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GROUNDWATER THRESHOLD VALUES

In-depth assessment of the differences in groundwater threshold values established by Member States

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1 AIM OF THE ASSESSMENT

Starting point

The conclusions of the report from the European Commission to the Council and the European Parliament in accordance with Article 3.7 of the Groundwater Directive 2006/118/EC (GWD) (C(2010) 1096) showed significant differences between the established groundwater threshold values (TVs) in Europe: "There is a huge variability in the ranges of threshold values across Europe. The reason behind this could be that the GWD provides certain flexibility to the Member States in the establishment of threshold values by allowing the consideration of the different receptors of the groundwater body as well as the risks and functions, the characteristics and behaviour of the pollutants and the hydrogeological characteristics represented by the background levels. The consideration of these different requirements, potentially adapted to each individual groundwater body, leads to the different approaches followed by the Member States. The reasons for the differences can be assessed in detail only after seeing the threshold values in the context of the river basin management plans (e.g. the pressure and impact analysis)."

Aim of this in-depth assessment

The aim of this in-depth assessment is to further explore the reasons behind these variations at the level of selected parameters by considering also the recently submitted information published in the River Basin Management Plans (RBMPs) and to assess how the flexible approach given in the Water Framework Directive 2000/60/EC (WFD) and its daughter Directive 2006/118/EC on groundwater protection (GWD) ensure or hinder a comparable level of implementation and therefore a comparable level of groundwater status assessment within the EU. Finally, the assessment explores the potential of further harmonization specifications at European level and gives recommendations.

2 ROLE OF THRESHOLD VALUES IN GROUNDWATER PROTECTION

Legal basis

The WFD and GWD aims at achieving good status of surface and groundwater in the EU by 2015. Good status for groundwater consists of good chemical and quantitative status.

Groundwater threshold values play a key role in the assessment of groundwater chemical status and the assessment of significant and sustained upward trends of pollutants, because, besides other mandatory compliance elements, evaluation of groundwater chemical status is based on a comparison of monitoring data and numerical standard values (these can be EU-wide groundwater quality standards and/or national groundwater quality standards laid down by Member States – the latter are called threshold values).

TV establishment

The GWD provides EU-wide groundwater quality standards for nitrates and pesticides reinforcing the parent directives[1] and requests Member States to establish complementary groundwater quality standards (referred to as "threshold values", TVs), taking identified risks into account. Annex II of GWD contains an indicative list of pollutants/indicators that has to be considered as a minimum when establishing TVs. The GWD also provides guidelines for the establishment of TVs considering the interactions between groundwater and 1) associated aquatic and dependent terrestrial ecosystems (represented by environmental criteria), 2) the interference with actual or potential legitimate uses or functions of groundwater (represented by usage criteria) and 3) the high natural variability of substances in groundwater (depending upon hydrogeological conditions, natural background levels (NBLs), pollutant pathways, and interactions with different environmental compartments).

It is at the discretion of Member States to establish TVs at the most appropriate scale, either at the national level, the level of River Basin Districts (RBDs) or national parts of international RBDs or at the level of groundwater bodies (GWBs) or groups of GWBs. In case of transboundary groundwater bodies, coordination on the establishment of threshold values between Member States has to be ensured. Between Member States and non-Member States coordination should be endeavoured.

Reporting

Member States are required to publish the established TVs in each River Basin Management Plan (RBMP) in the form of a single value per substance / indicator or in the form of ranges of the lowest and highest values applied.

[1] EU Nitrates Directive (91/676/EEC), Plant Protection Products Directive (91/414/EEC), Biocidal Products Directive (98/8/EC).

3 METHODOLOGY OF THE ASSESSMENT

3.1 Source of information

The TVs and the information on the compliance regime were picked from the RBMPs which are available in the Water Information System for Europe (WISE). In a second step, Member States were approached to verify the TVs and to clarify the detailed criteria behind the establishment of certain TVs which deviated considerably from commonly reported value ranges. Within this verification process a considerable number of TVs were corrected, either because TVs were changed in the meantime or due to transmission errors in the Member States' reporting to WISE. Unfortunately, a considerable number RBMPs did not or not clearly enough describe the applied compliance regime - how groundwater chemical status was assessed. Furthermore, the description of the interrelationship between the use and/or ecosystem related quality standards and the natural background levels within the establishment of groundwater threshold values does not allow for a comparable analysis.

3.2 Selection of substances

Groundwater TVs were established and reported by the EU Member States for the substances listed in Annex I of the GWD (nitrate, individual and total pesticides), for the 10 substances/indicators of Annex II GWD and for nearly another 550 substances/indicators.

The in-depth assessment focused at a representative set of parameters meeting the following criteria:

- both natural and synthetic substances;
- substances that cause problems in a significant number of MS;
- substances where the range of the established TVs is significant; and
- specific focus is put on substances with different TVs in the different national shares of the same international RBD.

Based on the criteria listed above the following 14 substances were selected to be assessed in more detail:

Annex I substances	Annex II substances	Other natural substances	Synthetic substances
Nitrates	Ammonium	Copper	Anthracene
Total Pesticides	Arsenic	Nickel	Chloroform
	Cadmium	Zinc	Toluene
	Chloride		Xylene
	Lead		

Nitrates and total pesticides are covered by Annex I of the GWD giving common European quality standards for groundwater chemical status assessment – 50 mg/l for nitrates and 0.5 µg/l for total pesticides. If the objectives of the WFD cannot be met with the quality standards, Member States need to establish stricter threshold values.

For the Annex II substances, TVs were most commonly established in Europe, among them ammonium, arsenic, cadmium, chloride and lead showed considerably high ranges of TVs between Member States but also within international RBDs. Copper, nickel and zinc are other naturally occurring substances not listed in Annex II GWD but were also reported by a considerable number of Member States.

Anthracene, chloroform, toluene and xylene were the most frequently reported synthetic substances, all with considerably high variations of TVs, even within international RBDs.

3.3 Selection of international River Basin Districts

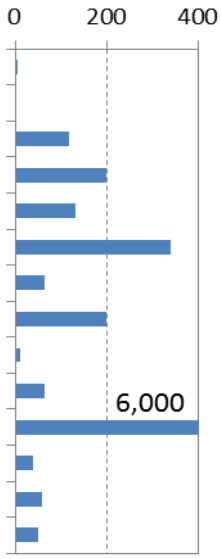
Based on the reported TVs and the significance of the differences among them, comparison of TVs within international RBDs was decided to cover twelve international RBDs: Danube (share of 8 Member States in this assessment), Rhine (6 MS), Elbe (4 MS), Meuse (4 MS), Scheldt (4 MS), Odra (3 MS), Daugava (2 MS), East Aegean (2 MS), Ems (2 MS), Nemunas (2 MS), Tornionjoki (2 MS) and Venta (2 MS).

4 VARIATIONS OF THRESHOLD VALUES

For many of the reported substances and indicators the TVs vary considerably from Member State to Member State, from River Basin District to River Basin District and also between national shares of the same international River Basin Districts. These variations were subject to scrutiny for the selected number of substances. The following table illustrates the ranges of TVs between the smallest and the largest reported TV, which is also presented as a ratio, starting from 5-times range for nitrates up to an impressive 6000-times range between the lowest and the highest TV for anthracene.

Table 1: Ranges of TVs and nominations by Member States and RBDs

Selected substance	Reported from		Threshold values		Unit	TV Range (x-times)
	MS	RBDs	from	to		
Nitrates*	5	30	10.68	50	mg/l	5
Total Pesticides*	1	7	0.375		µg/l	
Ammonium**	23	114	0.084+	9.9	mg/l	118
Chloride**	25	126	24	4,750	mg/l	198
Arsenic**	22	116	5	653	µg/l	131
Cadmium**	20	114	0.08	27	µg/l	338
Lead**	22	116	5	320	µg/l	64
Copper	9	47	10.1	2,000	µg/l	198
Nickel	11	77	10	116	µg/l	12
Zinc	6	43	58	3,750	µg/l	65
Anthracene	3	28	0.01	60	µg/l	6,000
Chloroform	5	28	2.53	100	µg/l	40
Toluene	5	28	12	700	µg/l	58
Xylene	5	28	10	500	µg/l	50
Total	**25**	**133**				



* Annex I substance ** Annex II substance + reported for NH_4-N and recalculated to NH_4

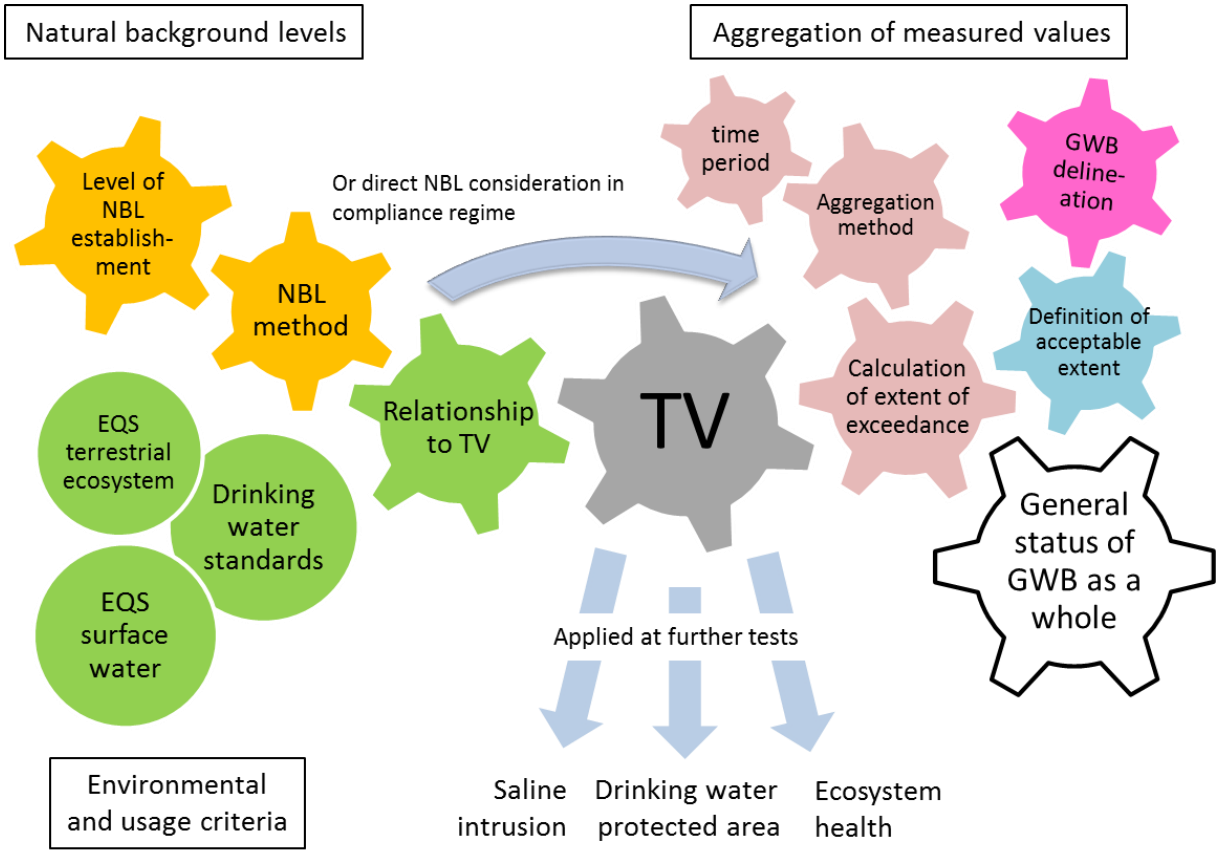
5 RESULTS OF THE ASSESSMENT: THE REASONS BEHIND TV VARIATIONS

In general, Member States based the establishment of TVs on the requirements of WFD and GWD and they also frequently reported having considered and applied the procedures laid down in the CIS Guidance Document No. 18[2] which aims at supporting Member States in the establishment of groundwater threshold values and the assessment of groundwater status.

Flexible elements in WFD and GWD

However, the WFD and the GWD leave considerable flexibility to the Member States in assessing groundwater chemical status (see Figure 1). This flexibility concern mainly 3 areas: 1) the establishment of TVs themselves, 2) the compliance regime and 3) the delineation of groundwater bodies. The following sections of this chapter give more detailed information on the different reasons in these 3 areas.

Figure 1: Flexible criteria for the establishment of TVs and compliance regime in assessing the general status of a GWB as a whole



[2] CIS Guidance Document No. 18 'Guidance on Groundwater Status and Trend Assessment'

This chapter contains the summary of the findings of the in-depth assessment. More detailed results of the assessment can be found in Annex I, where individual selected parameters and the reasons for certain established groundwater threshold values and the considerably high variations are presented in closer detail comparing the ranges at MS level and at the level of the international RBDs. As far as available the detailed underlying reasons and criteria for the established TVs reported by the Member States are summarised and compared there. Table 5 of Annex I gives an overview of the different national compliance regimes of chemical status assessment and TV establishment.

5.1 Different approaches during the establishment of threshold values

The groundwater threshold values were mainly derived considering (national and international) **standards for drinking water consumption** (DW standards), **natural background levels** (NBLs) and in a few cases **environmental quality standards** (EQS) which were mainly derived from surface waters as receptors.

Reasons for high and low TVs

The main rationale behind lower values and upper values of ranges of TVs lays in the consideration of different receptors and their individual criteria values. Table 2 indicates which criteria and receptors give reason for lower values and which are behind upper values of the reported ranges of TVs for each substance assessed. The details of the assessment per substance can be found in Annex I.

It can be seen, that for naturally occurring substances the lower values of TV ranges are either caused by natural background levels (NBLs), by drinking water standards (DWS) (if drinking water use was considered as receptor) or by environmental quality standards (EQS) in case of consideration of ecosystems. The upper values of the TV ranges are mainly due to NBLs.

For synthetic substances, the consideration of ecosystems by EQS result in the lower values of TV ranges whereas the consideration of drinking water use by DWS cause the upper higher values.

Table 2: Criteria for the lower and the upper ranges of TVs

Substance	Ranges of threshold values and criteria/receptors causing the lower values				upper values		
Criteria values	NBL	DWS	EQS		NBL	DWS	EQS
Nitrates*							
Total Pesticides*							
Ammonium**							
Chloride**		corrosion					
Arsenic**							
Cadmium**							
Lead**							
Copper							
Nickel							
Zinc						taste	
Anthracene					Risk assessment cont. sites		
Chloroform							
Toluene		taste					
Xylene		taste					

* Annex I substance ** Annex II substance; NBL…Natural Background Levels; DWS…Drinking Water Standards; EQS…Environmental Quality Standards

The reasons for considerable variations of TVs are not only due to the different criteria from which these TVs were derived, but also due to different national levels of such criteria, different approaches in establishing such criteria, and different approaches in the derivation process from the criteria to the threshold values. The main reasons are explained in the following sections.

5.1.1 Approaches to derive and consider natural background levels (NBLs)

The huge variability of natural background levels, even within an international RBD, may reflect the actual variability in terms of hydrogeological variations of different parts of Europe. However, it has to be considered that the **national methodologies for deriving such natural background levels vary considerably** from Member State to Member State. The detailed assessment of the national methodologies for the calculation of NBLs is beyond the scope of this report, but some general considerations can be drawn.

The **established relationship between TVs and the observed natural background levels of naturally occurring substances** gives raise to considerable differences between the Member States. Two main cases can be distinguished (see also Figure 2):

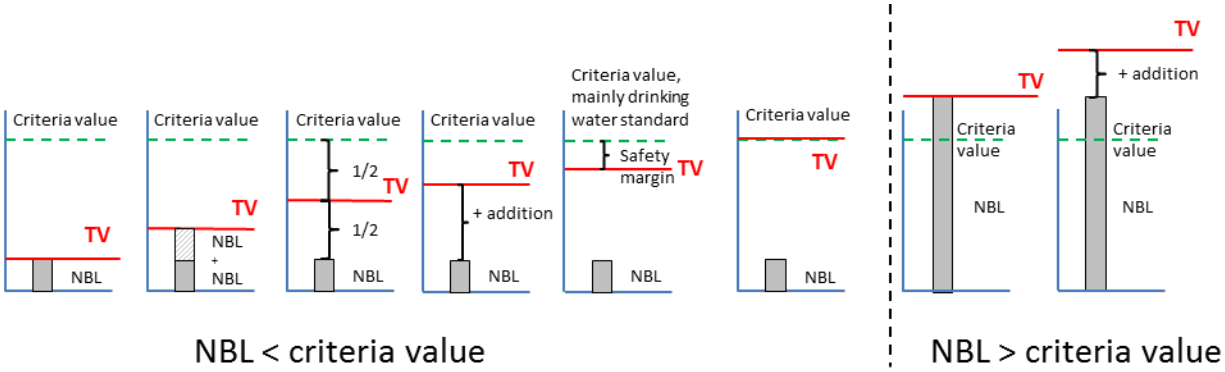
a) In cases where natural background levels are lower than criteria values (that are derived from environmental and/or usage criteria) Member States applied five different methods for deriving TVs: 1.) nine Member States established their TVs at the level of the criteria values; 2.) five of them established a percentage of drinking water standards as their TVs; 3.) two other Member States used NBLs plus an addition, either considering dilution and attenuation or considering tolerable concentrations

with no effect to ecosystems (PNECs); 4.) one Member State used 2-times the NBLs and 5.) three others calculated a mean value of the criteria value (or a percentage of it) and the NBL and set the TVs there. For some Member States the information was not clear, but no Member State established the TV at the level of NBLs in the case where NBLs are lower than criteria values.

b) In cases where natural background levels are higher than relevant criteria values, most of the Member States established the TVs at the level of the NBLs but some also considered an addition (e.g. plus 20 %) to be added to the NBLs.

The comparison of approaches of the relationship between TVs and NBLs is not always straight forward as Member States apply different approaches for different substances.

Figure 2: Approaches for deriving TVs considering NBLs and criteria values, leading to different TVs



TV ... Groundwater threshold value; NBL ... Natural background level

The assessment also shows that beyond the differences in NBL calculation methods and the relationship between NBLs and TVs, the main reason for the variation of TVs within a Member State or a national share of an international RBD is due to the fact that **NBLs were established in different geographical levels**: individually at the level of GWBs or groups of GWBs or at the national level.

The fact that NBLs are established at different scales might lead to incomparable status results. It can make a considerable difference if a NBL, which considers an anomaly in a certain area, is applied to the whole country or if individual NBLs are derived for each GWB. Although the methodology for calculating NBLs needs to consider this aspect, there might still be the possibility that NBLs established at Member State level might lead to status results which hide anthropogenic pollution in GWBs where the actual NBL in a GWB is much lower than the common NBL established for the whole Member State.

5.1.2 Drinking water standards

Although most of the national drinking water standards are identical with values established in the Drinking Water Directive 98/83/EC, some differences could be observed as Member States may exempt from the provisions of the Directive at smaller abstractions. Examples of this case can be found e.g. in Sweden, where the standard of ammonium for private water supplies is 3 times higher than the indicator parameter issued by the Drinking Water Directive. Another example is copper, where reported national drinking water standards range from 1,000 µg/l in the Slovak Republic up to 4,000 µg/l in Malta.

For naturally occurring substances the drinking water standards are mainly resulting in the lower values of TV ranges as in many groundwater bodies and for certain substances the natural background levels exceed the DWS by far. For synthetic substances NBLs do not exist and the lower and upper ranges of TVs are only caused by EQS and DWS. As many ecosystems are more sensitive to pollution from synthetic substances than humans, EQS are for many substances lower than DWS. This is the reason why the lower values of TV ranges are caused by EQS and the upper values are due to DWS, as far as these receptors were considered.

Further difference in TVs is caused by the **relationship between TVs and drinking water standards:** when deriving TVs from DWS, many Member States considered a safety margin or level of precaution and established the TVs as a percentage of DWS. Such percentages vary between 50 % and 100 % of respective national drinking water standards causing a certain level of variations of TVs (up to 2-times) between Member States.

5.1.3 Environmental quality standards

Within the establishment of TVs aquatic and terrestrial ecosystems – as receptors of groundwater – are principally considered by environmental quality standards. Such standards were only reported in connection with associated aquatic ecosystems and not with terrestrial ecosystems. In general, for naturally occurring substances ecosystems are adapted to natural background levels and therefore TVs derived from EQS could result in higher values than those derived from drinking water standards. In case of synthetic substances, due to the lack of natural background levels, the EQS are usually lower than DWS as many ecosystems are more sensitive to pollution from synthetic substances than humans.

EQS for groundwater dependent terrestrial ecosystems were not reported to be directly included in the derivation of TVs at all. A few Member States mentioned terrestrial ecosystems in connection with the TV establishment, mainly stating that both knowledge of the needs of such ecosystems and knowledge about the interaction between groundwater and dependent terrestrial ecosystems are insufficient for a proper consideration in the derivation of TVs. This topic was al-

ready discussed in the Technical Report No 6[3] prepared by the Working Group on Groundwater under the Common Implementation Strategy (CIS) of the WFD.

5.2 The compliance regime – approaches and differences

The definition of good groundwater chemical status is given in the WFD. The GWD sets the compliance regime to meet the requirements of good chemical status in the form of several objectives. A CIS Guidance Document[4], jointly developed by the European Commission, Member States and stakeholders, aims at supporting proper implementation of the WFD and GWD by addressing the status compliance elements in detail.

One status objective of the WFD, where TVs play a major role, is the test of the general groundwater chemical status for the groundwater body as a whole. According to Article 4 GWD a groundwater body is in good status 1) where monitoring demonstrates the good status, or 2) when groundwater quality standards or TVs are not exceeded at any monitoring point, or 3) where a groundwater quality standard or TV has been exceeded at one or more monitoring points, but appropriate investigation, with appropriate aggregation of monitoring results, confirms that several conditions listed in Article 3 c) are met. In the latter case Member States have to estimate the extent of the groundwater body (in terms of volume or spatial area) having an annual arithmetic mean concentration of a pollutant higher than a groundwater quality standard or TV (as defined in Annex III.3). This specification leaves certain flexibility to the Member States in aggregating the monitored data and in defining the acceptable extent of the GWB where TVs are exceeded and the conditions of good chemical status are still met.

This in-depth assessment revealed considerable differences in the national approaches to comply with this specific status objective, especially concerning:

1) the aggregation of monitoring results and
2) the acceptable extent of TV exceedances where the conditions of good chemical status are still met.

5.2.1 Aggregation of monitoring results

There are differences in the **aggregation level of monitoring results**, where the following approaches were reported: 1. Calculation of annual mean values per monitoring point followed by an aggregation over a certain time period. 2. Calculation of mean values per monitoring point of all measurements in the whole time period in one step. 3. Calculation of mean values for the GWB as a whole. 4. Calculation of periodic mean values. These aggregated values are then compared to the groundwater quality standards and TVs.

[3] European Commission (2012): Technical Report on groundwater dependent terrestrial ecosystems. Technical report No 6.

[4] CIS Guidance Document No. 18 'Guidance on Groundwater Status and Trend Assessment'

Another detected difference in the aggregation approach is the **aggregation method:** mean values are mainly calculated as arithmetic means but also confidence limits of Kriging means and medians were reported to be applied.

The third difference in the aggregation of monitoring results appears in **aggregation periods:** The time period considered in the aggregation procedure varies considerably: 9, 6, 4, 3 and 2 years periods are used in different Member States. Especially longer time periods might lead to a smoothing of results hiding potential critical increases in recent years.

5.2.2 Acceptable extent of TV exceedances where the conditions of good chemical status are still met

The calculation method of acceptable extent of exceedance is determined by different national approaches, either by considering the number of monitoring sites, the affected (weighted) area, the affected GWB volume or by not further detailed (and probably not European-wide comparable) expert judgements.

The definition of acceptable extent of exceedance itself also shows differences: The acceptable extent of a GWB which might exceed quality standards or TVs, where the conditions of good chemical status are still met, varies from a fixed value of 25 km² over 10% up to 50% of the monitoring points / area / volume. But also expert judgment was reported not further specifying the underlying criteria.

5.3 Consideration of some elements in different phases of the procedure

Some Member States integrate aspects like safety margins or precaution levels etc. when establishing threshold values, while others integrate those margins and levels in the compliance regime by comparing the monitored values to a percentage of TVs.

Similarly, most of the Member States integrate natural background levels (NBLs) into the TVs but two Member States (AT and IE) reported that the NBLs are not included in the TVs but later considered in the compliance regime by excluding monitoring points from the assessment in case the measured values represent NBLs. The measured values are, in case of exceedance of TVs, compared to the NBLs at GWB level. This results in the fact, that although the level of groundwater status is comparable in this case, the TVs are often not.

5.4 Delineation of groundwater bodies

The results of the status and compliance assessment are to some extent dependent on the size of GWBs as a result of GWB delineation. This means that the relevance and significance of receptors when considering the status of a GWB as well as the accuracy and the relevance of a natural background level (NBL) at GWB level is strongly related to the size of a GWB. Within the general assessment of the status of a GWB as a whole, the same relative acceptable extent of exceedance of a TV changes considerably with the GWB size in terms

of absolute extents – 20 % of 10 km² correspond to 2 km² whereas 20 % of 1,000 km² mean 200 km². Large differences in the sizes of GWBs result in a different weighting of compliance elements in the status assessments. In a relatively small groundwater body, a certain receptor could be relevant for the groundwater body as a whole whereas it is not in a larger groundwater body. E.g. as the future legitimate use of groundwater is mainly covered by the general assessment of the status of a GWB as a whole, a polluted area of 100 km² which is intended for future drinking water use in a 1000 km² groundwater body is not endangering the good status of the groundwater body as a whole while the area of 3 km² in a 10 km² groundwater body shows a much larger impact on the status.

6 CONCLUSIONS AND RECOMMENDATIONS

The Water Framework Directive and the Groundwater Directive request Member States to establish groundwater threshold values for pollutants and indicators that represent or indicate a risk to the good status of groundwater. They provide guidelines, give an indicative list of pollutants and request for information to be provided by Member States in their river basin management plans linked to TV establishment.

This in-depth assessment shows that Member States did not always follow the guidelines or they interpreted them in different ways, while also the reported information in the river basin management plans is not complete in a number of cases or information provided in the plans has been updated in a later phase.

Transparency in the reported information would be the first important condition of correct interpretation and of comparability of the results. This concerns reporting of groundwater bodies characterised as being at risk and of the pollutants that contribute to this classification and that were considered in the establishment of groundwater threshold values. Also the methodologies of calculating and considering natural background levels of pollutants should be transparent as well as information on exceedance of quality standards should be reported in case groundwater bodies are of good chemical status.

The WFD and GWD lays down requirements but at the same time ensures certain flexibility to the Member States in the establishment of groundwater threshold values by allowing the consideration of the different receptors of the groundwater body as well as the risks and functions, the characteristics and behaviour of the pollutants and the hydrogeological characteristics represented by the background levels.

A certain degree of harmonisation within the establishment of TVs and the compliance regime is given in the Directives, but the assessed criteria, approaches and methodologies which were applied by Member States in the chemical status assessment are considerably different and offer room for further harmonization to achieve better comparability of the results.

This in-depth assessment discovered a number of different reasons behind the differences of TVs and it identifies areas where further harmonization could be considered:

- **Natural background levels:** To explore the potential for enhancing comparability of the status assessment regimes by potential harmonization of the methodologies for calculating NBLs, it is recommended to assess the different national approaches in closer detail.
  The different established relationships between TVs and the observed NBLs cause important variations of TVs. It seems reasonable to further explore the possibility of harmonising these approaches which contributes to a higher level of comparability of status assessments.

The establishment of NBLs at different geographical scales (Member State, RBD or GWB) also leads to considerable variations of TVs and might result in incomparable status assessments. It is proposed to consider the further harmonization of these levels and promote the establishment of NBLs at GWB scale.

- **Drinking water standards:** For certain parameters national drinking water standards might be subject to considerable variations, especially for those parameters which are not covered by the Drinking Water Directive or in cases where Member States may exempt from the provisions of the Directive (individual private supplies providing less than 10 m^3 a day as an average or serving fewer than 50 persons) or where Member States established stricter norms. To make the status results more comparable it is recommended to look into the possibility of further harmonising the drinking water standards to be applied in the status assessment for a broader set of substances/indicators. The potential for harmonization of TVs might also be explored with regard to the commonly applied safety margins in the derivation of TVs from drinking water standards.
- **Environmental quality standards for associated surface waters and groundwater dependent terrestrial ecosystems:** surface waters associated to groundwater and groundwater dependent terrestrial ecosystems should be more commonly considered in status assessment as they are essential elements in the groundwater status assessment according to the WFD. The main obstacle is the limited knowledge about the needs of groundwater dependent ecosystems as well as the interaction between groundwater and these ecosystems. The appropriate consideration of these elements has been subject to discussion at European level and led recently to the elaboration of a Technical Report[5] by the CIS Working Group on Groundwater summarising the current state of knowledge. This process needs to be continued and intensified also by integrating ecosystems experts. Member States should take opportunity of sharing and exchanging experiences gathered so far regarding the interconnections between groundwater and the ecosystems and regarding the needs of the ecosystems in order to increase the knowledge base considerably.
- **Compliance regimes – aggregation of monitoring results:** Currently a broad variation of methods for the aggregation of monitored values is applied in Europe, characterised by different aggregation methods, different aggregation levels and differing aggregation periods. More detailed specifications e.g. on the aggregation period could contribute to a better comparability of status results. Especially longer time periods might lead to a smoothing of results hiding potential critical increases in recent years, which would not respect the requirements of the compliance regime under the Drinking Water Directive where single exceedances (maximum allowable concentrations) are relevant.
- **Compliance regimes – 'acceptable extent of exceedance':** The definition of the acceptable extent of a GWB which might exceed quality standards or TVs, where the conditions of good chemical status are still met is a key element in the status assessment and inherits several aspects leading to considerable variations in the status results.

[5] European Commission (2012): Technical Report on groundwater dependent terrestrial ecosystems. Technical report No 6.

When interpreting and comparing the status results, it is highly recommended to consider the different definitions of the ‘acceptable extent of exceedance’ together with the approaches for establishing TVs. Some Member States integrated aspects like safety margins or precaution in the TVs, others might have integrated it in the ‘acceptable extent of exceedance’. Most of the Member States integrated NBLs into the TVs but few Member States consider NBLs in the compliance regime by excluding monitoring points from the assessment in case the measured values represent NBLs.

It is recommended to explore options of further streamlining the implementation of the GWD to make the whole compliance regime more comparable by e.g. specifying the ‘acceptable extent of exceedance’ in more detail or by specifying where possible safety margins should be considered, either at the level of TVs or at the level of ‘acceptable extent of exceedance’. It is proposed to clarify to which metric (mean value, maximum etc.) the quality standards are related to, especially those which are identical with drinking water standards. In any case ‘acceptable extent of exceedance’ should be based on transparent criteria considering CIS guidance documents in order to allow for better comparability of status results between Member States.

- **Delineation of GWBs:** The flexibility in the delineation of GWBs leads to considerably different sizes of GWBs influencing both the establishment of NBLs at GWB level and the weighting of the significance of compliance elements (e.g. receptors, absolute extents of acceptable exceedance) in the status assessment. It is recommended to look at the possible ways of exchanging information, providing best practice and/or improve guidance on carrying out and reporting of the delineation of GWBs.

The issues mentioned above could be well tackled by international cooperation in the implementation of EU legislation as it has been done so far in the frame of the Common Implementation Strategy of the Water Framework Directive. A Working Group on Groundwater under this procedure has been successfully working on different implementation issues for years and it is advisable to include the findings of this in-depth assessment in the work programme of this Working Group.

However there are also other fora where the establishment of TVs could and should be harmonized. International coordination of TVs is an important requirement of GWD but based on the assessment of the river basin management plans only part of the Member States coordinated the establishment of threshold values with other Member States and non-Member States and in some cases the information provided about the coordination was not clear. Transboundary coordination of threshold values should be better exploited by Member States during the second cycle of river basin management planning and the details of the coordination should be clearly indicated in the plans.

ANNEX – DETAILED DATA

CONTENT

OVERVIEW – RANGES OF TVS ESTABLISHED

Table 3: Ranges of TVs for Annex I and II substances - at Member State level

	Ammonium		Arsenic		Cadmium		Chloride		Lead		Nitrates**		Total pest.**	
	from	to	from	to	from	to	from	to	from	to	from	to	from	to
AT		0.45		9		4.5		180		9		45		
BE	0.3	3.9	10	20	1	5	142	245	7.2	15				
BG	0.377	0.42					194.26	781.9			37.888	38.788		
CY		0.5		10		5	250	3,000		10				
CZ		0.5		10		1		200		5				
DE		0.5		10		0.5		250		7				
DK	0.25	5.5	5	11			250	300						
EE							250	350						
ES	0.5	2	7	653	4	16	40	4,750	10	100				
FI		0.25		5		0.4		25		5				
FR		0.5		10			200	250		7.2				
GR		0.5		10		5		250		25				
HU	0.5	5				5		250		10	25	50		
IE	0.084*	0.23*		7.5		3.75	24	187.5		18.75		37.5		0.375
IT		0.5		10		5		250		10				
LT		3		10	1.5	6	250	350	25	75				
LU		0.5		10		1		250		10				
LV	0.5	0.8		7		2	130	190		6				
MT		0.25	5	7.5			210	1,000		10				
NL			15	25		0.5	140	1,990		11				
PL		1.5		20	5	5		250		100				
RO	0.5	9.9	10	40	5	27	250	860	10	320				
SE		1.5	0	10		5	100	100		10				
SK	0.255	0.9	5.25	10	1.525	2.5	50.9	104	5.25	10				
UK	0.29	1.73	7.5	199	0.08	3.75	25	188	7.2	39.8	10.68	42		
EU	**0.084**	**9.9**	**5**	**653**	**0.08**	**27**	**24**	**4,750**	**5**	**320**	**10.68**	**50**		**0.375**

*… reported for NH_4-N and recalculated to NH_4

**…a European EQS is established for these pollutants by the Groundwater Directive 2006/118/EC. TVs has to be established for them only if the identified risks require the establishment of more stringent standards

Table 4: Ranges of TVs for other selected substances than Annex I and II - at Member State level

	Copper		Nickel		Zinc		Anthracene		Chloroform		Toluene		Xylene	
	from	to	from	to	from	to	from	to	from	to	from	to	from	to
AT		1,800		18										
BE		100	20	60	200	375								
BG														
CY														
CZ														
DE		14		14		58		0.01						
DK				20										
EE														
ES		2,000	20	30						6				
FI		20		10		60		60		100		12		10
FR												700		500
GR				20										
HU														
IE														
IT				20								15		10
LT														
LU														
LV										6				
MT		2,000				3,000								
NL				30										
PL		200		20		1,000								
RO														
SE										100				
SK	500.2	504										437.5		312.5
UK	10.1	1,500	15	116	75.8	3,750	0.1	0.55	2.53	75	50.5	276	30.3	166
EU	**10.1**	**2,000**	**10**	**116**	**58**	**3,750**	**0.01**	**60**	**2.53**	**100**	**12**	**700**	**10**	**500**

*Table 5: Ranges of TVs for Annex I and II substances - at RBD level**

		Ammonium		Arsenic		Cadmium		Chloride		Lead		Nitrates**	
RBDname	RBD	from	to	from	to	from	to	from	to	from	to	from	to
Danube	AT1000		0.45		9		4.5		180		9		45
	BG1000											37.888	38.788
	DE1000		0.5		10		0.5		250		7		
	HU1000	0.5	5				5		250		10	25	50
	PL1000		1.5		20		5		250		100		
	RO1000	0.5	9.9	10	40	5	27	250	860	10	320		
	SK40000	0.255	0.9	5.25	10	1.525	2.5	50.9	104	5.25	10		
	CZ_1000		0.5		10		1		200		5		
Daugava	LT4500		3		10	1.5	6	250	350	25	75		
	LVDUBA	0.5	0.8		7		2	130	190		6		
East Aegean	BG3000	0.377	0.39										38.705
	GR12		0.5		10		5		250		25		
Elbe	DE5000		0.5		10		0.5		250		7		
	PL5000		1.5		20		5		250		100		
	AT5000		0.45		9		4.5		180		9		45
	CZ_5000		0.5		10		1		200		5		
Ems	DE3000		0.5		10		0.5		250		7		
	NLEM			15	19.5		0.5		140		11		
Meuse	BEMaas_VL	0.3	1.5	11	20	2.6	2.8	142	220	10	15		
	DE7000		0.5		10		0.5		250		7		
	NLMS			15	19.5		0.5	140	240		11		
	BEMeuse_RW		0.5		10	5	5		150		10		
Nemunas	LT1100		3		10	1.5	6	250	350	25	75		
	PL8000		1.5		20		5		250		100		
Odra	DE6000		0.5		10		0.5		250		7		
	PL6000		1.5		20		5		250		100		
	CZ_6000		0.5		10		1		200		5		
Rhine	AT2000		0.45		9		4.5		180		9		45
	DE2000		0.5		10		0.5		250		7		
	FRC								250				
	NLRN				15		0.5	140	1,990		11		
	LU RB_000		0.5		10		1		250		10		
	BERhin_RW		0.5		10		5		150		10		
Scheldt	BESchelde_VL	0.3	3.9	10	20	2.5	3	142	245	10	15		
	NLSC			15	25		0.5	140	1,500		11		
	BEEscaut_RW		0.5		10		5		150		10		
	BEEscaut_Schelde_BR		0.5		10	1	5		150	7.2	10		
Tornionjoki	FIVHA6		0.25		5		0.4		25		5		
	SE1TO		1.5		10		5		100		10		
Venta	LT2300		3		10	1.5	6	250	350	25	75		
	LVVUBA								150				
Total		**0.25**	**9.9**	**5**	**40**	**0.4**	**27**	**25**	**1,990**	**5**	**320**	**25**	**50**

* Based on the reported TVs and the significance of the differences among them, comparison of TVs within international RBDs was decided to cover twelve international RBDs: Danube (share of 8 Member States in this assessment), Rhine (6 MS), Elbe (4 MS), Meuse (4 MS), Scheldt (4 MS), Odra (3 MS), Daugava (2 MS), East Aegean (2 MS), Ems (2 MS), Nemunas (2 MS), Tornionjoki (2 MS) and Venta (2 MS).

**…a European EQS is established for Nitrates by the Groundwater Directive 2006/118/EC. TVs has to be established for Nitrates only if the identified risks require the establishment of more stringent standards

Table 6: Ranges of TVs for other selected substances than Annex I and II - at RBD level

		Copper		Nickel		Zinc		Anthracene		Chloroform		Toluene		Xylene	
RBDname	RBD	from	to	from	to	from	to	from	to	from	to	from	to	from	to
Danube	AT1000		1,800		18										
	BG1000														
	DE1000		14		14		58		0.01						
	HU1000														
	PL1000		200		20		1000								
	RO1000														
	SK40000	500.2	504										437.5		312.5
	CZ_1000														
Daugava	LT4500														
	LVDUBA										6				
East Aegean	BG3000														
	GR12				20										
Elbe	DE5000		14		14		58		0.01						
	PL5000		200		20		1000								
	AT5000		1,800		18										
	CZ_5000														
Ems	DE3000		14		14		58		0.01						
	NLEM				30										
Meuse	BEMaas_VL			23	60	305	360								
	DE7000		14		14		58		0.01						
	NLMS				30										
	BEMeuse_RW		100		20		200								
Nemunas	LT1100														
	PL8000		200		20		1,000								
Odra	DE6000		14		14		58		0.01						
	PL6000		200		20		1,000								
	CZ_6000														
Rhine	AT2000		1,800		18										
	DE2000		14		14		58		0.01						
	FRC														
	NLRN				30										
	LU RB_000														
	BERhin_RW		100		20		200								
Scheldt	BESchelde_VL			23	38	310	375								
	NLSC				30										
	BEEscaut_RW		100		20		200								
	BEEscaut_Schelde_BR				20										
Tornionjoki	FIVHA6		20		10		60		60		100	12	12		10
	SE1TO										100				
Venta	LT2300														
	LVVUBA														
Total		**14**	**1,800**	**10**	**60**	**58**	**1,000**	**0.01**	**60**	**6**	**100**	**12**	**437.5**	**10**	**312.5**

COMPLIANCE REGIMES – GW CHEMICAL STATUS

This comparative table illustrates the different Member State compliance regimes of groundwater chemical status assessment for the GWB as a whole

Table 7: Member States approaches for the aggregation of monitored values and consideration of extent of exceedance.

(1)…Member State; (2)…defined acceptable extent of exceedance; (3)…approach for the calculation of the actual extent of exceedance; (4) …time period considered in the aggregation of measured values

MS	%	P...points A...area V...volume	Time period	Further description of the calculation criteria and approaches
(1)	(2)	(3)	(4)	
AT	50%	P	2006–2008	Calculation of arithmetic mean (over the period 2006-2008) of annual arithmetic means of monitoring point and comparison of each point to QS and TVs. A sampling site is not endangered when the exceedance of a TV is due to natural background concentrations.
BE*	20%	P		(Brussels)
BE*			2004–2007	(Flanders): Average over time period per sampling point. For each GWB the 90-percentile value of these averages was determined and compared to the EQS (if EQS > NBL) or to the NBL (if NBL > EQS). Poor status if EQS/NBL is exceeded.
BG*	30%	P	2007–2008	less than 30% of stations (area GWB) volumes exceed thresholds GW (different in Eastern Aegean). Calculation of arithmetic mean with 2 monitoring points and median in case of more than 2 points.
CY			3 years	Expert judgement, taking in consideration all available data, such as the local NBL, lithology, groundwater level.
CZ	30%	A	2004–2006	Delineation of sub-units of GWB based on impacts and pressures analysis and representativeness of monitoring sites due to identified pressures; also trend assessment considered
DE	33% 10%	A		Different criteria for diffuse and point sources of pollution: - Diffuse pollution: Poor status if 25 km² are polluted (independently of the size of the GWB) or - if a GWB is smaller than 75 km² if > 1/3 of the area is polluted. - Point pollution: Poor status if 25 km² are polluted (independently of the size of the GWB) or - if a GWB is smaller than 250 km² if > 10% of the area is polluted.
DK	20%	A, V		
EE	30%	P		

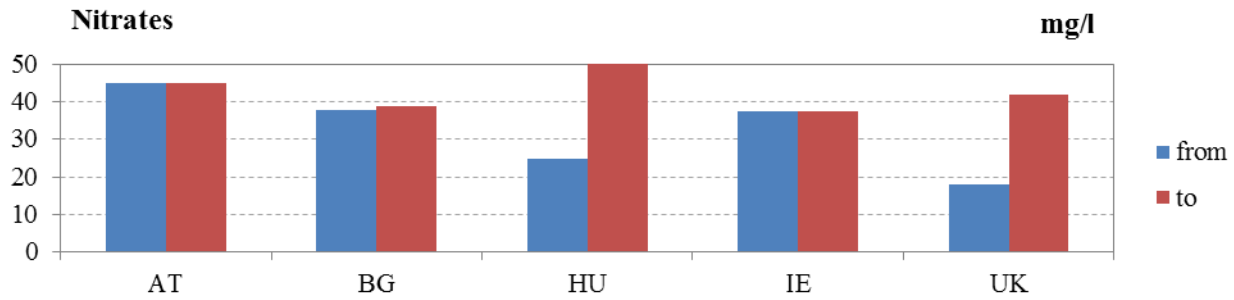
MS	%	P...points A...area V...volume	Time period	Further description of the calculation criteria and approaches
(1)	(2)	(3)	(4)	
ES	20%	P	2007–2008	less than 20% = good status
FI			Since 2007	Calculation of annual arithmetic mean for each monitoring point and comparison with EQS (= TV). Still good if the level of concentration is not causing significant environmental risk in the GWB or the exceedance has not significantly deteriorated the usability of the GWB.
FR	20%	P	2006–2008	less than 20% = good status
GR	20%	P, V	Last years	Alternatively: assessment of the affected volume of the GWB (20% criterion)
HU	20%	A		
IE		A	2003–2008	Calculation of average concentration per site. GWBs with similar hydrogeology and pressures were grouped. Monitoring data from all monitoring points within these groups of GWBs were assessed together. Where a TV was exceeded at an individual monitoring point an aggregated average (mostly un-weighted) pollutant concentration was calculated across the GWB group for the relevant pollutant. Poor status for GWBs in the group if aggregated concentrations exceed TVs except when NBLs were higher than the average concentrations.
IT	20%	V		
LU	33%	P		A GWB is not of good chemical status when: - 75% of the QS/TV is exceeded (annual arithmetic mean) at more than 1/3 of the monitoring points. - 75% of the QS/TV is exceeded (annual arithmetic mean) at less than 1/3 of the monitoring points, but the impact of the pollutants to the GWB is significant (comparison land use/ hydro-geological settings). Additionally it has been considered: - Comparison between possible punctual and wide spread impacts due to different land uses in GWB where only few monitoring stations are available. - NBL of arsenic and sulphate in GWB *LU_GB_MES2.*
LT	20%	P		Calculation of annual arithmetic mean for each monitoring point and comparison with TV.
LV			1998–2006	Expert judgment

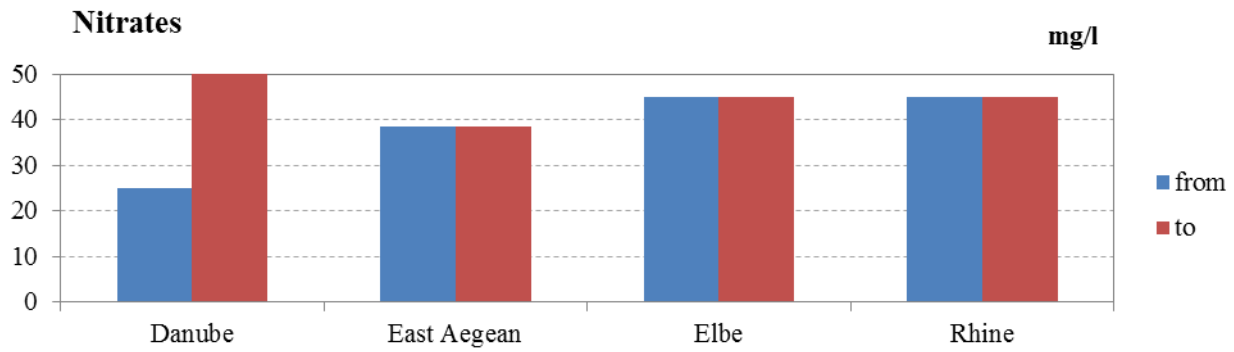
MS	%	P...points A...area V...volume	Time period	Further description of the calculation criteria and approaches
(1)	(2)	(3)	(4)	
MT		P, A		Calculation of annual and periodic arithmetic mean of each monitoring point and comparison with TV. The annual mean is used for the more slow response GWBs whilst the periodic mean is used for the fast response (fractured/karstic) GWBs. Status is determined according to the number of monitoring points which exceed the threshold value with due consideration given to the aerial representativity of each respective monitoring station.
NL	20%	P	2006–2007	
PL	20%	A	2005–2007	Mean concentrations for GWBs and comparison with TVs. If necessary, GWBs are divided into sub-bodies. If an area of a sub-body, in which an exceedance occurred, is less than 20% of the total area of a GWB, then the GWB is of good status.
RO	20%	P	2006–2007	
SE			2000–2008	Additional expert judgment that the exceedance does not pose risk to DW or other use.
SI	30%	A	2006–2008	GWB with sites exceeding TVs are divided into smaller homogenous areas. The sub-bodies are treated as independent GWBs. If parts of the GWB with exceeded values represent 30% or less of the total areas of the GWB the GWB is in a good chemical condition
SK				Good status when the model average and TV is not exceeded by the upper 95% confidence limit of the average (Kriging mean) value for a given parameter.
UK	App-rop-riate %	A	last 6 years	Northern Ireland: A GWB is of good status when the area weighted average value does not exceed TVs. England & Wales: Aggregate data from all representative areas using a flow-weighted or area-weighted average and comparison whether the aggregation exceeds the appropriate percentage of the relevant standard.

* reported for certain RBDs in the Member State

ANNEX I SUBSTANCES

Nitrates (mg/l)





Annex I of the GWD provides an EU-wide groundwater quality standard for nitrates of 50 mg/l. Where this quality standard could result in failure to achieve the environmental objectives specified in Article 4 of the WFD, more stringent threshold values need to be established.

Five Member States established TVs for nitrates which are stricter than 50 mg/l. The TVs range from 10.68 mg/l in United Kingdom up to 50 mg/l.

The reasons for establishing stricter TVs are as follows → **NBL, DW-standards, EQS**:

- Hungary established (in line GWD, Annex I.3) a TV of 25 mg/l for karstic aquifers, considering the requirements of associated aquatic ecosystems (10 mg/l) and dilution and denitrification (+150 %)
- Ireland took regard of the requirement of the Drinking Water Directive to avoid any peak concentrations exceeding the drinking water standard of 50 mg/l and the different compliance regime of the GWD (average concentrations) compared to the Drinking Water Directive by establishing a TV of 75 % (37.5 mg/l) of the DW standard.
- United Kingdom followed the same principles like Ireland and established TVs of 31 mg/l (Scotland), 37.5 mg/l (Northern Ireland) and 42 mg/l (England and Wales) respectively – derived from measured data. The 18 mg/l established in Scotland are solely relevant if there is a failure of the environmental standard for the pollutant in associated surface waters.
- Bulgaria derived its TVs from DW standards considering NBL and dilution and attenuation.
- Austria derived the TV from the DW standard and established 90 % of the DW standard considering a precautionary safety margin.

Table 8: Nitrates – Ranges of established TVs at the level of Member States and international RBDs

MS	from	to
AT		45
BG	37.888	38.788
HU	25	50
IE		37.5
UK	18	42
Total	**10.68**	**50**

RBDname	RBD	from	to
Danube	AT1000		45
	BG1000	37.888	38.788
	HU1000	25	50
East Aegean	BG3000	38.705	38.71
Elbe	AT5000		45
Rhine	AT2000		45

Table 9: Nitrates – Remarks to the established TVs for some Member States

MS	TV	Remarks to the established TVs for nitrates
HU	25	NBL (90 percentile): 0.5-13.9 mg/l 25 = ecologically induced TV for karstic GWBs were established where karstic springs feed surface water bodies or aquatic ecosystems. The SWBs ecology criteria are 10 mg/l for Nitrate but considering dilution and denitrification factors the TV is 2.5 times higher than SWB EQS concentration.
IE	37.5	75% of the DW standard Drinking water standards are expressed as maximum admissible concentrations, i.e. peak concentrations. Therefore, to ensure consistency with the DWD, the assessment of groundwater in relation to drinking water/human use criteria, i.e. for the Drinking Water Protected Area and General Chemical status tests, should also be made against peak concentrations. However, the WFD requires a comparison of average monitoring point concentrations against TVs when assessing status. If a comparison of an average concentration is made directly against the 50 mg/l standard then it may result in misclassification, e.g. if the average Nitrate concentration is 48 mg/l, it is probable that there are individual samples that are above 50 mg/l, i.e. exceeding the maximum admissible concentration. Therefore a lower TV (the one we have used is 75% of the DW standard) has been introduced to take account of the large variability in hydrogeological settings, potential temporal variability in parameter values and because it introduces what is believed to be an adequate degree of protection such that the risk of misclassification is unlikely, i.e. if the average concentration is lower than the TV then it is unlikely individual samples will be greater than the maximum admissible concentration. Further work on Nitrate data has been undertaken in Ireland and has concluded that using 75% of the DW standard is roughly equivalent to using the 95%ile approach that is undertaken for surface water classification.
UK	NI: 37.5 E&W: 42 S: 31	75 % of the DW standard of 50 mg/l 42 mg/l and 31mg/l nitrate TV was calculated by comparing the relationship between the mean and the 95th percentile for all groundwater monitoring data. Note this document suggested a value of 37 mg/l, but this subsequently changed to 42 mg/l for E&W and 31mg/l for Scotland when the monitoring data were updated.

Total Pesticides (µg/l)

Table 10: Total pesticides – Ranges of established TVs at the level of Member States and international RBDs

MS	from	to
IE		0.375

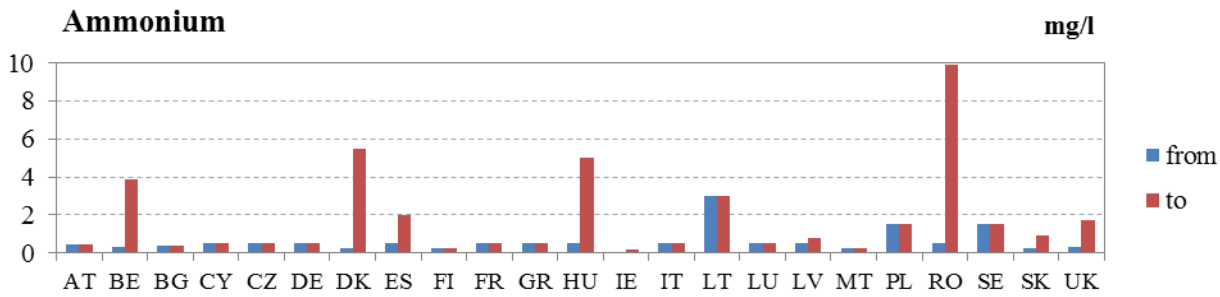
Annex I of the GWD provides an EU-wide groundwater quality standard for total pesticides of 0.5 µg/l (individual pesticides were not subject of this assessment). Where this quality standard could result in failure to achieve the environmental objectives specified in Article 4 of the WFD, more stringent threshold values need to be established.

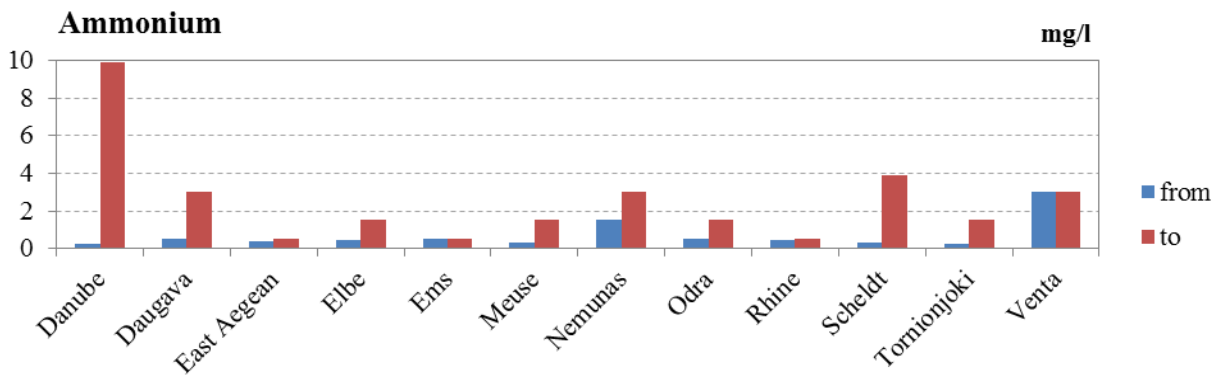
Only Ireland established a TV for total pesticides stricter than 0.5 µg/l.

The stricter TV of 0.375 µg/l was reported to be derived from 75% of national DW standard. The rational for its derivation is identical with that for nitrates. Ireland took regard of the requirement of the Drinking Water Directive to avoid any peak concentrations exceeding the drinking water standard of 0.5 µg/l and the different compliance regime of the GWD (average concentrations) compared to the Drinking Water Directive by establishing a TV of 75 % of the DW standard.

ANNEX II SUBSTANCES

Ammonium (mg/l)





The established TVs for ammonium show significant differences, ranging up to 118 times between the lowest (0.084 mg/l) and the highest (9.9 mg/l) value. Most of the TVs for ammonium were established at around 0.5 mg/l and they were mainly derived from (national and international) standards for drinking water (DW standard) consumption and the natural background levels (NBLs). Ireland and Germany derived the TVs from environmental quality standards (surface waters as receptors).

The main reasons for the considerable range of TVs within international RBDs is due to the fact that: 1. the considered national DW standards are not uniform; 2. DW standards were also differently considered (different percentages); 3. in case of NBLs below DW standards some Member States applied the DW standards, some applied percentages of those standards as TVs and others calculated the half of NBL + DW standard and 4. in case of NBLs higher than DW standards, the NBLs were taken as TVs.

TVs above 0.5 mg/l → NBL, DW-standards: Some TVs are higher than the majority of TVs which are established at around 0.5 mg/l. Most of these high values reflect *natural background levels (NBLs).* This was reported by Belgium (3.9 mg/l), Denmark (5.5 mg/l), Lithuania (3 mg/l), Poland (1.5 mg/l) and Romania (9.9 mg/l) – Romania considered an addition of 20% to the NBL accounting for the methodology of deriving the NBL and potential errors in sampling and analyses. The Romanian and Polish NBLs are the reason for the high variation in the Danube RBD, ranging from 0.255 mg/l (SK) to 9.9 mg/l.

But also national *drinking water standards (DW standards),* where TVs were derived from, cause TVs above 0.5 mg/l as Hungary defined four different usage (drinking water) criteria of 0.5, 2, 3 and 5 mg/l, as at these levels change of treatment would be needed. The appropriate TV was selected after consideration of the NBLs. In Sweden the TV is equal to the national DW standard for private wells of 1.5 mg/l.

TVs of exactly 0.5 mg/l → **DW-standards:** Seven Member States established their TVs at national DW standards which are identical with the indicator parameter of 0.5 mg/l as laid down in the Drinking Water Directive (DWD).

TVs below 0.5 mg/l → NBL, DW-standards, EQS: Some DW related TVs were established below 0.5 mg/l, which is the case in Austria (0.45 mg/l = 90% of the DW standard) and Finland and Malta (0.25 mg/l = 50 % of the DW standard).

In Slovak Republic TVs are a combination of DW standards and NBLs: in case NBLs were below the DW standard, all TVs were calculated between NBL and DW standard [TV = (DW standard + NBL)/2].

Ireland considered associated surface waters as receptors and established a TV of 0.084 mg/l and it considered drinking water usage by establishing a TV of 0.23 mg/l (Note: this number was recalculated from NH_4-N) which reflects 75 % of the relevant DW standard.

Table 11: Ammonium – Ranges of established TVs at the level of Member States and international RBDs

MS	from	to
AT		0.45
BE	0.3	3.9
BG	0.377	0.42
CY		0.5
CZ		0.5
DE		0.5
DK	0.25	5.5
ES	0.5	2
FI		0.25
FR		0.5
GR		0.5
HU	0.5	5
IE	0.084*	0.23*
IT		0.5
LT		3
LU		0.5
LV	0.5	0.8
MT		0.25
PL		1.5
RO	0.5	9.9
SE		1.5
SK	0.255	0.9
UK	0.29	1.73
EU	**0.084**	**9.9**

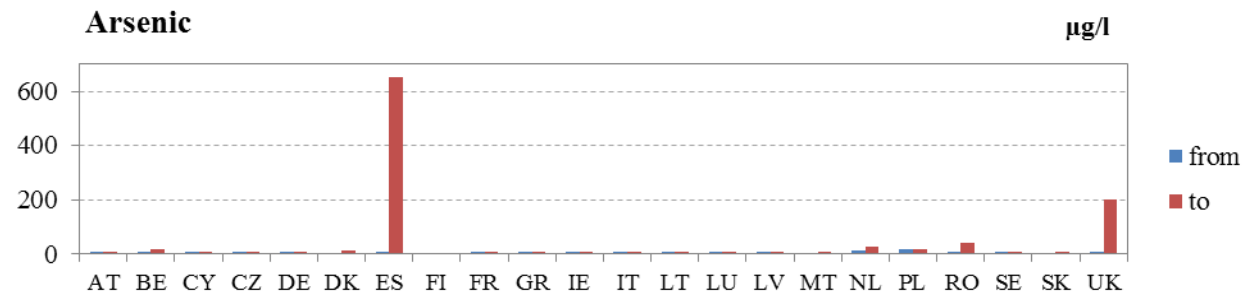
*…reported for NH_4-N and recalculated to NH_4

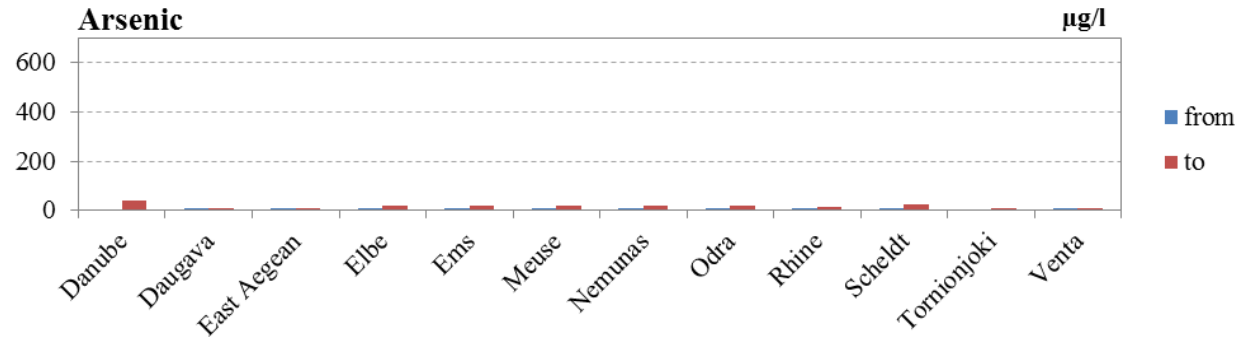
RBDname	RBD	from	to
Danube	AT1000		0.45
	CZ_1000		0.5
	DE1000		0.5
	HU1000	0.5	5
	PL1000		1.5
	RO1000	0.5	9.9
	SK40000	0.255	0.9
Daugava	LT4500		3
	LVDUBA	0.5	0.8
East Aegean	BG3000	0.377	0.39
	GR12		0.5
Elbe	AT5000		0.45
	CZ_5000		0.5
	DE5000		0.5
	PL5000		1.5
Ems	DE3000		0.5
Meuse	BEMaas_VL	0.3	1.5
	DE7000		0.5
	BEMeuse_RW		0.5
Nemunas	LT1100		3
	PL8000		1.5
Odra	CZ_6000		0.5
	DE6000		0.5
	PL6000		1.5
Rhine	AT2000		0.45
	DE2000		0.5
	LU RB_000		0.5
	BERhin_RW		0.5
Scheldt	BESchelde_VL	0.3	3.9
	BEEscaut_RW		0.5
	BEEscaut_Schelde_BR		0.5
Tornionjoki	FIVHA6		0.25
	SE1TO		1.5
Venta	LT2300		3

Table 12: Ammonium – Remarks to the established TVs for some Member States

MS	TV	Remarks to the established TVs for ammonium
BE	3.9	NBL = 3.9; EQS = 0.5 → TV = NBL = 3.9
DK	5.5	represents the NBL
FI	0.25	50 % of national DW standard
HU	0.5 2 3 5	In case of vulnerable (shallow porous) GWBs or groups of GWBs the NBL concentrations are the 90 percentile, in case of not vulnerable (deep porous or covered karstic) GWBs or groups of GWBs the NBL concentrations are the 95 percentile. The usage criteria (DW) were considered which can be 0.5, 2, 3 or 5 mg/l because at these concentrations change of or additional measure in the drinking water treatment technology is necessary. For each GWB or groups of GWBs the DW treatment technology level value closest to, but higher than the NBL concentration was considered as TV. NBL: 0.28–4.3 mg/l
IE	0.065 0.175	Remark: The values are established as Ammonium-N 0.065 mg/l NH4-N = EQS for the associated surface water receptor. 0.175 mg/l NH4-N = 75% of relevant DW standard
LT	3	Represents the upper NBL (98%)
MT	0.25	50% of national DW standard
PL	1.5	Various regions in Poland show low redox conditions (Eh<100mV) and the concentrations of ammonium are elevated due to natural conditions.
RO	9.9	NBL= 8.24 mg/l + 20% addition = 9.9 mg/l
SE	1.5	The TV is equal to the national guideline for ammonium of health reasons issued by The National Board of Health and Welfare for drinking water from private wells
SK	0.255 to 0.9	if NBL < DW standard: TV = 0.5 (NBL + DW standard) national DW standard = 0.5 mg/l if NBL > DW standard: TV = NBL NBL have been determined for each GWB. NBL: 0.01–0.9 mg/l

Arsenic (µg/l)





The established TVs for arsenic show significant differences, ranging up to 131 times between the lowest (5 µg/l) and the highest (653 µg/l) value. Most of the TVs for arsenic range between 5 and 20 µg/l and they were manly derived from (national and international) DW standards and considering natural background levels (NBLs). United Kingdom reported the consideration of environmental quality standards (associated surface waters as receptors).

Within international RBDs no considerable differences between TVs for arsenic established at the level of national shares of RBDs could be found but at the Member States level. The main reasons for the considerably high TVs are high NBLs.

TVs above 10 µg/l → NBL, EQS: Two national ranges of TVs are remarkably wide, reaching up to 199 (in United Kingdom) respectively 653 µg/l (in Spain). The rather high groundwater TVs of up to 653 µg/l in Spain were reported to represent NBLs for the respective GWBs. United Kingdom reported that the TVs between 25 and 199 µg/l were derived from the consideration of the EQS for associated surface waters of 50 µg/l and the NBL for each individual GWB.

Romania established a TV of 40 µg/l considering 30 µg/l as NBL and an addition of 25 %. The Netherlands considered both a maximum toxic addition of 0.5 µg/l for surface waters to the NBL and an addition of 50 % considering attenuation and dilution leading to TVs between 15 and 25 µg/l.

TVs of exactly 10 µg/l → DW-standards: Nine Member States established their TVs at national DW standards which are identical with the parametric value of 10 µg/l as laid down in the Drinking Water Directive (DWD).

TVs below 10 µg/l → NBL, DW-standards: Some DW related TVs were established below 10 µg/l, which is the case in Austria (9 µg/l = 90% of the DW standard), Finland (50%), Malta (50% to 75%) and United Kingdom (75 % of the national DW standard of 10 µg/l).

In Slovak Republic and in Spain TVs are a combination of DW standards and NBLs: in case NBLs were below the DW standard, all TVs were calculated between NBL and DW standard [TV = (DW standard + NBL)/2].

Table 11: Arsenic – Ranges of established TVs at the level of Member States and international RBDs

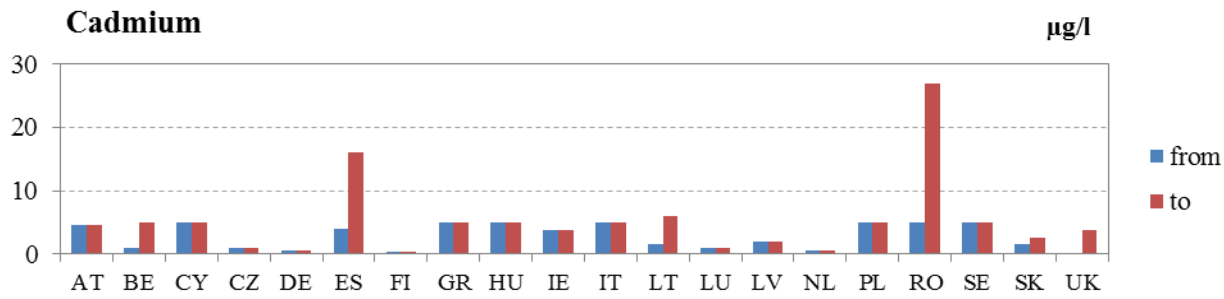
MS	from	to
AT		9
BE	10	20
CY		10
CZ		10
DE		10
DK	5	11
ES	7	653
FI		5
FR		10
GR		10
IE		7,5
IT		10
LT		10
LU		10
LV		7
MT	5	7.5
NL	15	25
PL		20
RO	10	40
SE		10
SK	5.25	10
UK	7.5	199
EU	**5**	**653**

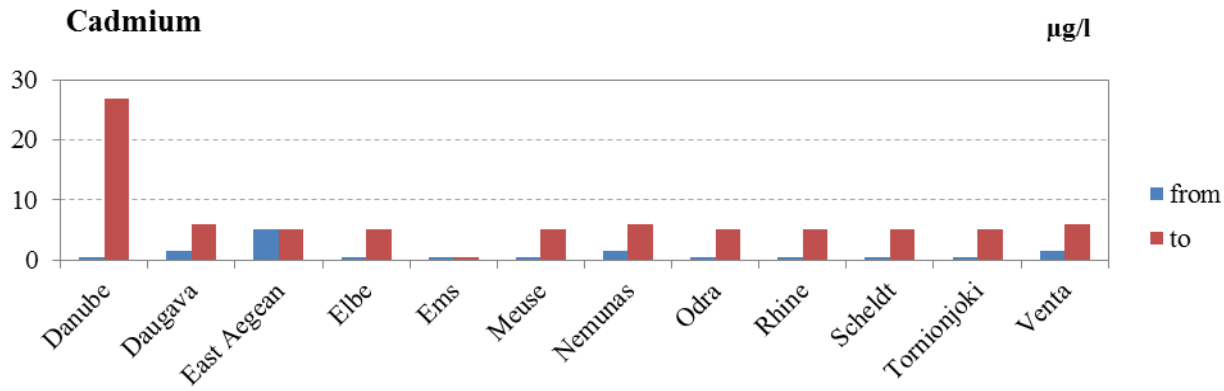
RBDname	RBD	from	to
Danube	AT1000		9
	CZ_1000		10
	DE1000		10
	PL1000		20
	RO1000	10	40
	SK40000	5.25	10
Daugava	LT4500		10
	LVDUBA		7
East Aegean	GR12		10
Elbe	AT5000		9
	CZ_5000		10
	DE5000		10
	PL5000		20
Ems	DE3000		10
	NLEM	15	19.5
Meuse	BEMaas_VL	11	20
	DE7000		10
	NLMS	15	19.5
	BEMeuse_RW		10
Nemunas	LT1100		10
	PL8000		20
Odra	CZ_6000		10
	DE6000		10
	PL6000		20
Rhine	AT2000		9
	DE2000		10
	LU RB_000		10
	NLRN		15
	BERhin_RW		10
Scheldt	BESchelde_VL	10	20
	NLSC	15	25
	BEEscaut_RW		10
	BEEscaut_Schelde_BR		10
Tornionjoki	FIVHA6		5
	SE1TO		10
Venta	LT2300		10

Table 13: Arsenic – Remarks to the established TVs for some Member States

MS	TV	Remarks to the established TVs for arsenic
ES	7–653	if NBL < DW standard: TV = 0.5 (NBL + DW standard national DW standard = 10 if NBL > DW standard: TV = NBL (97.7 or 90-percentile)
FI	5	50 % of national DW standard
MT	5–7.5	50% to 75% of national DW standard, depending on the NBLs in the respective GWBs.
NL	15	The minimum TV for arsenic is based on the DW standard of 10 µg/l. If the NBL + maximum toxic addition (MTA) of 0.5 µg/l for surface water was higher than the DW standard, then the NBL+MTA has been applied. Finally, an attenuation and dilution factor of 1.5 has been applied to the EQS giving way to a TV of 15 µg/l except or higher when the NBL + MTA was more than 10 mg/l. The NBLs were derived as the highest value of two methods: – the 50-percentile of the complete dataset without pre-selection – the 95% lower limit of the confidence interval of the 90-percentile with pre-selection of the non-anthropogenic influenced data. For both methods the median value of the measurements at each groundwater monitoring location was determined. In principle, the NBL was determined for each GWB. In some cases there were not enough data, less than 5 median values, to determine an NBL. In that case the NBL was determined over a group of similar GWBs.
RO	40	TV = NBL of 30 µg/l + addition
SE	10	National DW standard
SK	5.25–10	if NBL < DW standard: TV = 0.5 (NBL + DW standard) national DW standard = 10 if NBL > DW standard: TV = NBL NBLs have been determined for each GWB. NBL: 0.5-10 µg/l
UK	7.5	75 % of the national DW standard of 10 µg/l
UK	25–199	TVs derived from the impacts on Surface Water. Consideration of the surface water EQS (50 µg/l) value and individual calculation of TVs for each GWB using NBL.

Cadmium (µg/l)





The established TVs for cadmium show significant differences, ranging up to 338 times between the lowest (0.08 µg/l) and the highest (27 µg/l) value. Most of the TVs for cadmium were established at around 5 µg/l and they were mainly derived from national DW standards and the natural background levels (NBLs). Belgium and UK reported that the TVs were derived from the consideration of environmental quality standards (for associated surface waters).

The main reason for the low TVs of 0.4 µg/l in Finland is the consideration of the NBL only and in the Netherlands (0.5 µg/l) the consideration of NBLs and an eco-toxicological addition. Also Germany considered eco-toxicological values and NBLs. The relatively high ranges up to 16 µg/l in Spain and 27 µg/l in Romania are also caused due to the consideration of NBLs.

TVs above 5 µg/l → NBL: Two national ranges of TVs are wider, reaching up to 16 and 27 µg/l. The TVs up to 16 µg/l in Spain were reported to reflect the NBLs for the respective GWBs and the TVs up to 27 µg/l in Romania reflect the NBLs of up to 22.5µg/l and an addition of around 20%.

TVs of exactly 5 µg/l → DW-standards: Six Member States established their TVs at national DW standards which are identical with the parametric value of 5 µg/l as laid down in the Drinking Water Directive (DWD).

TVs below 5 µg/l → NBL, DW-standards, EQS: Slovak Republic reported a national DW standard of 3 µg/l and established TVs between the DW standard and the NBLs [TV = (DW standard + NBL)/2]. The same procedure was reported by Spain but with a national DW standard of 5 µg/l.

Austria established 4.5 µg/l which represents 90% of the national DW standard.

The relatively small TVs of 0.4 and 0.5 µg/l reported by Finland, Germany and the Netherlands were derived as follows: The TV of Finland results from the consideration of the NBLs only, where the TV of 0.4 µg/l reflects 2-times the NBL of 0.2 µg/l. The Netherlands derived the TV from the NBL of 0.1 µg/l which represents the limit of detection plus a maximum toxic addition of 0.25 µ/l and a default attenua-

tion and dilution factor of 50% leading to a TV for cadmium of 0.5 µg/l. Germany added the NBL (90 percentile) of 0.3 µg/l to the PNEC of 0.19 µg/l.

United Kingdom considered EQS for surface waters for TVs starting at 0.08 µg/l up to TVs corresponding to 75% of the DW standard. Belgium reported to having derived their cadmium TVs (between 1 and 5 µg/l) entirely from environmental quality standards for surface waters, taking into account dilution and attenuation.

Table 14: Cadmium – Ranges of established TVs at the level of Member States and international RBDs,

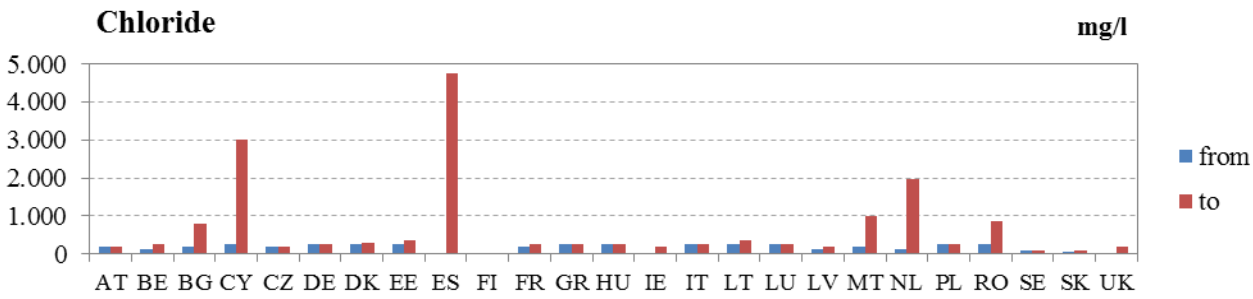
MS	from	to
AT		4.5
BE	1	5
CY		5
CZ		1
DE		0.5
ES	4	16
FI		0.4
GR		5
HU		5
IE		3.75
IT		5
LT	1.5	6
LU		1
LV		2
NL		0.5
PL		5
RO	5	27
SE		5
SK	1.525	2.5
UK	0.08	3.75
Total	**0.08**	**27**

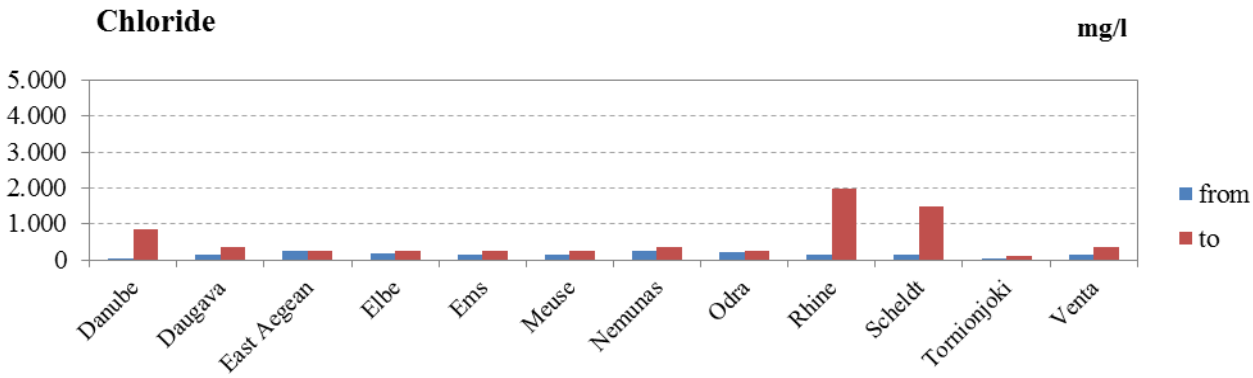
RBDname	RBD	from	to
Danube	AT1000		4.5
	CZ_1000		1
	DE1000		0.5
	HU1000		5
	PL1000		5
	RO1000	5	27
	SK40000	1.525	2.5
Daugava	LT4500	1.5	6
	LVDUBA		2
East Aegean	GR12		5
Elbe	AT5000		4.5
	CZ_5000		1
	DE5000		0.5
	PL5000		5
Ems	DE3000		0.5
	NLEM		0.5
Meuse	BEMaas_VL	2.6	2.8
	DE7000		0.5
	NLMS		0.5
	BEMeuse_RW		5
Nemunas	LT1100	1.5	6
	PL8000		5
Odra	CZ_6000		1
	DE6000		0.5
	PL6000		5
Rhine	AT2000		4.5
	DE2000		0.5
	LU RB_000		1
	NLRN		0.5
	BERhin_RW		5
Scheldt	BESchelde_VL	2.5	3
	NLSC		0.5
	BEEscaut_RW		5
	BEEscaut_Schelde_BR	1	5
Tornionjoki	FIVHA6		0.4
	SE1TO		5
Venta	LT2300	1.5	6

Table 15: Cadmium – Remarks to the established TVs for some Member States

MS	TV	Remarks to the established TVs for cadmium
BE	1–5	To comply with the limit values for good status of surface water (values usually more stringent than for groundwater). By taking into account locally appropriate factors of dilution and attenuation
DE	0.5	The TV results, according to the added risk approach, from adding the PNEC of 0.19 µg/l to the NBL (90 percentile) of 0.3 µg/l.
ES	4–16	if NBL < DW standard: TV = 0.5 (NBL + DW standard national DW standard = 5 if NBL > DW standard: TV = NBL (97.7 or 90-percentile)
FI	0.4	2 x NBL (90-percentile)
HU	5	5 = national DW standard because all NBLs (0.005–1.2 µg/l) are below
LT	6	EQS were established based on collected information about existing regulations on MAC's or TV's set for groundwater from various countries. It was decided that the same stricter TV will be applicable for very sensitive areas, which includes sanitary protection zones (strict and biological limitation) of well fields, protection zones of surface water bodies and protected areas (e.g. NATURA2000).
NL	0.5	The TV of cadmium is based on the NBL+MTA (0.1 + 0.25 µg/l) multiplied by the default attenuation and dilution factor of 1.5 and rounded to 0.5 µg/l. For NBLs are based on current analytical detection limits because too little measurements were above the detection limit. For cadmium the background concentration is 0.1 µg/l.
RO	27	NBL = 22.5 µg/l + addition
SE	5	National DW standard
SK	1.525–2.5	if NBL < DW standard: TV = 0.5 (NBL + DW standard national DW standard = 3 if NBL > DW standard: TV = NBL NBLs have been determined for each GWB. NBL: 0.05-2 µg/l
UK	0.08 3,75	EQS for surface waters 75% of national DW standard

Chloride (mg/l)





TVs for chloride were most frequently established in Europe, reported from 25 Member States and for 126 River Basin Districts.

The established TVs for chloride show significant differences, ranging up to 198 times between the lowest (24 mg/l) and the highest (4,750 mg/l) value. Most of the TVs were established at around 250 mg/l and they were mainly derived from (national and international) DW standards and the NBLs. The Netherlands reported the consideration of environmental quality standards.

The main reasons for the considerable range of TVs within international RBDs is due to the fact that: 1. the considered usage standards are not uniform (drinking water and corrosion); 2. usage standards were also differently considered (different percentages); 3. in case of NBLs below DW standards some Member States applied the usage standards, some applied percentages of those standards as TVs and others calculated the half of NBL + DW standard and 4. in case of NBLs higher than DW standards, the NBLs were taken as TVs, where some added a percental addition, others did not.

TVs above 250 mg/l → NBL: The highest TVs were reported from Bulgaria (781.9 mg/l), Cyprus (3,000 mg/l), Spain (4,750 mg/l) Malta (1,000 mg/l), Netherlands (1,900 mg/l) and Romania (860 mg/l). All of these values were derived from NBLs, where Cyprus and Romania included an addition of 20% to the NBLs.

TVs of exactly 250 mg/l → DW-standards: Six Member States established their TVs at national DW standards which are identical with the indicator parameter of 250 mg/l as laid down in the Drinking Water Directive.

TVs below 250 mg/l → NBL, DW-standards (corrosion), EQS: Some usage related TVs were established below 250 mg/l, which is the case in e.g. Austria (180 mg/l = 90% of the DW standard), Finland and Sweden (25 mg/l and 100 mg/l respectively = national guide to prevent corrosion), and also Spain and Slovak Republic where the TVs were derived as a combination of DW standards and NBLs.

The Netherlands derived a minimum TVs for chloride (140 mg/l) from EQS for surface waters (94.1 mg/l) adding a 50 % addition for attenuation and dilution.

Table 16: Chloride – Ranges of established TVs at the level of Member States and international RBDs

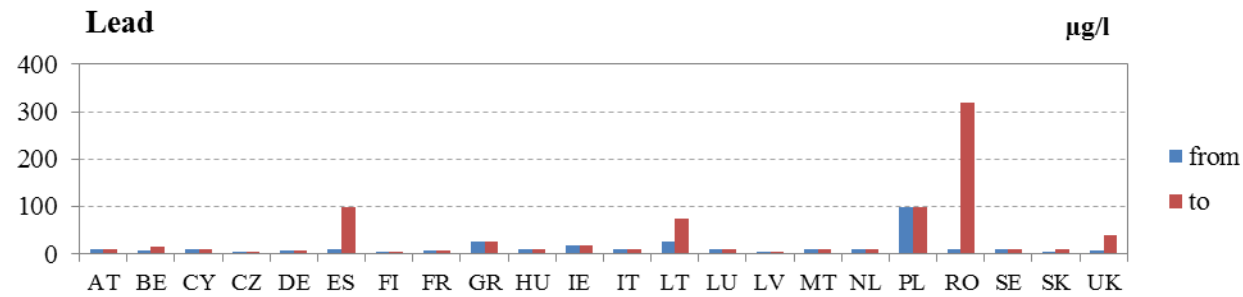
MS	from	to
AT		180
BE	142	245
BG	194.26	781.9
CY	250	3,000
CZ		200
DE		250
DK	250	300
EE	250	350
ES	40	4,750
FI		25
FR	200	250
GR		250
HU		250
IE	24	187.5
IT		250
LT	250	350
LU		250
LV	130	190
MT	210	1,000
NL	140	1,990
PL		250
RO	250	860
SE		100
SK	50.9	104
UK	25	188
Total	**24**	**4,750**

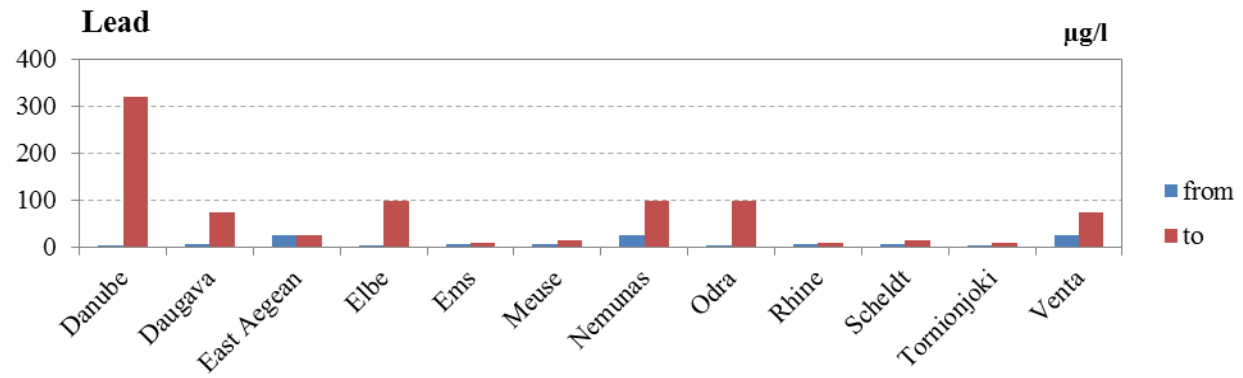
RBDname	RBD	from	to
Danube	AT1000		180
	CZ_1000		200
	DE1000		250
	HU1000		250
	PL1000		250
	RO1000	250	860
	SK40000	50.9	104
Daugava	LT4500	250	350
	LVDUBA	130	190
East Aegean	GR12		250
Elbe	AT5000		180
	CZ_5000		200
	DE5000		250
	PL5000		250
Ems	DE3000		250
	NLEM		140
Meuse	BEMaas_VL	142	220
	DE7000		250
	NLMS	140	240
	BEMeuse_RW		150
Nemunas	LT1100	250	350
	PL8000		250
Odra	CZ_6000		200
	DE6000		250
	PL6000		250
Rhine	AT2000		180
	DE2000		250
	FRC		250
	LU RB_000		250
	NLRN	140	1,990
	BERhin_RW		150
Scheldt	BESchelde_VL	142	245
	NLSC	140	1,500
	BEEscaut_RW		150
	BEEscaut_Schelde_BR		150
Tornionjoki	FIVHA6		25
	SE1TO		100
Venta	LT2300	250	350
	LVVUBA		150

Table 17: Chloride – Remarks to the established TVs for some Member States

MS	TV	Remarks to the established TVs for chlorides
BE	142–245	fixed by expert judgement for industrial uses of water which is more stringent than DW standards.
CY	3,000	NBL = Maximum observed concentration of 2,300 + ~20 % addition NBL in a gypsum aquifer used only in agriculture; not related to sea water intrusion.
ES	40–4,750	if NBL < DW standard: TV = 0.5 (NBL + DW standard national DW standard = 250 if NBL > DW standard: TV = NBL (90-percentile)
FI	25	National guidance value to prevent corrosion
HU	250	National DW standard
LT	250–350	250: national DW standard which is applied to all GWBs except for GWB in anomaly zones, where upper limit is set at NBL (95%)
MT	1000	NBL under disturbed conditions in the immediate coastal zone
NL	140–1990	TV for chloride is based on the Dutch EQS for surface water of 94.1 mg/l. If the NBL was higher than the EQS for surface water the NBL has been used. Finally, an attenuation and dilution factor of 1.5 has been applied to the EQS or background value giving way to a threshold value of 140 mg/l except when the NBL was higher than 94 mg/l. For the salt groundwater no threshold value has been defined. The high TVs of 1550 and 1900 mg/l are because the groundwater in these bodies is brackish.
RO	860	NBL = 709.25 mg/l + 20 % addition
SE	100	National DW standard of technical reasons (corrosion) implying that water is potable with remark.
SK	50.9–104	if NBL < DW standard: TV = 0.5 (NBL + DW standard) national DW standard = 100 if NBL > DW standard: TV = NBL NBLs have been determined for each GWB. NBL: 1.8–104 mg/l

Lead (µg/l)





The established TVs for lead show significant differences, ranging up to 64 times between the lowest (5 µg/l) and the highest (320 µg/l) value. Most of the TVs for lead range at around 10 µg/l and they were manly derived from (national and international) DW standards and the NBLs. Belgium and Lithuania reported the consideration of environmental quality standards.

The main reasons for the high TVs within some international RBDs and Member States respectively are high NBLs.

TVs above 10 µg/l → NBL, EQS: Some TVs are high compared to the majority of TVs which were established at around 10 µg/l. The highest value was reported from Romania with 320 µg/l which considered an addition of around 20 % to the highest NBL of 261 µg/l. Also the high TVs of Spain and Poland were established due to high NBLs. Lithuania reported a TV of 75 µg/l which is identical with the national EQS.

TVs of exactly 10 µg/l → NBL, DW-standards: Six Member States established their TVs at the level of the parametric value of 10 µg/l as laid down in the Drinking Water Directive (DWD). In Malta and in Spain the reported national DW standards are different than 10 µg/l.

For some TVs which are at nearly the same level of 10 µg/l it can be seen that the starting point for their derivation is quite different. In Spain the value of 10 is derived from a combination of NBL and a DW standard of 25 µg/l, the 10 µg/l in Malta results from 50 % of the national DW standard and in the Netherlands the 11 µg/l results from the NBL of 0.2 µg/l + a maximum toxic addition of 7.2 µg/l for surface water and an addition of 50 % for considering attenuation and dilution. Same TV, different approaches.

TVs below 10 µg/l → NBL, DW-standards, EQS: Some Member States established TVs below 10 µg/l which are mainly derived from drinking water standards, by considering 'safety margins' or by establishing the TVs between the NBLs and the DW-standards. Germany established the TV based on EQS and NBL but changed the TV since the reporting to 10 µg/l as laid down as DW-standard.

Table 18: Lead – Ranges of established TVs at the level of Member States and international RBDs

MS	from	to
AT		9
BE	7.2	15
CY		10
CZ		5
DE		7
ES	10	100
FI		5
FR		7.2
GR		25
HU		10
IE		18.75
IT		10
LT	25	75
LU		10
LV		6
MT		10
NL		11
PL		100
RO	10	320
SE		10
SK	5.25	10
UK	7.2	39.8
Total	**5**	**320**

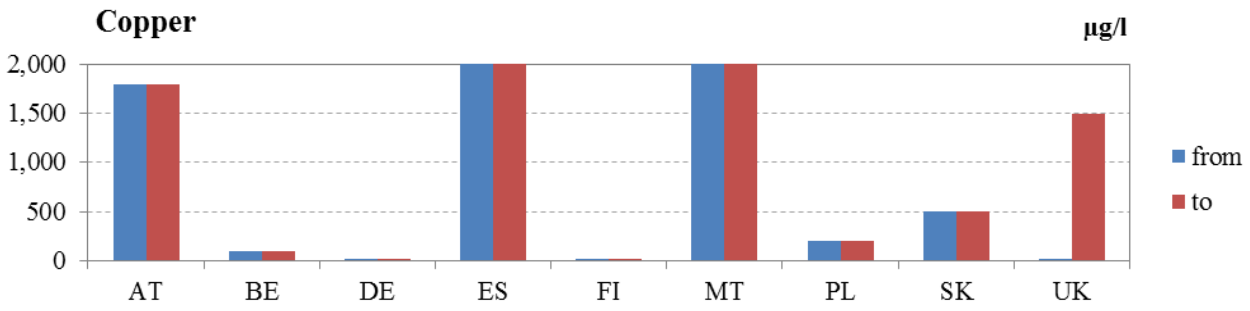
RBDname	RBD	from	to
Danube	AT1000		9
	CZ_1000		5
	DE1000		7
	HU1000		10
	PL1000		100
	RO1000	10	320
	SK40000	5.25	10
Daugava	LT4500	25	75
	LVDUBA		6
East Aegean	GR12		25
Elbe	AT5000		9
	CZ_5000		5
	DE5000		7
	PL5000		100
Ems	DE3000		7
	NLEM		11
Meuse	BEMaas_VL	10	15
	DE7000		7
	NLMS		11
	BEMeuse_RW		10
Nemunas	LT1100	25	75
	PL8000		100
Odra	CZ_6000		5
	DE6000		7
	PL6000		100
Rhine	AT2000		9
	DE2000		7
	LU RB_000		10
	NLRN		11
	BERhin_RW		10
Scheldt	BESchelde_VL	10	15
	NLSC		11
	BEEscaut_RW		10
	BEEscaut_Schelde_BR	7.2	10
Tornionjoki	FIVHA6		5
	SE1TO		10
Venta	LT2300	25	75

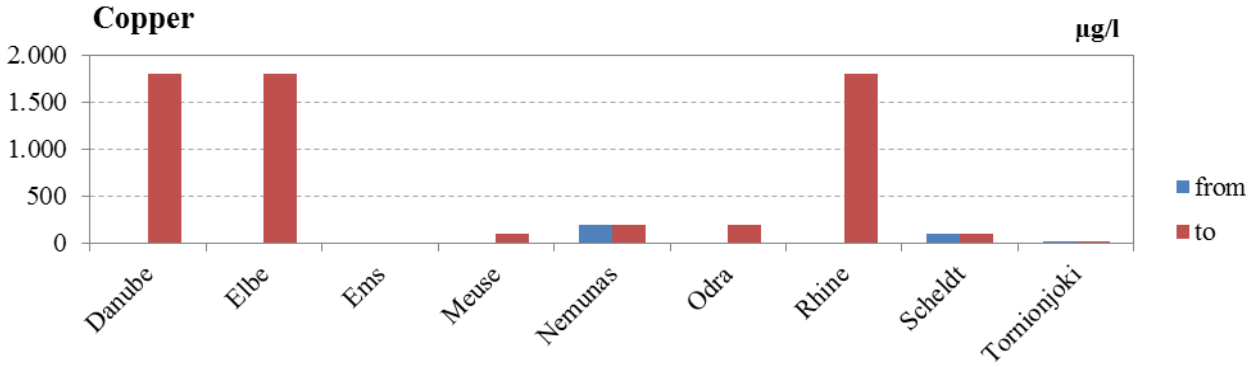
Table 19: Lead – Remarks to the established TVs for some Member States

MS	TV	Remarks to the established TVs for lead
AT	9	90 % of DW standard
BE	7.2–15	To comply with the limit values for good status of surface water (values usually more stringent than for groundwater). By taking into account locally appropriate factors of dilution and attenuation
DE	7	The TV was derived from ecotox criteria and considering the added risk approach. The TV results from adding the basic value (EQS) of 3.4 µg/l and the NBL (90 percentile) of 3.9 µg/l and rounding them to 7, at the date of establishing the programme of measures. Since then, the EQS changed to 11 and therefore the TV was established at 10 µg/l which is the DW-standard.
ES	10–100	if NBL < DW standard: TV = 0.5 (NBL + DW standard national DW standard = 25 µg/l (10 µg/l from 2014 onwards) if NBL > DW standard: TV = NBL (97.7 or 90-percentile)
FI	5	50 % of national DW standard
SK	5.25–10	if NBL < DW standard: TV = 0.5 (NBL + DW standard) national DW standard = 10 µg/l if NBL > DW standard: TV = NBL NBL have been determined for each GWB. NBL: 0.5–10 µg/l
HU	10	national DW standard
LT	75	TV is identical with the national EQS EQS were established based on collected information about existing regulations on MAC's or TV's set for groundwater from various countries. It was decided that the same stricter TV will be applicable for very sensitive areas, which includes sanitary protection zones (strict and biological limitation) of wellfields, protection zones of surface water bodies and protected areas (e.g. NATURA2000).
MT	10	50 % of national DW standard
SE	10	National DW standard
RO	320	NBL = 261 µg/l + 20 % addition
PL	100	TVs were set based on real data. The NBLs for this element are considered lower; however, there are many examples of weathering zones where concentrations of this element are elevated and this resulted in setting TVs on a national scale at this level
NL	11	The threshold value of lead is based on the NBL of 0.2 µg/l, raised with the MTA of 7.2 µg/l, multiplied by 1.5 and rounded to 11.0 µg/l. The NBLs are based on current analytical detection limits because too few measurements were above the detection limit.

OTHER NATURALLY OCCURRING SUBSTANCES

Copper (µg/l)





The established TVs for copper show significant differences, ranging up to 198 times between the lowest (10.1 µg/l) and the highest (2,000 µg/l) value, which is identical with the parametric value laid down in the Drinking Water Directive.

The TVs for copper were manly derived from (national and international) DW standards and the natural background levels (NBLs). Belgium, Germany and United Kingdom considered environmental quality standards.

The considerable differences between TVs for copper within the international RBDs Danube, Elbe and Rhine are due to the German TV of 14 µg/l and the Austrian TV of 1,800 µg/l. The German TV is derived from eco-toxicological values and NBLs and the Austrian TV is derived from the DW standard (90 % of 2,000 µg/l) Comparing national DW standards for copper a range from 1,000 µg/l (SK) up to 4,000 in Malta can be detected.

TVs above 1,000 µg/l → DW-standards: The TVs established at around 1,500 to 2,000 are derived from national DW standards: 1,500 (UK) refers to 75% of the DW standard, 1,800 (AT) refers to 90 % DW standard and the 2,000 in Spain refer to 100% DW standard and the 2,000 in Malta refer to 50 % of the national DW standard.

TVs below 1,000 µg/l → NBL, DW-standards, EQS: Belgium (100 µg/l) and United Kingdom considering the health of associated aquatic ecosystems, German derived a TV of 14 µg/l from eco-toxicological values and NBLs.

Slovak Republic derived the TVs from the DW standard and the NBLs and Finland only took NBLs into consideration.

Poland established the TV on real data, assuming that some NBLs reach these concentrations.

Table 20: Copper – Ranges of established TVs at the level of Member States and international RBDs

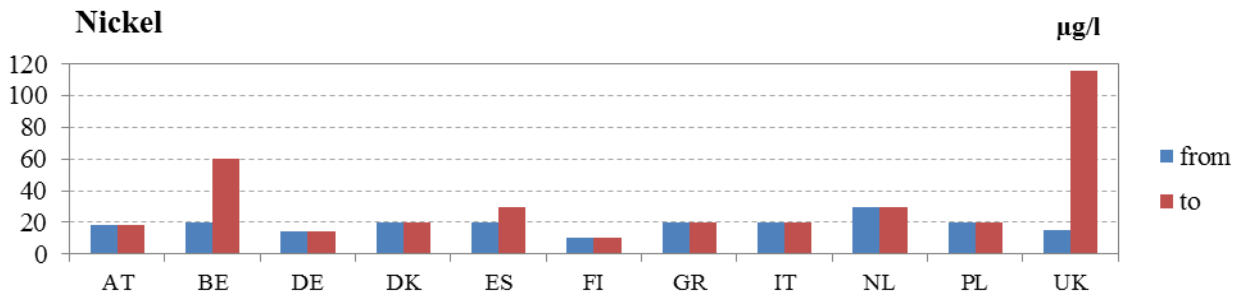
MS	from	to
AT		1,800
BE		100
DE		14
ES		2,000
FI		20
MT		2,000
PL		200
SK	500.2	504
UK	10.1	1,500
Total	**10.1**	**2,000**

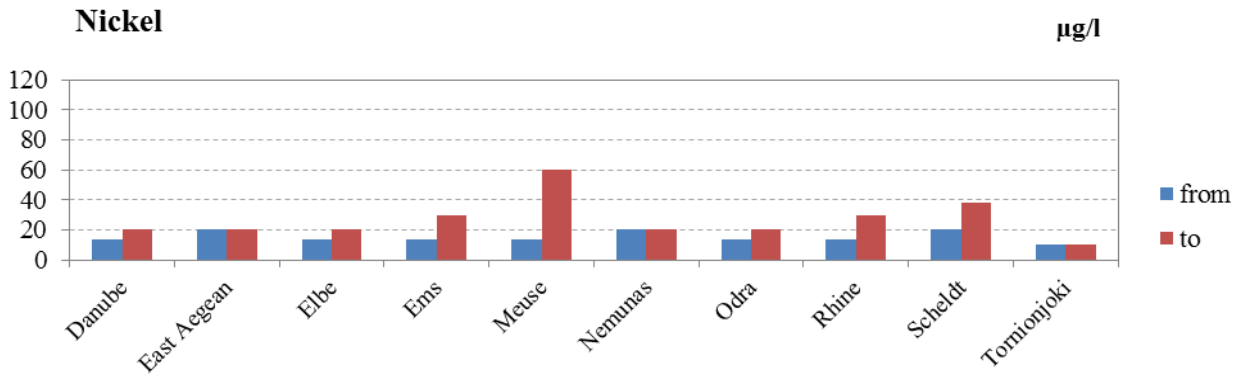
RBDname	RBD	from	to
Danube	AT1000		1800
	DE1000		14
	PL1000		200
	SK40000	500.2	504
Elbe	AT5000		1,800
	DE5000		14
	PL5000		200
Ems	DE3000		14
Meuse	DE7000		14
	BEMeuse_RW		100
Nemunas	PL8000		200
Odra	DE6000		14
	PL6000		200
Rhine	AT2000		1,800
	DE2000		14
	BERhin_RW		100
Scheldt	BEEscaut_RW		100
Tornionjoki	FIVHA6		20

Table 21: Copper – Remarks to the established TVs for some Member States

MS	TV	Remarks to the established TVs for copper
AT	1,800	90 % of national DW standard
ES	2,000	National DW standard
FI	20	= 2 x NBL (90- percentile)
MT	2,000	50 % of national DW standard
PL	200	TVs were set based on real data. The NBLs for these elements are considered lower; however, there are many examples of weathering zones where concentrations of these elements are elevated and this resulted in setting TVs on a national scale at this level
SK	500.2–504	if NBL < DW standard: TV = 0.5 (NBL + DW standard) national DW standard = 1000 if NBL > DW standard: TV = NBL NBLs have been determined for each GWB. NBL: 0.4-8 µg/l

Nickel (µg/l)





The established TVs for nickel show variations, ranging up to 12 times between the lowest (10 µg/l) and the highest (116 µg/l) value. The parametric value laid down in the Drinking Water Directive is set at 20 µg/l.

The TVs for nickel were manly derived from (national and international) DW standards and the natural background levels (NBLs). Germany and United Kingdom considered environmental quality standards.

High TVs → NBL: Most of the TVs are around 20 µg/l. The higher TVs up to 60 µg/l in Belgium and up to 116 µg/l in United Kingdom are due to higher NBLs.

Table 22: Nickel – Ranges of established TVs at the level of Member States and international RBDs

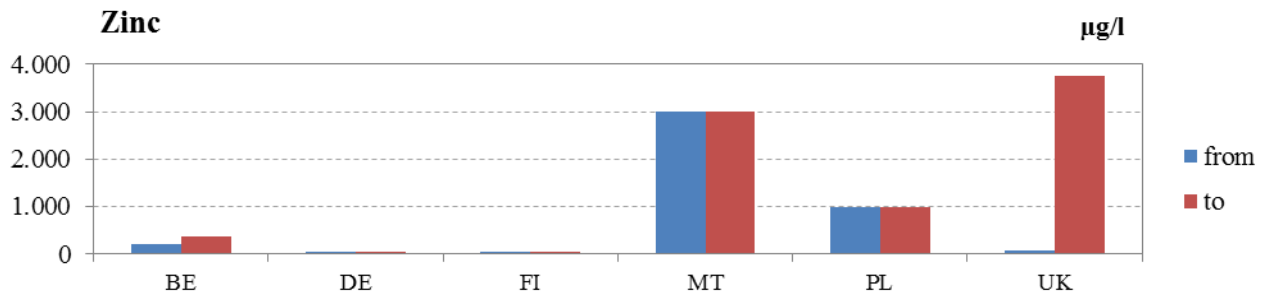
MS	from	to
AT		18
BE	20	60
DE		14
DK		20
ES	20	30
FI		10
GR		20
IT		20
NL		30
PL		20
UK	15	116
Total	**10**	**116**

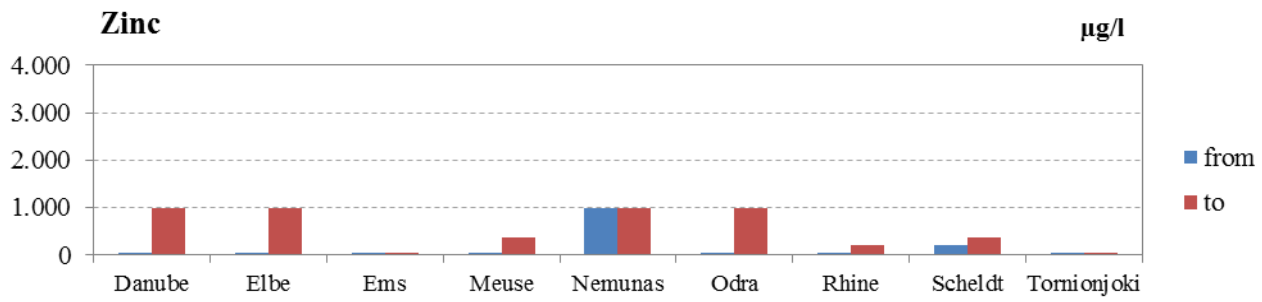
RBDname	RBD	from	to
Danube	AT1000		18
	DE1000		14
	PL1000		20
East Aegean	GR12		20
Elbe	AT5000		18
	DE5000		14
	PL5000		20
Ems	DE3000		14
	NLEM		30
Meuse	BEMaas_VL	23	60
	DE7000		14
	NLMS		30
	BEMeuse_RW		20
Nemunas	PL8000		20
Odra	DE6000		14
	PL6000		20
Rhine	AT2000		18
	DE2000		14
	NLRN		30
	BERhin_RW		20
Scheldt	BESchelde_VL	23	38
	NLSC		30
	BEEscaut_RW		20
	BEEscaut_Schelde_BR		20
Tornionjoki	FIVHA6		10

Table 23: Nickel – Remarks to the established TVs for some Member States

MS	TV	Remarks to the established TVs for nickel
AT	18	90 % national DW standard
BE	60	NBL = 60; EQS = 40 → TV = NBL = 60
ES	20 30	20: National DW standard 30: NBL (97.7 or 90-percentile respectively)
FI	10	50 % of national DW standard
NL	30	TV based on DW standard of 20 µg/l, multiplied by the default attenuation and dilution factor of 1.5. NBL = 0.5 µg/l.
UK	15 20.2–116	15: 75 % of DW standard of 20 µg/l (in DWPA test) 20.2–116: in associated surface water test, considering also NBLs

Zinc (µg/l)





The established TVs for zinc show significant differences, ranging up to 65 times between the lowest (58 µg/l) and the highest (3,750 µg/l) value.

The TVs for zinc were manly derived from (national and international) DW standards and the natural background levels (NBLs). Belgium, Germany and United Kingdom considered environmental quality standards.

Low TVs → NBL, EQS: The quite low TV of 60 µg/l in Finland and 58 µg/l in Germany are derived from NBLs, where Finland took 2-times the NBL and Germany added an eco-toxicological value (PNEC) to the NBL.

High TVs → NBL, DW-standards: Malta and United Kingdom derived their TVs from the consideration of taste aspects for drinking water and came to different TVs: Malta established 3,000 µg/l which was reported to be identical with the WHO indicator as regards taste of drinking water. United Kingdom established a TV of 75 % of 5,000 µg/l.

Poland established the TV (1,000 µg/l) on real data, assuming that some NBLs reach these concentrations.

Table 24: Zinc – Ranges of established TVs at the level of Member States and international RBDs

MS	from	to
BE	200	375
DE		58
FI		60
MT		3,000
PL		1,000
UK	75.8	3,750
Total	**58**	**3,750**

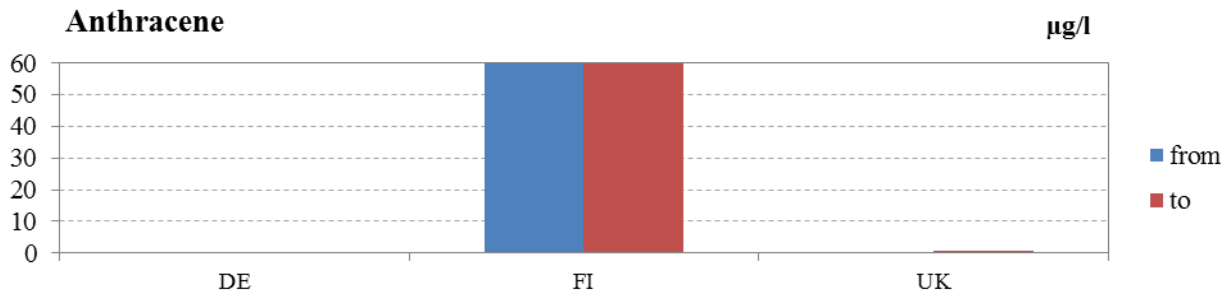
RBDname	RBD	from	to
Danube	DE1000		58
	PL1000		1,000
Elbe	DE5000		58
	PL5000		1,000
Ems	DE3000		58
Meuse	BEMaas_VL	305	360
	DE7000		58
	BEMeuse_RW		200
Nemunas	PL8000		1,000
Odra	DE6000		58
	PL6000		1,000
Rhine	DE2000		58
	BERhin_RW		200
Scheldt	BESchelde_VL	310	375
	BEEscaut_RW		200
Tornionjoki	FIVHA6		60

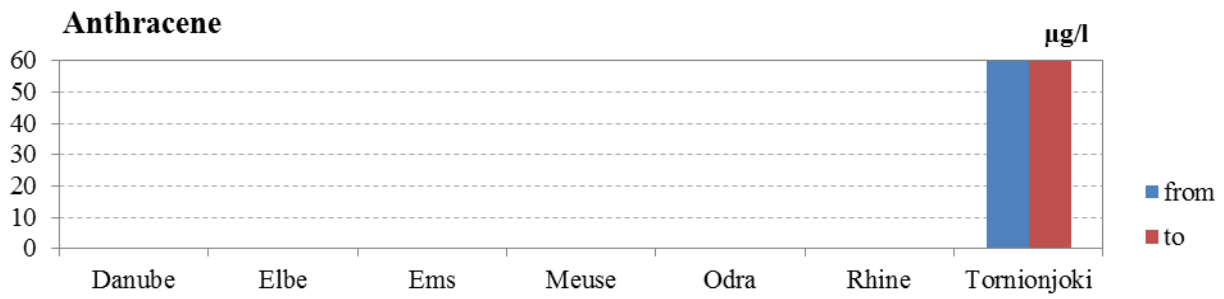
Table 25: Zinc – Remarks to the established TVs for some Member States

MS	TV	Remarks to the established TVs for zinc
BE	200–375	Related to EQS for good status of surface water NBL = 110; EQS = 500 → (NBL+EQS)/2 = 305 NBL = 250; EQS = 500 → (NBL+EQS)/2 = 375
DE	58	results from adding the PNEC of 7.8 µg/l to the NBL (90 percentile) of 49.8 µg/l.
FI	60	2 x NBL (90- percentile)
MT	3,000	WHO indicator as regards taste of drinking water
PL	1,000	TVs were set based on real data. The NBLs for these elements are considered lower; however, there are many examples of weathering zones where concentrations of these elements is elevated and this resulted in setting TVs on a national scale at this level
UK	75.8–414 3,750	TVs derived from the Impacts on Surface Water test. They use the surface water EQS value but are calculated individually for each groundwater body using NBL. TV for the Drinking Water Protected Area test = 75 % of a 5 mg/l (5,000 µg/l) limit (based on taste and appearance)

SYNTHETIC SUBSTANCES

Anthracene (µg/l)





The few established TVs for anthracene show significant differences, ranging up to 6,000 times between the lowest (0.01 µg/l) and the highest (60 µg/l) value.

The TVs for anthracene were manly derived from environmental quality criteria.

High TVs → risk assessment contaminate sites: Finland derived its TV of 60 µg/l from 50 % of the TV which is applied for the risk assessment of contaminated sites.

Low TVs → EQS: UK derived the TVs between 0.1 and 0.55 µg/l from environmental criteria and apply the TVs within the tests on the impact of groundwater on surface waters.

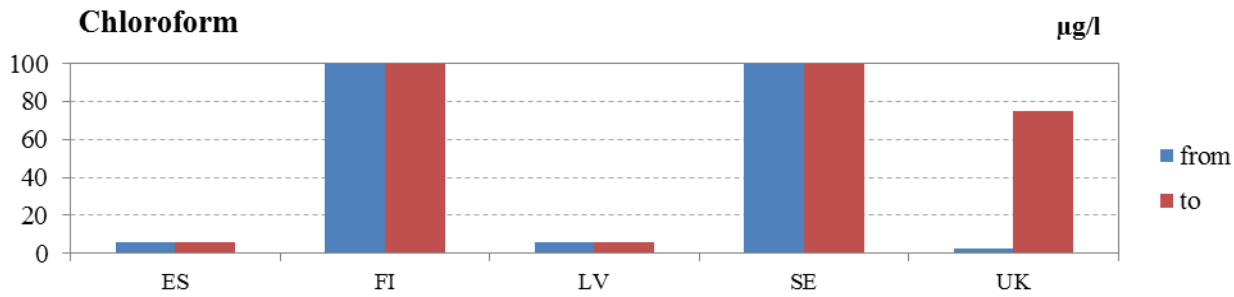
The TV of 0.01 µg/l as established by Germany is used for the assessment of local groundwater contamination and it is derived from environmental quality standards for surface waters.

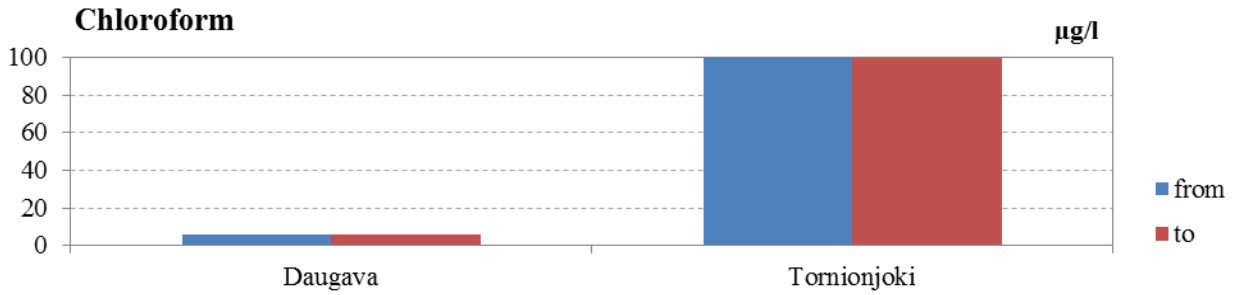
Table 26: Anthracene – Ranges of established TVs at the level of Member States and international RBDs

MS	from	to
DE		0.01
FI		60
UK	0.1	0.55
Total	**0.01**	**60**

RBDname	RBD	from	to
Danube	DE1000		0.01
Elbe	DE5000		0.01
Ems	DE3000		0.01
Meuse	DE7000		0.01
Odra	DE6000		0.01
Rhine	DE2000		0.01
Tornionjoki	FIVHA6		60

Chloroform (µg/l)





The few established TVs for chloroform show differences, ranging up to 40 times between the lowest (2.53 µg/l) and the highest (100 µg/l) value. The TVs for chloroform were manly derived from environmental quality criteria and from DW standards.

High TVs → DW-standards: The TV of 100 µg/l in Finland corresponds to 50 % of the national DW standard, whereas in Sweden it corresponds to 100 % of the national DW standard. United Kingdom established 75 µg/l, which corresponds to 75 % of the national DW standard.

Low TVs → EQS: The rather small TVs in United Kingdom are derived from surface water EQS value (2.53–13.8 µg/l) considering base flow. The TV of 6 µg/l in Latvia represents 50% of the strictest available EQS (for surface water as no EQS for groundwater is available)

Table 27: Chloroform – Ranges of established TVs at the level of Member States and international RBDs

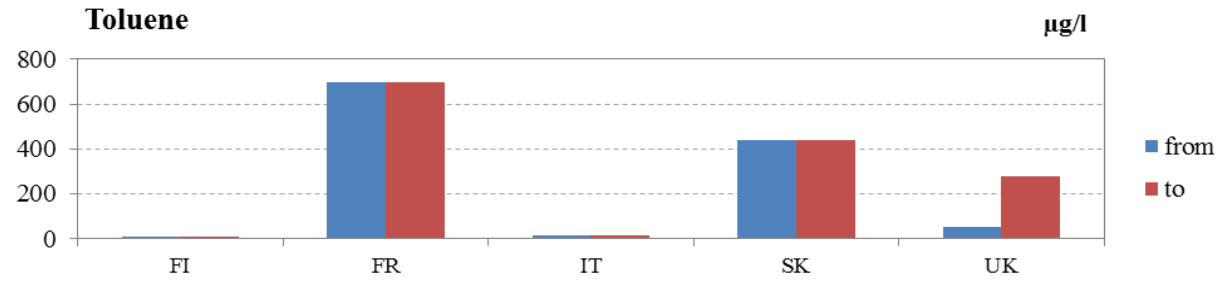
MS	from	to
ES		6
FI		100
LV		6
SE		100
UK	2.53	75
Total	**2.53**	**100**

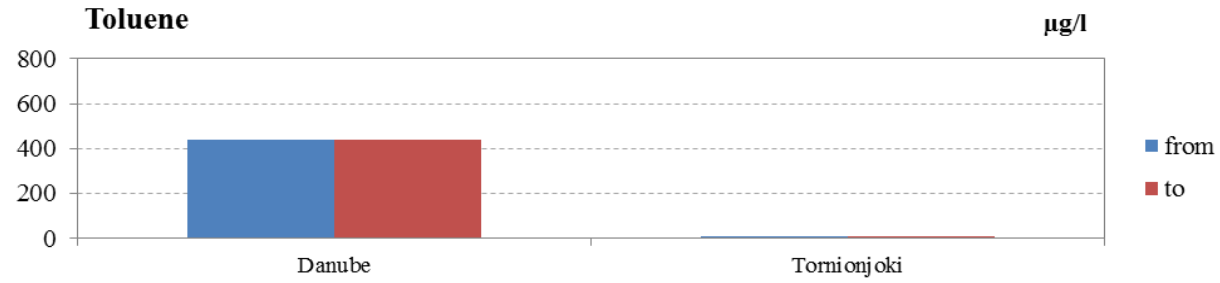
RBDname	RBD	from	to
Daugava	LVDUBA		6
Tornionjoki	FIVHA6		100
	SE1TO		100

Table 28: Chloroform – Remarks to the established TVs for some Member States

MS	TV	Remarks to the established TVs for chloroform
ES	6	Guideline value from the New Dutch List (2000)
FI	100	50 % of national DW standard
LV	6	TV = (NBL + EQS)/2 where NBL=0 and EQS = 12 µg/l which is the strictest EQS for surface waters (no EQS for groundwater available).
SE	100	National DW standard for the sum of trihalomethanes
UK	2.53–13.8 75	TVs derived from the Impacts on Surface Water test. They use the SW EQS value (2.5µg/l) but are calculated individually for each GWB using baseflow. 75 % of national DW standard

Toluene (µg/l)





The established TVs for toluene show differences, ranging up to 58 times between the lowest (12 µg/l) and the highest (700 µg/l) value. The TVs for toluene were manly derived from environmental quality criteria and from usage criteria (drinking water).

Higher TVs → DW-standards: The TV of 700 µg/l in France corresponds to the WHO guideline value for drinking water. Slovak Republic derived the TV of 437.5 µg/l from the DW standard of 700 µg/l and the LOQ of 175 µg/l.

The TVs in United Kingdom are derived from the EQS for surface waters (50 µg/l) considering base flow and reach up to 276 µg/l.

Lower TVs → DW-standards (taste), EQS: Finland considered odour and taste as main criteria for deriving a TV of 12 µg/l and Italy derived the TV of 15 from eco-toxicological criteria.

Table 29: Toluene – Ranges of established TVs at the level of Member States and international RBDs

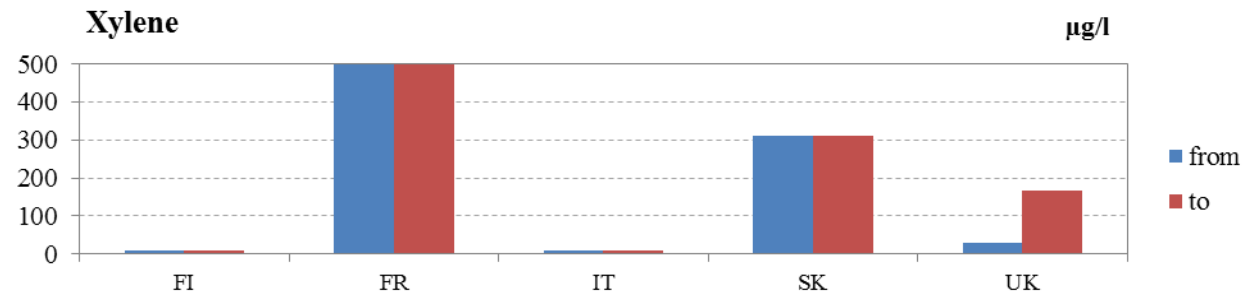
MS	from	to
FI		12
FR		700
IT		15
SK		437.5
UK	50.5	276
Total	**12**	**700**

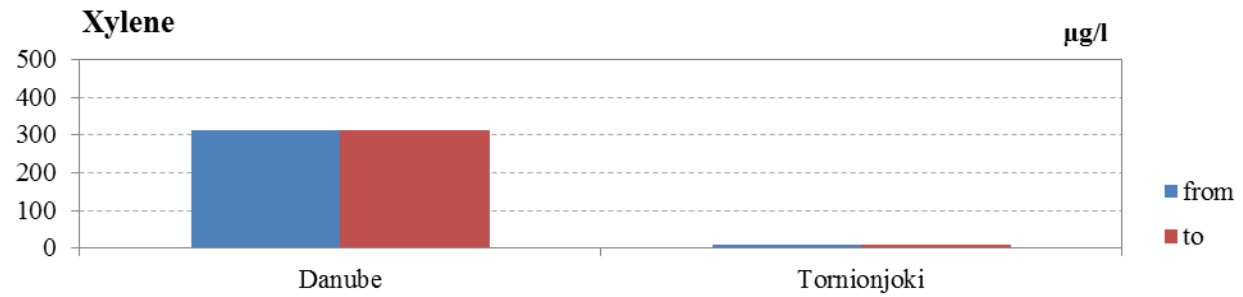
RBDname	RBD	from	to
Danube	SK40000	437.5	438
Tornionjoki	FIVHA6		12

Table 30: Toluene – Remarks to the established TVs for some Member States

MS	TV	Remarks to the established TVs for toluene
FI	12	50 % of lowest odour or taste limit value
FR	700	WHO guideline value
SK	437.5	The TV is a half of the interval between the LOQ (=NBL for synthetic substances = 175) and the national DW standard (700). TV = 0.5 (DW standard + LOQ)
IT	15	Derived from both eco-toxicological and toxicological criteria. From a toxicity point of view toluene is endocrine disrupting chemicals with effects on reproduction and foetus development, for this reason a prec. approach has been applied.
UK	50.5–276	TVs derived from the Impacts on Surface Water test. They use the surface water EQS value (50µg/l) but are calculated individually for each GWB using baseflow.

Xylene (µg/l)





The established TVs for xylene show differences, ranging up to 50 times between the lowest (10 µg/l) and the highest (500 µg/l) value. The TVs for xylene were very similarly to toluene, manly derived from environmental quality criteria and from usage criteria (drinking water).

Higher TVs → DW-standards: The TV of 500 µg/l in France corresponds to the WHO guideline value for drinking water. Slovak Republic derived the TV of 312.5 µg/l from the DW standard of 500 µg/l and the LOQ of 125 µg/l.

The TVs in United Kingdom are derived from the EQS for surface waters (30 µg/l) considering base flow and reach up to 166 µg/l.

Lower TVs → DW-standards (taste), EQS: Finland considered odour and taste as main criteria for deriving a TV of 10 µg/l and Italy derived the TV of 10 from eco-toxicological criteria.

Table 31: Xylene – Ranges of established TVs at the level of Member States and international RBDs

MS	from	to
FI		10
FR		500
IT		10
SK		312.5
UK	30.3	166
Total	**10**	**500**

RBDname	RBD	from	to
Danube	SK40000	312.5	313
Tornionjoki	FIVHA6		10

Table 32: Xylene – Remarks to the established TVs for some Member States

MS	TV	Remarks to the established TVs for xylene
FI	10	50 % of lowest odour or taste limit value
FR	500	WHO guideline value
IT	10	Derived from both eco-toxicological and toxicological criteria (PNEC less than 10 µg/l). From a toxicity point of view these substances are both endocrine disrupting chemicals with effects on reproduction and foetus development, for this reason a precautionary approach has been applied.
SK	312.5	The TV is a half of the interval between the LOQ (=NBL for synthetic substances = 125 µg/l) and the national DW standard (500). TV = 0.5 (DW standard + LOQ)
UK	30.3–166 37.5	TVs derived from the Impacts on Surface Water test. They use the surface water EQS value (30µg/l) but are calculated individually for each GWB using baseflow. 75% of 50µg/l. WHO reported the lowest odour threshold for xylenes in DW as 20 µg/l