1	Total dust	10	30	10
2	TOC	10	20	10
3	HCl	10	60	10
4	HF	1	4	2
5	SO ₂	50	200	50
6	CO	50	100	150
7	NO _x as NO ₂	200	400	200
		Average of 1 h sampling		
8	Cd + Tl	0,05		
9	Hg	0,05		
10	Sb + As + Pb + Cr + Co + Cu + Mn + Ni + V	0,5		
		Average of 8 h sampling		
11	PCDD + PCDF (TE)	0,1 ng/m ³		
12	IPA	10 µg/m ³		

Limits for discharge in the surface water (mg/L)

	D. Lgs. 133/05		D. Lgs. 152/06 part III
	30 95% valori	45 100% valori	
Total suspended solids			80
Hg and its compounds, as Hg		0,03	0,005
Cd and its compounds, as Cd _g		0,05	0,02
Tl and its compounds, as Tl _g		0,05	-
As and its compounds, as As		0,15	0,5
Pb and its compounds, as Pb		0,2	0,2
Cr and its compounds, as Cr		0,5	2
Cu and its compounds, as Cu		0,5	0,1
Ni and its compounds, as Ni		0,5	2
Zn and its compounds, as Zn		1,5	0,5
PCDD + PCDF (TEQ)		0,3 ng/L	-
PAH (11 carcinogenic PAHs)		0, 2 µg/L	-

Landfill

⇒ The following wastes are not allowed in any types of landfill sites:

- ✧ Liquid wastes.
- ✧ Wastes classified as explosive, combustive, flammable.
- ✧ Wastes contaminated by corrosive substances in higher concentration than limit values according to the specific classification.
- ✧ Sanitary wastes with infective risk.
- ✧ Chemical non identified substances or deriving from research/development/teaching activity, whose effects on humans and/or on the environment are not known (for example laboratory wastes).
- ✧ Wastes derived from production of active principles for biocides and pesticides.
- ✧ Specific material with sanitary risk (proteins and animal melted greases).
- ✧ Wastes contaminated by PCB and PCDD/F in concentration higher than 50 mg/kg and 0,01 mg/kg.
- ✧ Wastes containing CFC and/or HCFC in concentration higher than 0,5%.
- ✧ Wastes with LCV higher than 13.000 kJ/kg.

Acceptance of waste at landfills (leaching test)

Component	Limit values (mg/L)			Limits for wastewater discharge in surface water D. Lgs. 152/06
	Landfill for inert wastes	Landfill for non hazardous wastes	Landfill for hazardous wastes	
As	0,05	0,2	2,5	0,5
Ba	2	10	30	20
Cd	0,004	0,1	0,5	0,02
Cr	0,05	1	7	2
Cu	0,2	5	10	0,1
Hg	0,001	0,02	0,2	0,005
Mo	0,05	1	3	-
Ni	0,04	1	4	2
Pb	0,05	1	5	0,2
Sb	0,006	0,07	0,5	-
Se	0,01	0,05	0,7	0,03
Zn	0,4	5	20	0,5
Chloride	80	2.500-1.500	2.500	1.200
Fluoride	1	15	50	6
Sulphate	100	5.000-2.000	5.000	1.000
Phenol index	0,1			
DOC	50	100-80	100	
TDS	400	10.000-6.000	10.000	

Total concentration

Component	Landfill for inert wastes	Landfill for non hazardous wastes	Landfill for hazardous wastes
Dry solids		≥ 25%	≥ 25%
Total organic carbon (organic chemically active substances able to interfere with the environment)	3%	≤5% (hazardous wastes after an inertisation process)	≤6%
pH		≥ 6 (hazardous wastes after an inertisation process)	
BTEX	6 mg/kg		
Mineral oils (C10 - C40)	500 mg/kg		
PCB	1 mg/kg	10 mg/kg	50 mg/kg
PCDD/F (TE)	0,1 µg/kg	2 µg/kg	10 µg/kg
Aldrin, chlordane, dieldrin, endrin, heptachlor, hexachlorobenzene, mirex, toxaphene, DDT, HCH (sum α, β, γ), hexabromobiphenyl	5.000 mg/kg	5.000 mg/kg	5.000 mg/kg

Agricultural utilisation

⇒ Italian D. Lgs. 99/92 permits sewage sludge utilisation in agricultural only for those sludge produced during treatment of domestic wastewaters or mixed with industrial wastewaters but with quite the same characteristics of the previous sludges.

Prerequisites for sludge agricultural use

- ⇒ Sewage sludge must be biologically, chemically or thermally treated for a substantial reduction of their unpleasant smelling and the inconveniences due to their utilisation. Normally this can be achieved by a biological treatment, either aerobic in small plants or anaerobic in medium-large plants, which are able to reduce the volatile solids up to 50%. Currently no standard test to assess sludge biological stability is available.
- ⇒ Sludge must be able to produce a fertilizing or soil conditioning effects and they must not contain any toxic or noxious or persistent or bio-accumulating component in harmful concentration.

Heavy metals limits in sludge

Element	D. Lgs. 99/92 (mg/kg SS)	New proposal of the Italian Ministry of the Environment	3 rd draft European Commission ENV.E.3/LM April 2000	
			(mg/kg SS)	(mg/kg P)
Cd	20	5	10	250
Cr	-	130	1.000	25.000
Cu	1.000	630	1.000	25.000
Hg	10	3	10	250
Ni	300	90	300	7.500
Pb	750	160	750	18.750
Zn	2.500	1.700	2.500	62.500
Se		According to regional permits		
As				
Be				

Limit values of heavy metals in soil

Element	D. Lgs 99/92 (mg/kg SS)	New proposal of the Italian Ministry of the Environment (mg/kg SS)	3 rd draft European Commission ENV.E.3/LM April 2000 (mg/kg SS)		
			5≤pH<6	6≤pH<7	pH≥7
Cd	1,5	Same than 3 rd draft	0,5	1	1,5
Cr		Same than 3 rd draft	30	60	100
Cu	100	Same than 3 rd draft	20	50	100
Hg	1	Same than 3 rd draft	0,1	0,5	1
Ni	75	Same than 3 rd draft	15	50	70
Pb	100	Same than 3 rd draft	70	70	100
Zn	300	Same than 3 rd draft	60	150	200

Permitted uses according to processes (3rd draft *ENV.E.3/LM ENV.E.3/LM*)

	Advanced treatments	Conventional treatments
Pastureland	Yes	Yes, deep injection and no grazing in the six following weeks
Forage crops	Yes	Yes, no harvesting in the six weeks following spreading
Arable land	Yes	Yes, deep injection or immediate ploughing down
Fruit and vegetable crops in contact with the ground	Yes	No harvest for 12 month following application
Fruit and vegetable crops in contact with the ground eaten raw		No. No harvest for 30 months following application
Fruit trees, vineyards, tree plantations and re - afforestation		Yes, deep injection and no access to the public in the 10 months following spreading
Parks, green areas, city gardens, all urban areas where the general public has access	Yes, only well stabilised and odourless sludge	No
Forests	No	No
Land reclamation	Yes	Yes, no access to the public in the 10 months following spreading

Advanced treatment processes for hygienisation¹

Thermal drying ensuring that the temperature of the sludge particles is higher than 80°C with a reduction of water content to less than 10% and maintaining a water activity above 0.90 in the first hour of treatment

Thermophilic aerobic stabilisation at a temperature of at least 55°C for 20 hours as a batch, without admixture or withdrawal during the treatment

Thermophilic anaerobic digestion at a temperature of at least 53°C for 20 hours as a batch, without admixture or withdrawal during the treatment

Thermophilic anaerobic digestion at a temperature of at least 53°C for 20 hours as a batch, without admixture or withdrawal during the treatment

Conditioning with lime reaching a pH of 12 or more and maintaining a temperature of at least 55°C for 2 hours

Conditioning with lime reaching and maintaining a pH of 12 or more for three months

Conventional processes²

Thermophilic aerobic stabilisation at a temperature of at least 55°C with a mean retention period of 20 days

Thermophilic anaerobic digestion at a temperature of at least 53°C with a mean retention period of 20 days

Conditioning with lime ensuring a homogenous mixture of lime and sludge. The mixture shall reach a pH of more than 12 directly after liming and keep a pH of at least 12 for 24 hours

Mesophilic anaerobic digestion at a temperature of 35°C with a mean retention period of 15 days

Extended aeration at ambient temperature as a batch, without admixture or withdrawal during the treatment period

Simultaneous aerobic stabilisation at ambient temperature(*)

Storage in liquid form at ambient temperature as a batch, without admixture or withdrawal during the storage period

¹ The process shall be initially validated through a 6 Log₁₀ reduction of a test organism such as *Salmonella Seftenberger W775*.

The treated sludge shall not contain *Salmonella Spp* in 50 g (wet weight) and the treatment shall achieve at least a 6 Log₁₀ reduction in *Escherichia Coli* to less than 5 × 10² CFU/g.

² The sludge treatment shall at least achieve a 2 Log₁₀ reduction in *Escherichia Coli*

Limits on organic micropollutants

Organic compound	Limit values new proposal of Italian ministry of the environment (mg/kg SS)	Limit values 3 rd draft (mg/kg SS)
Sum of halogenated organic compounds (AOX)	*	500
Linear alkylbenzene sulphonates (LAS)	*	2.600
Di(2-ethylhexyl)phthalate (DEHP)	*	100
Nonylphenol and nonylphenoethoxylates with 1 or 2 ethoxy groups	*	50
Sum of the following polycyclic aromatic hydrocarbons: acenaphthene, phenanthrene, fluorene, flouranthene, pyrene, benzo(b+j+k)fluoranthene, benzo(a)pyrene, benzo(ghi)perylene, indeno(1, 2, 3-c, d)pyrene (PAH)	6	6
Sum of the polychlorinated byphenils components number 28, 52, 95, 101, 118, 128, 138, 146, 149, 151, 153, 170, 177, 180, 183, 187 (PCB)	0,8	0,8
Polychlorinated dibenzodioxins/ dibenzofuranes (PCDD/F)	25 (ng/kg SS)	100 (ng/kg SS)

* The limit should be indicated when the permit is required

Limit values for heavy metal giving to soils

Metal	3° draft (g/ha/anno)	
	Medium term (2015)	Long term (2025)
Cd	15	6
Cr	2.400	1.800
Cu	2.4003.000	1.800
Hg	15	6
Ni	600	300
Pb	1.500	600
Zn	6.000	4.500

Agronomical and microbiological characteristics

Parameter	D. Lgs. 99/92	New proposal
Organic carbon (% SS)	≥20%	≥20%
P (% SS)	≥0,4%	≥0,4%
N (% SS)	≥1,5%	≥1,5%
Organic nitrogen		≥80% (not mandatory)
Humification		≥20% (not mandatory)
<i>Salmonellae SPP</i>	10 MPN/g	Absent in 25 g of sample
<i>Escherichia Coli</i> UFC/g		≤ 1.000

D. Lgs. 75/10 (29/4/2010)

- ⇒ Il D. lgs. 29 aprile 2006, n. 217, ha disciplinato i fertilizzanti ai fini della loro commercializzazione. Questo decreto ha abrogato la L. 19 ottobre 1984, n. 748.
- ⇒ Limiti e prescrizioni sono riportati negli allegati da 1 a 14.
- ⇒ L'allegato 2 riporta i limiti che devono essere rispettati per gli ammendanti, definiti come materiali da aggiungere al suolo in situ, principalmente per conservarne o migliorarne le caratteristiche fisiche e/o chimiche e/o l'attività biologica.

D. Lgs. 75/10

Fra gli ammendanti disciplinati rientrano anche i seguenti:

a) **Ammendante compostato misto.**

Prodotto ottenuto attraverso un processo di trasformazione e stabilizzazione controllato di rifiuti organici che possono essere costituiti dalla frazione organica degli RSU proveniente da raccolta differenziata, da rifiuti di origine animale compresi liquami zootecnici, da rifiuti di attività agro-industriale e da lavorazione del legno e del tessile naturale non trattati, da reflui e fanghi, nonché dalle matrici previste per l'ammendante compostato verde.

b) **Ammendante compostato verde.**

Prodotto ottenuto attraverso un processo di trasformazione e stabilizzazione controllato di rifiuti organici che possono essere costituiti da scarti della manutenzione del verde ornamentale, residui delle colture, altri rifiuti di origine vegetale con esclusione di alghe e altre piante marine.

c) **Ammendante compostato torboso.**

Prodotto ottenuto per miscela di torba con ammendante compostato verde e/o misto.

Agronomic characteristics of compost for its management outside the waste legislation

Parameter	Limits C.I. 27/07/1984	Limits Annex 2 D. Lgs. 75/10
pH	6,0 ÷ 8,5	6,0 ÷ 8,5
Moisture (%)	<45% on dry solids	≤50% as it is (green and mixed compost)
Organic substance (% on dry solids)	>40	
Humified substance (% on dry solids)	>20	
Total N (% on dry solids)	>1	
Organic N (% total N)		≥80%
Total P (% on dry solids)	>0,5	
C/N	<30	≤25 (mixed compost) ≤50 (green and peat like compost)
Organic C (% on dry solids)		≥25% (peat like compost); ≥50% (peat) ≥20% (green and mixed compost)
Humic and fulvic C (% on dry solids)		≥7% (mixed and peat like compost) ≥2,5% (green compost)

Glasses (% on dry solids)	≤3	≤ 0,5% on dry solids for materials $\Phi > 2$ mm
Plastics (% on dry solids)	≤1	
Other inert materials (% on dry solids)		≤ 5% for fractions ≥ 5 mm
Ferrous materials (% on dry solids)	≤0,5	
Salmonellae		Absent in 25 g as it is. No dissimilar sample out of 5
Escherichia coli		<1000 CFU/g. Only 1 dissimilar sample out of 5 with presence in the range of 1.000-5.000 CFU/g
Germination index		With dilution of 30% ≥ 60%
Algae and marine plants		They are allowed, like Poseidoniae, with preliminary separation of sand with maximum input in the mixture to composting process of 20% in weight of the feed material. In this case $TI \leq 2$ mg/kg dry solids

Compost characteristics for environmental protection

Parameter	Limit C.I. 27/07/1984 (mg/kg dry solids)	Limits Annex 2 D. Lgs. 75/10 (mg/kg dry solids)
Cd	10	1,5
Cr	500	
Ni	200	100
Pb	500	140
Zn	2500	500
Cu	600	230
As	10	
Hg	10	1,5
Cr VI	10	0,5