European Commission

Implementation Report of the Sewage Sludge Directive 86/278/EEC

Final implementation report

Written by Wood in partnership with Trinomics, Ricardo, IMDEA and Tyrsky

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Environment

EUROPEAN COMMISSION

Directorate-General for Environment
Directorate B
Unit B3 Circular Economy - From waste to resources

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Implementation Report of the Sewage Sludge Directive 86/278/EEC

Final implementation report

Directorate-General for Environment

2022

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Document revisions

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1	Implementation report (draft outline)	14/04/2020
2	Implementation report (revised)	30/07/2021
3	Implementation report – final	05/11/2021
4	Implementation report – final i2	15/12/2021

Contents

1. Introduction

The purpose of the report is to summarise the implementation of Directive 86/278/EEC on the protection of the environment, and in particular of the soil, when sewage sludge is used in agriculture (the Sewage Sludge Directive or SSD). The primary purpose of the Directive is the ensure that the use of sewage sludge is regulated in a manner which prevents any detrimental impact on soil, vegetation, animals, and man[1]. To achieve this, the Directive outlines a number of compulsory requirements for Member States. Although the Directive sets limitations and requirements for the EU, Member States are able to set more stringent national requirements than those set in the SSD. This is an option which has been applied by a number of Member States, with national legislation exceeding the requirements set out in the SSD in many instances.

This report focuses on the information reported in response to the implementation questionnaire[2] for the 2016 – 2018 reporting period for the SSD. The questionnaire has been completed by all 27 Member States and provides, as required, details on the national implementation plans for the Directive. This report builds upon the previous report, published three years ago, and is part of a longer series of reports on the implementation of the Directive. The report focuses on a number of key areas, following the order of the questionnaire on implementation. Key topics which are analysed include national limit values set for the application of heavy metals in soils, sludges and to agricultural land, sludge treatment techniques, frequency of soil analysis, and any national prohibitions on the use of sludge.

The data reported by Member States has been used to conduct a horizontal analysis, i.e., to ascertain the current level of implementation of several provisions of the Directive across all Member States. This analysis will help to identify if there are any remaining gaps in the implementation of the Directive in Member States, and to understand any additional practices which have been implemented across the EU. Where possible, results have been compared with the information provided in the 2013 – 2015 questionnaire in order to assess the evolution of legislative policies and implementation of the Directive over a longer time period.

[1] Council Directive 86/278/EEC of 12 June 1986 on the protection of the environment, and in particular of the soil, when sewage sludge is used in agriculture (OJ No L 181/6 of 4.7.86)

[2] Commission Decision of 24 October 1994 concerning questionnaires for Member States reports on the implementation of certain Directives in the waste sector (implementation of Council Directive 91/692/EEC), https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A31994D0741

2. Completeness assessment

This section provides an overview of the approach taken to assess completeness of Member States implementation reports. The assessment covered all questions included in the Commission Decision 94/741/EC[3]. For each question, completeness of the information provided by the Member States was checked and a traffic light system was used to highlight whether a response was provided, and whether the information was complete or incomplete. The scoring is described in Table 2.1. Answers marked amber, red, optional or N/A were complemented with a short justification stating what is missing or considered incomplete. For Member States reporting at regional level, an answer was marked as complete only if information was provided for all regions.

Table 2.1 Traffic light rating system (Red-Amber-Green) for assessment of data completeness

R	No answer provided although required (1)
A	Information partly missing or unclear
G	Complete information available
	No answer but it was an optional question
N/A	Member State responded not applicable or based on the information in response to other questions it was judged as not applicable

Notes: (1) Gaps in Member States reporting have been flagged in Member States overview reports that will be provided to the Member States for validation. The intention was that any missing information provided by the Member States during validation of these summary reports will be reflected in the final report presenting the EU-level assessment of implementation of the SSD. It is unclear however whether the feedback from Member States will be received by 25 April 2021 when the final report is due.

Table 2.2 below provides the results for each Member State, Norway and United Kingdom in a matrix showing the level of completeness for each aspect of the questionnaire. The assessment is based on the information provided by the Member States in the original reporting and was updated in light of any additional clarifications received during validation of Member State summary reports. The assessment highlights the questions where information provided was particularly incomplete or missing (considered horizontally across all Member States).

Overall, across all questions Member State reporting is considered largely complete. The questions with most gaps are:

- Section I Q2c (concerning national measures stricter than the provisions in the SSD): Bulgaria, Lithuania, Portugal, and Spain did not respond to this question.
- Section II Question 5a (concerning reduced limit values and other measures at national level where the pH of the soil is below 6): Bulgaria, Estonia and Lithuania did not report whether reduced limit values/other rules permitted at national level are compliant with Article 8 for soil with a pH below 6,

[3] Commission Decision of 24 October 1994 concerning questionnaires for Member States reports on the implementation of certain Directives in the waste sector (implementation of Council Directive 91/692/EEC), https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A31994D0741

- Section II Question 5b (concerning the details of reduced limit values and additional measures listed in question 5a): this question was only applicable if the answer to question 5a was yes. In addition to Bulgaria, Estonia and Lithuania which did not respond to question 5a, additional information was missing for Hungary and Italy,
- Section II Question 7 (concerning quantitative data on the sludge produced, used in agriculture and optionally the surface covered, as well as average content of sludge used in agriculture): Gaps in reporting to this question varied across the Member States. Austria did not report information for all regions. Czechia provided no information on the N and P content in sludge. Denmark provided no data on average content in sludge. Italy reported information only for seven out of 21 regions. Latvia provided no information on the total sludge used in agriculture. Luxembourg, the Netherlands, and Romania provided no data for 2018. Slovakia did not provide data on sludge used in agriculture nor on the average content in sludge. Slovenia did not provide information on the average content of heavy metals and nutrients in sludge. Spain provided no data for the full reporting period.

At a Member State level, the largest gaps in reporting have been identified for the following six Member States: Lithuania (eight gaps), Spain (six gaps), Bulgaria (five gaps), Estonia (four gaps), Italy and Slovakia (three gaps). 13 Member States (Austria, Belgium, Cyprus, Czechia, Denmark, Finland, Hungary, Latvia, Luxembourg, the Netherlands, Portugal, Romania, and Slovenia) provided questionnaires with one or two gaps or partial answers to some questions. Seven Member States (Croatia, Germany, Greece, France, Ireland, Poland, and Sweden) provided fully complete responses. The response of Malta is also judged as complete - most questions are not applicable to Malta as no sludge is used on agricultural land.

Table 2.2 Summary table for completeness assessment of Member State reporting on implementation of the SSD in the period 2016-2018

	European Union Member States																										Non-EU	
	AT	BE	BG	CY	CZ	DE	DK	EE	EL	ES	FI	FR	HR	HU	IE	IT	LT	LV	LU	MT	NL	PL	PT	RO	SE	SK	SI	NO	UK
SECTION I																													
Q1.a)	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	R	G	G	G	G	G	G	G	G	G	G	G	G
Q1.b)*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	G	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	R	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Q2.a)	G	G	R	G	G	G	G	G	G	G	G	G	G	G	G	G	R	G	G	N/A	G	G	G	G	G	G	G	G	G
Q2.b)*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	G	G	N/A	N/A	N/A	N/A	N/A	N/A	N/A	R	G	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Q2.c)	G	G	R	G	G	G	G	G	G	G	G	G	G	G	G	G	R	G	G	N/A	G	G	R	G	G	G	G	G	R
Q2.d)*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	G	G	R	N/A	N/A	N/A	N/A		N/A	R	N/A	N/A	N/A	N/A	N/A	R	N/A	N/A	N/A	N/A	N/A	R
SECTION II																													
Q1	G	G	G	G	G	G	G	R	G	G	G	G	G	G	G	R	G	G	G	N/A	G	G	G	G	G	G	G	G	G
Q2a.	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	N/A	G	G	G	G	G	G	G	G	G
Q2b.*	G				G				G	G		G	G			G	G	G	G	N/A	G	G	G	G		G	G	G	G
Q2c.*										G		G					G			N/A		G	G			G	G	G	G
Q2d.*										G		G								N/A			G			G	G		
Q2e.*	G									G		G					G			N/A			G			G	G	G	G
Q3a.	G	A	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	N/A	G	G	G	G	G	G	G	G	G
Q3b.	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	R	G	G	G	G	G	G	G	G	G	G	G	G
Q3c.*	A	G	G	R	G	N/A	G	G	N/A	R	G	G	G	G	G	G	G	G	G	N/A	G	G	G	N/A	G	N/A	G	N/A	G
Q3d.	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	R	G	G	G	G	G	G	G	G	G	G	G	G
Q3e.*	A	N/A	N/A	N/A	N/A	N/A	N/A	R	N/A	N/A	G	G	N/A	N/A	G	N/A	R	N/A	N/A	N/A	N/A	N/A	N/A	N/A	G	N/A	N/A	N/A	G
Q4	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G
Q5a.	G	G	R	G	G	G	G	R	G	G	G	G	G	G	G	G	R	G	G	G	G	G	G	G	G	G	G	G	G
Q5b.*	G	G	R	N/A	N/A	G	N/A	R	N/A	N/A	G	G	G	R	N/A	R	G	N/A	G	N/A	N/A	N/A	G	N/A	N/A	G	N/A	N/A	G
Q6a.	G	A	G	G	G	G	G	G	G	G	R	G	G	G	G	G	G	G	G	N/A	G	G	G	G	G	R	G	G	G
Q6b.	G	A	R	G	G	G	G	G	G	G	G	G	G	G	G	R	G	G	G	N/A	G	G	G	G	G	R	G	G	G
Q7	A	G	G	G	A	G	A	G	G	G	G	G	G	G	G	A	G	R	A	N/A	A	G	G	A	G	R	A	G	A
Q8	G	G	G	G	G	G	G	G	G	G	G	G	G	R	G	G	R	G	G	N/A	G	G	G	G	G	G	G	G	G

3. Incorporation into national law

Part I of the questionnaire requires Member States to report on whether the Commission has been notified about the current laws and regulations incorporating SSD, national measures adopted pursuant to Article 5 of the Directive and stricter measures applied at national level compared to SSD.

3.1 Details of current laws and regulations incorporating the Directive

1.a. Has the Commission been provided with details of the current laws and regulations in force to incorporate the Directive as amended into national law?
1.b. If the answer to (a) above is 'No', please state the reasons why.

All Member States except for Lithuania provided a response to this question. Responses were also provided by Norway and the United Kingdom.

25 Member States have reported that they had provided the Commission with details of the current laws and regulations in force to incorporate the SSD into national law. Only Bulgaria stated in their response that some changes to the regulatory framework might have been implemented in the 2016-2018 reporting period. However, it is not clear what changes these were based on the information reported. Austria and Belgium used this question to provide additional information concerning bans on the use of sewage sludge in agriculture (for Austria such a ban has been introduced in Salzburg, Vienna, and Tyrol, and in Belgium in Flanders).

Estonia responded negatively to the question. It explained that studies show that Estonian soils contain very low levels of heavy metals and that the use of sewage sludge is prohibited in Estonia if the heavy metal content of the soil does not comply with the established limit values. It is unclear how the explanation provided links to the topic of the question, and it is therefore considered a likely reporting error. In the 2013-2015 questionnaire, Estonia stated that all details of the current laws and regulations had been provided to the Commission.

The number of MSs that have indicated that they have provided details of their current laws and regulations to the Commission has increased in comparison to the previous reporting periods. For the 2013 – 2015 period 22 Member States indicated this, (although the remaining six Member States had not completed the questionnaire). The previous reporting periods, (2013 – 15 and 2010 – 2012) both also noted that all responses provided indicated that all Member States had transposed the Directive into national legislation.

3.2 National measures adopted pursuant to Article 5

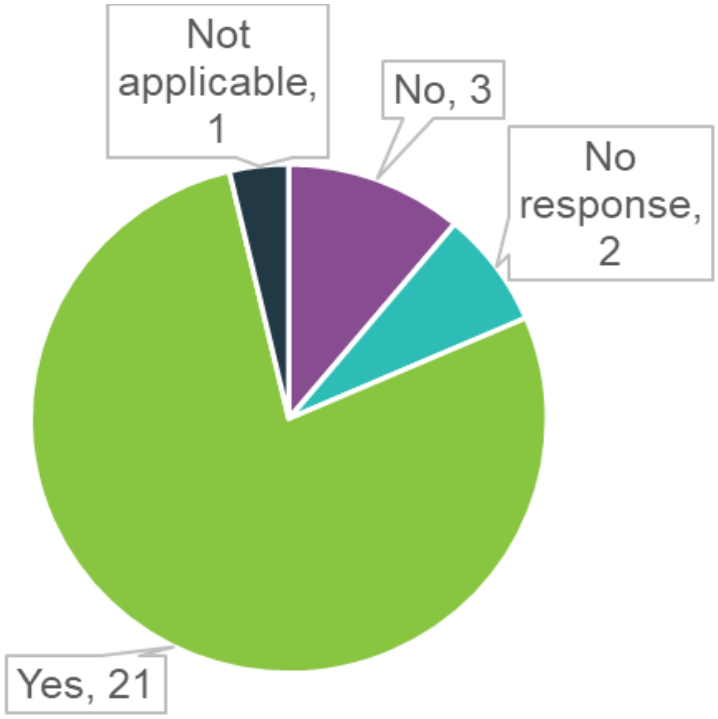
2.a. If national measures have been adopted pursuant to Article 5 to ensure that sewage sludge may not be used in soils with concentrations of one or more heavy metals that exceed the agreed limit values, has the Commission been notified of these measures?
2.b: If the answer to (a) above is 'No', please state the reasons why.

All Member States except for Bulgaria and Lithuania provided a response to this question. Responses were also provided by Norway and the United Kingdom. Member State responses to the question are illustrated in Figure 3.1. 21 Member States, Norway and the United Kingdom responded that the Commission had been notified about national measures adopted pursuant to Article 5. Malta responded that the question did not apply.

Estonia, Greece, and Latvia responded "No" and accordingly provided further details in response to question 2.b. In all three cases the question appears to have been misunderstood:

- Estonia and Latvia explained in 2.b. that the Commission had not been notified as there were no stricter measures about which the Commission should be notified. Thus, the answer to 2.a. should have been "not applicable" rather than "no".
- Greece provided details of the stricter measure (i.e., a permitting process was put in place) in question 2b. It did not state the reasons for the lack of notification to the Commission. The same answer was provided by Greece for the 2013-2015 reporting period. The response appears, therefore, to be a re-current error in interpretation of the question.

Figure 3.1 Number of Member States responding to question 2a on notification of national measures according to Article 5



Notes: The chart excludes non-EU Member States (Norway, United Kingdom)

Approximately 88% of the Member States who provided responses agreed that the Commission had been notified of the measures. For the 2013 – 2015 reporting period, a similar proportion of responses from Member States also agreed with this statement (86%), whilst for the 2010 – 2012 period this proportion was 87%.

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3.3 National measures stricter than those provided for in the Directive

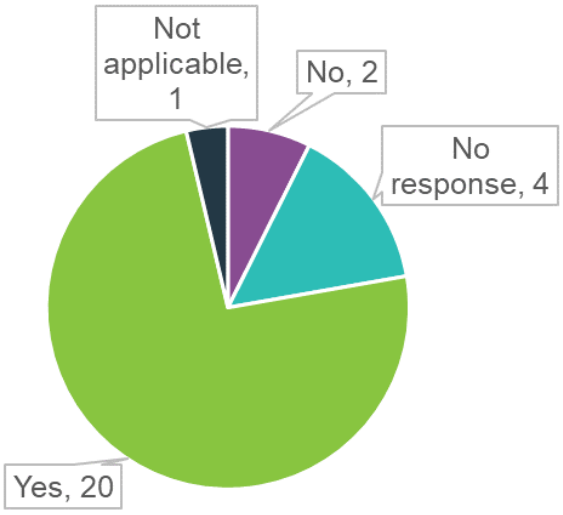
2.c: If national measures have been adopted that are stricter than those provided for in the Directive, has the Commission been notified of these measures pursuant to Article 12?

2.d: If the answer to (c) above is 'No', please state the reasons why:

All Member States except Bulgaria, Lithuania, Portugal, and Spain provided a response to this question. A response was also provided by Norway but not the United Kingdom. 20 Member States and Norway responded that the Commission had been notified about stricter national measures pursuant to Article 12. Malta responded that the question did not apply to it. Based on the responses provided and the wording of the question, it is not clear whether any Member State introduced any new stricter measures compared to the 2013-2015 reporting period or whether this refers to stricter measures than the SSD more generally. Member States' responses to the question are illustrated in the figure below.

Estonia and Greece responded "No" and provided further details in response to question 2.d. Estonia stated that there were no stricter measures to notify. Thus, similarly as in question 2.b. the answer should have been "not applicable" rather than "no". Greece provided details of the national measure (i.e., on concentration limits and application of maximum quantities of sludge). It did not state the reasons for the lack of notification to the Commission. Similarly, to question 2.b., and the response appears to be an error in interpretation of the question.

Figure 3.2 Number of Member States responding to question 2c on notification of stricter measures than those provided for in the Directive



Notes: The chart excludes non-EU Member States (Norway, United Kingdom)

4. Implementation of the Directive

4.1 Sewage sludge from septic tanks and similar installations

1. Please quote any specific conditions which have been deemed necessary for the protection of human health and the environment in accordance with the first indent of Article 3(2), when using sludge residues from septic tanks and other similar installations for the treatment of waste water for agricultural purposes

All Member States except Estonia and Italy responded to this question. While Hungary and Poland did not respond to the question additional information provided stated that this question is not applicable and thus this is not considered a gap.

Five Member States have set conditions deemed necessary for the protection of human health and the environment aligned with those in place at urban waste water treatment plants. One Member State (Bulgaria) stated this and provided the example that sludge must be treated and meet the requirements for heavy metal content in accordance with Annexes 1 and 2, as well as microbiological and parasitological requirements set out in Annex 3 to the Ordinance on the procedures for recovery of sewage sludge by using them in agriculture. A further two Member States responded that sludge that has not been treated and does not meet the specific conditions listed in national legislation may not be used for agricultural purposes.

A range of different responses were provided by a further 12 Member States. The responses differed in providing a range of different conditions which have been deemed necessary to protect human health and the environment. A few examples of responses include detailed answers provided by different regions in Austria, focussed mainly on listing the prohibitions for the application of sewage sludge, such that sewage sludge may be applied only on the basis of a certificate of application (Styria) and that sludge from municipal waste water from non-biological waste water purification plants – may not be applied to agricultural land (Carinthia). Prohibitions were also listed for the remaining Austrian regions. One response of interest was provided by Germany, which stated that their law requires that the contents of septic tanks with no drainage facilities, and similar installations, must be handed over to the local waste water management authorities and, therefore, cannot be used directly for agricultural purposes. Furthermore, the Netherlands noted in its territory all sludge used in agriculture must have been treated by biological, chemical, or thermal methods, long-term storage, or some other suitable process with the result that the majority of the pathogenic organisms in the sludge are killed. As part of their response, Slovenia stated that applications for an environmental permit to use compost or digestate must contain the following (amongst others):

1. The location of the intended use of compost or digestate, specifying the parcel number of the piece of land and the code and name of the cadastral municipality or GERK-PID in the case of agricultural land,
2. The quantity of compost or digestate that is intended to be used,
3. Data on owners or lessees of land and their declarations stating that they agree with the quantity of compost or digestate that is to be used, and with the time of its use,

Slovenia has also stated that the use of quality class or digestate shall be permitted unless otherwise specified in the regulations governing water protection areas. It is unclear which specific regulation(s) is being referred to in the response. Further requirements set out by Slovenia also include requiring a user of compost of digestate of quality class 1 to produce a written fertiliser plan for use on agricultural land; and a prohibition of fertilisation with organic liquid fertilisers, including sewage sludge. In both instances a detailed list of conditions is also applicable.

Two Member States responded that there are no special conditions in place (Croatia and Sweden) with a further Member State reporting that these conditions have not been defined (Slovakia) It is unclear from the response whether Slovakia has, therefore, also not set any specific conditions. In Greece and Belgium (Brussels and Flanders) sludge residues from septic tanks have not been used in agriculture.

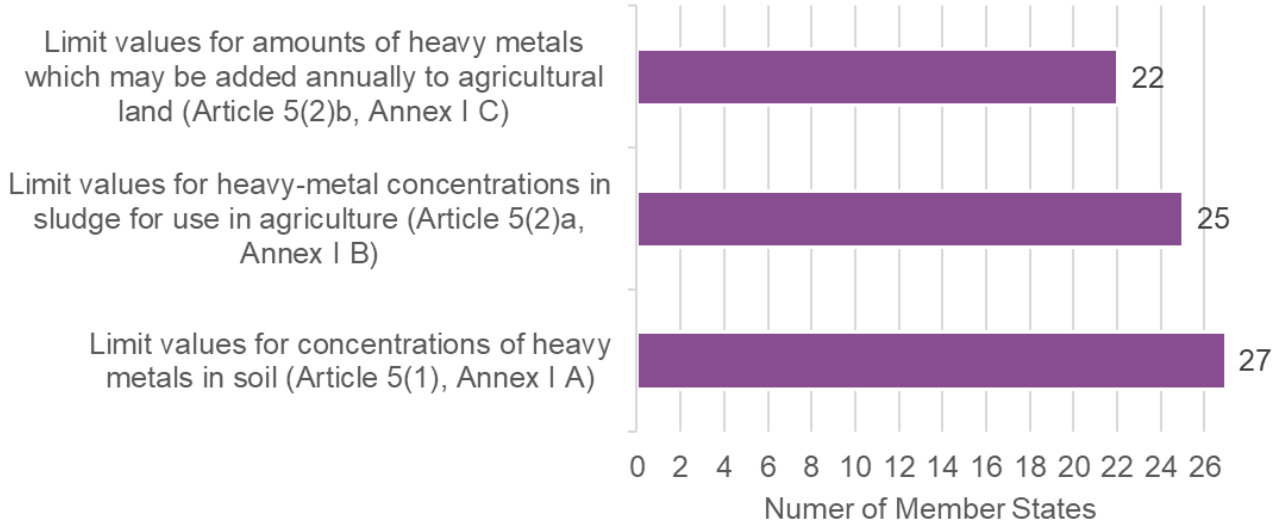
For the 2013 – 2015 reporting period, 14 Member States out of the 20 that responded quoted specific conditions they had implemented in their responses, whilst for the 2010 – 2012 period, 22 Member States quoted specific conditions they had implemented in their replies or else reported that no such specific conditions had been deemed necessary. The reporting for 2016 – 2018 has similarly shown that a majority of Member States (17) considered there to be conditions which have been deemed necessary.

4.2 National limit values

2.a: With regard to Article 5, please complete the table, stating whether any of the information given is an estimate.
2.b: If the option proposed under Article 5(2)(a) has been chosen, please indicate the maximum quantity of sludge that may be applied to the soil per surface unit per annum (in tonnes of dry matter per hectare per annum).
2.c: If any less stringent limit values for heavy-metal concentrations in soils have been permitted in accordance with Annex IA, please complete the table, stating whether any of the information given is an estimate.
2.d: If any less stringent limit values for heavy-metal concentrations in soils have been permitted in accordance with Annex I A, footnote 2, please complete the table.
2.e. If any less stringent limit values for heavy-metal concentrations in soils have been permitted in accordance with Annex I C, footnote 1, please complete the following table, stating whether any of the information given is an estimate.

All Member States as well as Norway and United Kingdom reported by completing the tables of limit values provided in question 2.a. Figure 4.1 presents the number of Member States reporting limit values set in accordance with Article 5 of the SSD. As shown, all Member States have set limit values for concentrations of heavy metals in soil. 25 and 22 Member States have set limit values for heavy-metals concentrations in sludge applied to agricultural land and heavy metals which may be added annually to agricultural land, respectively. Spain also noted that the option proposed in Article 5(2) (a) had not been retained and that the option proposed in Article 5(2) (b) had been chosen.

Figure 4.1 Number of Member States reporting limit values in accordance with Article 5 of the SSD



4.2.1 Limit values for concentrations of heavy metals in soil

Member States have set separate limits for the concentration of each heavy metal in soil. It should be noted that for some metals some Member States have set upper and lower limits, whilst others have set only one limit. Where only one limit has been set this has been described as the upper limit in the figures. It should be noted that for Spain and Portugal the upper limit values in this section refer to soil with a pH level greater than 7, and for Bulgaria a pH level greater than 7.4. Spain and Portugal have set lower limit values for soil with a lower pH level than 7 for all metals.

It should be noted that Spain have stated that with the possibility contained in the note in annex IA of the Spanish Directive, established in the decree of October 29 (which regulates the use of sewage sludge in the agricultural sector), higher values for Copper, Nickel and Zinc in soils. with ph.> 7 have been set. The limit values for these parameters do not exceed the values of annex IA by more than 50%. Bulgaria has also set lower limit values for soil with a pH level between 6 - 7.4 for all metals except Mercury and Chromium. The difference in limit values displayed in the charts for these Member States therefore represents the lowest and highest limit values outlined for soils of different pH levels. The other reporting Member States have not provided additional references to soil pH levels and have set only one limit in reference to all soils with the exception of Lower Austria reporting for Cadmium.

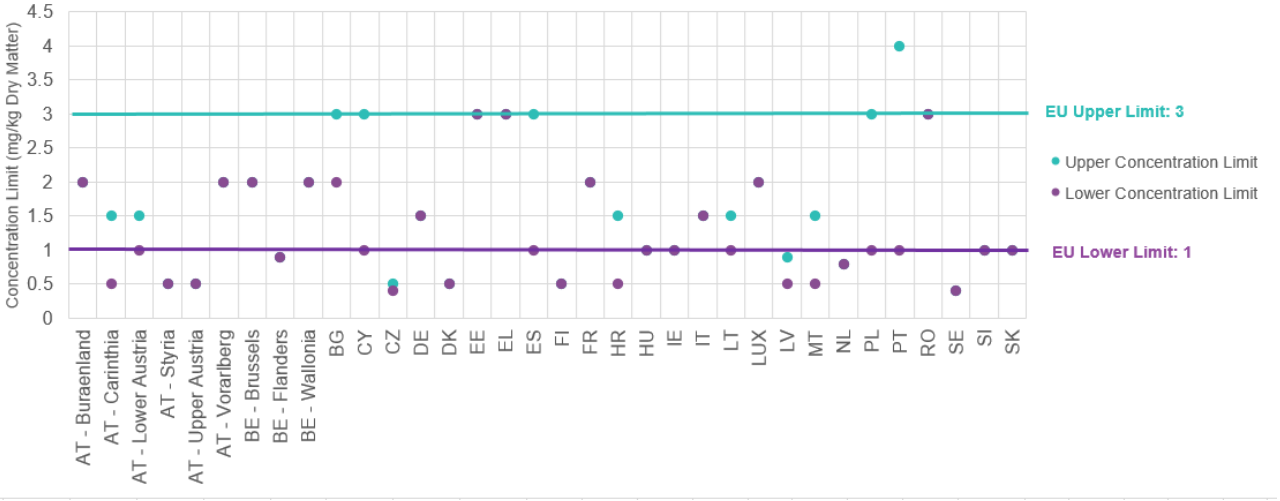
In all charts where a Member State has reported only one limit this has been described as the lower limit and is represented by a purple marker.

Cadmium

The limit values for each Member State for the concentration of cadmium are displayed in the figure below. Portugal has set upper limit values above the EU limit value limits set out in the SSD. It has been noted that this applies to land where commercial crops are grown for animal consumption only. This applies to soil with a pH level greater than 7. It is likely that the diverging limit value is linked to pH levels of the soil, however confirmation that this does not constitute non-

compliance with the requirements of the SSD should be sought with the Member State. The lower limit displayed for Austria represents the limit for soil with a pH level of below 6. Seven Member States have set their limits in accordance with the upper limits set out in the SSD. The most stringent limits have been set in Czechia and Sweden.

Figure 4.2 EU Member State limit values for the concentration of cadmium in soils

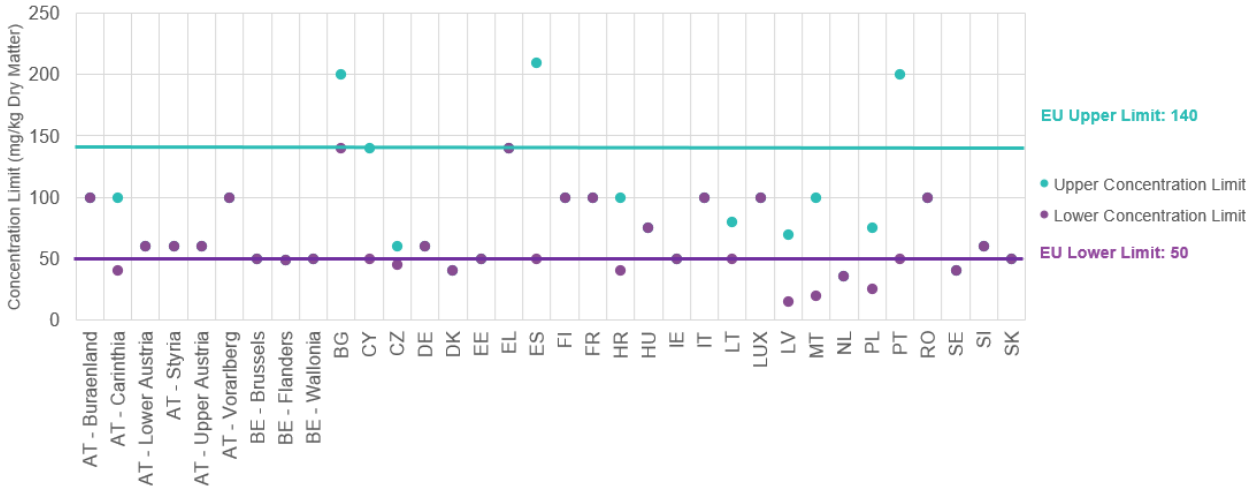


Copper

The limit values for each Member State for the concentration of copper are displayed in the figure below. Bulgaria, Portugal, and Spain have set upper limit values above the EU limit value limits set out in the SSD, which applies only to soil with a pH level above 7.4 (Bulgaria) or above 7 (Portugal and Spain). Portugal have noted that this limit applies to land where commercial crops are grown for animal consumption only. It is likely that the diverging limit values are linked to pH levels of the soil, however confirmation that this does not constitute non-compliance with the requirements of the SSD should be sought with the Member State.

Two Member States (Cyprus and Greece) have set their limits in accordance with the upper limits set out in the SSD. The most stringent limits have been set in the Netherlands, with Sweden and Denmark setting only slightly less strict limits.

Figure 4.3 EU Member State limit values for the concentration of copper in soils

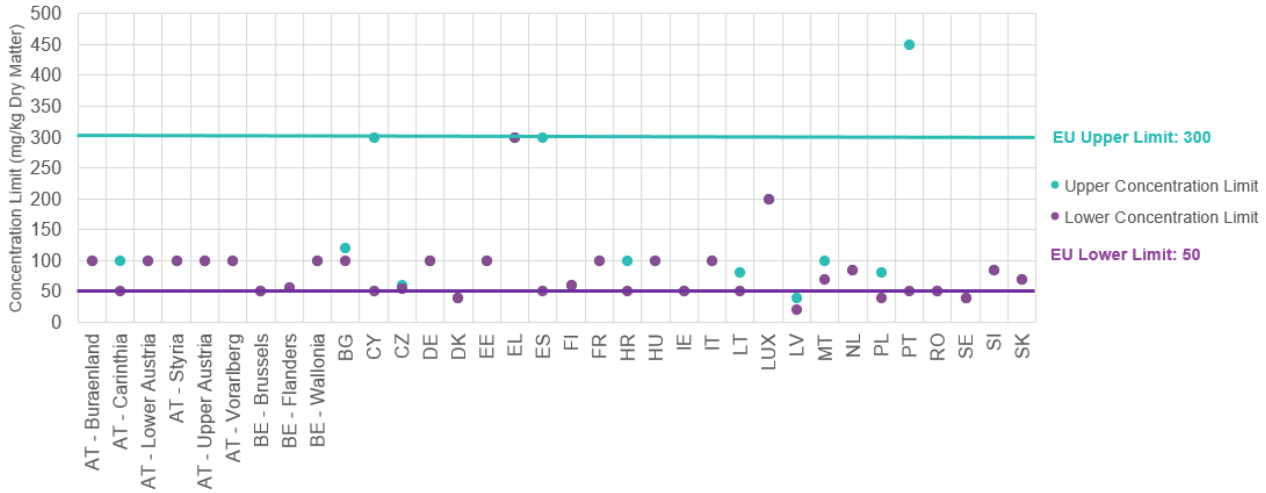


Lead

The limit values for each Member State for the concentration of lead are displayed in the figure below. Portugal is the only country to have set a national limit value above the upper EU limit set out in the SSD. This applies to soil with a pH level greater than 7. Portugal have noted that this limit applies to land where commercial crops are grown for animal consumption only. It is likely that the diverging limit value is linked to pH levels of the soil, however confirmation that this does not constitute non-compliance with the requirements of the SSD should be sought with the Member State.

Three Member States (Cyprus, Greece, and Spain) have set their limits in accordance with the upper limits set out in the SSD. The most stringent limits have been set in Denmark, Latvia, and Sweden.

Figure 4.4 EU Member State limit values for the concentration of lead in soils

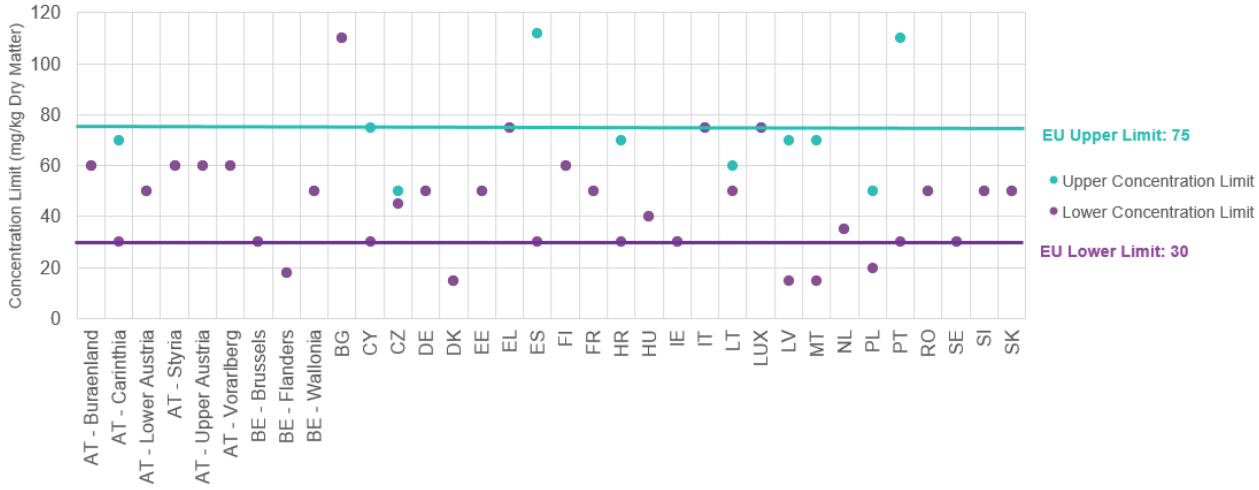


Nickel

The limit values for each Member State for the concentration of nickel are displayed in the figure below. Bulgaria, Portugal, and Spain have set national limit values above the upper EU limit set out in the SSD. This applies only to soil with a pH level above 7.4 (Bulgaria) or above 7 (Portugal and Spain). Portugal have noted that this limit applies to land where commercial crops are grown for animal consumption only. It is likely that the diverging limit values are linked to pH levels of the soil, however confirmation that this does not constitute non-compliance with the requirements of the SSD should be sought with the Member State.

Four Member States (Cyprus, Greece, Italy, and Luxembourg) have set their limits in accordance with the upper limits set out in the SSD. The most stringent limits have been set in Denmark. It should be noted that Bulgaria have provided different limit values for soils with different pH levels which have not been displayed in the chart.

Figure 4.5 EU Member State limit values for the concentration of nickel in soils

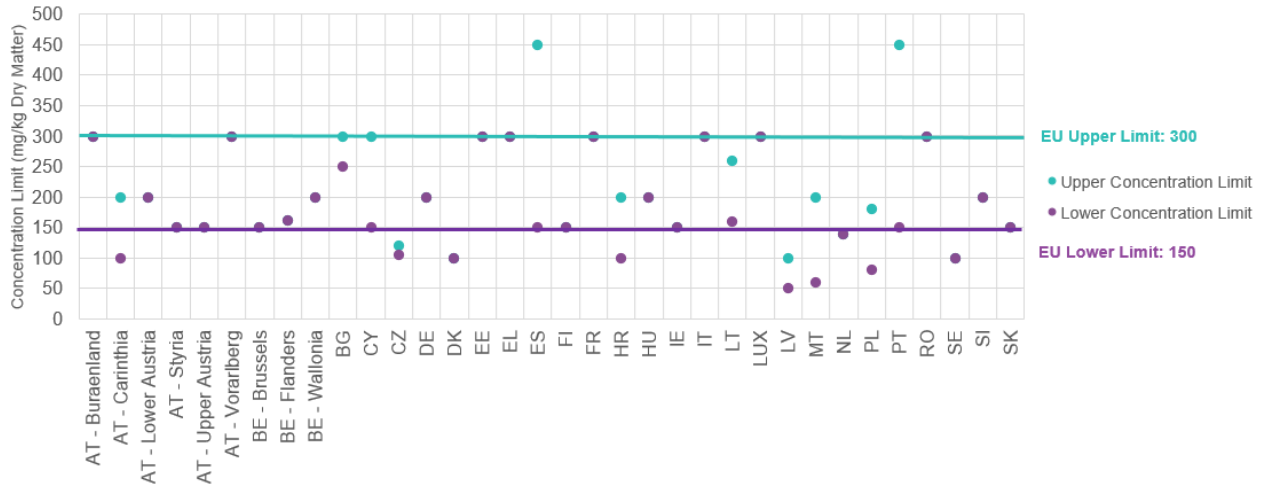


Zinc

The limit values for each Member State for the concentration of zinc are displayed in the figure below. Portugal and Spain are the only countries to have set a national limit value above the upper EU limit set out in the SSD. This applies to soil with a pH level greater than 7. A lower limit has been set for soil with a lower pH level, which is aligned with the limits set out in the SSD. It is likely that the diverging limit values are linked to pH levels of the soil, however confirmation that this does not constitute non-compliance with the requirements of the SSD should be sought with the Member States.

Nine Member States (Bulgaria, Cyprus, Estonia, Greece, Italy, Luxembourg, Romania and two Austrian regions) have set their limits in accordance with the upper limits set out in the SSD. The most stringent limits have been set in Latvia, Sweden, and Denmark.

Figure 4.6 EU Member State limit values for the concentration of zinc in soils

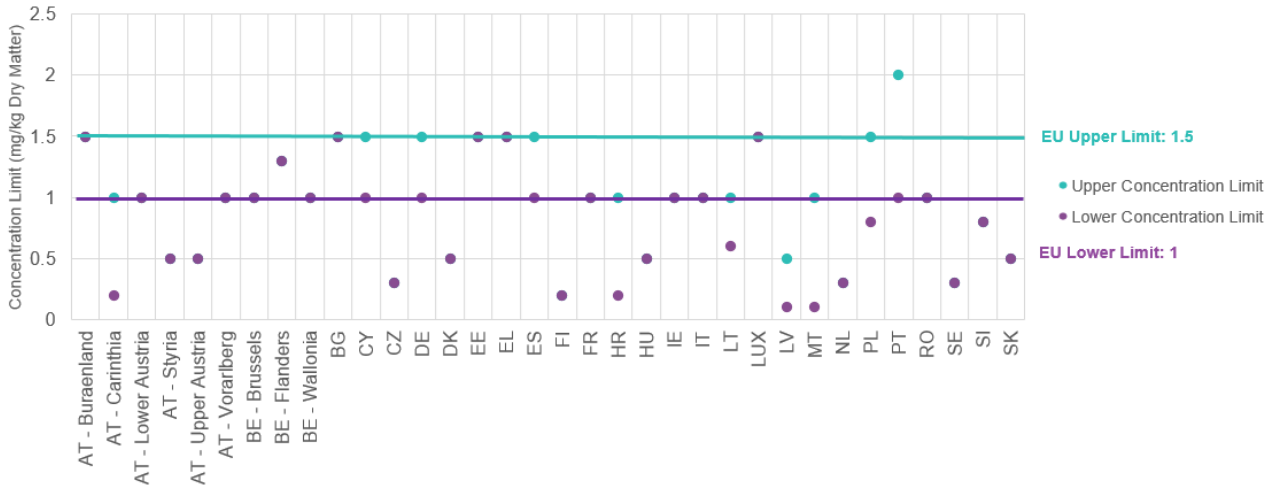


Mercury

The limit values for each Member State for the concentration of mercury are displayed in the figure below. Portugal is the only Member State to have set a national limit value above the upper EU limit set out in the SSD. This applies to soil with a pH level greater than 7. Portugal have noted that this limit applies to land where commercial crops are grown for animal consumption only. It is likely that the diverging limit value is linked to pH levels of the soil, however confirmation that this does not constitute non-compliance with the requirements of the SSD should be sought with the Member State.

Nine Member States (Bulgaria, Cyprus, Estonia, Greece, Spain, Luxembourg, Portugal and one Austrian region) have set their limits in accordance with the upper limits set out in the SSD. The most stringent lower limit has been set by Finland.

Figure 4.7 EU Member State limit values for the concentration of mercury in soils

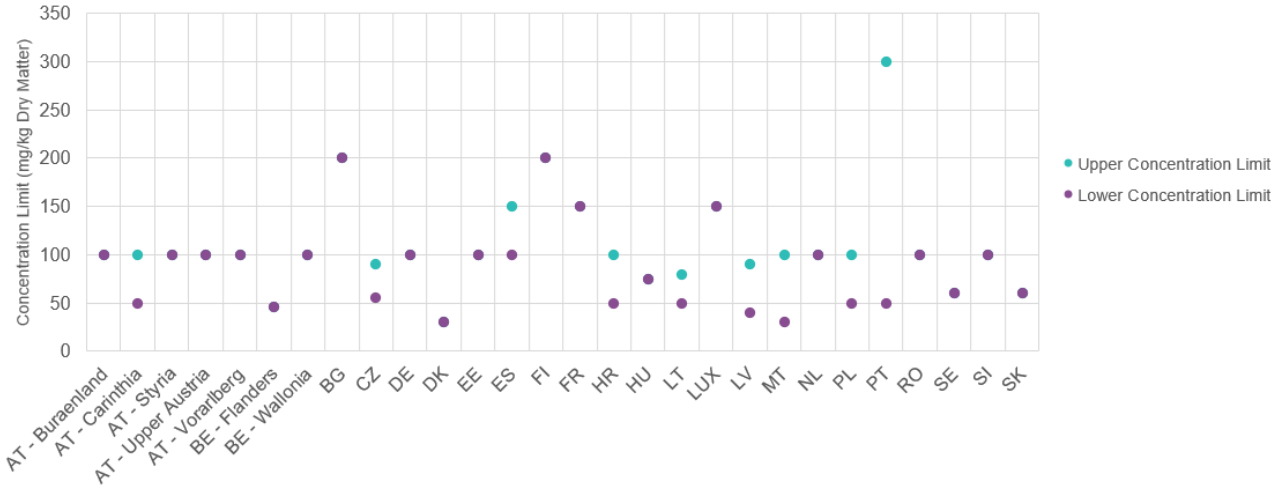


Chromium

The limit values for each Member State for the concentration of chromium are displayed in the figure below. The most stringent upper limit has been set by Denmark, and the least stringent by Portugal, although this applies only to soil with a pH level greater than 7.

The EU does not set a limit for the concentration of chromium in soil under the SSD.

Figure 4.8 EU Member State limit values for the concentration of chromium in soils



Conclusions

With the exception of chromium, Member States have reported national limits for the concentration of all metals in soil. All limits have been set below or equal to the upper limit set out in the SSD. The only exceptions are Bulgaria, Portugal and Spain which have set limits in exceedance of some of these limits for soils with a high pH level (greater than 7 for Portugal and Spain or greater than 7.4 for Bulgaria). For Spain and Bulgaria, only some of the limit values in the Directive are exceeded but in the case of Portugal, limit values have exceeded those set out in the SSD for all metals (for soil with a pH level greater than 7). For Spain, the conditions under which the higher limits were set have been outlined above.

The countries which have set the most stringent upper limits have typically been Denmark, Latvia, and Sweden, although the Netherlands and Finland have also set strict limits for copper and mercury respectively.

The reporting was therefore largely aligned with the reporting for the 2013 – 2015 reporting period, which recorded that all of the limit values for heavy metal concentrations in soil reported by Member States were either within or lower than the ranges permitted by the Directive. Similarly, to the 2016 – 2018 reporting period, it was noted that for the earlier period that Denmark and Sweden had typically set the most stringent limits, with the two Member States setting lower limits in every case. The limit values for heavy metal concentrations in soil reported by the Member States were also either lower or within the ranges permitted by the Directive for the 2010 – 2012 period also. During this period Sweden set limits lower than the minimum for five cases, highlighting that the low limits in Sweden have been in place since at least 2010.

4.2.2 Limit values for concentrations of heavy metals concentrations in sludge for use in agriculture

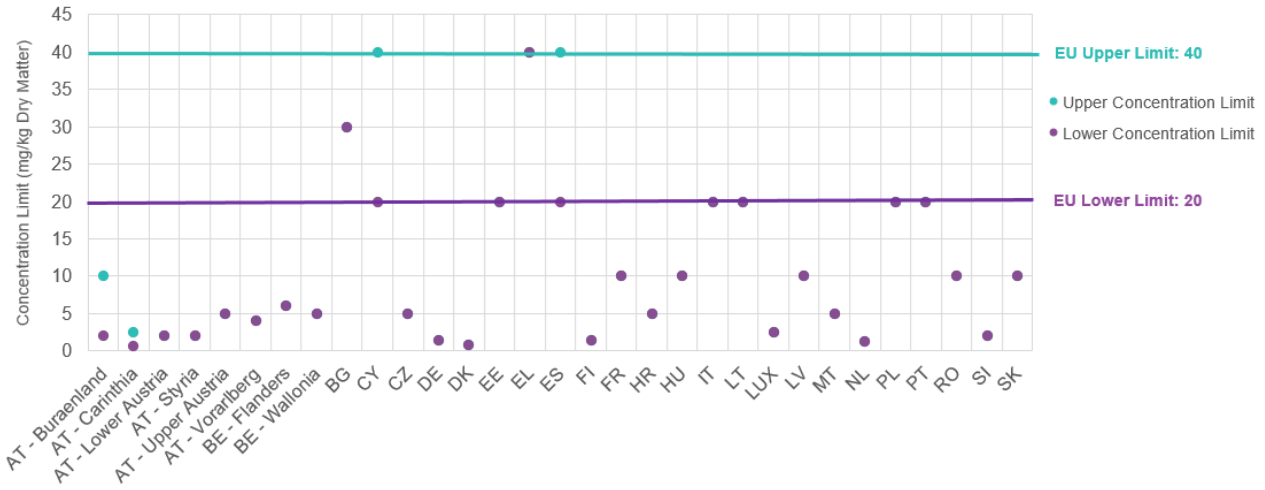
Member States have set separate limits for the concentration of each heavy metal in sludges. It should be noted that for some metals some Member States have set upper and lower limits, whilst others have set only one limit. Where only one limit has been set this has been described as the upper limit in the figures. In the case of Spain, each of the limit values refers to soil with a pH level greater than 7 and for all metals a more stringent limit has been set for soil with a pH level lower than 7.

In all charts where a Member State has reported only one limit this has been described as the lower limit and is represented by a purple marker.

Cadmium

The limit values for each Member State for the concentration of cadmium are displayed in the figure below. All Member States have set limits within those outlined in the SSD. Three Member States (Cyprus, Greece, and Spain) have set their national limits at the equivalent level to the upper limit set out in the SSD. The most stringent upper limit has been set by Denmark. Ireland and Sweden have not reported national limits for the concentration of cadmium in sludge for use in agriculture.

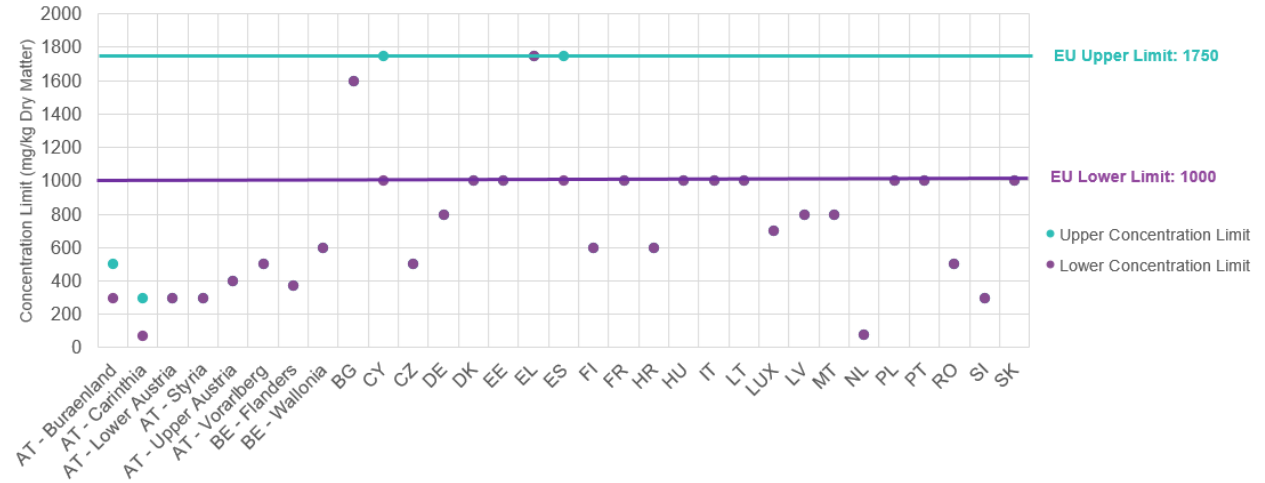
Figure 4.9 EU Member State limit values for the concentration of cadmium in sludge



Copper

The limit values for each Member State for the concentration of copper are displayed in the figure below. All Member States have set limits within those outlined in the SSD. Three Member States (Cyprus, Greece, and Spain) have set their national limits at the equivalent level to the upper limit set out in the SSD. The most stringent limit has been set by the Netherlands. Ireland and Sweden have not reported national limits for the concentration of copper in sludge for use in agriculture.

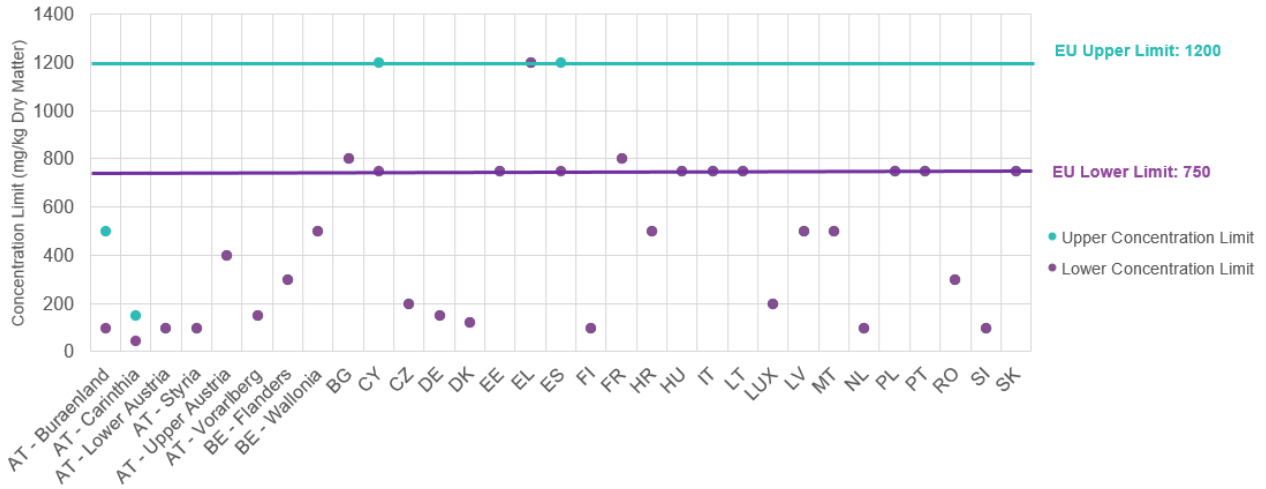
Figure 4.10 EU Member State limit values for the concentration of copper in sludge



Lead

The limit values for each Member State for the concentration of lead are displayed in the figure below. All Member States have set limits within those outlined in the SSD. Three Member States (Cyprus, Greece, and Spain) have set their national limits at the equivalent level to the upper limit set out in the SSD. The most stringent limits have been set in two Austrian regions, Finland, Slovenia, and the Netherlands. Ireland and Sweden have not reported national limits for the concentration of lead in sludge for use in agriculture.

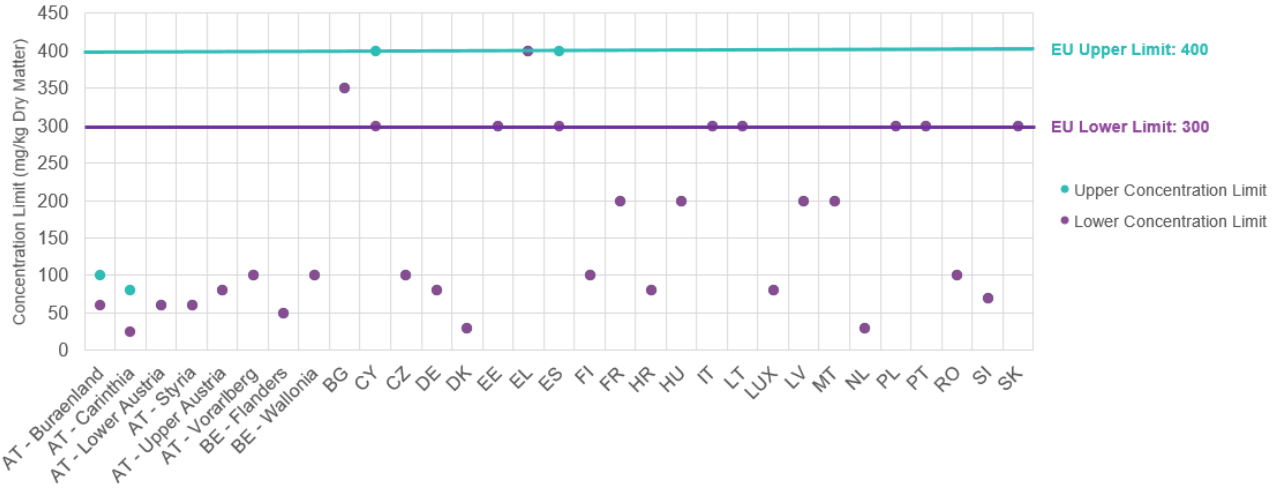
Figure 4.11 EU Member State limit values for the concentration of lead in sludge



Nickel

The limit values for each Member State for the concentration of nickel are displayed in the figure below. All Member States have set limits within those outlined in the SSD. Three Member States (Cyprus, Greece, and Spain) have set their national limits at the equivalent level to the upper limit set out in the SSD. The most stringent limits have been set by Denmark and the Netherlands. Ireland and Sweden have not reported national limits for the concentration of nickel in sludge for use in agriculture.

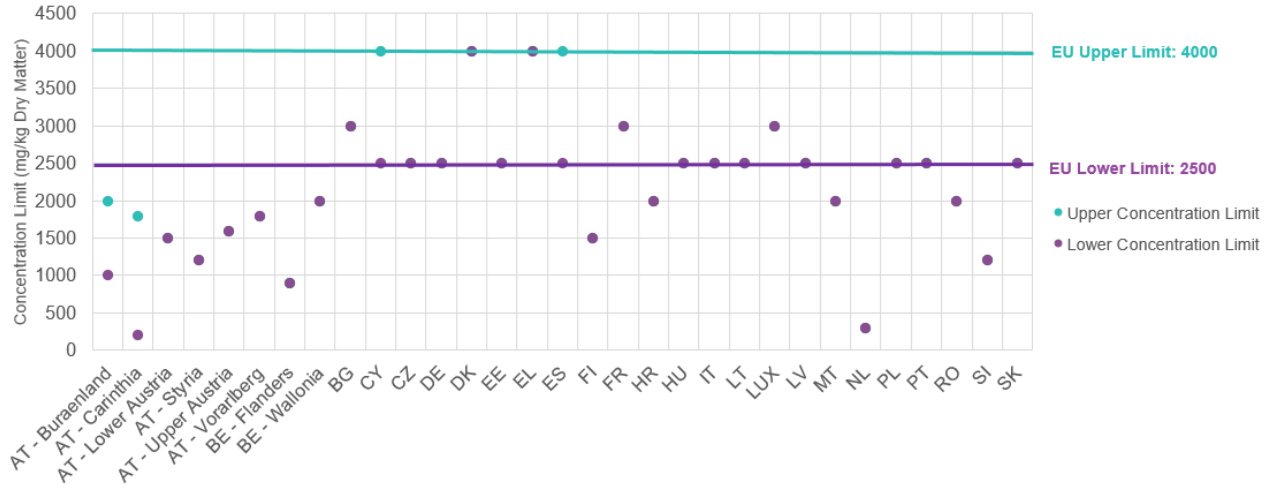
Figure 4.12 EU Member State limit values for the concentration of nickel in sludge



Zinc

The limit values for each Member State for the concentration of zinc are displayed in the figure below. All Member States have set limits within those outlined in the SSD. Four Member States have set their national limits at the equivalent level to the upper limit set out in the SSD. The most stringent limit has been set by the Netherlands. Ireland and Sweden have not reported national limits for the concentration of zinc in sludge for use in agriculture.

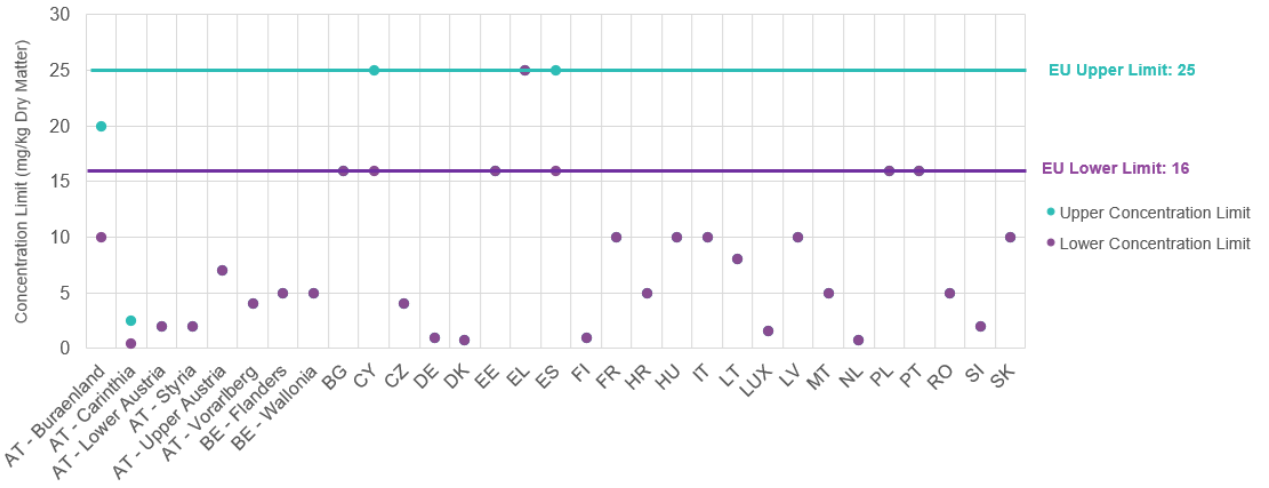
Figure 4.13 EU Member State limit values for the concentration of zinc in sludge



Mercury

The limit values for each Member State for the concentration of mercury are displayed in the figure below. All Member States have set limits within those outlined in the SSD. Three Member States (Cyprus, Greece, and Spain) have set their national limits at the equivalent level to the upper limit set out in the SSD. The most stringent limits have been set in the Netherlands, Germany, Finland, and Denmark. Additionally, a stringent limit has been set in one Austrian region. Ireland and Sweden have not reported national limits for the concentration of mercury in sludge for use in agriculture.

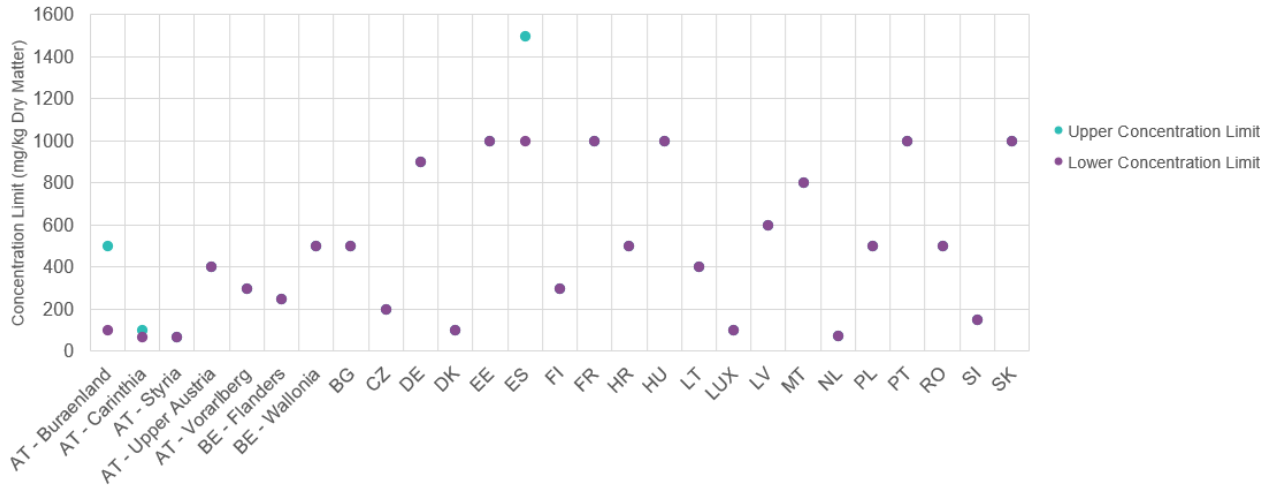
Figure 4.14 EU Member State limit values for the concentration of mercury in sludge



Chromium

The limit values for each Member State for the concentration of chromium are displayed in the figure below. The following Member States did not report concentration limits for chromium in the 2016 – 2018 implementation report – Cyprus, Greece, Ireland, Italy, and Sweden. The most stringent upper limits have been set by the Netherlands and Austria. In addition, the EU does not set a limit for the concentration of Chromium in soil under the SSD.

Figure 4.15 EU Member State limit values for the concentration of chromium in sludge



Conclusion

Spain, Greece, and Cyprus have typically set limits equivalent to the upper limit set out in the SSD for all metals. All other Member States have set national limits below this level.

The most stringent limits have most commonly been set by Denmark and the Netherlands, with the exception of copper, for which the most stringent limits were set by Austria, Finland, the Netherlands, and Slovenia. Ireland and Sweden did not report national limit values for the concentration of heavy metals in sludge for any metals. Similarly, for the 2013 – 2015 reporting period all of the limit values reported by Member States for heavy metal concentrations sludge for use in agriculture in 2013-2015 were either within the ranges permitted by the Directive or lower. A number of Member States - Austria, Belgium, Croatia, Finland, Malta, Romania, Slovenia, and Sweden – were reported to have set limit values stricter than those contained within the Directive in all cases. This marks a difference from the 2016 – 2018 period where the most stringent limits were set by Denmark and the Netherlands, and for which Sweden did not report national limit values for the concentration of heavy metals in sludge for any metals. As with the more recent reporting periods, all Member States reported limit values within the ranges permitted by the Directive. Austria, Belgium, Croatia, Finland, Malta, the Netherlands, and Slovenia have reported that they have set limit values lower than those contained within the Directive in all cases which is comparatively similar reporting to the 2013 – 2015 period, but again different from the Member States setting the most stringent limits in the period 2016 – 2018.

4.2.3 Limit values for concentrations of heavy metals which may be added annually to agricultural land

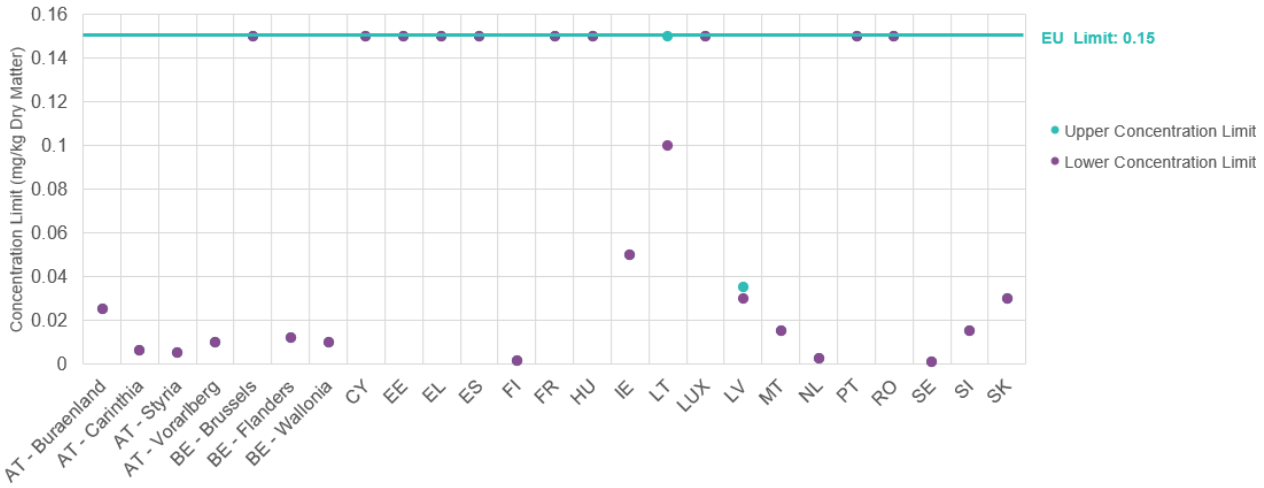
Member States have set separate limits for the concentration of each heavy metal which may be added annually to agricultural land. It should be noted that for some metals some Member States have set upper and lower limits, whilst other have set only one limit. Where only one limit has been set this has been described as the upper limit in the figures.

In all charts where a Member State has reported only one limit this has been described as the lower limit and is represented by a purple marker.

Cadmium

The limit values for each Member State for the concentration of cadmium are displayed in the figure below. All Member States have set limits within those outlined in the SSD. 11 Member States (Cyprus, Estonia, Greece, Spain, France, Hungary, Lithuania, Luxembourg, Portugal, Romania and one Belgian region) have set their national limits at the equivalent level to those set out in the SSD. The most stringent upper limits have been set by the Netherlands, Finland, and Sweden. The following Member States did not report concentration limits for cadmium in the 2016 – 2018 implementation report – Bulgaria, Croatia, Czechia, Germany, Denmark, Italy and Poland, and a number of the Austrian regions.

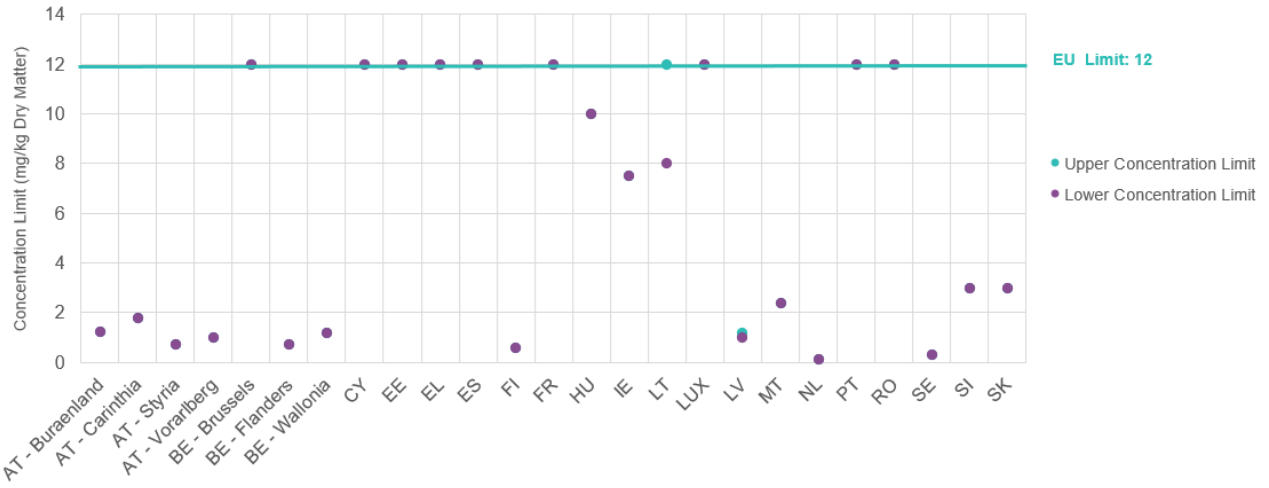
Figure 4.16 EU Member State limit values for the concentrations of cadmium which may be added annually to agricultural land



Copper

The limit values for each Member State for the concentration of copper are displayed in the figure below. All Member States have set limits within those outlined in the SSD. Ten Member States (Cyprus, Estonia, Greece, Spain, France, Luxembourg, Lithuania, Portugal, Romania and one region of Belgium) have set their national limits at the equivalent level to those set out in the SSD. The most stringent upper limits have been set by the Netherlands and Sweden. The following Member States did not report concentration limits for copper in the 2016 – 2018 implementation report – Bulgaria, Croatia, Czechia, Germany, Denmark, Italy, and Poland.

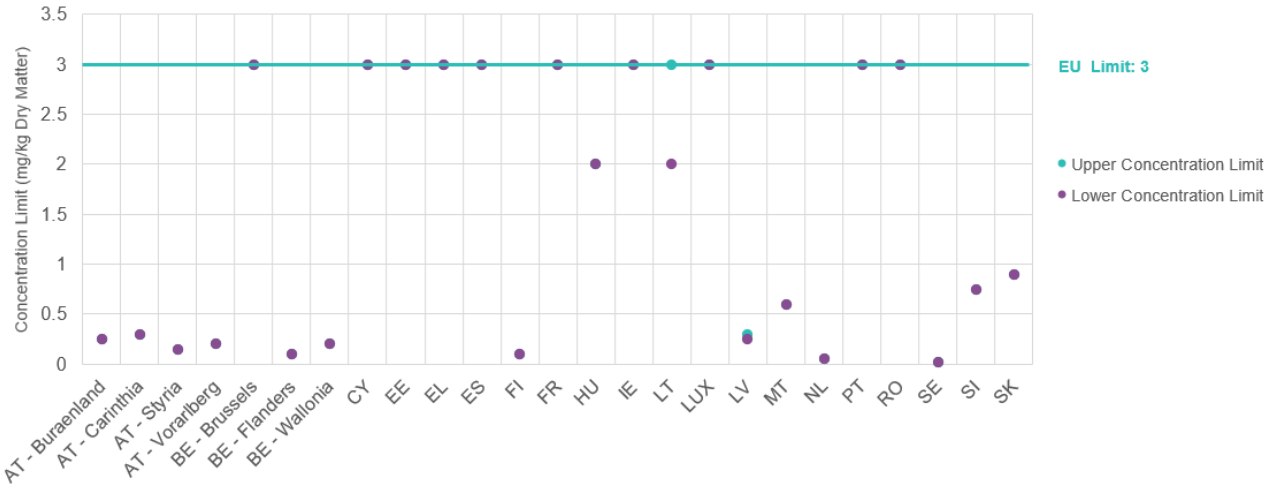
Figure 4.17 EU Member State limit values for the concentrations of copper which may be added annually to agricultural land



Nickel

The limit values for each Member State for the concentration of nickel are displayed in the figure below. All Member States have set limits within those outlined in the SSD. 11 Member States (Cyprus, Estonia, Greece, Spain, France, Ireland, Lithuania, Luxembourg, Portugal, Romania and one region of Belgium) have set their national limits at the equivalent level to those set out in the SSD. The most stringent limits have been set by the Netherlands and Sweden. The following Member States did not report concentration limits for nickel in the 2016 – 2018 implementation report – Bulgaria, Croatia, Czechia Germany, Denmark, Italy, and Poland.

Figure 4.18 EU Member State limit values for the concentrations of nickel which may be added annually to agricultural land

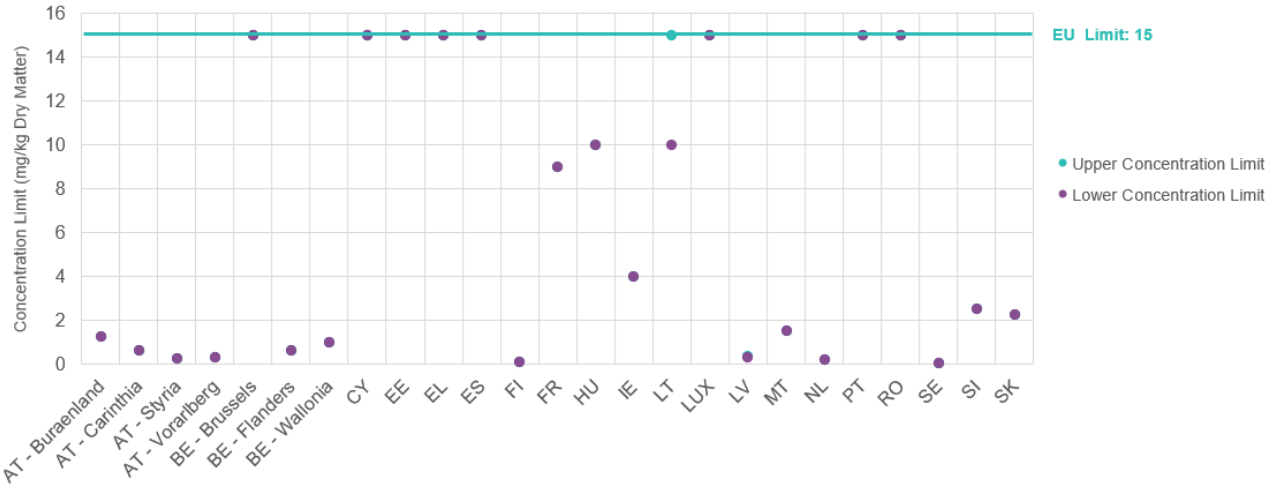


Lead

The limit values for each Member State for the concentration of lead are displayed in the figure below. All Member States have set limits within those outlined in the SSD. Nine Member States (Cyprus, Estonia, Greece, Spain, Lithuania, Luxembourg, Portugal, Romania and one region of

Belgium- have set their national limits at the equivalent level to those set out in the SSD. The most stringent limits have been set by the Netherlands, Finland, Latvia, and Sweden. In addition, the Austrian regions have typically set stringent limits, in particular Styria and Vorarlberg. The following Member States did not report concentration limits for Lead in the 2016 – 2018 implementation report – Bulgaria, Croatia, Czechia, Germany, Denmark, Italy, and Poland.

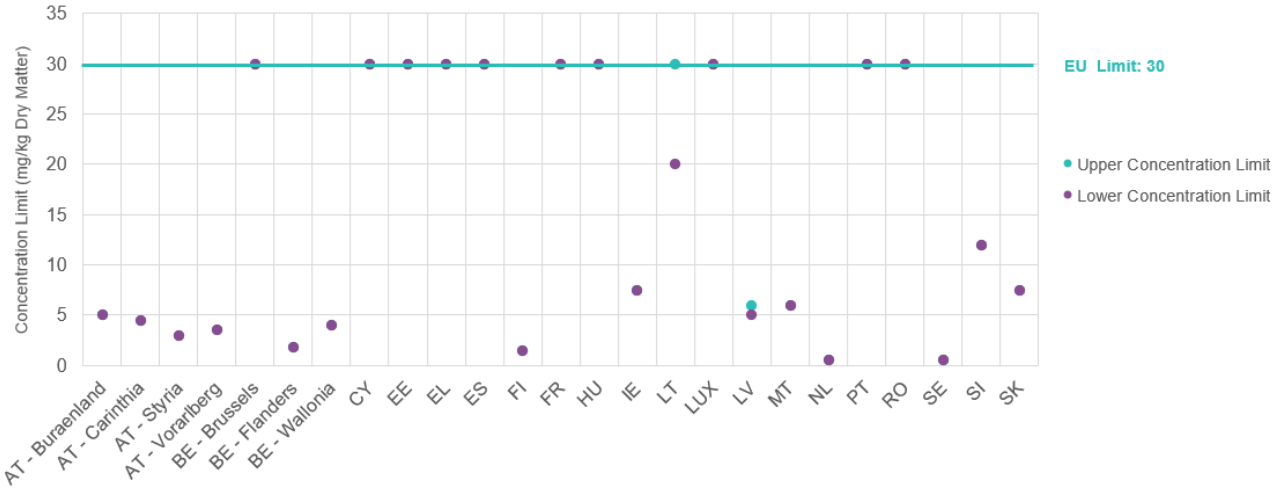
Figure 4.19 EU Member State limit values for the concentrations of lead which may be added annually to agricultural land



Zinc

The limit values for each Member State for the concentration of zinc are displayed in the figure below. All Member States have set limits within those outlined in the SSD. 11 Member States (Cyprus, Estonia, Greece, Spain, France, Hungary, Lithuania, Luxembourg, Portugal, Romania and one region of Belgium) have set their national limits at the equivalent level to those set out in the SSD. The most stringent upper limits have been set by the Netherlands and Sweden. The following Member States did not report concentration limits for zinc in the 2016 – 2018 implementation report – Bulgaria, Croatia, Czechia, Germany, Denmark, Italy, and Poland.

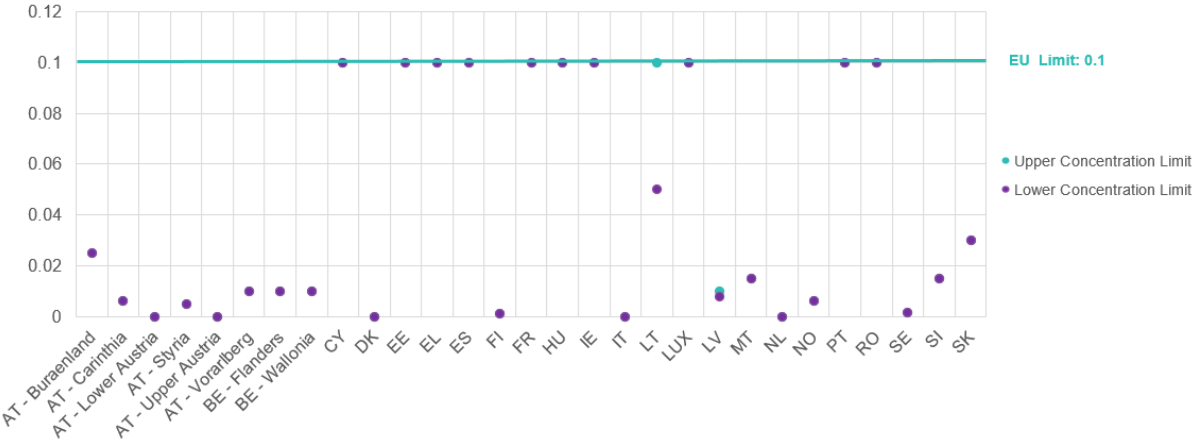
Figure 4.20 EU Member State limit values for the concentrations of zinc which may be added annually to agricultural land



Mercury

The limit values for each Member State for the concentration of mercury are displayed in the figure below. 12 Member States (Cyprus, Estonia, Greece, Spain, Ireland, Hungary, Lithuania, Luxembourg, Portugal, Romania and one region of Belgium) have set their national limits at the equivalent level to those set out in the SSD. The most stringent limits have been set by the Netherlands, Denmark, Italy, Finland, and Sweden. Additionally, two Austrian regions set stringent limits. The following Member States did not report concentration limits for mercury in the 2016 – 2018 implementation report –Bulgaria, Croatia, Czechia, Germany, and Poland.

Figure 4.21 EU Member State limit values for the concentrations of mercury which may be added annually to agricultural land



Chromium

The EU does not set a limit for the concentration of Chromium in soil under the SSD. The limit values for each Member State for the concentration of chromium are displayed in the figure below. The following Member States did not report concentration limits for chromium in the 2016 – 2018 implementation report – Bulgaria, Cyprus, Croatia, Czechia, Germany, Denmark, Italy, and Poland.

Figure 4.22 EU Member State limit values for the concentrations of chromium which may be added annually to agricultural land

Conclusion

Member States have reported limit values for concentrations of heavy metals which may be added annually to agricultural land in accordance with the limits set out in the SSD for all heavy metals. The most stringent limits have generally been set by Finland, the Netherlands and Sweden. A significant number of Member States have not reported limits for any heavy metals, namely Bulgaria, Cyprus, Croatia, Czechia, Germany, Denmark, Italy, and Poland. Similarly, to the 2016 – 2018 reporting period, all of the limit values reported in the 2013 – 2015 period were equal or lower than the limits set out in the Directive. Further to this, all Member States were shown to be with the limits set out in the Directive for the 2010 – 2012 period.

4.2.4 Maximum amount of sludge that can be applied to the soil per surface unit per year if making use of option proposed under Article 5(2)

Nine Member States (and additionally one region in Austria) did not provide a response to the question and a further three Member States responded that the question was not applicable. Sweden and Spain stated that the option proposed under Article 5 (2) to set a limit on the maximum amount of sludge was not chosen.

Table 4.1 Member States that did not provide further detail regarding the maximum amount of sludge that can be provided to soil

Member State	Response
Brussels (Belgium)	No response
Bulgaria	No response
Burgenland (Austria)	No Response
Cyprus	No response

Member State	Response
Estonia	No response
Finland	No response
Flanders (Belgium)	No response
Germany	No response
Hungary	No response
Wallonia (Belgium)	No response
Italy	Not Applicable
Ireland	Not Applicable
Malta	Not Applicable
Sweden	Not Chosen
Spain	Not Chosen
Portugal	Response is unclear (dated back to reporting period 2000)

Nine Member States (and additionally a number of regions in Austria) have provided a limit in tonnes for the amount of sludge which can be applied. The limits provided by five of the Member States have been stated as strict set limits for the amount of sludge which can be applied. The limits set in other Member States are dependent upon a range of other factors which have been outlined within their individual responses. The factors which affect the limit include the habitat conditions and components of the soil (Czechia), and the pH level of the soil (Italy).

The remaining Member States have not provided a specific limit for the maximum amount of sludge that can be applied to soil. Latvia has stated that sewage sludge may be utilised for the fertilisation of soils when the concentration of no more than three heavy metals exceeds the limiting concentration by no more than 10%. Greece has stated that the procedure of Article 5(2) applies in each case of granting a permit for the use of sludge in agriculture.

Table 4.2 Member State responses providing a maximum amount of sludge that can be applied to the soil

Member State	Summary of Response
Carinthia (Austria)	Sewage Sludge— & Compost V, Appendix 4; depending on the quality class of sewage sludge between 4.8 and 10 t TS/ha within 2 years. Grassland is subject to 50 % of the quantities allowed for arable land.
Croatia	1.66 tonnes of dry matter/ha/year
Czechia	The total input of hazardous substances that may be introduced into the soil by using treated sludge is determined as follows: The total amount of hazardous substances authorised for use in agricultural land through the

Member State	Summary of Response
	use of sludge over 10 years is determined by the amount of sludge authorised as referred to in Section 3 (1) (f) and limit values of the concentrations of hazardous substances and elements listed in Annex 3 to Decree No 437/2016 on the conditions of use of treated sludge on agricultural land. The permitted dose of sludge referred to in Section 3 (1) (f): "A maximum of 5 tonnes of dry sludge may be used per 1 hectare; the treated sludge must be applied on one part of the land parcel in a single agro-technical operation and in one continuous period of time under favourable physical and wet conditions; if the sludge used contains less than half of the limit level of each of the controlled risk substances and components, the quantity of sludge may reach 10 tonnes of dry sludge dry matter per 1 hectare.' Limit values for concentrations of hazardous substances in accordance with Annex 3 to Decree No 437/2016 (see also the above table — Article 5 (2) (a) Concentration in faeces — National limits): '*Check previous column*' The amount and the period of use of the lees shall also be governed by the requirement of plant nutrients, taking into account the available nutrients and organic components in the soil, as well as to the habitat conditions.
Denmark	A maximum of 7 tonnes of dry matter may be applied per hectare per year, calculated as an average over 10 years.
Greece	The procedure of Article 5 (2) applies in each case of granting a permit for the use of sludge in agriculture (as mentioned in the answer of Question I 2(b).
Italy	Sludge may be applied to the soil in doses not exceeding 15 tonnes of dry matter per hectare over a three-year period (which corresponds to an average of 5 tonnes per hectare per annum), provided that the soil has a cation exchange capacity exceeding 15 meq/100 g and a pH between 6.0 and 7.5. This maximum quantity decreased by 50 % when used on land with a pH lower than 6 and c.s.c. less than 15 meq/100 g; while for soil with a pH exceeding 7.5 the maximum quantity that may be used is increased by 50 %. It is forbidden to use sludge on soil with a pH less than 5 and a cation exchange capacity less than 8 meq/100 g.
Lithuania	The maximum rate at which sludge is applied in agriculture must be such that: No more than 170 kg/ha/yr of nitrogen and no more than 40 kg/ha/yr of phosphorus are released into the soil. The rate at which sludge is applied as a fertiliser must be such that the amount of heavy metals in the sludge to be applied per year does not exceed the maximum amount of heavy metals which may be released into the soil per year. In any event, the concentrations of heavy metals in soil as a result of the application of sludge must not exceed the limit values. These requirements are laid down in environmental protection regulation LAND 20-2005 'Requirements to be met by the use of sewage sludge as a fertiliser and for land rehabilitation purposes.
Lower Austria	Following a comprehensive assessment of the suitability of the soil (see Lower Austria – Sewage Sludge Ordinance Sections 1.2.3 and annexes), the permitted application quantities are determined in accordance with Section 7 (restrictions on application), which was cited in the report for the years 1998 to 2001.
Luxembourg	3 Tonnes
Netherlands	The assumption is that total amount of heavy metals entering the soil with the sludge is no higher than the national limit in the table under Question 2 (a). The limits for concentrations in the soil are calculation examples. It is based on 10 % organic matter (H) and 25 % lutum (L). The soil limits are calculated using a formula in which L =% lutum and H =% organic matter. In the calculations the percentage of organic matter never exceeds 15 %. The figures are calculated

Member State	Summary of Response
	using the formulae given in the notes to Table 2 (a). Liquid sewage sludge may be used at a maximum dosage of 2 tonnes dry matter per ha per year. For semi-solid sewage sludge twice the quantity may be applied once every two years.
Poland	The maximum quantity of sludge applied in agriculture is 3 tonnes of dry matter per hectare.
Portugal	The reply given in the report relating to the three-year period from 2006 to 2009 still applies
Romania	Ministerial Order No 344/708/2004 established maximum concentrations of heavy metals for soil and sludge intended for use in agriculture, as well as limit values for the annual quantities of heavy metals that can be introduced into agricultural land on the basis of an average of 10 years (kg/ha/year) as indicated in the above table.
Slovakia	The dose of treatment sludge applied into the agricultural soil must not be higher than 15 tonnes of dry matter per hectare during five consecutive years, and soil user is responsible for that as sludge consumer.
Slovenia	Article 25 (1) (1) of the Decree on the treatment of biodegradable waste and the use of compost or digestate provides that, when top-quality compost or digestate is used in or on the soil of agricultural land, the annual input of dry matter may not exceed 8 t/ha on average over a five-year period if that compost or digestate contains more than 20 % of dry matter.
Styria (Austria)	A maximum annual amount of sewage sludge of 1.25 tonnes dry matter per hectare of grassland and 2.5 tonnes dry matter per hectare of arable land may be used. This amount of dry matter may be increased twice if sludge has not been applied in the previous year
Upper Austria	Soil Protection Act 1991: 'Restriction of application quantity (1) Within three years, a total of 10 tonnes of dry matter per hectare of sewage sludge may be used on soil. may be spread. When sewage sludge is applied, its copper or zinc content must not exceed the limit laid down by regulation by more than 50 %, depending on the ratio of the excess or, where appropriate, the ratio of the higher excess. (2) Taking into account the quantity of land application referred to in paragraph 1, a maximum of 50 m^3 sewage sludge with: a dry matter content of less than 35 % per hectare per year.'
Vorarlberg (Austria)	In 2 years sewage sludge fertilisers with a quantity of phosphate calculated as P2O5 not exceeding 160 kg/ha (currently equivalent to approximately 2.0 tonnes/ha*year with a P2O5 content of approximately 4 %) From 1.1.2020: Only permitted as sewage sludge compost; Agriculture: The permissible amount of compost depends on the phosphorus content and is not more than 5.6 t TS/ha/a (after approval of excess quantities and provided that the minimum content of 2 % P2O5 is respected; The calculation period is 2 years (11.2 t TS/ha/2a). Landscape construction: Permissible amount of compost depends on the phosphorus content and does not exceed 4 t TS/ha/a (subject to compliance with the minimum content of 2 % P2O5;The calculation period is 10 years (40 t TS/ha/10 a)).

Note: Responses are a direct extract from implementation report

In the previous reporting period for 2013 – 2015, 15 Member States reported that they had set maximum quantities of sludge which may be applied to the soil per area unit per year while observing heavy metal limit values for sludge set in accordance with Annex I A. This is slightly higher than the 12 different Member States which have set reported maximum quantities for the 2016 – 2018 reporting period. For the 2010 – 2012 reporting, 12 Member States had also reported that they had set maximum quantities for the application of sludge accordingly. One key difference is that in the 2013 – 2015 period 10 Member States stated that they had applied the option available under Article 5 (2) (b). However, in the 2016 – 2018 period this has not been stated by any Member States.

4.3 Sewage sludge treatment and authorisation

4.3.1 Sewage sludge treatment techniques

Member States were asked to describe the technologies used for the treatment of sewage sludge. The question did not prescribe any techniques and consequently open responses were provided. The multitude of technology terms provided were not specific and the terms were often interpreted differently in each Member State. As a result, it has proven difficult to systematise this data. Therefore, the techniques have been grouped together as follows.

Group 1: Treatment for thickening and dewatering of sludge

The first group of treatment techniques contains technologies involved in sludge thickening and dewatering. The main objective of sludge thickening, and dewatering is the reduction of water content in the sludge to reduce its volume. Sludge thickening is mainly used in primary treatment, activated sludge and trickling filtering processes, having large implications on the design and operation of sludge digesters. Sludge dewatering, carried out on digested sludge, impacts sludge transportation and final disposal costs. In both cases, water removal influences sludge processing since the mechanical behaviour of sludge depends upon its solids content.

Sludge thickening and dewatering technologies were reported by Member States as:

- Dewatering;
- Mechanical drainage;
- Solar drying;
- Drying;
- Conditioning;
- Polymer drainage; and
- Lime drainage.

Group 2 Treatment for pathogen removal

The second group of treatment techniques covers treatment for pathogen removal from sewage sludge. Pathogenic organisms are sludge constituents that cause most concern in its processing and final disposal. Bacteria, viruses, protozoan cysts, and intestinal parasites eggs are present in

sewage sludge, and a significant proportion of them are disease causing agents. Pathogenic reduction assures a sufficiently low level of pathogenicity to minimise health risks to the population, and to reduce negative environmental impacts when applied to the soil.

Pathogen removal from sludge technologies were reported by Member States as:

- Aerobic stabilisation;
- Mesophilic aerobic sludge stabilisation;
- Thermophile aerobic sludge stabilisation;
- Lime drainage;
- Composting;;
- Recalcination
- Fermentation;;
- Polyelectrolyte
- Ammonia;
- Biological treatment;
- Chemical treatment; and
- Heat treatment.

Group 3 Treatment with potential for energy recovery

The third group of treatment techniques captures technologies that can achieve a similar treatment level as group 2 whilst also having the potential for energy recovery. Sludge regeneration aims to make effective use of sewage sludge via methane fermentation or fertilizer composting of organic waste. Thermal hydrolysis is a process which exposes sludge to high temperature and pressure, and as a result increases biogas yields in anaerobic digestion. Anaerobic digestion is the biological treatment of biodegradable organic waste in the absence of oxygen, utilising microbial activity to break down the waste in a controlled environment. All technologies enhance the simultaneous sludge stabilisation and energy recovery from the biogas produced.

Advanced treatment with potential for energy recovery were reported by Member States:

- Sludge regeneration;;
- Anaerobic stabilisation
- Thermal hydrolysis;
- Mesophilic anaerobic sludge stabilisation; and
- Thermophile anaerobic sludge stabilisation.

It is unclear if energy is actually recovered from treatment of sludge in the Member States that reported use of these techniques. Nevertheless, these technologies have, in principle, potential for energy recovery.

Overview of responses of Member States

All Member States in the period 2016-2018 responded to the question, with 26 providing technologies employed for treating sewage sludge. Portugal referred to previously submitted reports in which the same technologies still apply. Malta could not provide a response as it does not use sewage sludge in agriculture. Austria, Sweden, and Italy have responded with the widest range of technologies, including sludge thickening and dewatering, pathogen removal and energy recovery. There has been little change in the treatments reported since the previous reporting period in 2013-2015. The variations between previous reports are mostly attributed to the level of detail in describing technologies. Table 4.3 below shows the treatment technologies applied across the EU Member States. It demonstrates further potential to improve sludge treatment technology across the EU, particularly for energy recovery, as technologies in this group have not been reported by all Member States.

Table 4.3 Summary table of sludge treatment technologies across each Member State

Member State	Treatment for thickening and dewatering sludge	Treatment for pathogen removal	Treatment with potential for energy recovery
Austria	+	++	+
Belgium	+	+	+
Bulgaria	+	+	+
Croatia	-	+	+
Cyprus	+	+	+
Czechia	-	+	-
Denmark	-	++	+
Estonia	+	++	+
Finland	+	++	+
France	+	-	-
Germany	-	+	-
Greece	+	+	-
Hungary	-	++	-
Ireland	+	++	+
Italy	+	+	+
Latvia	-	-	-

Member State	Treatment for thickening and dewatering sludge	Treatment for pathogen removal	Treatment with potential for energy recovery
Lithuania	++	+	+
Luxembourg	+	-	-
Malta	-	-	-
Netherlands	-	+	-
Poland	-	+	-
Portugal	++	-	-
Romania	+	+	+
Slovakia	-	+	+
Slovenia	-	+	+
Spain	-	+	+
Sweden	+	++	+

Legend: - No technologies; + 1 – 2 technologies; ++ ≥3 technologies

From the table it can be seen that the most technologies were applied with respect to treatment for pathogen removal, with 22 Member States indicating they applied at least one technology from this group, seven of which applied three or more. In contrast, it is evident that the least technologies were applied with respect to treatment with potential for energy recovery, with 11 Member States indicating that no technologies from this group had been applied, and the remaining Member States indicating they had applied 1 -2 technologies. In the 2013 – 2015 reporting period 20 Member States described the technologies employed for treating sludge in their responses, with a wide range of different treatment technologies listed across the Member States. For the 2010 – 2012 reporting period, 22 Member States described different technologies, with a similarly wide range of techniques applied.

Rules drawn up to ensure that analyses are carried out at more frequent intervals than those provided for in Annex II A (1)

19 Member States reported drawing up rules to ensure that sewage sludge is tested at intervals equal or more frequent than those stipulated in Annex II A (1) of the SSD. Five Member States reported that they had established rules for the frequency of sewage sludge analyses which are not more frequent than those required by the Directive: Germany, Greece, Norway, Romania, and Slovakia.

For many of the Member States, the frequency of sludge analyses is dependent on the size of the waste water treatment plant. The larger the waste water treatment plant, the greater the frequency of sludge analyses.

The Netherlands conducted the most frequent analyses of sewage sludge for waste water treatment plants of all sizes whereby the sampling rate must be at least four times a year, averaging once every three months and, therefore, is double the frequency required by the Directive. Furthermore, the rate can increase to monthly depending on the variation in the composition of the sludge produced. There has been little change in the frequency of sewage sludge analyses since the previous reporting period in 2013-2015.

4.3.2 Conditions laid down for authorising the injection or working into the soil of untreated sludge (Article 6 (a))

As shown in Table 4.4, 19 Member States prohibit the injection or working into soil of untreated sludge. Member States that allow the use of untreated sewage sludge in agriculture under set conditions are Austria, Estonia, France, Ireland, and Sweden. There have been few changes in the conditions for allowing the use of untreated sewage sludge since the previous reporting period in 2013-2015. Since the last reporting period, Estonia has introduced conditions that authorise the use of untreated sludge. Bulgaria removed previous conditions and now does not allow the use of untreated sludge in agriculture.

Table 4.4 Summary table of Member States that A) have more frequent sludge analyses, B) have laid conditions for the application of untreated sludge

Member State	Have rules been drawn up to ensure that analyses are carried out at more frequent intervals than those provided for in Annex II A (1)? (Y/N)	Have conditions been laid down for authorising the injection or working into the soil of untreated sludge?
Austria	Y	Y
Belgium	Y	N
Bulgaria	Y	N
Croatia	Y	N
Cyprus	Y	N
Czechia	Y	N
Denmark	Y	N
Estonia	Y	Y
Finland	Y	N
France	Y	Y
Germany	N	N
Greece	N	N
Hungary	Y	N

Member State	Have rules been drawn up to ensure that analyses are carried out at more frequent intervals than those provided for in Annex II A (1)? (Y/N)	Have conditions been laid down for authorising the injection or working into the soil of untreated sludge?
Ireland	Y	Y
Italy	Y	N
Latvia	Y	N
Lithuania	N/A	N/A
Luxembourg	Y	N
Malta	N/A	N/A
Netherlands	Y	N
Poland	Y	N
Portugal	N	N
Romania	N	N
Slovakia	N	N
Slovenia	Y	N
Spain	N/A	N/A
Sweden	Y	Y

4.4 Length of the period during which it is forbidden to use sludge on grassland before it is grazed, and on forage crops before harvest

4. With regard to Article 7, please indicate, where appropriate, the length of the period during which it is forbidden to use sludge on grassland before it is grazed, and on forage crops before harvest.

All 27 Member States responded to this question. Five Member States stated that the time period in which this would remain forbidden would be three weeks, the minimum requirement. A further four Member States including two regions in Austria and all three of the reporting regions in Belgium have noted time limits within three to six weeks. No Member State indicated that this time period would be shorter than three weeks.

Seven Member States have stated that some level of prohibitions will remain for 10 months. The Netherlands stated that the use of sewage sludge is prohibited on land used to cultivate vegetables or crops which are normally in direct contact with the soil and are eaten raw within 10 months before harvest and during harvest. In Slovakia, prohibitions remain in place for 10 months

for agricultural soil intended for cultivation of fruits and vegetables, parts of which are in the direct contact with soil, and which are consumed crude[4]. The longest length of time was stated by Finland, who stated that on grassland it is permitted to use sludge just before sowing, but it is not permitted to grow potatoes, root-crops, and vegetables until at least five years have passed after spreading the sludge. Three Member States (Czechia, Denmark, and Hungary) have stated that the application of sewage sludge will always be prohibited. Two Member States did not report a specific time period.

In comparison with the 2013 – 2015 reporting period a larger number of Member States have reported specific time periods of three weeks or longer. 17 Member States reported for the 2013 – 2015 that they had set time periods of 3 weeks or later, compared to 21 Member States for the period 2016 – 2018. In the previous reporting period, the longest prohibition was stated as 10 months (by Denmark and Sweden). For the 2010 – 2012 period, the figure was slightly lower, with 16 Member States reported that they had set time periods of three weeks or greater, and a further five Member States setting a time period of less than three weeks. The longest prohibition time period for the 2016 – 2018 period has been set at five years by Finland. Five Member States (Croatia, Czechia, Germany, Hungary, and Poland) had previously reported that the use of sludge on grassland before grazing and crops before harvest is prohibited at all times. The same five Member States have noted that the prohibitions remained for the 2016-2018 period.

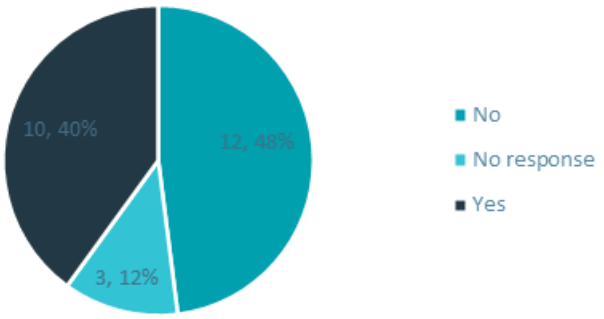
4.5 Reduced limits or other limits pursuant to Article 8

5.a. Have any reduced limit values or, where appropriate, any other measures, been authorized at national level where the pH of the soil is below 6, as provided for in Article 8?
5.b. If the answer to (a) above is 'Yes' please complete the table

All Member States provided an answer to the question except for Bulgaria, Estonia, and Lithuania. As shown in Figure 4.23, 12 Member States responded that they have introduced reduced limit values or other measures at national level. 12 Member States responded they have not. UK and Norway responded 'Yes' and 'No' respectively to the question. Latvia was the only Member State to provide additional information, stating that they responded 'No' because sewage sludge or compost may not be applied to soil for which pH in the surface layer is less than five.

[4] Presumed to refer to unprocessed

Figure 4.23 Number of Member States which introduced reduced limit values or other measures



Notes: The pie chart does not include responses from Norway or the United Kingdom. In Austria and Belgium different regions provided different responses and therefore these two Member States are excluded from the chart.

For the 2016 – 2018 reporting period it can be seen that Member States were split as to whether they have introduced reduced limit values or other measures at national level. Based on both the 2013 – 2015 and 2010 – 2012 reporting period there were 15 Member States which had introduced lower limit values or other special measures for soils of a pH lower than 6, with nine Member States reporting that no such provisions concerning soil of a low pH value have been implemented. This indicates a reduction in the number of Member States introducing reduced limit values over the recent years.

4.5.1 Additional information on the reduced limits and other measures

16 Member States did not respond to the question or stated either that the question was not applicable, or no data could be provided. Nine Member States provided a response to the question. Two Member States (Austria and Belgium) provided different responses dependent upon the region. In Austria the Styria, Vorarlberg and Burgenland regions stated that the question was not applicable, whilst the other regions provided a response. In Belgium, Wallonia and Brussels stated that the question was not applicable, but Flanders provided a response. Norway stated the question was not applicable and the UK provided a response.

The most common responses (including regional responses) focussed on providing a reference to the national legislation (seven responses) and stating that the use of sewage sludge is prohibited in certain circumstances (seven responses). National prohibitions include that sludge may be used only on soil with a pH value above 5 (Upper Austria, Finland, France), above 5.5 (Lithuania) and above 6 (Flanders).

Three responses provided reduced limit values for specific heavy metals, and one additional response (from Austria Vorarlberg) provided a limit only for zinc. The region of Lower Austria reported that a low pH does not lead to any change in the limit value, but only to a different classification of soil suitability. If soil is classified as inappropriate, either a partial or total ban on application applies. In addition, the UK responded that it does authorise reduced limit values at a national level where the pH of the soil is below 6. However, limit values for soil with pH <6 are within the range set by Annex 1A of the Directive.

4.6 Soil analysis and frequency

6.a. If appropriate, indicate which types of analysis are carried out, pursuant to Article 9, on soil parameters in accordance with Annex II B (1), other than those mentioned in Annex IIB
(3) (pH and heavy metals)
6.b. State the minimum frequency of soil analysis (Annex IIB(2))

4.6.1 Types of analysis are carried out, pursuant to Article 9, on soil parameters (pH and heavy metals)

Two Member States (Slovakia and Finland) did not provide a response to the question.

Six Member States have stated that either that the question is not applicable or that no further analysis other than those mentioned in Annex IIB (3) had been carried out. In addition, Brussels and Wallonia in Belgium did not indicate additional types of analysis, and Ireland stated that it had not set additional testing parameters. This is less than the 11 Member States which responded that they had set analysis parameters additional to those listed in Annex II B (3) for the 2016 – 2018 reporting period. For the 2013 – 2015 reporting period 12 Member States indicated that they set additional analysis parameters, with 11 Member States reporting that they had not set any additional analysis parameters. Comparatively similar responses were also recorded for the 2010 – 2012 reporting period, with 13 Member States having set additional parameters and 11 Member States having not set any.

When requested to provide a minimum frequency of soil analysis 13 Member States were able to provide a specified time period, with five Member States (and additionally the region of Wallonia in Belgium) reporting that the minimum frequency of soil analysis is every 10 years. The next most common response (four Member States) was that the minimum frequency for the analysis was every four years. Three Member States did not provide a response to the question (Bulgaria, Italy, and Slovakia) and Malta stated that the question was not applicable for the 2016 – 18 period reporting period. The remaining Member States provided an answer but did not specify a specific time period.

4.7 Metal concentrations

7. On the basis of the data contained in the records referred to in Article 10, complete the following tables, stating whether the information given is an estimate.

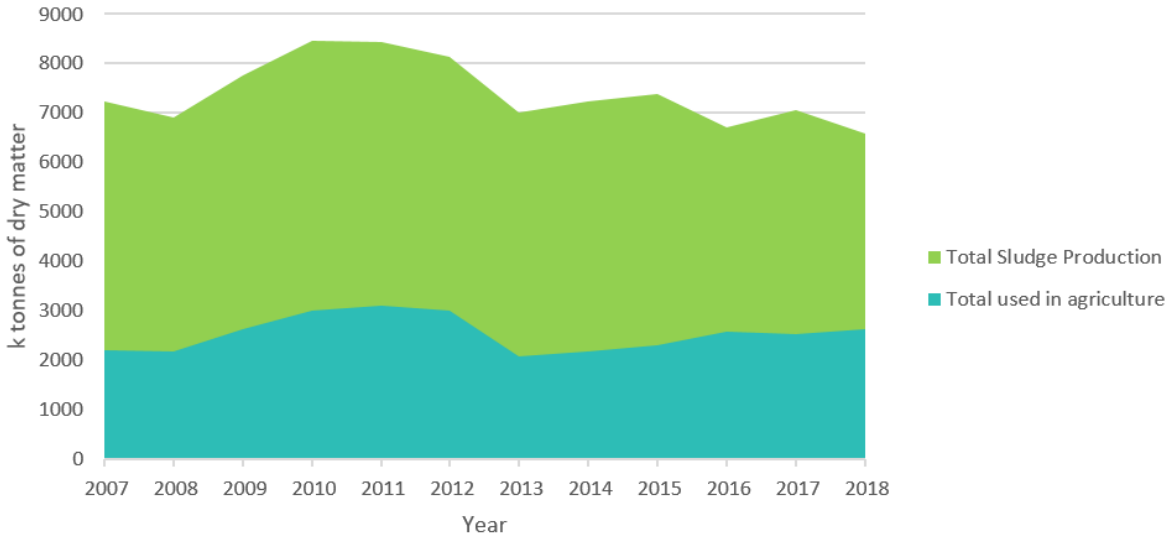
4.7.1 Mass of sludge produced and used in agriculture

The figure below shows the annual production of sludge (green area) and the annual use of sludge in agriculture (teal area) for the 2007 – 2018 time period. The results are based upon reporting by individual Member States through the implementation questionnaires, dating back to the year 2007. It should be noted that there were a number of gaps in the data reported by Member States in terms of both the total sludge produced and its use in agriculture, particularly for the 2007 – 2009 period. In order to avoid distortions in the representation of the data, the gaps were filled in through two criteria. Firstly, previous implementation reports were reviewed to fill any gaps where questionnaires have not been provided. Secondly, the remaining data gaps were estimated

through extrapolating the data which was provided to include estimates for the Member States which had not reported. The extrapolation approach was based upon the population size of each Member State. The approach has therefore relied upon the assumption that a Member State with a larger population has produced a greater amount of sludge/uses a greater amount of sludge in agriculture.

Based on the approach noted above, it can be seen that the amount of sludge produced has remained relatively stable over this period, with production typically falling between approximately 7M – 8M tonnes. The most notable increase is seen from the year 2008 – 2010, with the amount produced then remaining mostly consistent until 2012. Following a decrease in production in 2013, the amount produced has been approximately 7M tonnes, with small fluctuations each year. The amount of sludge used in agriculture has also remained mostly consistent between approximately 2M – 3M tonnes. The most notable yearly change occurred between 2012 – 2013 when there was a sharp decrease.

Figure 4.24 Total sludge produced and used in agriculture in the EU between 2007 and 2018



When considering these trends, one should acknowledge significant gaps in the data reported by each Member State for different years, which impact the aggregate total amounts for both total sludge production and sludge used in agriculture and, therefore, do not allow for definite identification of trends. The gaps are set out in Table 4.5.

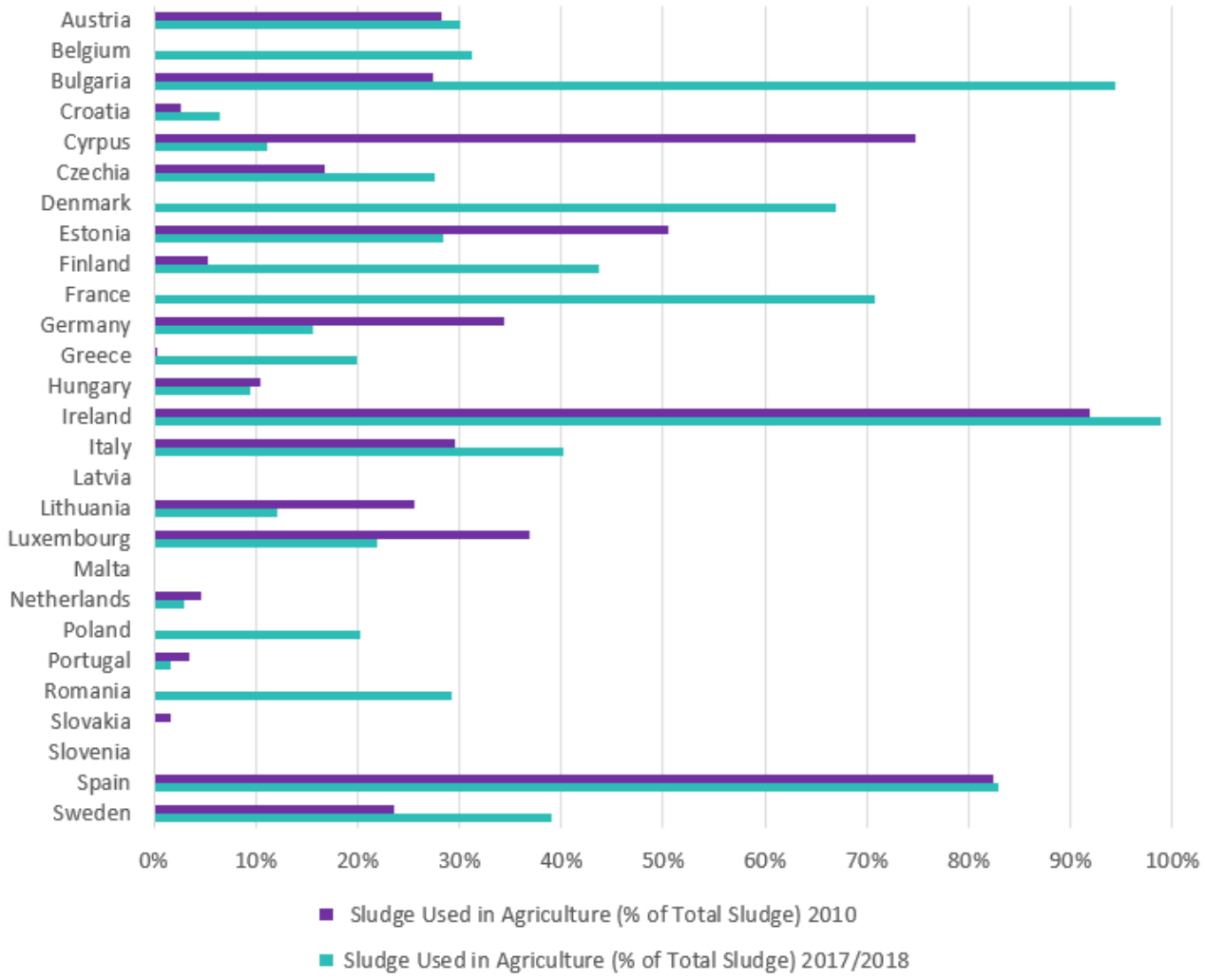
Table 4.5 Gaps in reporting on the total sludge production and use of sludge in agriculture between 2007 and 2018

	No reporting for total sludge production	No reporting on sludge used in agriculture
Austria	All regions: 2007, 2008, 2009 Lower Austria: 2010, 20212, 2013, 2014, 2016, 2017, 2018	All regions: 2007, 2008, 2009 Lower Austria: 2010, 20212, 2013, 2014, 2016, 2017, 2018
Belgium	All regions: 2007, 2008, 2009, 2010, 2011, 2012 Flanders: 2013, 2014, 2015, 2017	All regions: 2007, 2008, 2009, 2010, 2011, 2012 Flanders: 2013, 2014, 2015, 2017
Bulgaria	2007, 2008, 2009	2007, 2008, 2009

	No reporting for total sludge production	No reporting on sludge used in agriculture
Croatia	2007, 2008, 2009	2007, 2008, 2009
Cyprus	2007, 2008, 2009	2007, 2008, 2009
Denmark	2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015	2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015
Estonia	2007, 2008, 2009	2007, 2008, 2009
Finland		2007, 2008, 2009
France	, 2010, 2011, 2012	2010, 2011, 2012
Germany	2007, 2008, 2009	2007, 2008, 2009
Greece	2007, 2008, 2009	Did not apply sludge to agriculture pre-2012
Hungary	2007, 2008, 2009, 2012, 2015, 2018	2007, 2008, 2009
Ireland	2007, 2008, 2009	2007, 2008, 2009
Latvia	2010, 2011, 2012, 2013, 2014, 2015	Every year from 2007 and 2018 (inclusive)
Lithuania	2018	
Luxembourg	2007, 2008, 2009, 2018	2007, 2008, 2009, 2018
Malta	2007, 2008, 2009, 2010, 2011, 2012	Every year from 2007 and 2018 (inclusive) – Did not apply sludge to agriculture
Netherlands	2018	2018
Poland	2010, 2011, 2012, 2013, 2014, 2015	2010, 2011, 2012, 2013, 2014, 2015
Romania	2009, 2010, 2011, 2012, 2013, 2014, 2015, 2018	2009, 2010, 2011, 2012, 2013, 2014, 2015, 2018
Slovakia	2007, 2008, 2009	2007,2008,2009, 2014, 2015
Slovenia	2009	2009
Spain	2007, 2008, 2009,	2007, 2008, 2009
Sweden	2007, 2008, 2009	2007, 2008, 2009

The figure below shows the share of sewage sludge used in agriculture in 2010 compared with the most recent data reported (either 2017 or 2018) for all Member States for which the data was available. Overall, there are mixed results, with the majority of Member States increasing the use of sludge in agriculture, but a sizeable number reporting a decrease. There are a number of gaps visible in the chart below due to gaps in reporting for the years 2010/17/18.

Figure 4.25 Share of sewage sludge used in agriculture (as % of total sludge produced)



Note: If 2018 data on total sludge production or use of sludge in agriculture was unavailable data has been used from 2017. For some Member States data was not available for the year 2010.

Average metal content of sludge

The charts below show the average content of metals in sludge used in agriculture. The level of content has been aggregated across EU Member States based upon the figures reported in the Questionnaire for the report of the Member States on the transposition and implementation of Directive 86/278/EEC. The average content across the Member States has then been illustrated in charts for the years 2007 – 2018, with respect to each metal.

One limitation of the data is that different units have been reported by Member States. Given the challenges in aggregating figures across a range of units, the charts display the average content from the Member States reporting for the most frequently reported unit - Average content (mg/kg dry matter) or descriptions to the same effect. A further caveat is that several Member States did not report results for each reporting year. Consequently, the averages reflect an average content between different Member States in different years. This represents a limitation to the analysis as the trends in certain years could be as a result of data gaps rather than a decline in metals concentrations. An overview of the gaps observed is presented in the table below.

Table 4.6 Gaps in reporting on the metal concentration in sludge between 2007 and 2018

	Cadmium	Copper	Nickel	Mercury	Chromium	Lead	Zinc
Austria	2007 – 2009 Lower Austria: 2007-2018 (excluding 2008)	2007 – 2009 Lower Austria: 2007-2018 (excluding 2008)	2007 – 2009 Lower Austria: 2007-2018 (excluding 2008)	2007 – 2009 Lower Austria: 2007-2018 (excluding 2008)	2007 – 2009 Lower Austria: 2007-2018 (excluding 2008)	2007 – 2009 Lower Austria: 2007-2018 (excluding 2008)	2007 – 2009 Lower Austria: 2007-2018 (excluding 2008)
Belgium	2007 – 2012 Brussels; Wallonia: 2007-2012	2007 – 2012 Brussels; Wallonia: 2007-2012	2007 – 2012 Brussels; Wallonia: 2007-2012	2007 – 2012 Brussels; Wallonia: 2007-2012	2007 – 2012 Brussels; Wallonia: 2007-2012	2007 – 2012 Brussels; Wallonia: 2007-2012	2007 – 2012 Brussels; Wallonia: 2007-2012
Bulgaria	2007 – 2009	2007 – 2009	2007 – 2009	2007 – 2009	2007 – 2009	2007 – 2009	2007 – 2009
Cyprus	2007 – 2009	2007 – 2009	2007 – 2009	2007 – 2009	2007 – 2009	2007 – 2009	2007 – 2009
Czechia							
Denmark	2007-2018	2007-2018	2007-2018	2007-2018	2007-2018	2007-2018	2007-2018
Germany	2007-2009	2007-2009	2007-2009	2007-2009	2007-2009	2007-2009	2007-2009
Estonia	2007-2009	2007-2009	2007-2009	2007-2009	2007-2009	2007-2009	2007-2009
Greece	2007-2015	2007-2015	2007-2015	2007-2015	2007-2015	2007-2015	2007-2015
Spain							
Finland	2007-2009, 2012	2007-2009, 2012	2007-2009, 2012	2007-2009, 2012	2007-2009, 2012	2007-2009, 2012	2007-2009, 2012
France	2007-2012	2007-2012	2007-2012	2007-2012	2007-2012	2007-2012	2007-2012
Croatia	2007-2009	2007-2009	2007-2009	2007-2009	2007-2009	2007-2009	2007-2009
Hungary	2007-2009	2007-2009	2007-2009	2007-2009	2007-2009	2007-2009	2007-2009
Italy							

	Cadmium	Copper	Nickel	Mercury	Chromium	Lead	Zinc
Ireland	2007-2009, 2011-2015	2007-2009, 2011-2015	2007-2009, 2011-2015	2007-2009, 2011-2015	2007-2009, 2011-2015	2007-2009, 2011-2015	2007-2009, 2011-2015
Lithuania							
Latvia	2007-2015	2007-2015	2007-2015	2007-2015	2007-2015	2007-2015	2007-2015
Luxembourg	2007-2009, 2015, 2018	2007-2009, 2015, 2018	2007-2009, 2015, 2018	2007-2009, 2015, 2018	2007-2009, 2015, 2018	2007-2009, 2015, 2018	2007-2009, 2015, 2018
Malta	2007-2018	2007-2018	2007-2018	2007-2018	2007-2018	2007-2018	2007-2018
Netherlands	2018	2018	2018	2018	2018	2018	2018
Poland	2009-2015	2009-2015	2009-2015	2009-2015	2009-2015	2009-2015	2009-2015
Portugal	2009	2009	2009	2009	2009	2009	2009
Romania	2007-2015, 2018	2007-2015, 2018	2007-2015, 2018	2007-2015, 2018	2007-2015, 2018	2007-2015, 2018	2007-2015, 2018
Sweden	2007-2009	2007-2009	2007-2009	2007-2009	2007-2009	2007-2009	2007-2009
Slovenia	2007-2018	2007-2018	2007-2018	2007-2018	2007-2018	2007-2018	2007-2018
Slovakia	2007-2009, 2014-2018	2007-2009, 2014-2018	2007-2009, 2014-2018	2007-2009, 2014-2018	2007-2009, 2014-2018	2007-2009, 2014-2018	2007-2009, 2014-2018

Trends in metals concentrations

The charts below present the trends of average content of heavy metals, Nitrogen and Phosphorus in sludge used in agriculture between 2007 and 2018. The key observations for the concentrations of heavy metals are as follows:

- **Cadmium** - the content of Cadmium decreased between 2007 – 2010 from approximately 1.7 mg/kg dry matter to 1.1 mg/kg dry matter. Since 2010, despite yearly fluctuations, the level of content has stayed mostly consistent between 1 mg/kg dry matter to 1.3 mg/kg dry matter. The highest concentrations in 2017 and 2018 were reported by Portugal.
- **Copper** - the content of Copper has remained between 150 - 200 mg/kg dry matter during the 2007 – 2018 period. The most notable change was an increase between 2009 – 10 and a decrease between 2013 - 2014. The highest concentrations between 2016 and 2018 were reported by France and Sweden.

- **Nickel** – The chart below shows the average content of Nickel in sludge used agriculture. The content of Nickel has fluctuated over 2007 – 2018 period, although it has remained between approximately 22 - 30 mg/kg dry matter. The highest concentrations between 2016 and 2018 were reported by Greece and Romania.
- **Mercury** - The content of Mercury declined between the years 2007 – 2014 from approximately 1.2 mg/kg dry matter to 0.6 mg/kg dry matter, although there were some yearly rises during this period. Since 2014 there has been a gradual increase in average content, reaching an average of approximately 1.1 mg/kg dry matter in 2018. The highest concentrations between 2016 and 2018 were reported in Poland.
- **Chromium** - The average content of Chromium decreased between 2007 – 2018 from approximately 60 mg/kg dry matter to approximately 40 mg/kg dry matter. The highest concentrations between 2016 and 2018 were reported by Portugal and Romania.
- **Lead** - the content of Lead has decreased over the 2007 – 2018 reporting period. There has overall been a steady decline from an average content of 55 mg/kg dry matter to 35 mg/kg dry matter in that period. The highest reported concentrations between 2016 and 2018 were reported in Wallonia (Belgium), Ireland and Greece.
- **Zinc** - the content of Zinc has remained mostly between 600 – 700 mg/kg dry matter over the 2007 – 2018 period. Since 2016 the average content has steadily decreased. Between 2016 and 2018, the highest concentrations were reported in Austria (Carinthia), Cyprus and Romania.

Overall, the trends indicate a slight decline in all heavy metals and nutrients between 2007 and 2018, with the main exception being Copper where a slight increase is observed. Countries where the reported concentrations for several heavy metals were above average between 2016 and 2018 include Italy, Greece, and Portugal.

Figure 4-26 Average content of Lead and Nickel in sludge

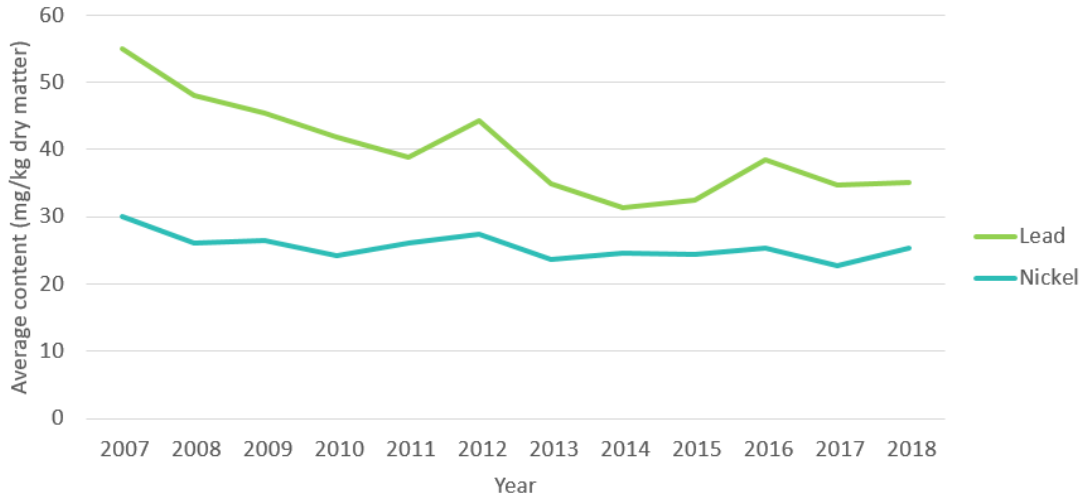


Figure 4.27 Average content of Chromium, Copper and Zinc

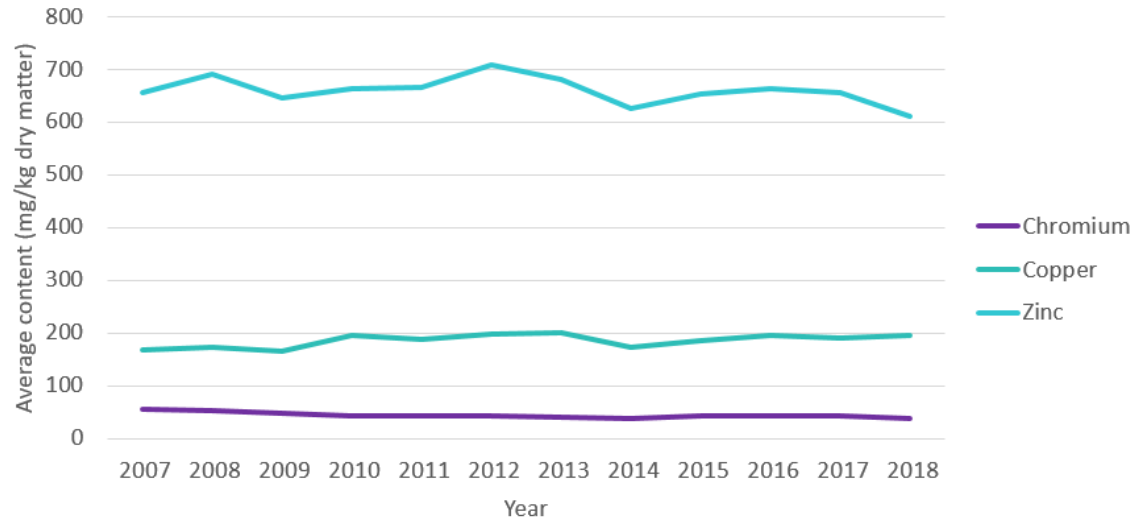
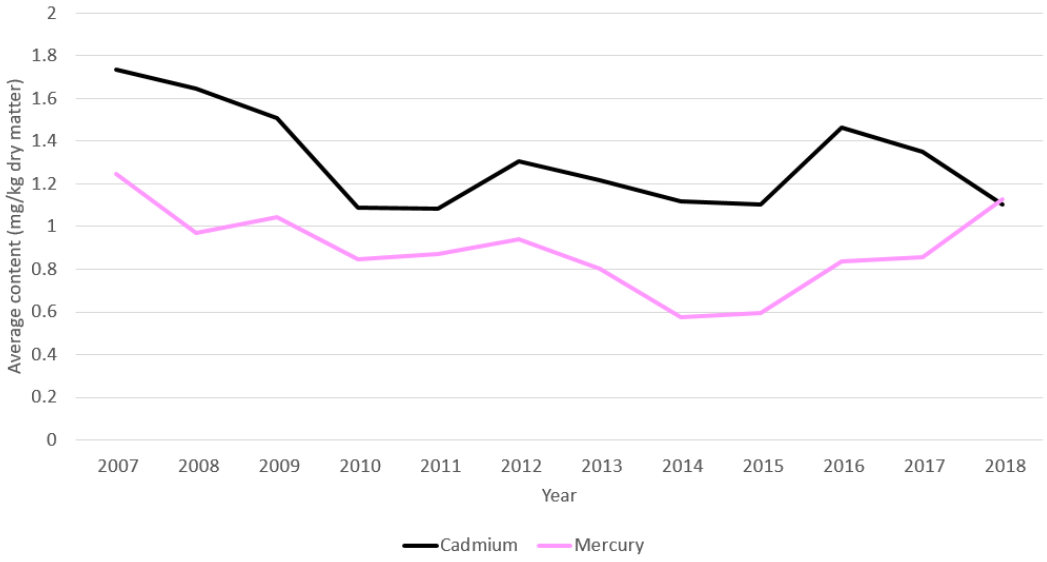
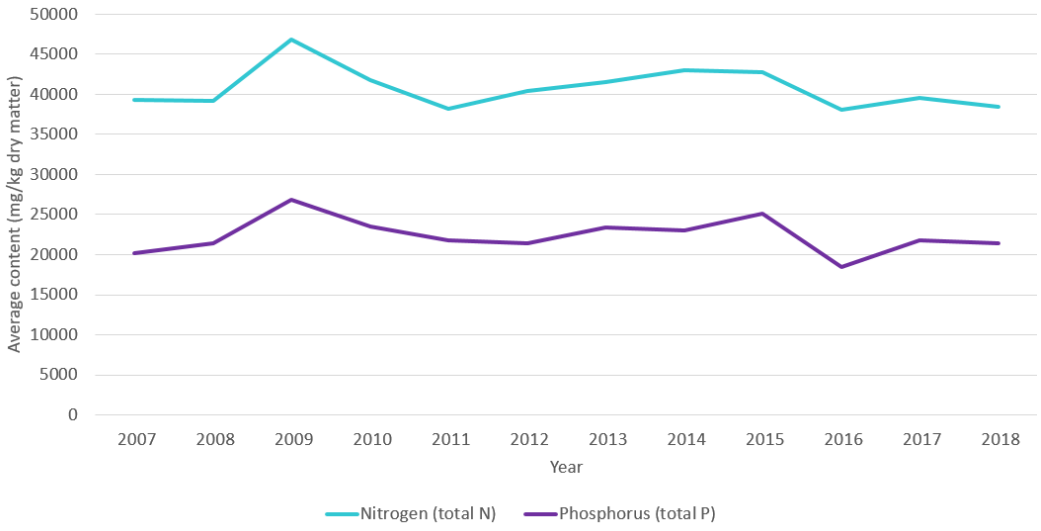


Figure 4.28 Average content of Cadmium and Mercury



Additionally, the Nitrogen content remained consistent between 2007 and 2018 at approximately 40,000 -45,000 mg/kg dry matter. Furthermore, the concentration of Phosphorus remained largely consistent over the period at 20,000 – 25,000 mg/kg dry matter.

Figure 4.29 Average content of Phosphorus and Nitrogen



4.8 Exemptions under Article 11

8. State the number of cases in which exemptions under Article 11 have been granted.

17 Member States have stated there are no exemptions under Article 11 that have been granted and Malta and the region of Brussels have stated that no sludge is used in agriculture. However, it was noted that six other Member States were not expected to have granted any exemptions through analysis of their previous reporting periods.

Three Member States (Lithuania, Luxembourg, and Hungary) did not provide a response to the question. Poland and France stated that the question was not applicable. It is unclear from the response whether any exemptions are granted in Portugal.

The remaining five Member States (Germany, Spain, Finland, Latvia, and Ireland) have indicated that exemptions have been granted in under certain circumstances. Examples of the circumstances include those exemptions concerning the required frequency of analyses of sludge/year have been granted to waste water treatment plants with less than 5000 person equivalents (Finland, Spain, and Ireland) and exemptions for waste water treatment plants with a size of less than 1000 population equivalents (Germany).

Of the Member States which responded, the majority have indicated that no exemptions under Article 11 have been granted. The number indicating this (17, with a further two indicating it was not applicable) is slightly lower than the 22 Member States which reported that they did not provide any exemptions for the 2013 – 2015 and 2010 - 2012 reporting periods. It should be noted that the initial responses to the questionnaire indicated a lower number of Member States granted no exemptions under Article 11 in the two previous reporting periods from 2010-2012 and 2013-2015, but the actual number is considered to be higher for both previous reporting periods. When references to previous reporting, taking into account previous questionnaires, from the Member States were also considered, it was ascertained that 22 Member States had not granted exemptions to small sewage treatment plants.

5. Conclusions

5.1 Sewage sludge from septic tanks and similar installations

Significant variation was reported by Member States with respect to specific conditions which have been deemed necessary for the protection of human health and the environment in accordance with the first indent of Article 3(2), when using sludge residues from septic tanks. The single most frequent response (five Member States) was that conditions in place are aligned with those in place at urban waste water treatment plants, although 12 Member States provided individual answers on a range of different conditions and prohibitions. Only two Member States stated that they did not have any special conditions in place.

5.2 National limit values

For the concentration of all heavy metals in soil all limits have been set below or equal to the upper limit set out in the SSD. The only exception are limits set by Bulgaria, Portugal and Spain which have set limits in exceedance for soils with a high pH level (minimum <7). The countries which have set the most stringent upper limits have typically been Denmark, Latvia, and Sweden, although the Netherlands and Finland have also set strict limits for Copper and Mercury respectively.

All Member States have reported limits within the upper limit set out in the SSD for the concentration of heavy metals in sludge. Spain, Greece, and Cyprus have typically set limits equivalent to the upper limit set out in the SSD for all metals. All other Member States have set national limits below this level. The most stringent limits have most commonly been set by Denmark and the Netherlands. Ireland and Sweden did not report national limit values for the concentration of heavy metals in sludge for any metals.

Member States have reported limit values for concentrations of heavy metals which may be added annually to agricultural land in accordance with the limits set out in the SSD for all heavy metals. Most commonly the most stringent limits have been set by Finland, the Netherlands and Sweden. A significant number of Member States have not reported limits for any heavy metals. Those Member States were Bulgaria, Cyprus, Croatia, Czechia, Germany, Denmark, Italy, and Poland.

The reporting on national limit values shows an overall satisfactory level of the implementation of the Directive. Since the previous reporting period, some Member States have revised their limit values and made them more stringent than what is required under the Directive.

5.3 Sludge treatment techniques

All Member States in the period 2016-2018 responded to the question on treatment techniques, with 26 providing technologies employed for treating sewage sludge. As a result of the responses provided three key groups of techniques were developed - Treatment for thickening and dewatering of sludge; Treatment for pathogen removal; Treatment with potential for energy recovery. The current application of the technologies across the EU has demonstrated that there is considerable scope to improve sludge treatment technology across the EU, particularly for energy recovery.

5.4 Length of the period during which it is forbidden to use sludge on grassland before it is grazed, and on forage crops before harvest

Five Member States stated that the time period in which it is forbidden to use sludge on grassland before it is grazed and on forage crops before harvest is three weeks, the minimum requirement. A further four Member States including two regions in Austria and all three of the reporting regions in Belgium have noted time limits within three to six weeks, whilst a further seven Member States have stated that some level of prohibitions remains for 10 months, with Finland stating the longest prohibition of five years. Three Member States (Czechia, Denmark, and Hungary) have stated that the application of sewage sludge will always be prohibited, and two Member States did not report a specific time period. No Member States stated time periods of below three weeks – the specified minimum requirement under the Directive.

5.5 Reduced limits or other limits pursuant to Article 8

12 Member States responded that they have introduced reduced limit values or other measures at national level and in addition twelve Member States responded they have not. Three Member States (Bulgaria, Estonia, and Lithuania) did not provide an answer to the question.

When asked to provide additional information on the reduced limits and other measures 16 Member States did not respond to the question or stated either that the question was not applicable, or that data could not be provided. The most common responses (including regional responses) focussed on providing a reference to the national legislation (seven responses) and stating that the use of sewage sludge is prohibited in certain circumstances (seven responses). National prohibitions include that sludge may be used only on soil with a pH value above 5 (Upper Austria, Finland, France), above 5.5 (Lithuania) and above 6 (Flanders).

5.6 Soil Analysis and Frequency

14 Member States have stated that types of analysis are undertaken on parameters additional to those listed in Annex II B (3) and 10 Member States have stated that either that the question is not applicable or that no further analysis other than those mentioned in Annex IIB have been carried out. Two Member States (Slovakia and Finland) did not provide a response to the question, whilst it was unclear whether Austria had undertaken additional parameters.

When requested to provide a minimum frequency of soil analysis 13 Member States were able to provide a specified time period, with five Member States (and additionally the region of Wallonia in Belgium) reporting that the minimum frequency of soil analysis is every 10 years. The next most common response (four Member States) was that the minimum frequency for the analysis was every four years. Three Member States did not provide a response to the question (Bulgaria, Italy, and Slovakia) and Malta stated that the question was not applicable for the 2016 – 18 period reporting period. The remaining Member States provided an answer but did not specify a specific time period.

5.7 Use of Sludge in Agriculture

The amount of sludge produced has remained relatively stable over this period, with production typically falling between approximately 7M – 8M tonnes. The most notable increase is seen from the year 2008 – 2010, with the amount produced then remaining mostly consistent until 2012. Following a decrease in production in 2013, the amount produced has been approximately 7M tonnes, with small fluctuations each year. The amount of sludge used in agriculture has also remained mostly consistent, between approximately 2M – 3M tonnes. The most notable yearly change occurred between 2012 – 2013 when there was a sharp decrease.

5.8 Exemptions under Article 11

17 Member States have stated there are not any exemptions under Article 11 that have been granted and Malta and the region of Brussels have stated that no sludge is used in agriculture. Three Member States (Lithuania, Luxembourg, and Hungary) did not provide a response to the question. Poland and France stated that the question was not applicable. It is unclear from the response whether any examples are granted in Portugal. The remaining five Member States (Germany, Spain, Finland, Latvia, and Ireland) have indicated that exemptions have been granted under certain circumstances.

5.9 Overall Implementation

Based on the 2016 – 2018 reporting period it is evident that the SSD has, in general, been effectively implemented across Member States. In a number of cases, Member States have chosen to go further than the minimal requirements set out in the Directive. This is shown, for example, with regards setting national limit values for the concentration of heavy metals in soil and sludge, for which a large number of Member States have opted to set their own more stringent national limits.

Similar responses were provided for both the 2010 – 12 and 2013 – 15 reporting periods, indicating that there have not been significant changes in approach, although there were some differences in terms of the Member States which set the most stringent limits.

Based on a comparison with previous reporting periods, there has been progress in implementation in a number of areas. For example, there is evident progress based upon the length of the period during which it is forbidden to use sludge on grassland, with a larger number of Member States setting a time period of at least three weeks than in previous reporting periods. Further to this, with regards to soil analysis, there was a slight increase (relative to previous reporting periods) in the number of Member States reporting that they had undertaken additional analysis of soil parameters other than those mentioned in Annex IIB (3).

In other cases, significant improvements based upon responses provided in 2010 – 12 and 2013 – 15 appear limited. For example, when asked whether the Member State had reduced limit values or, where appropriate, any other measures, been authorised at national level where the pH of the soil is below 6, the number of Member States reporting that this had happened had decreased in comparison to both of the previous reporting periods. Further to this, the most recent reporting period has allowed a more systematic analysis of the technologies which have been used to treat sewage sludge, with treatments grouped into three key categories. With a significant number of Member States (26) providing some detail as to the technologies in use, it can be considered that

the Directive has been successful in encouraging the uptake of treatments. This is particularly clear given that the number of Member States reporting the use of technologies to treat sludge has increased from the previous reporting periods, with 22 Member States (2010 – 12) and 20 Member States (2013 – 15) reporting the use of technologies previously. However, it should be noted that when assessing the previous reporting periods, it was expected that based on previous responses the number of Member States employing technologies was likely to be higher and aligned with reporting for 2016 – 18.

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