Investigation of the Sludge management strategy in Estonia

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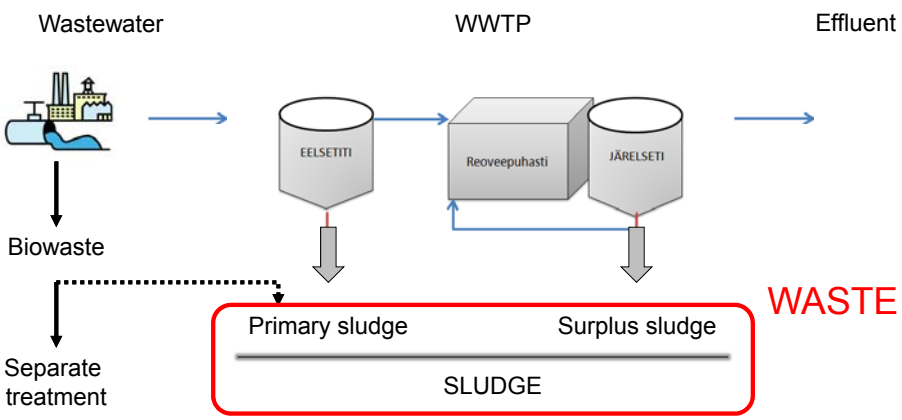
Palanga, 14.05.2015

The sludge study

- The Estonian Ministry of the Environment contract
- Investigation of the sludge management strategy in Estonia
- Development of the solutions for regional sludge treatment and elaboration of the waste discontinuation criteria for wastewater sludge
- June 2014 – October 2015
  - Stage I – Overview of the sludge management
  - Stage II – Sludge usage and clarification of the sludge potential users
  - Stage III – Discontinuation criteria
  - Stage IV – Financial and economic study for sludge management

Wastewater treatment and sludge management
Очистка сточных вод и управление с илом



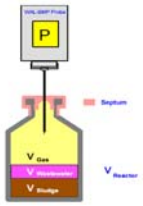
Sludge quality – what is it already in the legislation?

- Stabilisation
  - Content of organics
- Hygienisation
  - Content of pathogens
- Anthropogenic inorganic contaminants
  - Heavy metals (Cd, Hg, Ni, Zn, Cu, …)
- Anthropogenic (toxic) non-biodegradable organics
  - Drugs, antibiotics, hormones, PCB, …

ESTONIAN SLUDGE LEGISLATION

Stabilisation of sludge in the Estonian legislation

- Oxygen demand
  - < 10 mg O_2/g DS 96-hour period
- Content of organics – loss of ignition (VS)
  - VS has decreased more than 38%
- Content of organics (VS/TS)
  - VS/TS < 0,6
- Biogas potential
  - < 0,25 l/g VS;
- Volatile fatty acids
  - < 0,43 g KHT/g VS.



Taavo Tenno 5

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Anaerobic digestion
Composting
Aeobic stabilisation
Lime stabilisation

Taavo Tenno 6

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ESTONIAN SLUDGE LEGISLATION

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Sludge hygienisation

COMMISSION REGULATION (EC) No 208/2006

of 7 February 2006

amending Annexes VI and VIII to Regulation (EC) No 1774/2002 of the European Parliament and of the Council as regards processing standards for biogas and composting plants and requirements for manure

- Content of pathogens
  - Digestion residues or compost taken during or immediately after processing at the biogas or composting plant must comply with the following standards:
    - *Escherichia coli*: 1 000 CFU/g;
    - *Enterococcaceae*: 1 000 CFU/g;

Study by : Estonian Central lab

OÜ Eesti Keskkonnauuringute Keskus

Reoveesette töötlemise strateegia väljatöötamine, sh ohutu taaskasutamise tagamine järelevalve tõhustamise, keemiliste- ja bioloogiliste indikaatornäitajate rakendamise ning kvaliteedi süsteemide juurutamise abil. II ETAPP

Tallinn 2010

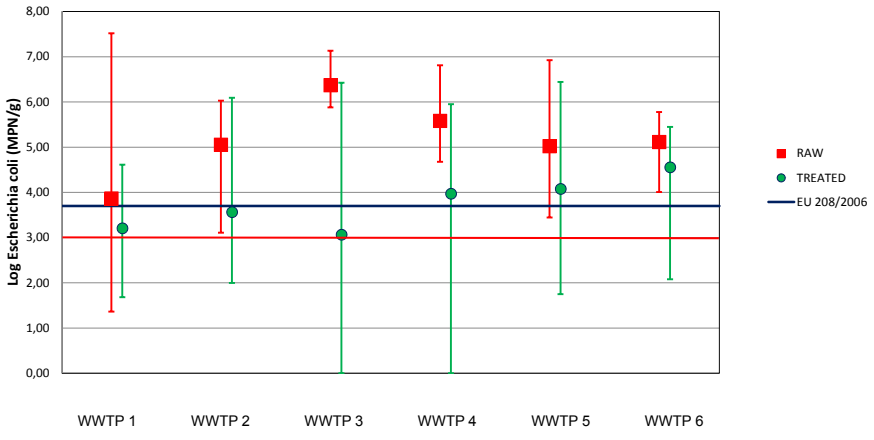
Kesklabor
Central Lab

Development of strategy for wastewater sludge treatment, including assurance of safe reuse, application of chemical ana biological indicators and introduction of quality system.

II STAGE

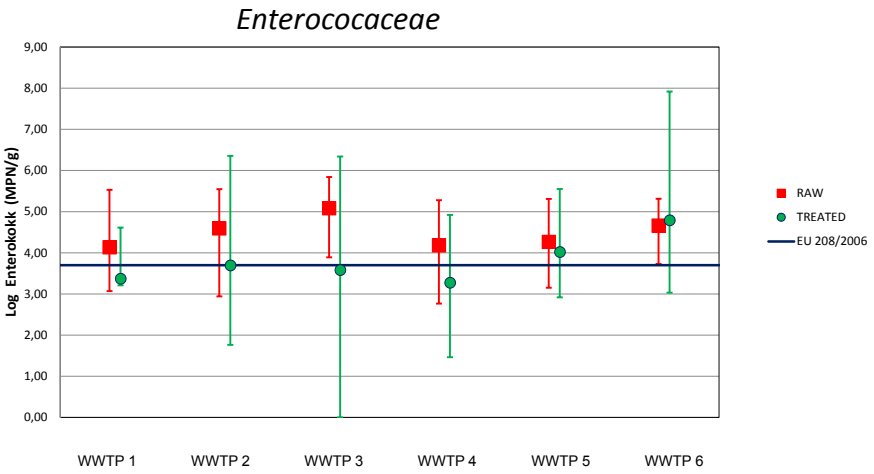
Pathogens in 6 Estonian WWTP with windrow composting

Escherichia coli



OÜ Eesti Keskkonnauuringute Keskus

Pathogens in 6 Estonian WWTP with windrow composting



OÜ Eesti Keskkonnauuringute Keskus

Can hygienisation be achieved?

- Windrow composting in ambient conditions needs extended periods and unstabilized sludge
- Reactor composting – properly controlled temperatures
- Anaerobic digestion needs hygienisation

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ESTONIAN & EU LEGISLATION

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Heavy metals – Legislation EU / Estonia

COUNCIL DIRECTIVE

of 12 June 1986

on the protection of the environment, and in particular of the soil, when sewage sludge is used in agriculture

(86/278/EEC)

- Limits for heavy metals in Estonian legislation are accordance with EC directive 86/278/EEC
- Limits apply for sludge usage in **agriculture, greenery and recultivation**

Heavy metal		Limit
		mg / kg TS
Cadmium	Cd	20
Copper	Cu	1000
Nickel	Ni	300
Lead	Pb	750
Zinc	Zn	2500
Mercury	Hg	16
Chromium	Cr	1000

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Heavy metals – HELCOM

Baltic Marine Environment Protection Commission

Group on Sustainable Agricultural Practices — AGRI 1-2014
Copenhagen, Denmark, 20-21 November 2014

Document title	Drafting of HELCOM Recommendation on sewage sludge handling
Code	9-2
Category	INF
Agenda Item	9 – Phosphorous recycling
Submission date	17.11.2014
Submitted by	Sweden and Germany
Reference	2013 Ministerial Declaration

Parameter	Concentration (mg/ kg DS)	Concentration (mg/kg P)
Cd	1	40
Cu	900	21 400
Ni	50	1 400
Pb	100	1 600
Zn	2 500	800
Hg	1	40
Cr	300	2 100
Ag	5	180
As	18	-
Tl	1.5	-
U	50 mg Uran/ kg P2O5	-
B(a)P (Benzo(a)pyren)	1	-
PCB (Polychlorinated Biphenyls)	0.1	2

18.05.2015

Heavy metals

- Limits for heavy metals in Estonian legislation are accordance with EC directive 86/278/EEC

	Estonian law SLUDGE [mg/kg TS]	HELCOM SLUDGE [mg/kg TS]	ECN-QAS COMPOST [mg/kg TS]
Mercury (Hg)	16	1	0,45
Cadmium (Cd)	20	1	1,3
Lead (Pb)	750	100	130
Zinc (Zn)	2 500	2 500	600
Nickel (Ni)	300	50	40
Chromium (Cr)	1 000	300	60
Copper (Cu)	1 000	900	200

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Heavy metals – levels in Estonia

- Study of Estonian wastewater sludge by Etonian Central Lab
- 8 wastewater treatment plants, toatal 80 sludge analyses
- Poportion of samples which are nonconforming with the respective limits

	Cd, mg/kg	Cr, mg/kg	Cu, mg/kg	Hg, mg/kg	Ni, mg/kg	Pb, mg/kg	Zn, mg/kg
Limits in tne Estonian legislation - 30.12.2002 nr 78	**20**	**1000**	**1000**	**16**	**300**	**750**	**2500**
- UNTREATED sludge - nonconforming analyses	0%	2%	0%	0%	0%	0%	1%
- TREATED sludge - nonconforming analyses	0%	0%	0%	0%	0%	0%	0%
HELCOM AGRI 1-2014 recommendations	**1**	**300**	**900**	**1**	**50**	**100**	**2500**
- UNTREATED sludge - nonconforming analyses	16%	2%	0%	7%	0%	0%	1%
- TREATED sludge - nonconforming analyses	16%	0%	0%	3%	0%	0%	0%
Limits for compost - ECN-QAS	**1,3**	**60**	**200**	**0,45**	**40**	**130**	**600**
- UNTREATED sludge - nonconforming analyses	7%	2%	21%	54%	0%	0%	17%
- TREATED sludge - nonconforming analyses	5%	1%	6%	31%	0%	0%	13%

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  ← ESTONIAN & EU LEGISLATION
- Anthropogenic (toxic) non-biodegradable organics
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  ← NO LEGISLATION JUST HESITATION

Which sludge quality conditions have to be fullfilled?

	Greenery	Recultivation	Agriculture
• Stabilisation – Content of organics	+	+	+
• Hygienisation – Content of pathogens	-	-	+
• Heavy metals – Cd, Hg, Ni, Zn, Cu, …	+	+	+ ?
• Non-biodegradable organics	-	-	?

Which sludge treatment technologies should be used?

- Stabilisation
  - Content of organics

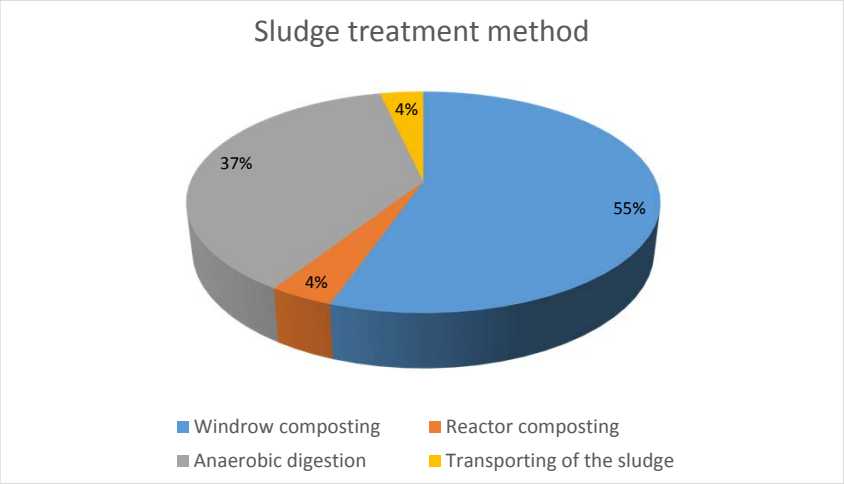
  ← composting anaerobic - biogas aerobic stabilisation …
- Hygienisation
  - Content of pathogens

  ← composting hygienisation …
- Anthropogenic inorganic contaminants
  - Heavy metals (Cd, Hg, Ni, Zn, Cu, …)

  ← drying - incineration
- Anthropogenic (toxic) non-biodegradable organics
  - Drugs, antibiotics, hormones, PCB, …

  ← drying - incineration

Sludge management in Estonia



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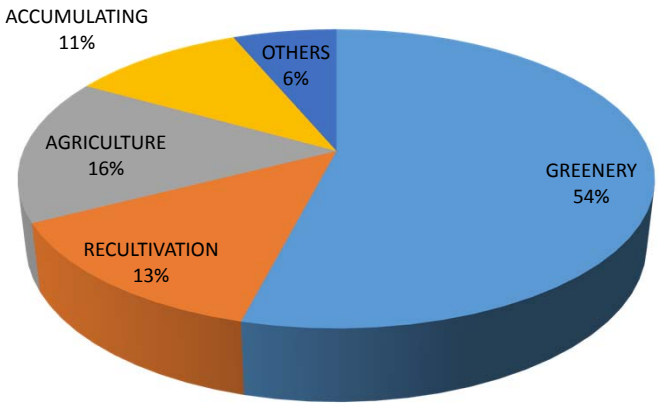
Sludge usage in Estonia



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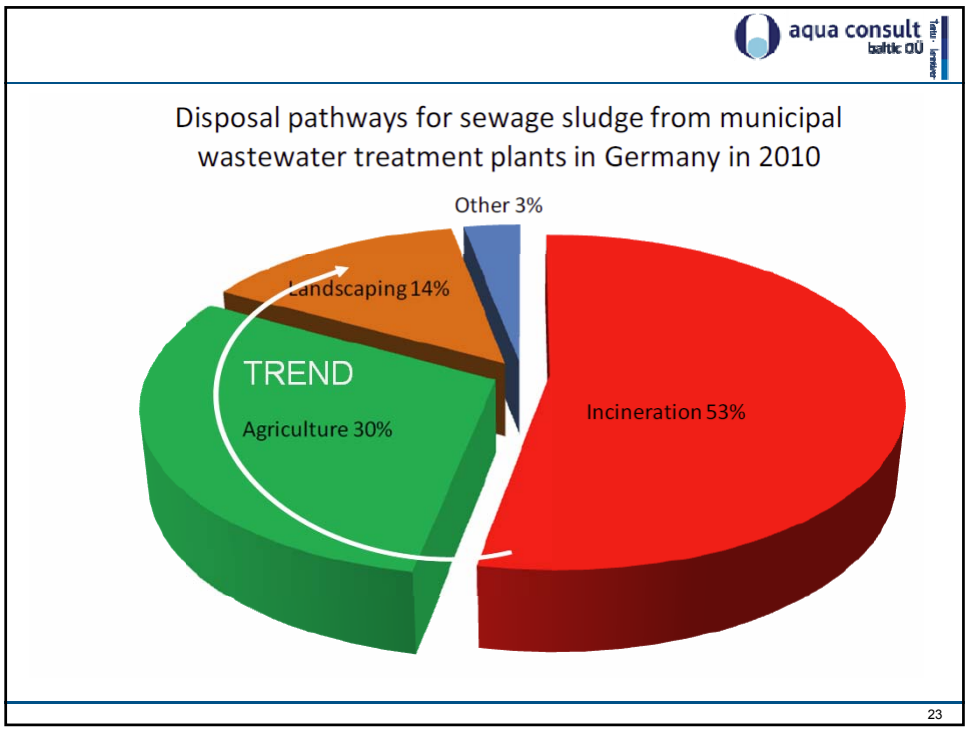


Sludge management concept for Estonia

Principles

- Sludge management has to be feasible
  - Minimise the effect on water price
- Sludge management centres
  - Sludge transportation from small WWTP to the centres

Options for sludge usage – GREERNERY

- Cheap and feasible treatment
- Sludge quality can be achieved
- Lack of sufficient loads to cover all sludge usage in greenery

What can be done?

- Municipality has a big role in managing sludge usage in greenery
  - Managing tenders for management of parks and greenlands
  - Municipal companies can be instructed and cooperated
- Good management and control of sludge (product) qualiy could increase usage.
- When properly treated and quality is controlled, sludge should be released from waste category

Options for sludge usage – RECULTIVATION

- Cheap and feasible treatment
- Sludge quality can be achieved
- Demands for recultivation is regionally varying
- Usually lack of sufficient loads to cover all sludge usage in recultivation

What can be done?

- State and municipality has a big role in managing sludge usage in greenery
  - Managing tenders for eg road construction (green tenders)
  - Green tenders for municipal and state construction sites for recultivation.
- Good sludge quality has to be guaranteed to increase demand.

Options for sludge usage – AGRICULTURE

- Cheap and feasible treatment
- In most areas the potential of sludge usage in agrigulture is sufficient.
  - Sludge forms <10% of the agricultural fertiliser demand in respective area.
- Properly treated sludge could be used in agriculture according to present legislation.
- Highly possible, that sludge quality can NOT be achieved in the future

What can be done?

- Strict sludge quality standards has to be defined and agricultural usage could be an alternative for plants with good sludge quality (industrial).
- Testing system and release from the waste category would increase usage.
- Incineration and P-recovery technology would solve the problem.

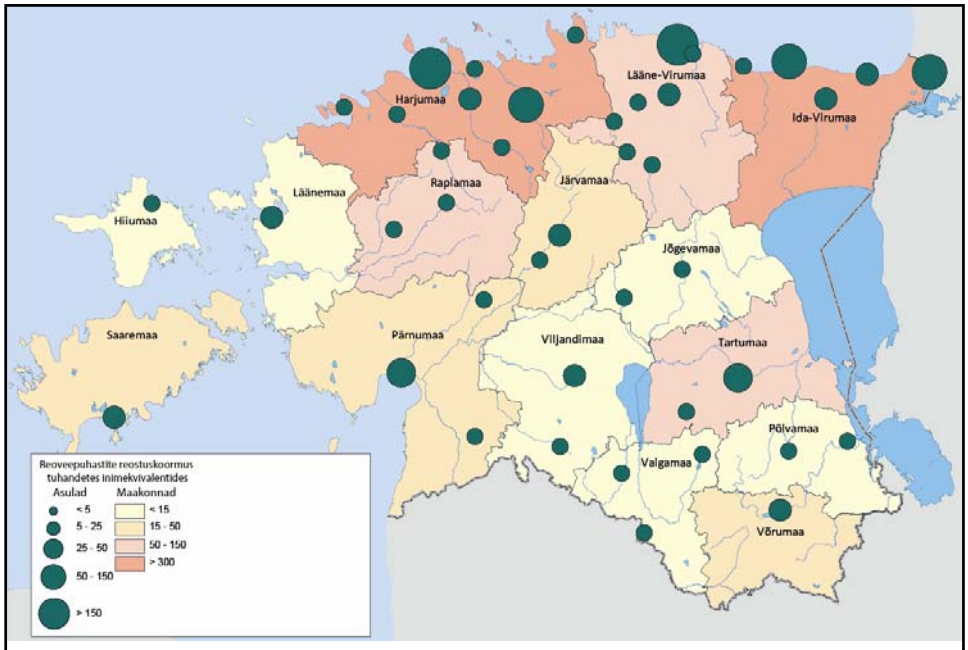
Options for sludge usage – OTHERS

FORESTRY

- Big potential
- Lack of interested parties

INCINERATION

- Safest alternative
- Potential of nutrient usage is lost
  - Monoincineration is preferable, since potential of nutrient recovery could come later
- Big centres should be formed (lots of transportatioin)
- Feasibility (highest cost)



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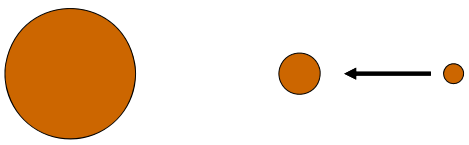
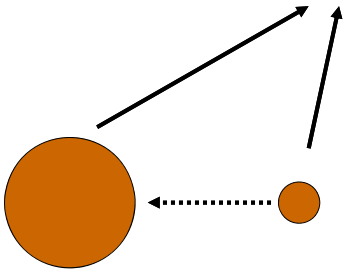
CONCLUSION



CONCLUSION

AGRICULTURE | GREENERY | RECULTIVATION



Local demand management

Waste discontinuation

Compost as product

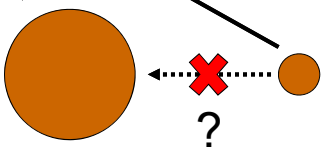
CONCLUSION

AGRICULTURE | GREENERY | RECULTIVATION

Big potential

Waste discontinuation

LIMITS under development



CONCLUSION

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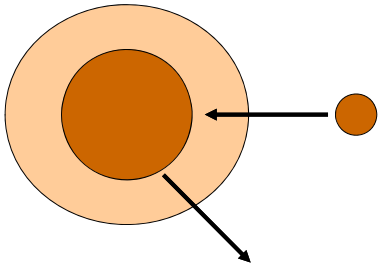

Monoincineration preferrable

Most expensive

INCINERATION

Thank you!

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