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**REVIEW OF THE GUIDELINES ON THE APPLICATION OF ENVIRONMENTAL  
INDICATORS**

Informal note by the secretariat<sup>1</sup>

**INTRODUCTION**

As a main activity by the Joint Task Force on Environmental Indicators, the process of reviewing the Guidelines for the Application of Environmental Indicators continued in 2011 focusing on the following indicators:

- Biochemical oxygen demand (BOD) and concentration of ammonium in rivers,
- Nutrients in freshwater (divided into 3 sub-indicators: nutrients in rivers, nutrients in lakes, nutrients in ground waters)
- Nutrients in coastal sea waters,
- Areas affected by soil erosion,
- Pesticide consumption,
- Consumption of ozone-depleting substances.

All target countries have obtained the detailed questionnaire on these indicators prepared by the secretariat. The following countries have reported the data for at least one indicator:

- Albania,
- Armenia,
- Azerbaijan,
- Belarus,
- Bosnia and Herzegovina,
- Georgia,
- Kazakhstan,

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- Kyrgyzstan,
- Montenegro,
- Republic of Moldova,
- Russian Federation,
- Serbia,
- Tajikistan,
- The former Yugoslav Republic of Macedonia,
- Ukraine,
- Uzbekistan.

The summary and basic analysis of the data reported by countries for individual indicators is presented below.

## **I. SUMMARY OF COUNTRY RESPONSES TO THE QUESTIONNAIRES ON SIX INDICATORS FROM THE GUIDELINES**

### **1. Biochemical oxygen demand (BOD) and concentration of ammonium in rivers**

Country	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Albania													
Armenia													
Azerbaijan													
Belarus													
Bosnia and Herzegovina													
Georgia													
Kazakhstan													
Kyrgyzstan													
Montenegro													
Republic of Moldova													
Russian Federation													
Serbia													
Tajikistan													
The former Yugoslav Republic of Macedonia													
Ukraine													
Uzbekistan													

*Note: The green colour means that the country has reported at least some data related to this indicator.*

This indicator characterizes the status of a water objects.

All 16 reporting countries reported data for the development of this indicator. Each country has presented data from one (Azerbaijan, Belarus, Kazakhstan, Ukraine) to six water courses (Armenia, Tajikistan) on which measurements of BOD<sub>5</sub> and concentration of ammonium is being carried out.

As for the data covering the whole length of rivers, the data has been reported by Belarus (6 sites at the Neman River), Russia (5 sites at the Irtysh River and the Amur River), Kyrgyzstan (3 sites at the Chu River), Armenia (3 sites at all 6 rivers), Azerbaijan (3 sites at the Kura River), Georgia (3 sites for both the Rioni and the Mtkvari rivers), the Republic of Moldova (3 sites for both the Dnestr and Prut rivers), Kazakhstan (3 sites at the Ertis River) and Ukraine (3 sites at the Dnipro river).

However, Bosnia and Herzegovina, the former Yugoslav Republic of Macedonia, Montenegro and Uzbekistan while presenting the data for 3 rivers did not relate this data to the sampling points and presented averaged values of BOD<sub>5</sub> and ammonium concentrations for the whole lengths of these rivers. Tajikistan reported the data on 6 rivers and Albania on 3 rivers, but the concentrations of BOD<sub>5</sub> and ammonium were only reported for one site per each river. As a result, this data cannot be used for the development of indicator.

Azerbaijan and Kazakhstan did not present the distances of sampling points to the junctions with another rivers or to the country borders but only presented names of populated areas where sampling is carried out. Not having maps of these populated areas, such information is not useful.

Time coverage of sampling differs from country to country. In Armenia, the former Yugoslav Republic of Macedonia, Georgia, Montenegro, Uzbekistan, Kyrgyzstan and Russia, sampling is being carried out from 1990 to 2010, in the Republic of Moldova from 1995 to 2010, in Belarus, and Ukraine from 2000 to 2010, in Kazakhstan regularly from 2003 to 2010, in Azerbaijan and Tajikistan (the Kapharnigan river) from 2005 to 2010, in Albania from 2007 to 2010 and in Bosnia and Herzegovina from 2000 to 2006.

In all countries, with the exception of the Russian Federation, the sampling frequency at different sites differs from 1 to 24 samplings per year. At the Russian rivers, the sampling frequency lies between 5 and 35 samplings per year (the Irtysh River). Serbia has presented low number of probes in certain years.

All countries with the exception of Bosnia and Herzegovina, the former Yugoslav Republic of Macedonia, Montenegro and Uzbekistan (as mentioned above), have presented the average concentrations of BOD<sub>5</sub> and ammonium for all sampling points (Georgia for almost all sampling points).

All countries with the exception of Azerbaijan, Tajikistan and Uzbekistan publish the results of BOD<sub>5</sub> and ammonium concentrations in different publications. The Republic of Moldova has reported on publication of the data, however without reporting the data themselves.

Armenia is the only country which has indicated the application of ISO 5815:1989 и ISO 6778:1984 for determination of BOD<sub>5</sub> and ammonium. The former Yugoslav Republic of Macedonia is using the EN 25813:1992 for the determination of BOD<sub>5</sub>. Other countries apply national methodologies for the determination of BOD<sub>5</sub> and ammonium in fresh waters.

Albania and Georgia use the ISO-17025 method to assure the quality of analyses.

Belarus suggests preparing methodology guidelines for quality assurance / quality control.

Armenia and Belarus have presented maps showing the location of sampling points.

Conclusions:

1. The majority of countries have available time series and spatial distribution of concentrations of BOD<sub>5</sub> and ammonium in water in rivers.
2. Applied methodologies for the determination of concentrations of BOD<sub>5</sub> and ammonium differ from country to country which makes mutual comparison of the data difficult.
3. Data on this indicator is not published in Azerbaijan and Uzbekistan.
4. It is recommended to Armenia, Belarus, Georgia, Kyrgyzstan, the Republic of Moldova, Russian Federation, Serbia and Ukraine to implement the indicator “BOD and ammonium in rivers” on the basis of reported data.
5. It is recommended to Albania, Azerbaijan, Bosnia and Herzegovina, Kazakhstan, the former Yugoslav Republic of Macedonia, Montenegro, Tajikistan and Uzbekistan to complement the reported data with the missing ones, as indicated above.

## 2. Nutrients in fresh waters

### A. Sub-indicator: Nutrients in rivers

Country	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Albania													
Armenia													
Azerbaijan													
Belarus													
Bosnia and Herzegovina													
Georgia													
Kazakhstan													
Kyrgyzstan													
Montenegro													
Republic of Moldova													
Russian Federation													
Serbia													
Tajikistan													
The former Yugoslav Republic of Macedonia													



The majority of countries (Armenia, Georgia, Kazakhstan, Kyrgyzstan, Montenegro, Uzbekistan, Russia) has reported measurements of nitrates starting from 1990, the Republic of Moldova starting from 1995, Azerbaijan, Bosnia and Herzegovina, Serbia, the former Yugoslav Republic of Macedonia starting from 2000, Tajikistan and Ukraine starting from 2005 and Albania from 2007. Belarus did not report on measurements of nitrates. In addition to the above mentioned parameters, Armenia has reported the concentrations of phosphates in rivers.

In all countries, with the exception of the Russian Federation, the sampling frequency at different sites differs from 1 to 12 samplings per year. At the Russian rivers, the sampling frequency lies between 5 and 35 samplings per year (the Irtysh River).

All countries with the exception of the Albania, Bosnia and Herzegovina, the former Yugoslav Republic of Macedonia, Montenegro and Uzbekistan (as mentioned above), have presented the average concentrations of nutrients for all sampling points, or the concentration from one sampling point for each river. Such data cannot be used as a background for the development of this indicator.

The majority of countries: Albania, Armenia, Belarus, Bosnia and Herzegovina, Georgia, Kazakhstan, Kyrgyzstan, the former Yugoslav Republic of Macedonia, Montenegro, the Republic of Moldova, Russia and Serbia publish the results of nutrient concentrations in different publications. Azerbaijan, Tajikistan and Uzbekistan do not publish this data.

Albania, Armenia and the former Yugoslav Republic of Macedonia are the only countries which has indicated the application of the following international methodologies for the determination of nutrients: phosphates - ISO 6878:1998; nitrates - ISO 7890:1986; total phosphorus - EPA 3125:1998. Georgia has stated that analysis of nitrates is being carried out in accordance with ISO 7890 -3:1988.

Other countries apply national methodologies for the determination of nutrients in river waters.

Belarus suggests preparing methodology guidelines for quality assurance / quality control.

Armenia, Azerbaijan and Belarus presented maps showing the location of sampling points.

#### Conclusions:

1. The majority of countries, with the exception of Belarus, have available time series and spatial distribution of concentrations of nitrates in rivers.
2. Analysis of the concentrations of phosphates in rivers has been started in Montenegro from 1990 (phosphates), in the Republic of Moldova from 1995, in the former Yugoslav Republic of Macedonia (phosphates), Russia, Serbia, Ukraine (phosphates) and Uzbekistan from 2000, in other countries even later. In Kyrgyzstan, total phosphorus is not analysed, replaced by the analysis of mineral phosphorus.
3. Applied methodologies for the determination of nutrient concentrations in rivers differ from country to country which makes mutual comparison of data difficult.
4. Data on this indicator is not published in Azerbaijan, Tajikistan and Uzbekistan.

5. It is recommended to the Republic of Moldova to implement the indicator „Nutrients in rivers“ on the basis of reported data starting from 1995, Russian Federatijn and Serbia from 2000, Armenia and Azerbaijan from 2005.
6. It is recommended to Albania, Bosnia and Herzegovina, Kazakhstan, the former Yugoslav Republic of Macedonia, Montenegro, Tajikistan and Uzbekistan to complement the reported data with the missing ones, as indicated above to be able to develop the indicator fully.
7. It is recommended to Georgia and Kyrgyzstan to start the measurements of total phosphorus in rivers as soon as possible.

**B. Sub-indicator: Nutrients in lakes**

Country	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Albania													
Armenia													
Azerbaijan													
Belarus													
Bosnia and Herzegovina													
Georgia													
Kazakhstan													
Kyrgyzstan													
Montenegro													
Republic of Moldova													
Russian Federation													
Serbia													
Tajikistan													
The former Yugoslav Republic of Macedonia													
Ukraine													
Uzbekistan													

*Note: The green colour means that the country has reported at least some data related to this indicator.*

This sub-indicator characterizes the status of water in lakes.

From the total of 16 reporting countries, the data has not been sent by Kyrgyzstan, the Republic of Moldova, Ukraine and Uzbekistan.

Azerbaijan has reported data on four lakes and one water reservoir, Montenegro, and the Russian Federation three lakes, the Republic of Moldova on three reservoirs, Albania and the former Yugoslav Republic of Macedonia for two lakes, Armenia, Belarus, Bosnia and Herzegovina, Georgia, Kazakhstan, Serbia and Tajikistan for one lake.

Albania, Azerbaijan, Bosnia and Herzegovina, Kazakhstan, the former Yugoslav Republic of Macedonia, the Republic of Moldova, Montenegro, the Russian Federation and Serbia measure the concentrations of total phosphorus and nitrates in lakes. Armenia measures the concentration of phosphates in addition. Georgia has only reported the measurements of nitrates. Belarus has only reported the measurements of total phosphorus. Tajikistan has reported the measurements of phosphates and nitrates.

Kazakhstan measures concentrations of nutrients in the Balkhash Lake from 1990 till 2010 with missing data for certain years.

The data reported by the Russian Federation for the Baikal Lake cover the period from 1990, but measurements have been terminated in 2007. The data for remaining two lakes cover the periods of 2004-2010 and 2008-2010, respectively.

Measurements of nutrients in reservoirs in the Republic of Moldova have started in 1995, in lakes in Armenia, Azerbaijan, Belarus, the former Yugoslav Republic of Macedonia and Montenegro have started in 2000, in Azerbaijan and Serbia in 2005. In the former Yugoslav Republic of Macedonia, the measurements of nitrates has been terminated in 2004 and 2005 due to the lack of funding. Georgia has started measurement of nitrates in 1990 but certain interruptions can be seen. In Bosnia and Herzegovina the measurements were being carried out from 2003 to 2006, in Albania from 2009 to 2010 and in Tajikistan in 2007 only.

In all countries with the exception of the Russian Federation, the frequency of sampling differs from one to 12 probes per year. The highest frequency of sampling of nitrates has been reported for the Baikal Lake in 1990 (225 samples). In the former Yugoslav Republic of Macedonia, the frequency of sampling is not available.

Armenia is the only country which has shown that sampling is being carried out in defined depth (0.5 m) at three verticals of the Sevan Lake. The remaining countries have only reported averaged data of measurements (Kazakhstan has reported data from three measuring sites for the Balkhash Lake and Serbia has reported data from three measuring sites for the Vlasina lake; however without morphometric characteristics of the lake). Mean and maximum depth has not been reported for four from five lakes in Azerbaijan.

Albania, Armenia, Belarus, Bosnia and Herzegovina, Georgia, Kazakhstan, the former Yugoslav Republic of Macedonia, Montenegro, the Republic of Moldova, Russia and Serbia publish the results of nutrient concentrations in different publications. Azerbaijan and Tajikistan do not publish this data.

Armenia and is the only country which has indicated the application of the following international methodologies for the determination of nutrients: phosphates - ISO 6878:1998; nitrates - ISO 7890:1986; total phosphorus - EPA 3125:1998.

Other countries apply national methodologies for the determination of nutrients in river waters.



Albania and Georgia apply the ISO-17025 methodology to control the quality of analyses.

Belarus suggests preparing methodology guidelines for quality assurance / quality control.

Armenia and Belarus presented maps showing the location of sampling points.

Conclusions:

1. Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Georgia, Kazakhstan, the former Republic of Macedonia, Montenegro, the Republic of Moldova, the Russian Federation, Serbia and Tajikistan) have reported data on the indicator „Nutrients in lakes“. Kyrgyzstan, the Republic of Moldova, Ukraine and Uzbekistan did not report data on this indicator.
2. Armenia is carrying out measurements for three parameters (phosphates, total phosphorus, nitrates), Albania, Azerbaijan, Bosnia and Herzegovina, Kazakhstan, the former Yugoslav Republic of Macedonia, Montenegro, the Republic of Moldova, the Russian Federation and Serbia for two parameters (total phosphorus, nitrates), Belarus for one parameter (total phosphorus) and Georgia for one parameter (nitrates).
3. Armenia is the only country which has reported the concrete depth of sampling; other countries have reported averaged data, either by verticals or for the lake as a whole. Azerbaijan, Kazakhstan and Serbia did not present several morphometric characteristics of lakes.
4. Analysis of nutrient concentrations in lakes was started in 1990 in Georgia (only nitrates), Kazakhstan and the Russian Federation, the Republic of Moldova was started in 1995 and during 2000s in other countries. The former Yugoslav Republic of Macedonia and Serbia started measurements of nitrates in the middle of 2000s, Albania in 2009. Measurements nitrates in the former Yugoslav Republic of Macedonia were terminated after four years.
5. Different countries apply different analytical methods for the determination of nutrient concentrations in lakes which makes the mutual comparison of data difficult.
6. Azerbaijan and Tajikistan do not publish data on nutrient concentrations in lakes.
7. It is recommended to the Republic of Moldova and Armenia which has the highest data coverage to implement the indicator “Nutrients in lakes” for the period 1995 – 2010 (the Republic of Moldova) and 2000 – 2010 (Armenia).
8. It is recommended to Albania, Azerbaijan, Belarus, Bosnia and Herzegovina, Georgia Kazakhstan, the former Yugoslav Republic of Macedonia, Montenegro, the Russian Federation, Serbia and Tajikistan to complement the reported data with the missing ones to be able to develop the indicator fully.
9. It is recommended to Kyrgyzstan and Uzbekistan to start measurements of nutrient concentrations in lakes as soon as possible.
10. It is recommended to Ukraine to report data on „Nutrients in lakes” as soon as possible.

### C. Sub-indicator: Nutrients in ground waters

Country	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Albania													
Armenia													
Azerbaijan													
Belarus													
Bosnia and Herzegovina													
Georgia													
Kazakhstan													
Kyrgyzstan													
Montenegro													
Republic of Moldova													
Russian Federation													
Serbia													
Tajikistan													
The former Yugoslav Republic of Macedonia													
Ukraine													
Uzbekistan													

*Note: The green colour means that the country has reported at least some data related to this indicator.*

This sub-indicator characterizes the status of ground waters.

From the total of 16 reporting countries, the data on this indicator have been obtained from nine only: the Republic of Moldova – 19 objects, Russian Federation – 6 objects, Azerbaijan, Belarus, Montenegro, Serbia, Ukraine and Uzbekistan – 2 objects, Armenia – one object.

All countries, which have reported on this indicator (with the exception of Azerbaijan and the Republic of Moldova), have measured the concentration of nitrates in the samples of ground waters taken from exploratory wells, as requested by the questionnaire. In addition, Azerbaijan has measured the concentrations of total phosphorus, the Republic of Moldova has measured the concentrations of nitrites and ammonium.

The highest data coverage can be seen in the case of Russian Federation, which has available the analysis of samples from different parts of the country (Saint Petersburg, Lipetskaya and Orlovskaya oblast).

The frequency of sampling is varying from one (Belarus) to nine (Uzbekistan) per year. In the case of more than one sample per year, the averaged values have been presented.

Azerbaijan has reported data on concentrations of nitrates in ground waters for the period 2000 – 2010 with missing 2004 and on concentrations of total phosphorus starting from 2004. The concentrations of nitrates were oscillating between 0.41 and 7.2 micrograms per litre.

Montenegro has reported data on nitrates concentrations in ground waters for the period 2000-2010. The concentrations were varying between 2.5 and 35.3 micrograms/litre.

Belarus has reported data on nitrates concentrations in ground waters varying between 0.1 and 17.2 micrograms/litre.

Serbia has started to analyse nitrates from 2003. Concentrations are varying from 5.8 to 22.8 milligrams/litre for water object Pozarevac which represents rather high value.

Ukraine has presented data for the period 1990 to 2010 with certain years missing. However, measurements were carried out once per year only. The concentrations of nitrates are varying from 0.6 to 7.2 micrograms/litre.

Uzbekistan has presented the data since 2005 with variance from 1 to 70 micrograms/litre.

After a long interruption, Armenia has started to measure concentrations of nitrates in ground waters in 2009. Actual average concentration is 11.2 micrograms/litre.

The Republic of Moldova has presented the data since 2000, but in the most objects, except one, they are going not every year. The concentrations of nitrates are varying from 0.1 to 112.9 micrograms/litre, which represent an extremely high value.

The Russian data cover the period 2001 – 2010, but systematic measurements have started in 2004. The concentrations are varying between 45.0 micrograms/litre in artesian basin of Saint Petersburg and 188.2 micrograms/litre at the water treatment company in Orel, which represents an extremely high value.

The methods of quality control/quality assurance are not presented by any country.

Belarus, Montenegro, the Republic of Moldova, the Russian Federation, Serbia and Ukraine publish the results of ground water quality in various publications. In Armenia, Azerbaijan and Uzbekistan this data is not published.

Belarus suggests preparing methodology guidelines for data quality assurance / quality control.

Belarus presented a map showing the location of sampling points.

Conclusions:

1. Data on concentrations of nutrients in ground waters were obtained from nine countries only: Armenia, Azerbaijan, Belarus, Montenegro, the Republic of Moldova, the Russian Federation, Serbia, Ukraine and Uzbekistan.
2. Other countries did not report on this indicators (not taking into account problems with water supply in some of them).

3. All countries reporting on this indicator, with the exception of Ukraine, have started measurements not earlier than in 2000.
4. There is no common methodology for measuring concentrations of nitrates in ground waters in these countries.
5. Data on this indicator is not published in Armenia, Azerbaijan and Uzbekistan.
6. It is recommended to Azerbaijan, which has reported the most complete data, to implement the sub-indicator “Nutrients in ground waters” for the period 2005 – 2010 including data publication.
7. Insufficient and discontinuous time series as well as low numbers of samples analyzed per year do not allow other countries to assess efficiency of the data with respect to the development of this indicator at present.
8. It is recommended to Armenia, Belarus, Montenegro, the Republic of Moldova, the Russian Federation, Serbia and Ukraine to complement the reported data by missing information to be able to develop this indicator in the future.
9. It is recommended to Albania, Bosnia and Herzegovina the former Yugoslav Republic of Macedonia, the Republic of Moldova, Georgia, Kazakhstan, Kyrgyzstan and Tajikistan to start collecting data for the indicator “Nutrients in ground waters”.

### 3. Nutrients in coastal seawaters

Country	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Albania													
Azerbaijan													
Bosnia and Herzegovina													
Georgia													
Kazakhstan													
Montenegro													
Russian Federation													
Ukraine													

*Note: The green colour means that the country has reported at least some data related to this indicator.*

This indicator characterizes the status of coastal sea waters.

From the total of 16 reporting countries, only seven have the access to sea and therefore coastal waters, concretely Albania, Azerbaijan, Bosnia and Herzegovina (20 km of seashore), Georgia, Kazakhstan, Montenegro, Russian Federation and Ukraine.

Azerbaijan, Bosnia and Herzegovina, Georgia, and Ukraine did not report on this indicator.

Albania has reported data on total phosphorus concentrations from 2 sampling points covering the period 2004 – 2010.

Report by Kazakhstan includes the data on concentrations of total nitrogen and total phosphorus in spring, winter and summer for a shipping channel flowing into the Caspian Sea

The data is rather heterogeneous with the highest coverage in 2001 and 2010. However, this data is not sufficient to allow the development of indicator.

Montenegro has started its seawater monitoring program having its first data for 2010 (8 sampling sites, data on concentrations of total nitrogen and total phosphorus available for spring, summer and autumn).

Huge amount of data has been reported by the Russian Federation which is based on detailed data describing the concentrations of nutrients in the Caspian seawater at the Dagestan coastal zone and including annual average concentrations of phosphates, total phosphorus, nitrates, ammonia and total nitrogen as well as seasonal concentrations (spring, summer, autumn, winter). The time coverage is from 1990 till 2010. The sampling frequency differs from 3 to 7 times per year and total number of sampling sites is 33 every year. The detailed map of coastal zones is attached.

In addition, data is reported for the concentrations of nutrients for the coast of the Azov Sea without specification of concrete sites. This data which cover the period from 1995 till 2010 only include the concentrations of total phosphorus and total nitrogen as annual average as well as seasonal values.

The Russian data on this indicator are being published in specialized publications by Roshydromet and the Ministry of Environment and Natural Resources. There is no evidence on the publication of data in Kazakhstan. In Montenegro, the data has not been published yet.

Measurements of nutrients in seawaters are obviously being carried out in accordance with national methodologies.

#### Conclusions:

1. The Russian Federation is the only country which has available the data for the development of this indicator.
2. The data covering the concentrations of nutrients in coastal waters of the Dagestan coastal zone of the Caspian Sea are in full compliance with the needs of this indicator and might be used for the purpose of environmental governance in this region.
3. It is recommended to those countries having the access to the sea to apply the Russian experience (the State Oceanographic Institute) in the development of indicator „Nutrients in coastal sea waters“.

#### 4. Area affected by soil erosion

Country	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Albania													
Armenia													
Azerbaijan													
Belarus													
Bosnia and Herzegovina													
Georgia													

Kazakhstan														
Kyrgyzstan														
Montenegro														
Republic of Moldova														
Russian Federation														
Serbia														
The former Yugoslav Republic of Macedonia														
Tajikistan														
Ukraine														
Uzbekistan														

*Note: The green colour means that the country has reported at least some data related to this indicator.*

This indicator characterizes the erosion status of agricultural land.

From the total of 16 reporting countries, Albania, Bosnia and Herzegovina, Montenegro did not report data on this indicator. Tajikistan has reported data on water erosion which do not seem to be consistent.

This indicator includes two types of data: wind erosion and water erosion as well as the data on total soil erosion.

The highest data coverage for the development of this indicator can be seen in the case of Azerbaijan where the data on the areas affected by both wind and water erosion broken down by particular categories of affect on agricultural land is being collected annually since 1990. The analysis of the data for the period of last 20 years shows that the area affected by water erosion has decreased from 58.1% to 56.3% while in the case of wind erosion the area has increased from 4.3% to 4.9%.

In the case of other reporting countries, the data coverage is much lower both for time periods covered and for types of erosion and categories of affect.

Armenia does not have data on wind erosion available as its impact is considered negligible. The data on water erosion has been reported for 1987 and 2004. It can be concluded that the areas affected by water erosion have increased from 55.6 % to 61.3 % during that 17-years period.

In the case of Belarus, the data is only available for 2000 where those on the strong affect of wind and water erosion is missing.

Kazakhstan has reported very heterogeneous data for this indicator regardless the total area of agricultural land is being assessed on annual basis. Having in mind the data reported, more or less complete assessment has been carried out for 1995 and 2000. In addition, data on total areas affected by wind and water erosion is available for 2005, 2009 and 2010 which show that less than 1 % of agricultural land is affected by erosion.

Kyrgyzstan has reported data on water erosion for 1990 and 2009 without those on strong affect. The data show that the affect of water erosion has increased from 54.4 % to 59.7 during that period of 20 years. Incomplete data on wind erosion is only available for 1990.

The former Yugoslav Republic of Macedonia has reported data on total areas affected by soil erosion for 1995. It can be seen that 96.5 % of total agricultural land was to certain level affected by soil erosion in that year. The data is available to general public. Similarly, Ukraine has reported the data for 1995 only where the area affected by water erosion represents 32.6 %. Georgia has reported data for 2001 with total area of 33 % of land affected by erosion and Uzbekistan for 2002 with total area of 2.4 % of land affected.

The Republic of Moldova has reported data for the period 1990 to 2010, however, in one table without distinguishing between wind and water erosion. The areas under the strong affect of erosion are not presented at all. It can be seen that during the period of 20 years the area affected by erosion has increase from 30,5% to 35,2%.

In the Russian Federation, the assessment of the level of agricultural land degradation is being carried out once per five years. The incomplete data has been presented by the Russian Federation for 2000 and 2005. Analyzing this data, it is hard to clarify why the area affected by water erosion is 17.7 – 17.8 % and that affected by wind erosion is 8.4 % but the total area affected by both types of erosion is reported as 2.4 % for 2000 and 3.1 % for 2005.

Serbia has reported the data on areas affected by water erosion for several years, however without distinguishing the degree of affect. The area has decreased from 6.8 % in 2000 to 5.1 % in 2010.

Belarus, Kazakhstan, the Republic of Moldova, the former Yugoslav Republic of Macedonia the Russian Federation and Serbia publish the information on the areas affected by erosion in different types of publications. Ukraine publishes the data on soil degradation, which are not compliant with this indicator. In the case of Azerbaijan, Armenia and Uzbekistan, this information is not available for general public while Kyrgyzstan does not publish this data at all.

Countries obviously apply the methodologies for the assessment of erosion affect as adopted at the national levels. Armenia has informed on the application of internationally recognized methodology without any specification.

#### Conclusions:

1. Albania, Bosnia and Herzegovina, Montenegro and Tajikistan did not report data on the indicator „Areas affected by soil erosion“.
2. Time coverage of data differs from country to country; from annual basis in the case of Azerbaijan and the Republic of Moldova to once per 15 years in the case of Belarus. Many countries collect the data once per 5 years. In Belarus, Georgia, the former Yugoslav Republic of Macedonia, Ukraine and Uzbekistan, the data seem to be collected only once during the whole reporting period. Kyrgyzstan has indicated problems with regular monitoring.
3. With the exception of Azerbaijan, all countries have reported incomplete data only which does not allow the development of this indicator.

4. In Azerbaijan, Armenia, Kyrgyzstan and Uzbekistan, data is published in a way which is not accessible for the general public.
5. It is recommended to Azerbaijan which has reported the most comprehensive data to develop the indicator “Areas affected by soil erosion” for the period 1990 – 2010 followed by publication of the data in a way accessible to general public.
6. It is recommended to Albania, Bosnia and Herzegovina, Montenegro and Tajikistan to start with the collection of data on this indicator as soon as possible and to Kyrgyzstan to develop an efficient system of monitoring related to this indicator.

## 5. Pesticide use

Country	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Albania													
Armenia													
Azerbaijan													
Belarus													
Bosnia and Herzegovina													
Georgia													
Kazakhstan													
Kyrgyzstan													
Montenegro													
Republic of Moldova													
Russian Federation													
Serbia													
Tajikistan													
The former Yugoslav Republic of Macedonia													
Ukraine													
Uzbekistan													

*Note: The green colour means that the country has reported at least some data related to this indicator.*

The indicator reflects the pressure on the environment due to the use of pesticides.

From the total of sixteen reporting countries, Albania, Montenegro, Serbia and Uzbekistan did not report data on this indicator. The Republic of Moldova has stated that this indicator is not being developed in the country.

In the report by the Russian Federation, the data is incomplete and not in compliance with the requirements of this indicator. The data does not cover the use of pesticides but their



deliveries to enterprises without specifying particular types of pesticides which is not identical.

From the data reported by other countries it can be seen that they started with collection of data on the use of pesticides since different starting years: 1990 in Kazakhstan, 2000 in Albania, Belarus, Kyrgyzstan, the former Yugoslav Republic of Macedonia and Ukraine (data is collected regularly since 2003 in Kyrgyzstan), 2003 in Armenia, 2006 in Russia (data on deliveries) and Georgia and 2007 in Azerbaijan. Bosnia and Herzegovina has reported data for the period 2000 – 2003 only.

Belarus has reported the data on pesticide use separately for agricultural and forest lands. Russia has informed that the data is collected separately for the use of pesticides in forest protection but this data was not reported. The resting countries have reported the data on the pesticide use without specifying the type of land (agricultural or forest).

In Armenia, the plant regulators are not being used at all in recent years. The data on pesticide use are obviously based on calculations.

Georgia has only reported the absolute amounts of pesticides used in 2006 - 2009 without recalculating per hectare.

In the reports by Georgia and Kyrgyzstan, data on the use of plant regulators and rodenticides is missing.

In the report by the former Yugoslav Republic of Macedonia, the information is presented for insecticides, herbicides and fungicides for every year between 2000 and 2008.

Ukraine has reported full data for the use of all types of pesticides (with the exception of 2010).

Tajikistan has only reported data on the use of certain types of pesticides for 2005 – 2009 without total amount used and without relative indicators on the use per unit of area.

Based on the analysis of the data available for particular reporting periods, it can be concluded that the area of land on which pesticides are being applied has increased more than five times in the case of Kazakhstan, remained more or less unchanged in the case of Azerbaijan and Kyrgyzstan and decreased slightly in Armenia and Ukraine. In Belarus, the area of agricultural land has decreased slightly which the area of forest land where pesticides are applied has increased 20-times. In the former Yugoslav Republic of Macedonia, the total consumption of pesticides has decreased 3.4 times from 2000 till 2008. In Georgia, the total consumption of pesticides has increased almost four times between 2006 and 2009.

The use of pesticides per unit of land has decreased 4-times during 8 years in the case of Kyrgyzstan and increased 1,5 times during 4 years in the case of Azerbaijan and 2.5-times during 8 years in the case Armenia. In Belarus, the unit consumption of pesticides has increased 3 times during 11 years in the case of agricultural land and 55 times during 16 years in the case of forest land. In the former Yugoslav Republic of Macedonia, the use of pesticides per unit of land has decreased from 0.51 t/hectare in 2000 to 0.17 t/hectare in 2008.

During last 20 years the area of land treated by pesticides in Kazakhstan has increased 7-times. However, total use of pesticides remained more or less the same and the use per unit of area has decreased seven times as a result.

In Ukraine, both total use of pesticides and the use per unit of area have decreased about eight times during the ten years period.

Belarus, Georgia, Kazakhstan, Kyrgyzstan, the former Yugoslav Republic of Macedonia and Ukraine publish the data on pesticide use in different types of documents. Belarus, Kazakhstan and the Russian Federation also publish the data on deliveries of pesticides. In the case of Azerbaijan, Armenia and Tajikistan, the data on this indicator is not available to general public.

#### Conclusions:

1. Eleven countries (Armenia, Azerbaijan, Georgia, Belarus, Bosnia and Herzegovina, Kazakhstan, Kyrgyzstan, the former Yugoslav Republic of Macedonia, the Russian Federation, Tajikistan and Ukraine) have reported the data on indicator „Pesticide use“.
2. The Republic of Moldova has stated that this indicator is not being developed in the country.
3. The data reported by the Russian Federation do not comply with the requirements for the development of this indicator.
4. The time coverage of data collection differs from country to country. The highest time coverage can be seen in the case of Kazakhstan (since 1990) while the shortest one in the case of Azerbaijan (since 2007).
5. Data on this indicator is not available to general public in the case of Azerbaijan, Armenia and Tajikistan.
6. Data reported by Armenia, Azerbaijan, Belarus, Kazakhstan and the former Yugoslav Republic of Macedonia could be used as a background for further development of this indicator taking into account the necessity of making this data available to general public in the case of Armenia and Azerbaijan.
7. It is recommended to Kazakhstan and Ukraine, which has presented the highest data coverage, to develop the indicator “Pesticide use” for the period 1990 – 2010 subsequently.
8. It is recommended to the Russian Federation to change its reporting system to be compliant with the requirements of this indicator.
9. It is recommended to Georgia and Tajikistan to complement missing data to be able to develop this indicator.
10. It is recommended to Albania, Montenegro, the Republic of Moldova, Serbia and Uzbekistan to start the collection of data on the indicator „Pesticide use“ as soon as possible.
11. It is recommended to Bosnia and Herzegovina to re-start the collection of data on the indicator „Pesticide use“ as soon as possible.

#### 6. Consumption of ozone depleting substances (ODS)

Country	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Albania													



Georgia, Kazakhstan, Kyrgyzstan, the former Yugoslav Republic of Macedonia and Montenegro publish the data on ODS consumption in environmental reviews or statistical yearbooks. Belarus did not inform on the data publication while the resting countries informed that this information is not available in media.

In Azerbaijan, Kazakhstan and Uzbekistan, chlorofluorocarbons CFCs were being used till the middle of 2000s, afterwards these countries switched to the use of hydrochloro fluorocarbons (HCFCs). In Belarus, only hydrochlorofluorocarbons (HCFCs) were being used during the whole reporting period. In Armenia and Kyrgyzstan, both CFCs and HCFCs are being used till now. The Republic of Moldova was using CFCs till 2007, during the period 2002 till 2007 in together with HCFCs; since 2008 has switched to HCFCs completely. In the Russian Federation, methyl bromide was being used till 2005, afterwards only HCFCs are being used. In Uzbekistan, CFCs together with tetrachlor methane (carbon tetrachloride) was used till 2002, afterwards, the consumption was switched to HCFCs. In the former Yugoslav Republic of Macedonia, CFCs were being used till 2006, carbon tetrachloride till 2005 and methyl bromide till 2002. After 2006, only HCFCs are in use. In Montenegro, CFCs and carbon tetrachloride were being used till 2008. Since 2009, only HCFCs are in use. In Georgia, the use of CFCs has been terminated in 2007 and the use of halons in 2005. Since 2008, only HCFCs and methyl bromide are in use. In Albania, CFCs were used from 2002 to 2008 while in 2009 their use was terminated. In Tajikistan, both CFCs and HCFCs are being used since 2006. In Serbia, only HCFCs are being used after 2009.

Albania, Kyrgyzstan, Tajikistan and Uzbekistan did not report the data on ODS consumption in terms of ozone depleting potential (ODP).

Analysis of the ODS consumption in terms of ODP shows on the reduction of consumption during the reporting period: More than 400-times in the former Yugoslav Republic of Macedonia, more than 185-times in Serbia, more than 130-times in the Russian Federation, more than 100-times in Azerbaijan, Montenegro and the Republic of Moldova, more than 20-times in Armenia, 15-times in Belarus and more than 10-times in Bosnia and Herzegovina and Georgia. In Kazakhstan, the consumption has increased 1.5-times.

#### Conclusions:

1. The consumption of ODS is registered in reporting all countries, either by customs authorities or by environmental authorities.
2. With the exception of Georgia, Kazakhstan, Kyrgyzstan, the former Yugoslav Republic of Macedonia and Montenegro, the data on ODS consumption is not published in media.
3. Albania, Kyrgyzstan, Tajikistan and Uzbekistan did not report the data in terms of ODP which does not allow assessing trends in consumption in these countries.
4. In all resting countries, with the exception of Kazakhstan, the ODS consumption was reduced during the reporting period. In Kazakhstan, the ODS consumption has increased 1.5-times during the last 20 years.
5. It is recommended to Albania, Kyrgyzstan, Tajikistan and Uzbekistan to add missing data to enable the development of indicator.

## II. GENERAL CONCLUSIONS

The summary of assessment of the data coverage of particular indicators by particular countries can be found in the table hereunder. From the point of view of indicator coverage, it can be concluded that:

- The best data coverage is in the case of “Consumption of ODS” (15 reporting countries have reported the data in sufficient time series),
- Relatively good coverage can be seen in the case of “Pesticide consumption”. “BOD5 and ammonium concentration in rivers”, “Nutrients in rivers” and “Nutrients in lakes” show good coverage but the data is often incomplete or not applicable,
- The worst situation is in the case of “Nutrients in ground waters” (only 9 reporting countries” and especially “Nutrients in coastal sea waters” (in fact, only the Russian Federation and partially Albania have reported applicable data series).

From the point of view of countries, the best coverage can be seen in Armenia, Azerbaijan, the Russian Federation and partly Albania and Republic Moldova.

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## ASSESSMENT OF THE INDICATOR DATA COVERAGE BY COUNTRIES

Indicator	Albania	Armenia	Azerbaijan	Belarus	BiH	FYROM	Georgia	Kazakhstan	Kyrgyzstan	Moldova	Turkmenistan	Montenegro	RF	Serbia	Tajikistan	Ukraine	Uzbekistan
<b>BOD5 and NH4 in rivers</b>			?			?		?				?					?
<b>Nutrients in fresh water</b>																	
<b>rivers</b>			?			?		?				?					?
<b>lakes</b>																	
<b>groundwaters</b>																	
<b>Nutrients in coastal sea waters</b>		n.a.		n.a.		n.a.		?	n.a.	n.a.				n.a.	n.a.		n.a.
<b>Areas affected by soil erosion</b>																	
<b>water erosion</b>																	
<b>wind erosion</b>																	
<b>total area</b>																	
<b>Pesticide consumption</b>																	
<b>Consumption of ODS</b>																	
<b>in tonnes</b>													?				
<b>in ODP</b>													?				

Notes:

	Full information reported	All parameters required by the definition of indicator are reported
	Information reported partially	Parameters required by the definition of indicator are reported partially
?	Reported information not applicable	Reported information cannot be used for the development of indicator
n.a	No access to sea	
	Information not reported	