D5.3 REVIEW OF CURRENT SITUATION, EXISTING REGULATIONS AND NUTRIENT LEAKAGE RISKS OF PRACTICES IN LATVIA

Sustainable Biogas
WP5 Analysing usage and disposal possibilities for sewage-based biomasses

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SUSTAINABLE BIOGAS

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1. INTRODUCTION

In project Sustainable Biogas, John Nurminen Foundation and Finnish and Latvian biogas associations and environmental authorities cooperate to improve the sustainability of climate-friendly biogas production from the point of view of water protection. The project is financed by the Interreg Central Baltic programme.

One of the project aims is to identify sustainable end uses for sewage sludge -based digestates in Finland and Latvia. Additionally, another aim is to promote the safe use of nutrient-rich digestates from biogas production as recycled fertilisers. Towards these ends, the feasibility of various end-use options for sewage sludge -based digestates will be discussed and elaborated with stakeholders in Finland and in Latvia.

This report is the starting point for such a process in Latvia. It includes a description of the current situation as regards the utilisation of sewage sludge -based digestates in Latvia. Particular attention is paid to current end use volumes (Chapter 2), existing regulations (Chapter 3) and observed nutrient leakage risks of practices (Chapter 4).

A separate report focuses on the current situation in Finland.

2. SEWAGE SLUDGE PRODUCTION, PROCESSING AND USE

About 25,000 tonnes of dry matter sludge is produced in Latvia annually, and up to 45% of sludge is produced in Riga (LWWWA 2021). Sludge is mainly utilised in composting and in agriculture. However, a specific feature of Latvia pointed out by e.g. Ministry of the Environmental Protection and Regional Development (2021), Smol et al. (2020) and OECD (2019) is that large quantities of sludge are placed at temporary storage sites.

In 2018, 45% of sludge was diverted to a temporary storage (see category “Other”), 37% was utilised as compost and other applications, and 18% in agricultural use. In total 71 tonnes (less than 0.3%) were landfilled. There was no sludge incineration (FIGURE 1).

During the past 10 years, the agricultural use and landfilling have decreased, and composting and storage increased (FIGURE 2).

FIGURE 1. SLUDGE PROCESSING AND USE IN LATVIA IN 2018 (SOURCE: EUROSTAT)

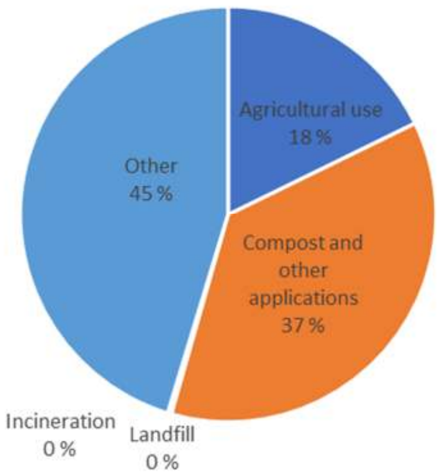
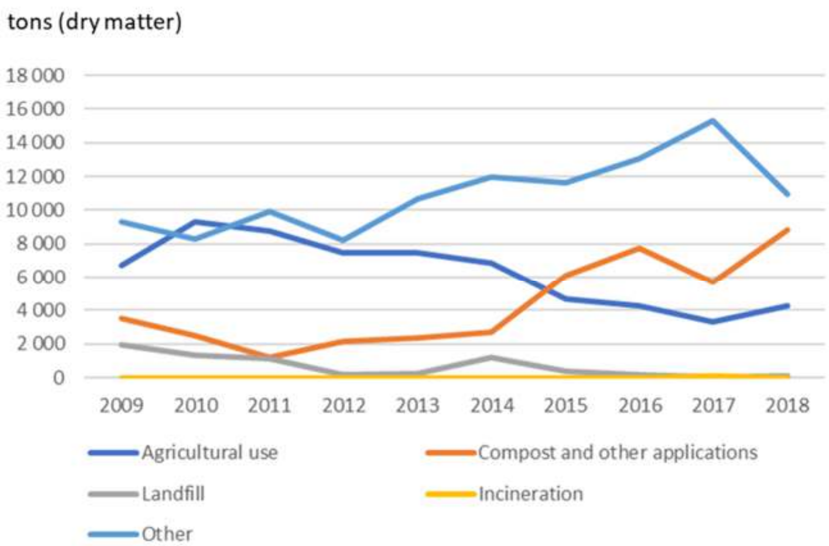


FIGURE 2. TRENDS IN SLUDGE PROCESSING AND USE IN LATVIA (SOURCE: EUROSTAT)



It is not possible to estimate the end use of composted sludge or sludge processed by other means:

- Composted sludge can be used for fertilisation of agricultural and forestry lands, landscaping and recultivation of degraded territories. As compost is a fertiliser product, its utilisation is not monitored by environmental authorities, but professional use is controlled by State Plant Protection Service. According to Latvian State Environmental Services (LSES), sludge compost usage for fertilisation of agricultural lands has decreased since 2013 because of lack of understandable and supporting legislation.
- According to the Latvian Biogas Association, there were 49 biogas plants operating in Latvia in the beginning of 2021, but sewage sludge was used as an input in only four plants: one biogas plant uses Riga city sewage sludge, and three plants use sewage sludge as one of their input materials. There is, however, no precise information on the sludge amount.

In summary, the current situation and challenges related to sludge estimates can be described as follows:

- Based on the EUROSTAT data, 50% of sludge has been disposed of by storing during the past 10 years. According to LSES, up to 40% of sewage sludge is still stored in the territory of wastewater treatment plants.
- After storing, field spreading is the second dominating end use. The end use applications of composted sludge and sewage sludge -based digestates are unknown, however.
- Total sewage sludge production seems to be an underestimate as the statistics include sludge produced in wastewater treatment plants with a load from 2000 person equivalents upwards only.

3. REGULATION

Regulation No 34 (2002)

Governmental Regulation No 34 “Regulations regarding discharge of polluting substances into water” (2002), as amended by Regulation No 59 (2007) require the operator of wastewater collection and treatment system to ensure utilisation of wastewater and sewage sludge and to obtain a permit for the disposal of sewage sludge. Installations for the discharge of wastewater and the disposal of sewage sludge shall be set up in such a way that they decrease the adverse effect of wastewater and sewage sludge on the environment. The operator may agree with other operators regarding the collection and disposal of sewage sludge at the places of deposition of other treatment plants but shall notify the regional environmental authority about such agreement (UNECE 2019).

Regulation No 362 (2006)

In Latvia, the use of sludge is governed by the Cabinet of Ministers’ Regulation No 362 “Sewage sludge and compost utilisation, monitoring and control” (2006). It does not cover sewage sludge -based digestates, the use of which on agriculture land is covered by Regulation 834.

Regulation 362 determines the use of sewage sludge and compost in agriculture, forestry, green areas and land reclamation. It stipulates that sludge shall be treated before use and must undergo biological, chemical, or heat treatment or long-term storage for at least 12 months.

The producer of sewage sludge and compost shall analyse its nutrient content and ensure its quality against heavy metal concentration limit values for sewage sludge/compost[1] (Table 1) and issue a quality certificate indicating the maximum permissible application of sewage sludge/compost.

In **agriculture**, the regulation also provides heavy metal concentration limit values for soils[2,3], and limit values for heavy metals loads (Table 2 and Table 3). The pH value of the soil must be above 5. Sludge / compost total nitrogen, ammonium nitrogen and phosphorus must be analysed, too. The ammonium nitrogen and total phosphorus annual emission limit values for sewage sludge and compost are 30 kg/ha and 40 kg/ha, respectively. No requirements for pathogens or organic compounds are given.

Table 1. Mass concentration limit of heavy metals in sewage sludge and compost intended for fertilisation and reclamation or disposal of soil in municipal waste landfills (mg/kg). Sources: Regulation No 362 and Directive 86/278/EEC

Parameter	Cadmium	Chromium	Copper	Mercury	Nickel	Lead	Zinc
Latvia	10	600	800	10	200	500	2500
Directive 86/278/EEC	20-40	-	1000-1750	16-25	300-400	750-1200	2500-4000

[1] Note: If the load of a WWTP does not exceed 5000 PE and it treats only domestic sewage, it is not necessary to determine the concentration of heavy metals in sewage sludge and compost produced from such sludge.
[2] Note: If sewage sludge from a WWTP with a load not exceeding 5000 PE is used for soil fertilisation, the heavy metals in the soil need not be determined.
[3] Sewage sludge and compost may also be used for soil fertilization if the mass concentration of no more than three heavy metals exceeds the limit concentrations by no more than 10%.

Table 2. Mass concentration limits for heavy metals in the topsoil for incorporation of sewage sludge and compost (mg / kg). In Latvia, the lower range refers to soils with pH 5-6 and the upper range to soils with pH >7. Sources: Regulation No 362 and Directive 86/278/EEC

Parameter	Cadmium	Chromium	Copper	Mercury	Nickel	Lead	Zinc
Latvia	0.5-0.9	40-90	15-70	0.1-0.5	15-70	20-40	50-100
Directive 86/278/EEC	1-3	-	50-140	1-1.5	30-75	50-300	150-300

Table 3. Annual emission limit values for heavy metals in agricultural soils (g/ha/a as an average for a period of five years). In Latvia, the lower range refers to sandy soils and the upper range to loamy/clayey soils. Sources: Regulation No 362 and Directive 86/278/EEC

Parameter	Cadmium	Chromium	Copper	Mercury	Nickel	Lead	Zinc
Latvia	0.030-0.035	0.6-0.7	1.0-1.2	0.008-0.010	0.25-0.30	0.30-0.35	5-6
Directive 86/278/EEC	0.15	-	12	0.1	3	15	30

Sewage sludge should be worked in the soil within three days after spreading on the field. Spreading is forbidden during the period from December 15 to March 1. Furthermore, sewage sludge and compost shall not be spread and incorporated on slopes with a gradient greater than 7°; on frozen or snow-covered soil; in flooded and flood-prone areas; closer than 100 m from individual water-supply points; closer than 100 meters from residential buildings, food processing and food trading companies; closer than 50 m from the shoreline of a water body or watercourse; and in protected areas where it is prohibited.

In addition, sewage sludge and compost shall not be used for growing vegetables and berries in covered areas; for growing potatoes, vegetables and berries in the open field, which is less than 0.10 ha; during the vegetation period of crops; and for pasture land except upon restoration.

The safety period between sludge and compost application and harvesting is set for the minimum of 10 months for fruit, berries, root vegetables, potatoes, and vegetables in direct contact with the soil. For other crops, the safety period is three months.

In **forestry**, treated sludge and compost may be used in plantation forests, but only compost may be used for afforestation of low-yielding sandy soils, degraded forest soils and forest fires. Sewage sludge and compost must be incorporated into the soil and the use of sewage sludge for surface fertilisation is not permitted.

A mass of heavy metals (determined separately for each heavy metal) which does not exceed the five-year emission limit values may be incorporated into the soil at the same time as sewage sludge or compost. Soil testing prior to the incorporation of sewage sludge or compost is not required.

In **green areas and landscaping**, soil concentration of heavy metals must not exceed class II and sewage sludge stored for one year with a dry matter content of at least 25% and without an unpleasant odour must be used. The provisions of the regulation state that limit values for the heavy metal concentrations in soil in green areas and landscaping can be increased by 50 % of those for agricultural use, and make it obligatory to work the sludge/compost into the soil within 24 hours after spreading.

When sludge or compost is used for **reclamation of degraded areas**, a soil analysis should be conducted before the application in order to determine pH and granular composition of the soil. The sludge/compost cannot be used in the degraded areas which are permanently or temporarily flooded or with pH below 5. There are application limits (Table 4), e.g. the application limit for sand clay or clayey soils range from 90 to 350 t DM/ha, depending on the sludge/compost quality which is determined based on heavy metal content. Sludges are classified as class V are treated as hazardous waste.

Table 4. Limits for sewage sludge and compost in recultivation of degraded areas (t DM/ha). Source: Regulation No 362

Sludge class								**Gravel, sand, clay sand**	**Sand clay, clay**
	Cd	**Cr**	**Cu**	**Hg**	**Ni**	**Pb**	**Zn**		
I	<2.0	<100	<400	<3.0	<50	<150	<800	250	350
II	2.1-5.0	101-250	401-500	3.1-5.0	51-100	151-250	801-1500	140	200
III	5.1-7.0	251-400	501-600	5.1-7.0	101-150	251-350	1501-2200	90	130
IV	7.1-10	401-600	601-800	7.1-10	151-200	351-500	2201-2500	60	90

Sludge and compost meeting the criteria in Table 1 may be **landfilled**, if the treated sewage sludge dry matter content is not less than 15%. Compost may also be used for covering landfills. Sludge and compost categorised as hazardous waste may be buried in a hazardous waste landfill.

Regulation No 834 (2014)

Governmental Regulation No 834 “Protection of water and soil against pollution caused by nitrates from agricultural sources” of 2014 prescribes how fertilisers shall be used based on the content of nitrates. If there is not another regulation containing additional limitations, this regulation applies to everyone who uses fertilisers, and all biogas plants and farmers who use digestates as a fertiliser must follow this regulation, regardless of the feedstock used.

This regulation specifies maximal permitted amount of nitrogen that may be applied by plant and harvest level, and the N content of digestate as analysed in an accredited laboratory. Fertilisers shall not be spread upon frozen, water saturated or snow-covered soil; in locations where it is prohibited in accordance with the laws and regulations on protection zones/ territories (e.g. around surface water bodies); or on flood-lands and areas under the threat of flood.

If the amount of nitrogen produced on the holding with manure and fermentation residues exceeds 170 kilograms per hectare of agricultural land per year, the operator shall document the transfer of the produced manure and fermentation residues to other holdings or their use in another way.

Additional restrictions for fertilisation are given for highly vulnerable zones, where operators must submit a plan that includes area of the field, cultivated plants and planned fertilisers, calculated or specified in accordance with laws and regulations of allowable amounts of nitrogen (N), phosphorus (P_2O_2) and potassium (K_2O) (kg/ha). Soil monitoring is made annually, and content of soil is controlled more strictly than in other parts of Latvia.

It also requires that new / rebuilt reservoirs for the storage of fermentation residues shall provide for the accumulation of residues for at least eight months.

Regulation No 834 states that inspector of the State Plant Protection Service and an inspector of the State Environment Service has the right to be on the area of land of the landowner or user, informing the landowner or user accordingly, in order to control the observance of the requirements referred to in this Regulation according to the competence thereof. However, some biogas plant owners admit that requirements of Regulation No 834 are not strictly controlled. (Ruģele et al. 2017)

Regulation No 506 (2015)

Republic of Latvia Cabinet Regulation No 506 “Rules for the identification, conformity assessment and marketing of fertilisers and substrates” regulates how fertilisers must be identified and sold. In Annex 3, maximum levels of impurities are set out for fertilisers and substrate (Table 5).

Table 5. Maximum levels of impurities in fertilisers and substrate. Source: Regulation No 506

	Impurity	Maximum level
Organic and organomineral fertilisers and liming materials, atypical fertilisers and plant growth promoters	mercury (Hg)	2 mg / kg
	cadmium (Cd)	3 mg / kg
	arsenic (As)	50 mg / kg
	nickel (Ni)	100 mg / kg
	lead (Pb)	150 mg / kg
	Escherichia coli and *Enterococaceae*	1000 CFU / g or 1000 CFU / ml
	salmonella	not detected in a 25 g sample
	plastic, glass or metal particles larger than 4 mm	0.5 weight percent
Substrate	mercury (Hg)	1 mg / kg
	cadmium (Cd)	2 mg / kg
	arsenic (As)	20 mg / kg
	nickel (Ni)	50 mg / kg
	lead (Pb)	100 mg / kg
	copper (Cu)	100 mg / kg
	zinc (Zn)	300 mg / kg
	chrome (Cr)	100 mg / kg
	Escherichia coli and *Enterococaceae*	1000 CFU / g
	salmonella	not detected in a 25 g sample
	foreign objects (glass, metal, plastic, bones, stones)	0.5 weight percent

Regulation No 401 (2011)

Sludge is currently not incinerated in Latvia. In principle, however, the incineration of sewage sludge is regulated (together with the other types of waste) by the Law on Waste Management and Cabinet of Ministers Regulation No 401 of 2011 “Requirements for waste incineration and operation of waste incineration plants”. (PURE 2012)

4. NUTRIENT LEAKAGE RISKS OF PRACTICES

Sewage sludge and compost

Depending on the facilities, sewage sludge **storages** may be prone to leaching of nutrients. The problem of temporary storages of sludge is recognised in the Wastewater management investment plan 2021-2027 (SIA "ISMADE" 2020). It proposes state aid for establishing centralised regional sewage sludge treatment and recycling centres and that the efficient use of sludge should be seen in the context of the circular economy. Moreover, the plan calls for investments in sewage purification quality improvement and in the improvement of existing sludge fields by construction of roof, wall, etc. elements. The report also points out that there is no regulation on specific sludge treatment criteria in Latvia.

For **sludge and compost**, Regulation No 362 determines conditions for utilising sewage sludge for soil fertilisation in agriculture, forestry, green areas and landscaping, or in the recovery of degraded areas. For **agriculture**, these include ammonium nitrogen and total phosphorus annual emission limit values of 30 kg/ha and 40 kg/ha, respectively. For **other end uses**, there are no nutrient limit values, which may pose a risk for over-fertilisation and nutrient leakages.

Sewage sludge -based digestate

According to the Wastewater management investment plan 2021-2027 (SIA "ISMADE" 2020), a frequently used solution for the utilisation of sewage sludge is the transfer of sludge to biogas production and that process is not regulated by the regulations of the Cabinet of Ministers No. 363.

According to digestate samples analysed by the Latvian Biogas Association in 2020-2021, the **sewage sludge -based digestate** quality is good and conforms to the limit values set for heavy metals in Latvia. There was, however, Salmonella bacteria present in some samples.

For **digestate** use in **agriculture**, Latvian legislation restricts use of digestate only based on nitrogen concentration. According to Ruģele et al. (2017), the highest probability leading to severe consequences is that ammonia leach from anaerobic digestate. But, according to Latvia's environmental monitoring data, about 65% of Latvia's land has a low nitrate content, but only 44.2% of land has low phosphorous content. When the soil is fertilised taking into account the nitrate concentration only, there is a risk for over fertilising by phosphorus especially when the process of spreading the digestate (or other fertilisers) is not strictly controlled (Kalnina et at. 2018).

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Climate-friendly biogas may lead to nutrients entering the watercourses if the treatment of digestates and wastewater from biogas plants is not carefully planned. The goal of the Sustainable Biogas project, funded by the EU's Interreg Central Baltic programme, is to promote the sustainability of biogas from a water protection perspective.

The project is implemented by the John Nurminen Foundation, the ELY Centre for Southwest Finland, the Finnish Biocycle and Biogas Association, Latvian State Environmental Services, and the Latvian Biogas Association.