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Feasibility study in support of policy developments of the Sewage Sludge Directive (SSD; 86/278/EEC)

Egle, L., Marschinski, R., Jones, A., Yunta Mezquita, F., Schillaci, C. and Huygens, D., Publications Office of the European Union, Luxembourg, 2023,doi:10.2760/305263, JRC134591.

Danube Water Forum 30 May 2024

Joint Research Centre

Agenda

- The Sewage Sludge Directive from 1986 (86/278/EEC)
- Outcome of the SSD evaluation
- Possible way(s) forwards:
  Results from JRC‘s ‚***Feasibility study in support of policy developments of the SSD***‘
- Conclusions

Publication available here:
https://publications.jrc.ec.europa.eu/repository/handle/JRC134591

The Sewage Sludge Directive 86/278/EEC

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The Sewage Sludge Directive (SSD)

The SSD was created to:

- correct use of sewage sludge in agriculture
- contributing to resource efficiency (through the recycling of useful nutrients such as phosphorus, but also nitrogen and organic matter)
- regulate its use in order to prevent harmful effects on soil, vegetation, animals and humans
- promoting health and environmental protection (by placing limit values for the heavy metals Cd, Cr, Cu, Hg, Ni, Pb and Zn in sludge and soils)

But in the nearly 40 years many things have changed! → EVALUATION

Selected excerpts of the SSD evaluation

European Commission (2023): Commission Staff working Document Evaluation (SWD(2023) 158 final) – Council Directive 86/278/EEC of 12 June 1986 on the protection of the environment, and in particular of the soils, when sewage sludge is used in agriculture

https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12328-Sewage-sludge-use-in-farming-evaluation_en

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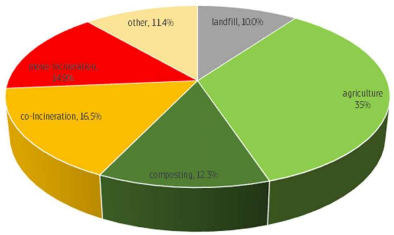
SSD Evaluation - selected excerpts



- 7 – 8 mio tons of sludge per year, agriculture has remained the **main route** management (30–50%)[1].

- Agricultural use is the **cheapest way of sludge disposal**. Beneficial for UWWT operators and farmers[2].

- **Decreasing level of heavy metals** in sewage sludge since the SSD came into force, can be attributed to an extent to the effect of the Directive [1].

- Many MS have adopted **more stringent requirements** (e.g. PCB, PAH, PCDD/F → challenging to distinguish the effects of the SSD from national action[3].

- **Limited information** linking overall agricultural soil quality and use of sewage sludge, especially long term.

- Wider **policy framework has considerably evolved** over recent years[4], notably as set by the Green Deal but also Zero Pollution Action Plan, adapted list of CRM.

[1] Effectiveness, [2] Efficiency, [3]Relevance, [4]Coherence

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Objective

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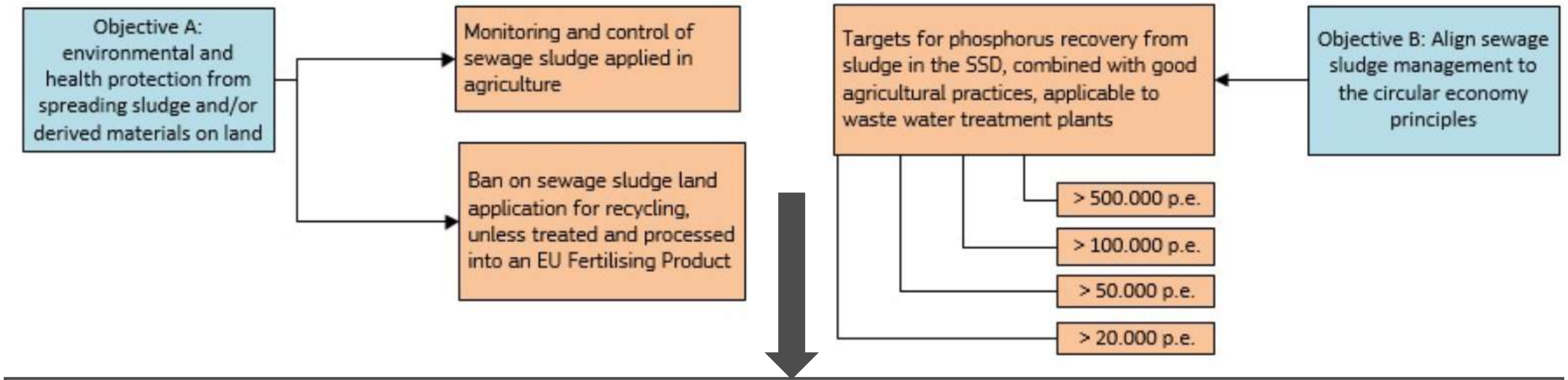
Feasibility study in support of policy developments of the SSD

- **Objective:** bring forward a preliminary assessment of policy options for a possible review of the Sewage Sludge Directive.
- **Baseline plus two policy options** were evaluated in detail (see next slide).
- P is the most **valuable and critical nutrient** within the sludge, OM and N are less important with regard to sewage sludge recycling.
- **Examination parameters (quantitative and qualitative):**
  - human health and environmental protection incl. methane emissions
  - nutrient recycling potential
  - costs/benefits
  - potential to stimulate innovation
  - social and distributional impacts
  - competitiveness and innovation incentives

Objectives and policy options considered



Baseline scenario: Development until 2050 without further policy intervention

Policy option 1: Monitoring and control of sewage sludge applied on land for recycling, plus a minimum target to recover at least 75% of the phosphorus from sludges generated at waste water treatment plants exceeding a certain size.

Policy option 2: Mandatory use of sludge generated at waste water treatment plants exceeding a certain size for the production of EU fertilising products

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Methodology

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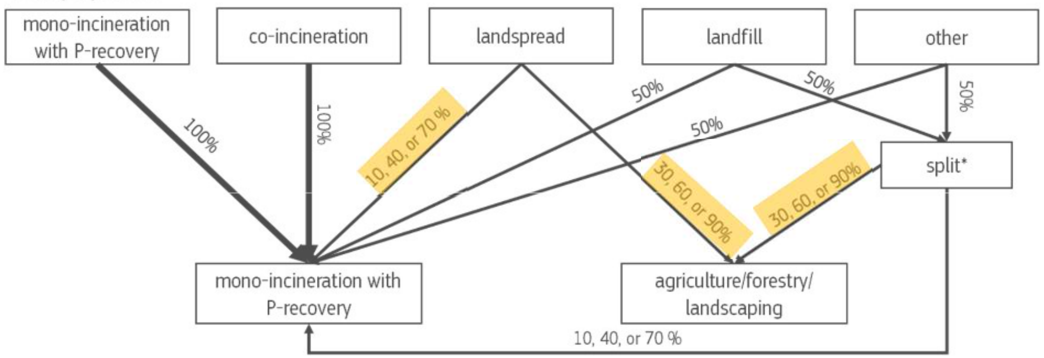
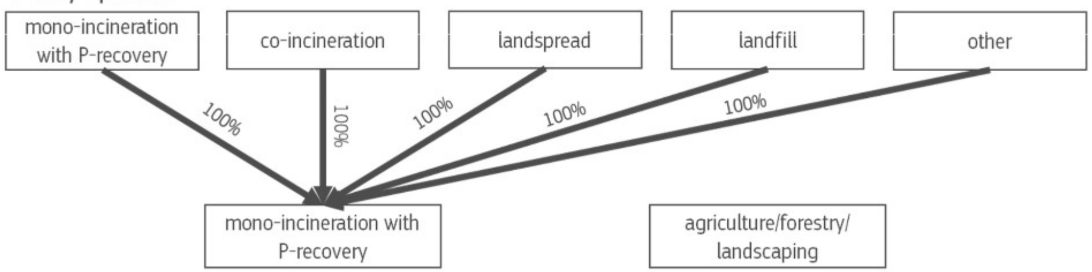
Methodology

- Baseline definition
  - demographic evolution
  - national legal framework on sewage sludge in different EU Member States
  - expected evolution of the main policies affecting sewage sludge generation and management (e.g. Urban Waste Water Treatment Directive, Landfill Directive, EU Biodiversity Strategy targeting nutrient loss reductions)
- Re-routing of sewage sludge for PO1 and PO2

Policy option 1



Policy option 2



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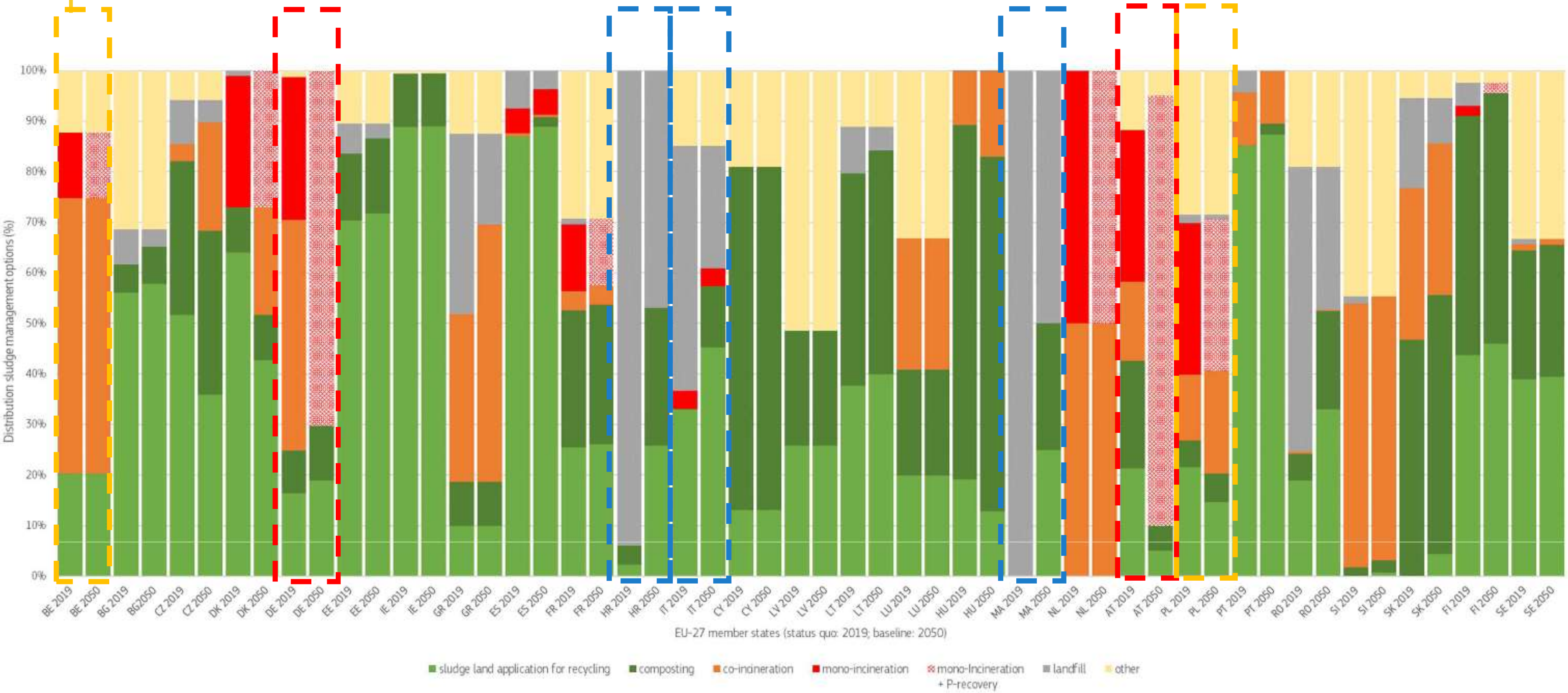
Results

Distribution of sludge management options in EU-27 for 2019 and the **baseline 2050**

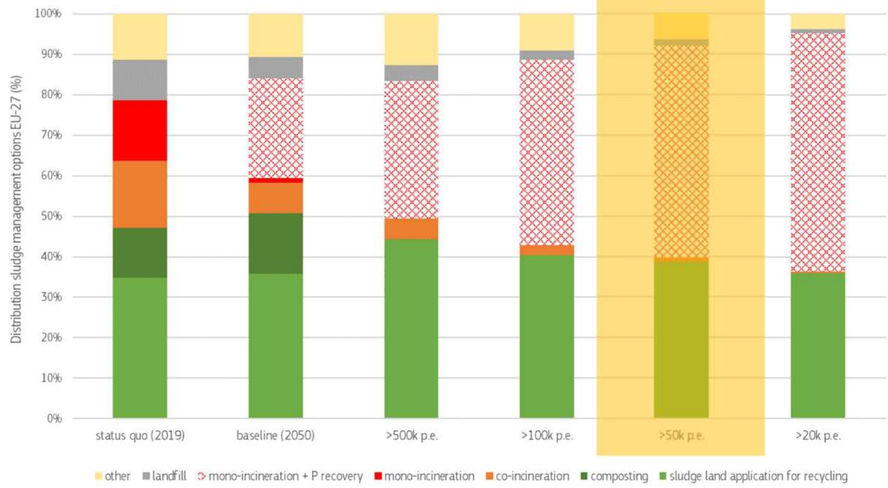


Results – Sewage sludge management option

- Mandatory P-recovery for WWTP >50k p.e. seems to be a sound compromise: It covers **70 % of EU 27 waste water**, by only addressing **12% of WWTP**).
- PO1 with higher rate of direct agricultural sludge application compared to PO2.
- **Higher level of mono-incineration with targeted P-recovery in PO2.**

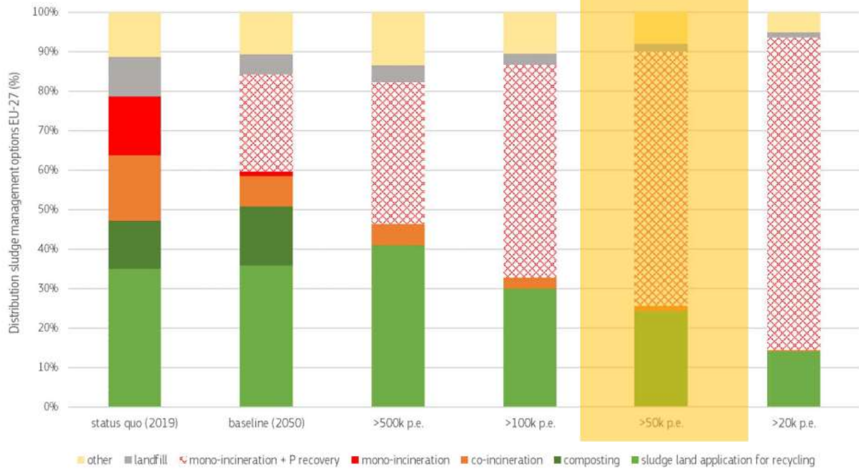
Policy option 1

> 50k p.e.



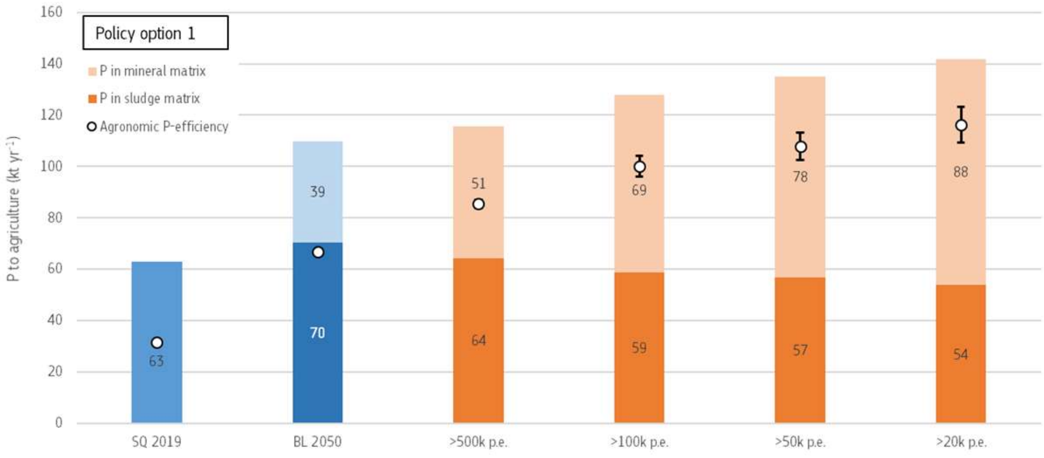
Policy option 2

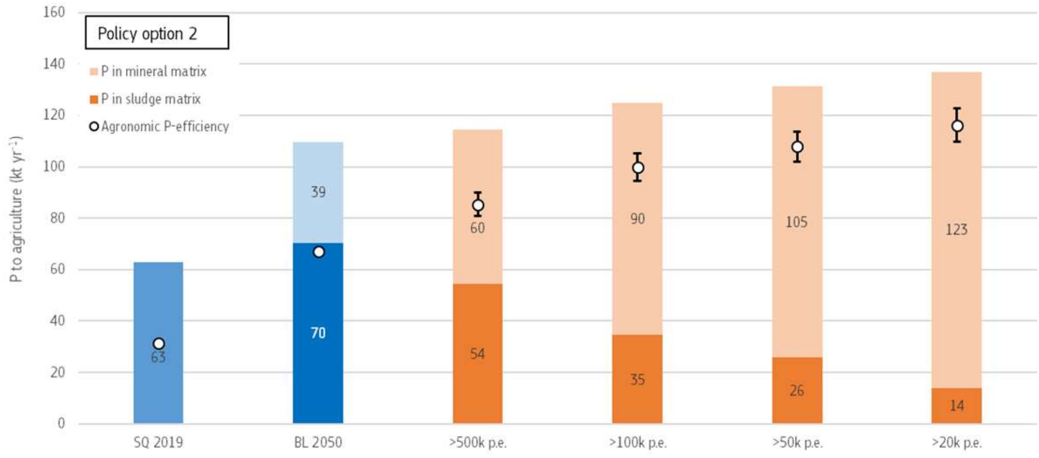
> 50k p.e.



Results – P recycling and environmental effects

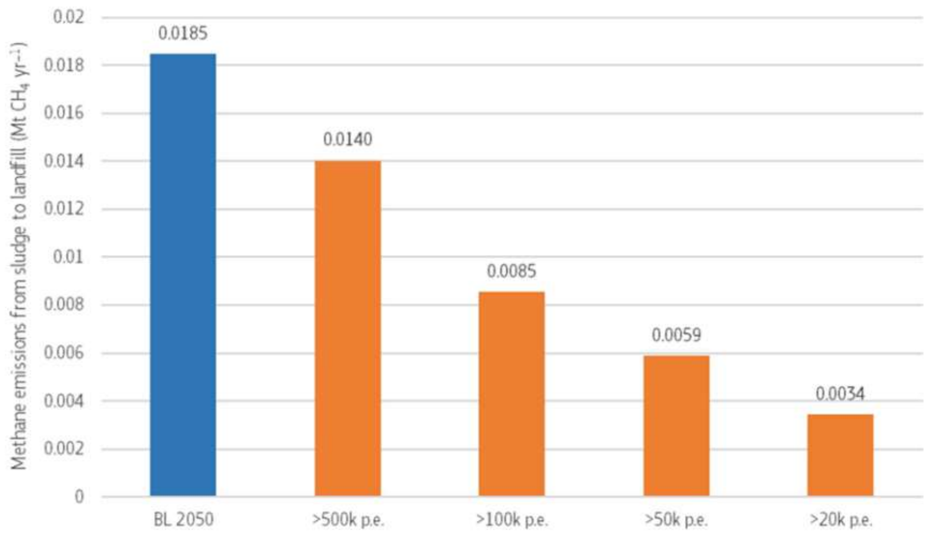
- P applied to agricultural land will be increased at same order of magnitude for both PO.
- **With PO2 slightly lower amount of recovered** P due losses in the technical recovery process, but the **P is more available to plants.**
- P is cleaner in PO2, because **organics are destroyed** and **heavy metals can be removed**.
- With PO2 more **carbon and nitrogen transfers into the gaseous phase** and must be **considered lost for recycling.**





Results – Methane emissions

- Reduction of methane emissions is similar for both PO.
- Reduction is a results of changing distribution (mainly avoidance of landfilling).
- In both options, CH_4 emissions are reduced significantly although, the contribution from landfilled sewage sludge to the total methane emission is already minor.



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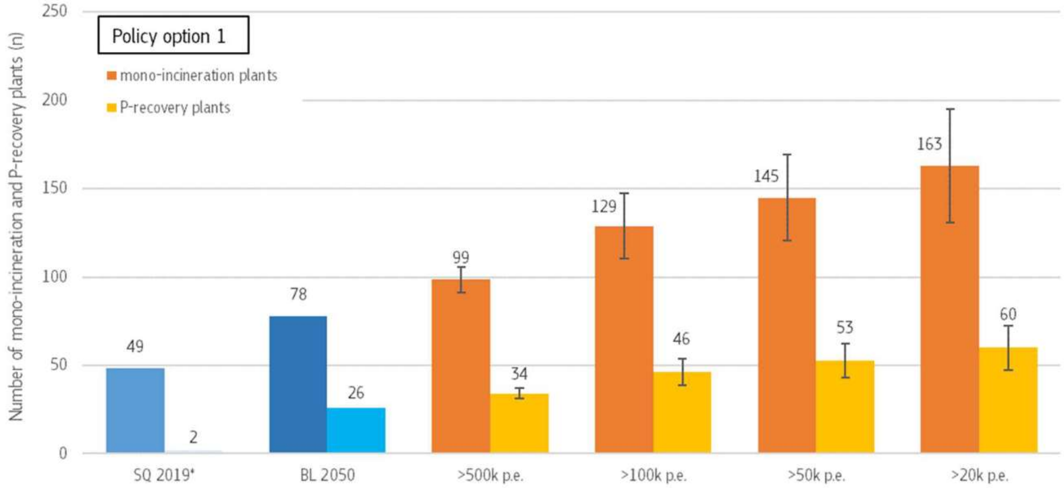
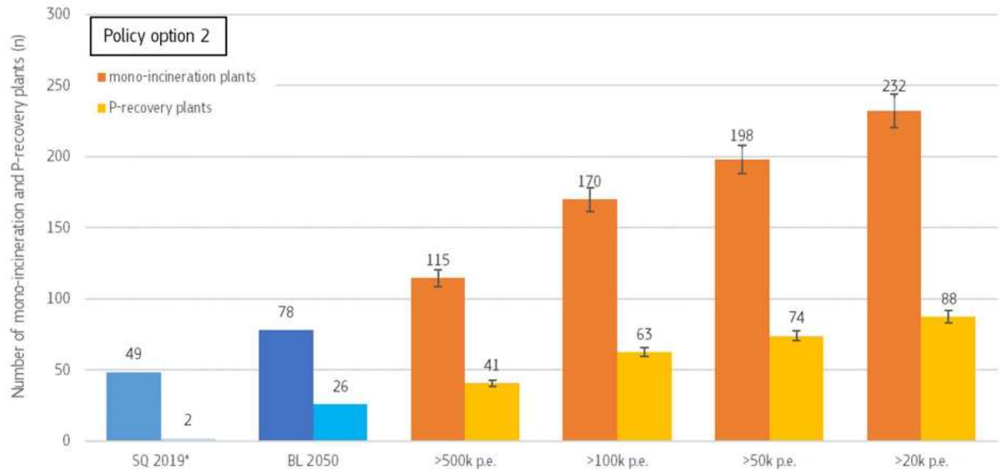
Results – Need for new installations

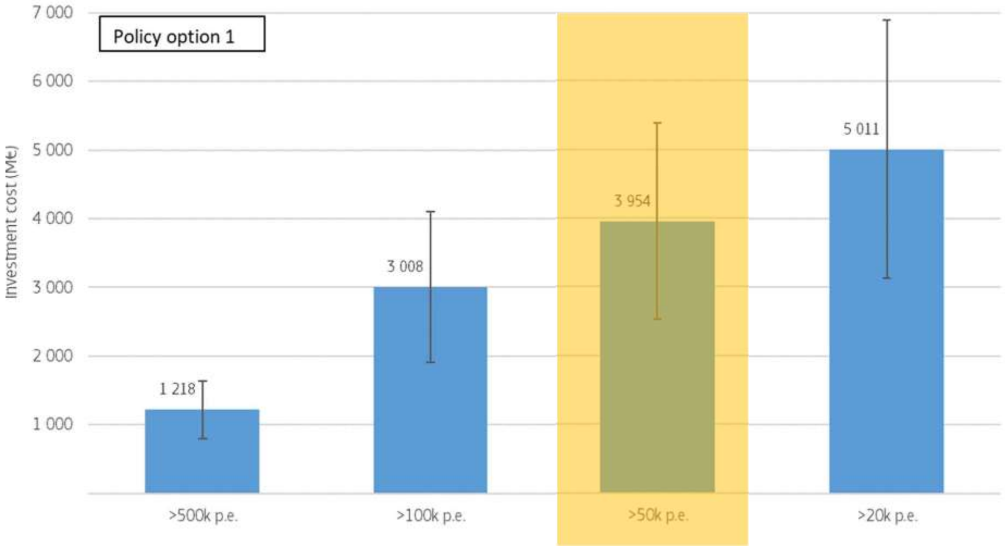
- For the baseline it was predicted that the numbers of mono-incinerators and P-recovery units will **already increase compared** due to the fact that certain MS will have national mandatory P-recovery in place by then.
- With implementation of the mandatory **technical P-recovery** for WWTP >50k p.e., around **115–232 additional mono-incineration** and **41–88 P-recovery plants** will need to be installed for PO2.

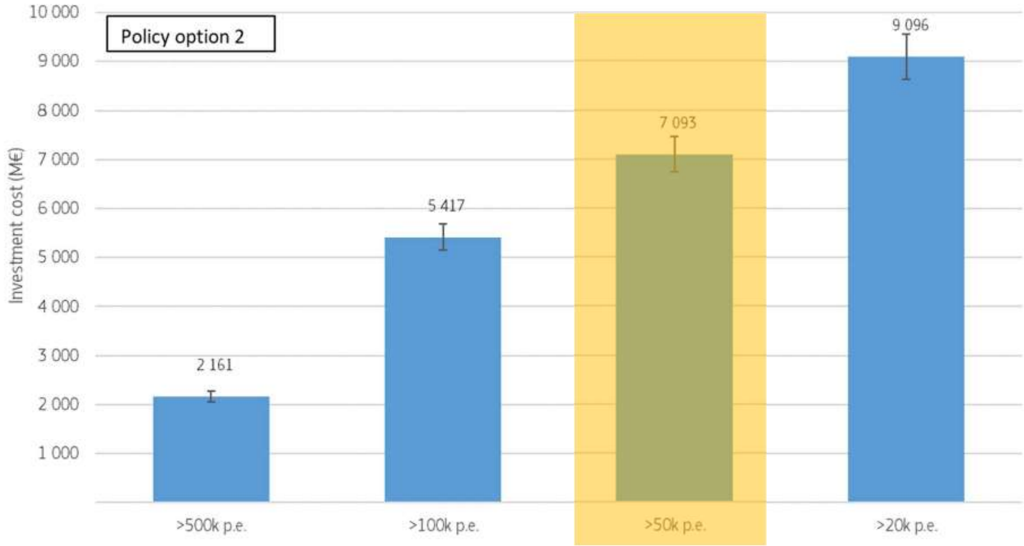




Results – Investment cost

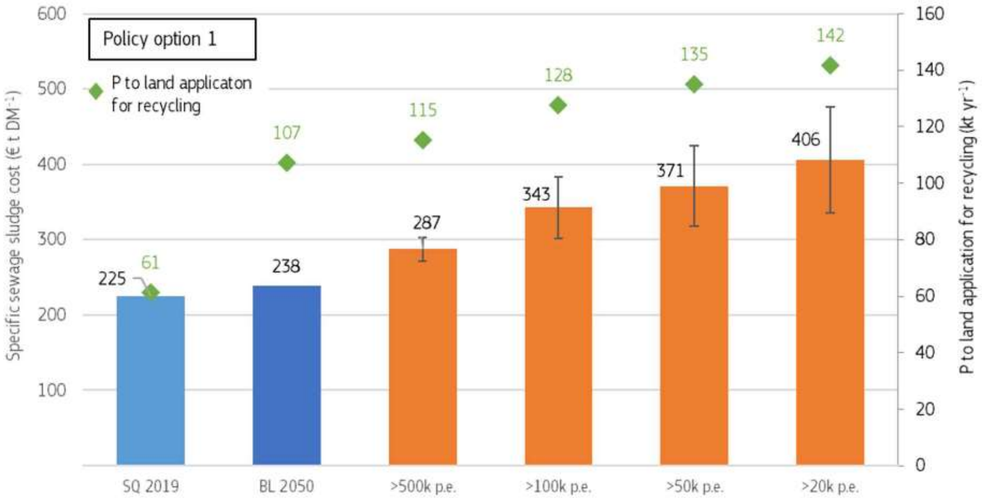
- **Total investment cost** for the installation of the new mono-incineration and P-recovery infrastructure are:
    - in the range of 2 500–5 400 M€ for PO1 and
    - around 7 000 M€ for PO2 (reinvestments are not considered).

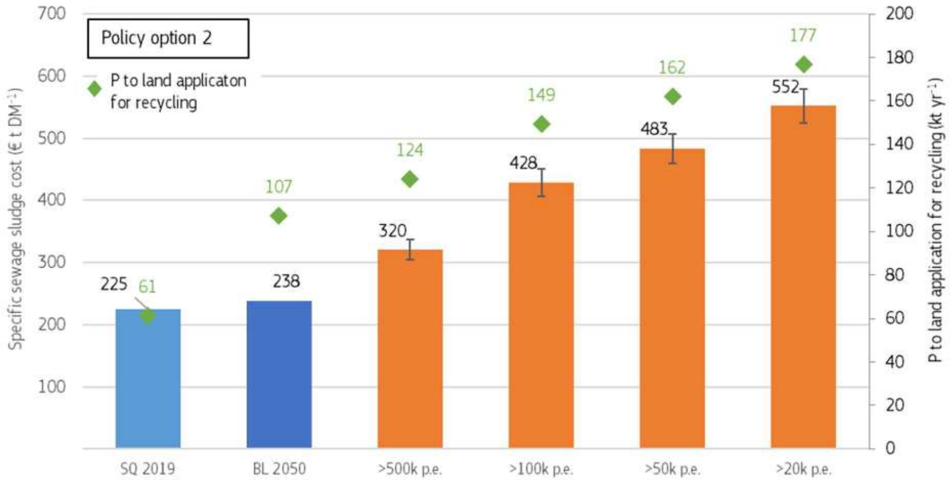




Results – Sludge specific cost

- Cost per ton of sewage sludge dry matter can **increase significantly** (PO1: +56% and PO2: +103% compared to baseline scenario).
- At the same time, the amount of **P applied to land** for recycling increases by 26% for PO1 and 51% for PO2 compared to the baseline.





Results – Further parameters

Impact	Category	Policy Option 1	Policy Option 2
Environmental & Health	Contamination	Improvement [+]	Strong improvement [++]
	Nutrient losses	Certain improvement [+]	Strong improvement [++]
	N, C recovery	Neutral to negative [-]	Strongly negative [--]
	Recovery of other elements (e.g. micronutrients)	Positive [+]	Very positive [++]
Economic	Transport over long distances	Certain improvement [+]	Strong improvement [++]
	Competitiveness	Neutral [0]	Somewhat negative [-]
	Innovation incentives	Neutral [0]	Slightly positive [0+]
	P import dependence	-0.04 Mt yr-1	-0.02 Mt yr-1
Social	Employment	3 610 jobs	4 780 jobs

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Conclusions

Conclusion

- Already **without sludge specific legislation**, sludge management will change until 2050 (baseline).
- In terms of environmental and health impacts, the PO2 performs better due to the **removal of organic compounds** but also possible **targeted removal of heavy metals.**
- PO2 would achieve a higher **reduction of contaminants** and a higher potential for the recovery of **elements such as Fe, Al, Ca, Mg**. This comes at the price of a **higher loss of nitrogen and organic matter**.
- PO2 results in **overall lower amount of recovered** P due losses in the technical recovery process, but the **P is more available to plants** in the short-term, enabling a **more controlled use** that may further reduce nutrient losses from sewage sludge.
- The higher ambition of PO2 also **implies sensibly higher investment** and **operational cost impacts**, almost by a factor two. Only for administrative costs, PO1 shows a higher financial burden.

Thank you

More information:
https://myintracomm.ec.europa.eu/corp/intellectual-property/Documents/2019_Reuse-guidelines%28CC-BY%29.pdf

Back-up

Distribution sludge management options

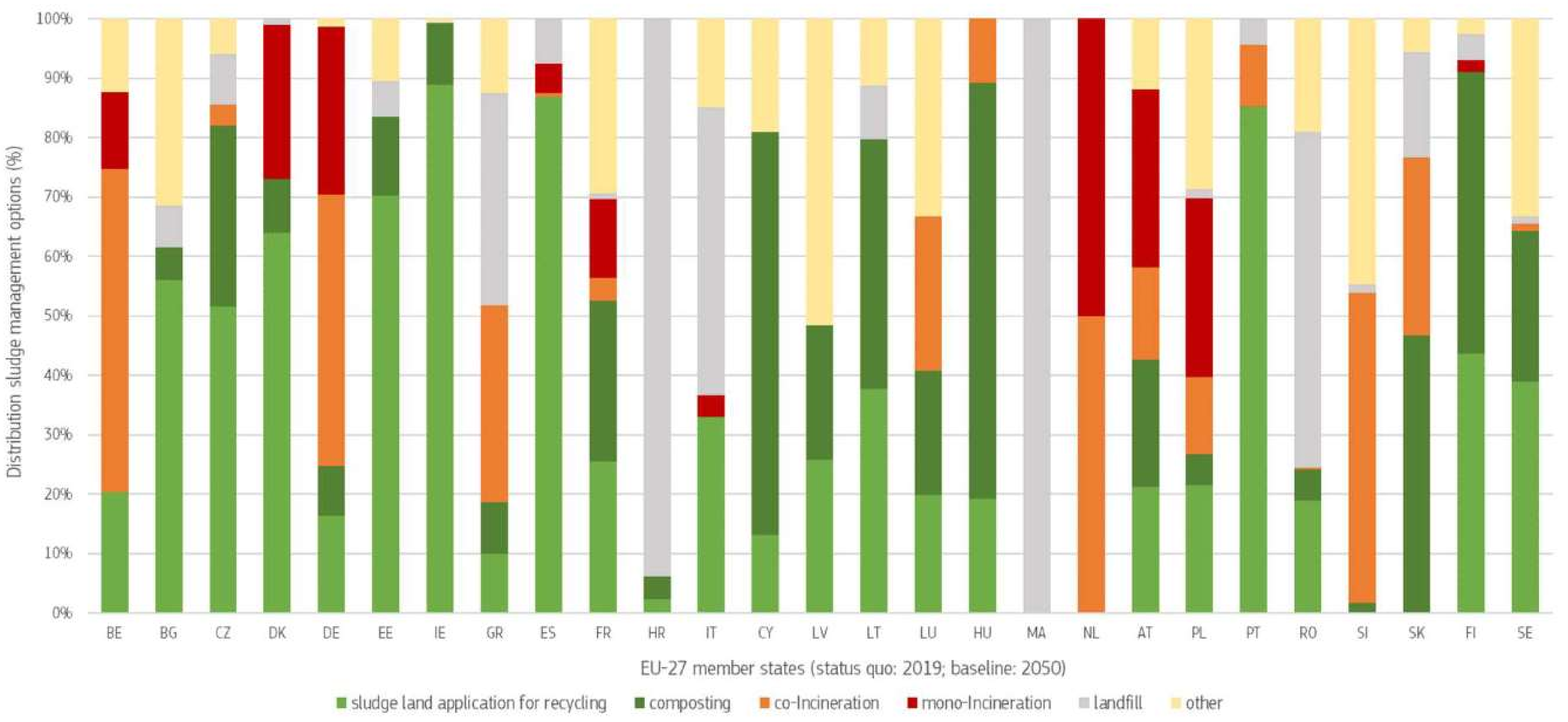

Figure 11. Final uses for sewage sludge management in the status quo (2019) and baseline (2050) (own computations).

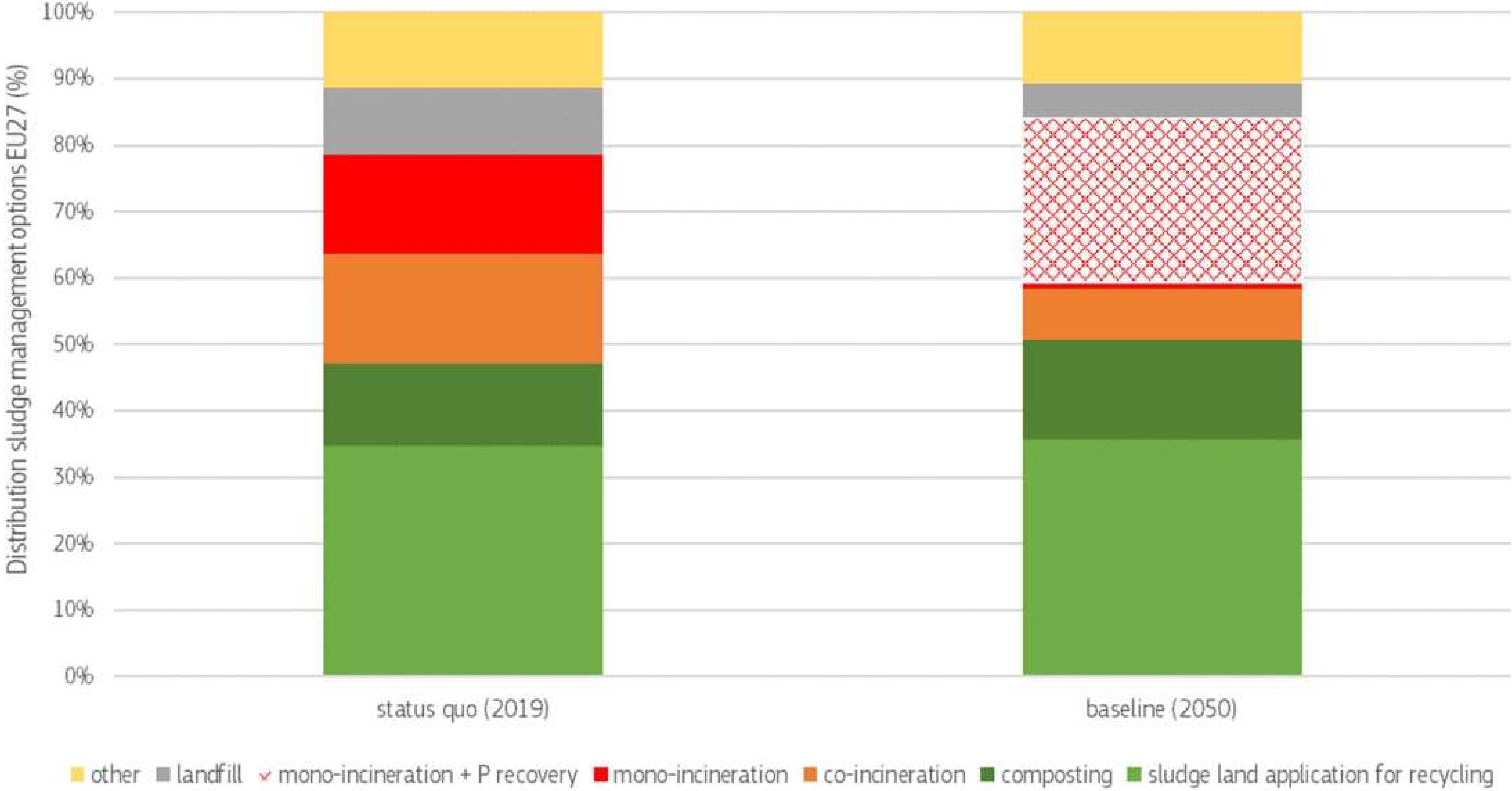

Table 1. Regulatory limit values for metals present in sewage sludge (mg kg^{-1} dry matter) in the EU Sewage Sludge Directive (SSD), national legislation across from different EU Member States, and the EU Fertilising Products Regulation (FPR; Product Function Categories Organic Fertilisers and Soil Improvers). The distribution of metals observed in sewage sludge has been inventoried from 61 samples taken in different EU Member States, as recorded in the JRC FATE sampling campaign (Tavazzi et al., 2012).

	SSD		national legislation		FPR	observed in sewage sludge		
	min	max	Min	max	max	min	max	average
As	-	-	15	25	40	<d.l.	56.1	-
Cd	20	40	0.8	10	1.5-2	<d.l.	5.1	0.9
Cr	-	-	25	900	-	11	1 542	80
Cu	1 000	1 750	75	1 000	300	27	578	257
Hg	16	25	0.75	8	1.0	0.1	1.1	0.4
Ni	300	400	30	200	50	9	310	29
Pb	750	1 200	100	900	120	4	430	48
Zn	2 500	4 000	300	4 000	800	213	1 218	663

Other possible policies that are not further considered in the analysis

- **Monitoring framework, without possibility to set EU-wide limits for contaminants of greatest concern measured in sewage sludge as part of the SSD**

In this policy proposal, MS would have to set up a monitoring framework to identify contaminants of highest concern in sewage sludge. Based on the data collection, MS could then individually draw up quality requirements and limit values for sewage sludge as part of their national legislation.

- **Repeal the SSD and self-regulation based on voluntary standards**

This measure would involve the repeal of the SSD and the introduction of self-regulation to ensure human health and environmental protection from the use and management of sewage sludge on agricultural land. Self-regulation is where **business or industry sectors formulate codes of conduct** or operating constraints on their own initiative for which they are responsible for enforcing. However, pure self-regulation is uncommon and at the EU level it generally involves the Commission in facilitating the drawing up of the voluntary agreement. Self-regulation for land applications of sewage sludge is relatively uncommon in the EU, and to the best of our knowledge presently limited to certification schemes in Sweden, France and Germany.