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COMMISSION STAFF WORKING DOCUMENT
Accompanying the document

Report from the Commission to the Council and the European Parliament

on the implementation of Council Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources based on Member State reports for the period 2012-2015

{COM(2018) 257 final}

SECTION VI

METHODS

Processing water quality data

Data delivery

Member States delivered water quality data for the reporting period 2012-2015 through EOINET (http://rod.eionet.europa.eu/obligations/106/deliveries). The essential data that are processed for the reporting exercise are summarized below for groundwater (GW) and surface water (SW).

Station information (GW_STAT and SW_STAT)

- Stationcode
- Stationtype
- Longitude
- Latitude

Annual nitrate measurements (GW_ANNCONC and SW_ANNCONC)

- Stationcode
- Stationtype
- Year
- Number of samples
- Annual average nitrate

Aggregated nitrate measurements (GW_CONC and SW_CONC)

- Stationcode
- Stationtype
- Period
- Number of samples
- Maximum nitrate
- Trend in annual average nitrate
- Winter average nitrate (SW only)
- Trend in winter average nitrate (SW only)

Eutrophication status (SW_EUTROSTATE)

- Stationcode
- Stationtype
- Period
- Number of samples
- Eutrophication status

Additionally, Member States deliver geo-referenced information about Nitrate Vulnerable Zones (NVZs) through GIS shapefiles and/or boundary files.

Data quality checks

The water quality data and NVZ information follow the specific EIONET dataset definition (http://dd.eionet.europa.eu/datasets/latest/NiD). The data go through an

automated EIONET check on the presence of mandatory elements, validity and correctness of codes and format of data types. An additional check is carried out on quality, completeness and coherence.

The additional check is executed using FME Workbenches. In these workbenches there is a check on the availability of a value for each of the mandatory attributes and a check on the validity of the given values. The validity check looks for example at the datatype, minimum and maximum values, use of valid codes and the number of characters as defined in the dataset definition.

The additional check also contains a check on the coordinates of the monitoring stations in GW_Stat and SW_Stat. The shapefile NUTS_2013_01M from Eurostat (http://ec.europa.eu/eurostat/web/gisco/geodata/reference-data/administrative-units-statistical-units/nuts) is used to check if the monitoring stations are within (or close to, as the boundaries of this dataset do not have a high positional accuracy) the Member State.

To be able to join the different tables with each other, the combination of CountryCode, ND_NatStatCode and ND_StationType should be unique and therefore a check on this uniqueness is included. For the tables GW_AnnConc and SW_AnnConc the combination of CountryCode, ND_NatStatCode, ND_StationType and ND_Year should be unique. For each unique combination it is checked whether there is a record in the other table(s). So, GW_Stat records are matched to records GW_AnnConc and GW_Conc and vice versa. SW_Stat records are matched to records in SW_AnnConc, SW_Conc, SW_EutroMeas and SW_EutroState.

The checked and completed water quality data and NVZ shapefiles are loaded into a GeoDatabase.

Data processing

Monitoring network

The Member States summary sheets and the Staff Working Document (SWD) present tables and figures of the number of stations in the monitoring networks and the sampling density and frequency. These data are based on the number of monitoring stations for which average annual nitrate measurements are reported.

Nitrates concentration

Annual nitrates average concentration presented in all figures, tables and maps of the SWD and Member States Summary Sheets are weighted averages. Nitrate concentrations in water are very variable in time. As the sampling programmes are not always balanced in time due to a varying number of samples per year, the four-year average nitrate concentrations may be affected by incidental extreme variations in nitrate concentrations.

Therefore the four-year average is calculated as the weighted average in which each annual value is weighted according to the number of underlying samples.

Four-year weighted average nitrate concentration = $\Sigma(n_i * AnnualConc_i) / \Sigma(n_i)$

n_i = number of samples in year i
$AnnualConc_i$ = Annual average nitrate concentration

Figure 1 in the Member States summary sheets presents the percentage of groundwater stations with average values equal to or exceeding 25, 40 or 50 mg nitrate per L during the current and previous reporting periods. Results are presented for all groundwater stations with measurements at different depths for each of the reporting periods (i.e. 2004-2007, 2008-2011 and 2012-2015) irrespective of possible changes in the Member States monitoring network over time.

Figure 3 in the Member States summary sheets presents the percentage of fresh surface water stations with average values equal to or exceeding 25, 40 or 50 mg nitrate per L during the current and previous reporting periods. Results are presented for all river and lake monitoring stations with measurements for each of the reporting periods (i.e. 2004-2007, 2008-2011 and 2012-2015) irrespective of possible changes in the Member States monitoring network over time.

Stations

Station type

The distinguished station types are presented in Table A1.

Table A1. Groundwater and surface water station types

	Code	Type	Aggregation
Ground water	0	Phreatic groundwater (shallow):0-5m	
	1	Phreatic groundwater (deep)	
	1a	Phreatic groundwater (deep) 5-15 m	
	1b	Phreatic groundwater (deep) 15-30 m	
	1c	Phreatic groundwater (deep) > 30 m	
	2	Captive groundwater	

	3	Karstic groundwater	
	9	Other stationtype	
Surface water	4	Rivers	Fresh surface waters
	5	Lakes	
	6	Coastal waters	Saline surface waters
	7	Transitional waters	
	8	Marine waters	

Ground water station type

Station density

The station density is calculated as the number of monitoring stations with annual average nitrate measurements per 1000 km^2 of land. The land area was derived from Eurostat total landcover in the year 2012. The station density was calculated for groundwater and fresh surface water stations.

Monitoring frequency

Member States submit an annual average nitrate concentration and the number of samples on which the annual average is based. The monitoring frequency is calculated as the sum of all samples taken during the reporting period divided by the total number of monitoring stations. The monitoring frequency was calculated for groundwater, fresh surface water and saline surface water stations.

Trends

Trends are calculated and submitted by Member States. Trends are calculated as the difference in the four-year average nitrate concentration between two consecutive reporting periods, for common monitoring stations of both reporting periods.

Trends are presented for all those stations, and additionally trends are broken down over the annual average nitrate classes of the current reporting period.

Figure 2 in the Member States summary sheets presents for groundwater the trends of all stations common to the two periods ("All stations" pie chart).

Figure 4 in the Member States summary sheets presents for fresh surface water (rivers and lakes) the trends of all stations common two the two periods ("All stations" pie chart).

Classification

Water quality data are classified into different categories in order to be presented in tables, figures and maps. The categories used to classify groundwater and surface water are presented in the following tables.

Table A2. Groundwater categories for average and maximum nitrate concentrations

Classification	Legend in MS Summary sheets and the SWD
< 25	< 25
≥25 and <40	25-40
≥40 and <50	40-50
≥ 25	≥ 25
≥ 40	≥ 40
≥ 50	≥ 50

Change between current and previous reporting period

Changes in an indicator (e.g. animal number or nutrient use) between the current and previous reporting period are calculated as follows:

[(average 2012–2015) – (average 2008–2011)]/[(average 2008–2011)] x 100%

Table A3. Surface water categories for average and maximum nitrate concentration

Classification	Legend in MS Summary sheets and the SWD
< 2	< 2
≥2 and <10	2-10
≥10 and <25	10-25
≥25 and <40	25-40
≥40 and <50	40-50

≥25	≥ 25
≥40	≥ 40
≥ 50	≥ 50

Table A4. Groundwater and surface water categories for trends in nitrate concentration

Classification	Legend in MS Summary sheets and the SWD	Category	Aggregated category
< -5	< -5	Strong decrease	Decreasing
>=-5 and <-1	-5 to -1	Light decrease	
>=-1 and <1	-1 to 1	Stable	Stable
>=1 and <5	1 to 5	Light increase	Increasing
≥5	≥5	Strong increase	

Regional aggregation

Data from Flanders and Wallonia are aggregated to Belgium, and data from England, Wales, Scotland and Northern Ireland are aggregated to United Kingdom.

Nitrate Vulnerable Zones

The information is based on the NVZ-shapefiles delivered by Member States.

Eutrophication

Member States submit the ND eutrophication status of surface waters. Valid values are Ultra-oligotrophic, Oligotrophic, Mesotrophic, Eutrophic and Hypertrophic. Only if this set of values were reported, the eutrophication data was used for standardised processing of figures and maps in MS summary sheets and the SWD report. The standard processing includes the pie diagrams (figures 5 and 6) in the MS summary sheets and the frequency diagrams and maps in the SWD report.

In some cases other classifications were used (Non Eutrophic, Non-eutrophic, No eutrophication, Unpolluted, Intermediate, May become eutrophic, Potential Eutrophic and Potentially Eutrophic). These data were only used for non-standard tables in the MS summary sheets.

Some Member States did not submit eutrophication status at all.

The water quality parameters to assess the eutrophication status show a large variation between Member States. For fresh waters (rivers and lakes), the most used parameters (nearly 50% of Member States) are total phosphorus and chlorophyll-a. Other parameters that are used regularly (between 10 and 40% of Member States) are ortho-phosphate, total nitrogen, nitrate, plankton, phytobenthos and macrophytes. Parameters used occasionally (less than 10% of Member States) are ammonium, oxygen, organic matter, nitrite and transparency. For saline waters (mainly transitional and coastal waters), the most used parameters (10 to 25%) are total phosphorus, total nitrogen, nitrate, oxygen and chlorophyll-a. Parameters used occasionally (less than 10% of Member States) are ammonium, nitrite and macroalgae.

Eutrophication status

MS	Rivers	Lakes	Transitional	Coastal	Marine
ND trophic state					
AT	v	v			
BE-F	v	v	v		
BE-W	v				
BG	v	v		v	
CY	v				
CZ	v				
EL	v	v			
ES	v	v	v	v	
FI	v	v		v	
HR	v	v			
IE	v	v			
IT	v	v	v	v	v
LT	v	v	v		
LU	v				
LV	v	v	v	v	v
MT	v	v	v	v	
PL	v	v	v	v	
PT	v	v			
RO	v	v	v	v	v
SE	v	v			
SI	v	v		v	
SK	v				
UK-NI	v	v	v	v	
Other classification					

EE	v	v		v
HU	v	v		
NL	v	v	v	v
IE			v	v

No data

DE
DK
FR
UK-EN
UK-WA
UK-SC

Country codes of Member States

Austria	AT
Belgium	BE
Bulgaria	BG
Cyprus	CY
Czech Republic	CZ
Germany	DE
Denmark	DK
Estonia	EE
Greece	EL
Spain	ES
Finland	FI
France	FR
Croatia	HR
Hungary	HU
Ireland	IE
Italy	IT
Lithuania	LT
Luxembourg	LU
Latvia	LV
Malta	MT
Netherlands	NL

Poland	PL
Portugal	PT
Romania	RO
Sweden	SE
Slovenia	SI
Slovakia	SK
United Kingdom	UK

Eurostat glossary

Animal categories

The livestock unit, abbreviated as LSU (or sometimes as LU), is a reference unit which facilitates the aggregation of livestock from various species and age as per convention, via the use of specific coefficients established initially on the basis of the nutritional or feed requirement of each type of animal (see table below for an overview of the most commonly used coefficients). The reference unit used for the calculation of livestock units (=1 LSU) is the grazing equivalent of one adult dairy cow producing 3,000 kg of milk annually, without additional concentrated foodstuffs.

Cattle refers to domestic animals of the species Bos taurus (cattle and water buffalo Bubalus bubalis together are called bovines). A distinction can be made by the age of the animal (less than one year old, aged between one and two years, and two years and over), with a further division between male and female cattle. Female cattle aged two years and over is divided into heifers (that have not yet calved) and cows. The latter are further divided into dairy cows and others.

A dairy cow is a cow kept exclusively or principally for the production of milk for human consumption and/or other dairy produce, including cows for slaughter (whether fattened or not between last lactation and slaughter).

A pig is a domesticated animal of the species Sus. A distinction is made between pigs, piglets, fattening pigs and breeding pigs.

Poultry, in the context of European Union (EU) statistics, refers to domestic birds of the species: Gallus gallus (hens and chickens); Meleagris spp. (turkeys); Anas spp. and Cairina moschata (ducks); Anser anser dom. (geese); Coturnix spp. (quails); Phasianus spp. (pheasants); Numida meleagris dom. (guineafowl); Columbinae spp. (pigeons); Struthio camelus (ostriches). It excludes, however, birds raised in confinement for hunting purposes and not for meat production.

Sheep are domesticated animals of the species Ovis aries kept in flocks mainly for their wool or meat. Sheep (of all ages) are divided into: Breeding females – which are female sheep (called ewes) and other sheep - all sheep other than breeding females.

Area

Agricultural area, abbreviated as AA, (or utilised agricultural area abbreviated as UAA) describes the area used for farming. It includes the land categories: arable land; permanent grassland; permanent crops; other agricultural land such as kitchen gardens (even if they only represent small areas of total UAA). The term does not include unused agricultural land, woodland and land occupied by buildings, farmyards, tracks, ponds, etc.

Land cover refers to the observed (bio)physical cover of the Earth's surface.

Nitrogen balance

The gross nitrogen balance is an agri-environmental indicator (AEI) calculated from the total inputs minus total outputs to the soil. The gross nitrogen balance per ha is derived by dividing the total gross nitrogen balance by the reference area. The reference area is the sum of arable land (L0001), permanent grassland (L0002) and land under permanent crops (L0003). Data on these areas can be found in Eurobase (apro_cpp_luse))

The inputs of the gross nitrogen balance are:

- Fertilisers:

- inorganic fertilisers;
- other organic fertilisers (not including manure).

- Gross manure input:

- manure production: animal excretion;
- manure withdrawals: manure export, manure processed as industrial waste, non-agricultural use of manure, other withdrawals;
- change in manure stocks;
- manure import.

- Other inputs:

- seeds and planting material;
- biological nitrogen fixation by leguminous crops (like clover, soya beans etc) and free living organisms;
- atmospheric nitrogen deposition.

The outputs of the gross nitrogen balance are:

- total removal of nitrogen with the harvest of crops (cereals, dried pulses, root crops, industrial crops, vegetables, fruit, ornamental plants, other harvested crops);
- total removal of nitrogen with the harvest and grazing of fodder (fodder from arable land, permanent and temporary pasture consumption);
- crop residuals removed from the field.

The Net Nitrogen Balance is the Gross Nitrogen Balance minus Total nitrogen emissions

Gross phosphorus balance

The gross phosphorus balance is an agri-environmental indicator (AEI) calculated from the total inputs minus total outputs to the soil. The gross phosphorus balance per ha is derived by dividing the total gross phosphorus balance by the reference area. The reference area is the sum of arable land (L0001), permanent grassland (L0002) and land under permanent crops (L0003). Data on these areas can be found in Eurobase (apro_cpp_luse)).

The inputs of the gross phosphorus balance are:

- Fertilisers:

- inorganic fertilisers;
- other organic fertilisers (not including manure).

- Gross manure input:

- manure production: animal excretion;
- manure withdrawals: manure export, manure processed as industrial waste, non-agricultural use of manure, other withdrawals;
- change in manure stocks;
- manure import.

- Other inputs:

- seeds and planting material;
- atmospheric phosphorus deposition.

The outputs of the gross phosphorus balance are:

- total removal of phosphorus with the harvest of crops (cereals, dried pulses, root crops, industrial crops, vegetables, fruit, ornamental plants, other harvested crops);
- total removal of phosphorus with the harvest and grazing of fodder (fodder from arable land, permanent and temporary pasture consumption);
- crop residuals removed from the field.