HELCOM — ENVIRONMENTAL FOCAL POINT INFORMATION

Evaluation of transboundary pollution loads

Helsinki Commission

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Contents

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Abstract

Available data show that the transboundary pollution loads flowing from Belarus, the Czech Republic and Ukraine into the Baltic Sea are significant for nutrients and heavy metals.

The total riverine loads of nitrogen and phosphorus originating in the three countries mentioned, and measured at the borders, were 8 and 7 % respectively and between 5 and 15 % for selected heavy metals when compared with the total loads measured at river mouths along the Baltic Sea coast. The significance of the transboundary pollution loads in the individual sub-catchments is naturally higher. Compared to the load at the river mouth, the transboundary pollution loads for nitrogen and phosphorus respectively are 31 % and 56 % at Nemunas, 63 % and 60 % at Daugava, 5 % and 5 % at Vistula and 16 % and 14 % at Oder, without taking into account riverine retention. In the case of heavy metals, the reported load is up to 172 % compared to the load at the river mouth.

The three countries mentioned are also significant sources of airborne nitrogen deposited into the Baltic Sea. The Czech Republic is the 11th largest depositor of nitrogen into the Baltic Sea - more than the contribution from Finland or Russia. Ukraine and Belarus rank 15th and 16th on the list of the most significant contributors, their input exceeding the levels of airborne nitrogen coming from Estonia, Latvia or Lithuania into the Baltic Sea.

Information on sources from the non-Contracting Parties is still lacking, while the available data does not permit the evaluation of solutions for further action by HELCOM. It is for this reason that HELCOM finds it important to strengthen its cooperation with Belarus, Ukraine and the Czech Republic.

Evaluation of transboundary pollution loads

Addressing transboundary pollution originating in Belarus, the Czech Republic and Ukraine has been identified as an important assignment for HELCOM. Therefore, HELCOM has compiled as much information as is available on riverine loads at the borders between the upstream/downstream countries and compared that with data on the load entering the Baltic Sea at the river mouths as well as the total loads going into the Baltic Sea.

Transboundary pollution loads from Belarus, the Czech Republic and Ukraine are significant sources of nutrients and heavy metals in the Baltic Sea. The available data show that the total riverine loads of nitrogen and phosphorus measured at the borders of the upstream/downstream countries reached 8 and 7 % respectively and in the case of heavy metals amounted to between 5 and 15 %, compared with the total loads reaching the Baltic Sea, without taking into account riverine retention.

Roughly 5 % of the total Baltic Sea catchment area lies in Belarus, which has the fifth largest surface area of all countries in the Baltic Sea catchment area after Sweden, Russia, Poland and Finland. However, in assessing the pollution load coming from Belarus, and particularly from the Daugava River, it should be noted that a significant proportion of the load originates in Russia, since almost one-third of the Daugava catchment area lies in Russia. The proportion of the catchment area lying in Ukraine and the Czech Republic is less than 1 %.

The significance of transboundary pollution in the individual sub-catchments is naturally higher. Table 1 shows the loads from these countries in the different sub-catchments.

Pollutant	Belarus	Ukraine	Czech Republic	Total load from upstream countries at the border	Total load into the Baltic Sea (PLC-4 data)	Total load at the borders compared to total load into Baltic Sea
Nitrogen	40153	5307	9063	54523	744867	7 %
Phosphorus	1895	311	509	2715	34489	8 %
Cadmium	0.74	3.8	3	7.5	53	14 %
Mercury	0	0.4	2	2.4	46	5 %
Lead	14	32	16	62	477	13 %
Zinc	192	42	80	314	3059	10 %
Copper	68	26	17	111	1068	10 %

Table 1.
Reported riverine load figures from Belarus, Czech Republic and Ukraine in tonnes during 2000.

The data show that of the three countries, Belarus is the largest source of nitrogen and phosphorus as well as zinc and copper. The load emanating from the Czech Republic to Poland is about one quarter of that coming from Belarus, while the nutrient load from Ukraine is approximately half of the Czech nutrient load.

Figures for nutrients show that the loads from Slovakia are roughly half of the loads from Ukraine and even less for most heavy metals.

The findings also show that the Czech Republic contributes the largest loads of mercury while Ukraine accounts for the most substantial loads of cadmium and lead. Heavy metal loads from the upstream countries are high; some figures for heavy metals at the border are even higher than data on loads reaching the sea at the corresponding river mouth in the Fourth Baltic Sea Pollution Load Compilation (PLC-4).

The comparability of the reported data among different locations is very important for making reliable assessments of the significance of loads as well as for the consideration of possible remedial measures. However, on the basis of the existing data, it has not been possible to make a comprehensive evaluation of pollution reaching the Baltic Sea or the contribution of pollution from different sources located in the three non-Contracting Parties.

It is recommended that data on pollution loads and the proportion coming from different sources located in non-Contracting Parties should be compiled in a more comprehensive and consistent way in the future. Contacts are being established to investigate how far such data could be included in the Fifth Pollution Load Compilation (PLC-5), which will be based on data collected in 2006.

Available reports indicate that diffuse sources are the main contributors to nutrient pollution in Belarus and Ukraine. However, point source pollution is still a significant factor and investments are needed to update environmental technologies. In some cases, industries discharge waste waters without pre-treatment into municipal sewers connected to waste water treatment plants using outdated technologies. Modernisation programmes have been implemented in the Czech Republic and a resulting reduction of pollution in the Baltic Sea catchment area from point sources has been observed.

EMEP reports show that the input of airborne nitrogen into the Baltic Sea from the three non-Contracting Parties under review is also significant. The Czech Republic is the 11th largest depositor of nitrogen into the Baltic Sea, accounting for 7 kilotonnes of nitrogen annually. This figure is slightly more than the inputs from Finland or Russia. Ukraine and Belarus contribute 5 kilotonnes of nitrogen per year and are 15th and 16th on the list of most significant contributors. Inputs from Ukraine and Belarus exceed airborne nitrogen loads coming from Estonia, Latvia or Lithuania into the Baltic Sea.

Belarus

Three of Belarus' river basins are located in the Baltic Sea catchment area: Vistula (Bug River) flowing into Poland, Daugava, which discharges into Latvia and Nemunas, which empties into Lithuania. About 5 % of the total Baltic Sea catchment area lies in Belarus, which has the fifth largest surface area of all the countries lying in the Baltic Sea catchment area.

- 6.5 % of the Vistula catchment area is located in Belarus (Bug River)
- 46 % of the Nemunas catchment area is located in Belarus
- 38 % of the Daugava catchment area is located in Belarus

The pollution loads emanating from Belarus via the Nemunas and Daugava include the riverine loads originating in the catchment area located in Russia. 3 % of the catchment area of Nemunas and 31 % of the Daugava catchment area is situated in Russia.

The percentage of total riverine load of nitrogen and phosphorus from Belarus to the HELCOM downstream countries compared with the total load to the Baltic Sea is more than 5 %, without taking into account riverine retention. The corresponding proportion of copper and zinc is 6 % compared to the total load reported in PLC-4. Other selected heavy metals, except lead, register 0-3 % - which is less than loads from the Czech Republic and Ukraine.

Sources of pollution
There are three JCP Hot Spots in Belarus. The PITF Regional workshop held in Lviv, Ukraine in 2002 provided information on the status of the Hot Spots.

Hot Spot No. 47: Vitebsk (Municipal & Industrial). The main problem is the Vitebsk wastewater treatment plant, where capacity has been exceeded. The city has very high water consumption rates (about 300 l/person per day). There are some industries (construction, metal, leather and food industries) connected to the plant, which create difficulties in the treatment process.

Table 2.
Riverine loads from Belarus in tonnes per year. The second column shows the proportion of the load at the border compared to the total load at the corresponding river mouth for each river. Retention in the river is not taken into account.

Parameter	Bug River in the Vistula catchment		Nemunas	
	t/a at the border	load at border/ load at river mouth	t/a at the border	load at border/ load at river mouth
Nitrogen	260	0.2%	14303	31%
Phosphorus	19	0.2%	1035	56%
Zinc	0	0%	87	39 %
Cadmium	0	0%	0	0%
Copper	1	-	15	37%
Nickel	0	0%	9.2	31%
Lead	0	0%	7.2	31%
Mercury	0	0%	0	0

Hot Spot No. 61: Grodno (Municipal & Industrial). The city of Grodno is an industrial centre in the area. The capacity of the wastewater treatment plant has been exceeded by 20-30%. The city has very high water consumption rates (about 350 l/person per day). There are plans for modernisation of the plant with the aim of solving the problems by 2010.

Hot Spot No. 93: Brest (Municipal & Industrial). The city of Brest, with 286000 inhabitants, discharges into the Bug River and eventually into the Vistula. The technology at the Brest municipal wastewater treatment plant is in need of modernisation and does not work effectively; additionally there has been no maintenance of the plant over the years. There are several industries in the area, of which some discharge into municipal sewers and others which have their own treatment plants. Information about these industries cannot be obtained.

Sludge is a major and urgent problem and some of it is discharged directly into the river. Sludge is not removed from the plant because there is no place to dispose of it. Approximately 300 000 m^3 is in storage, but there is a risk that the dams may break during heavy rain and consequently create an environmental disaster.

Bug River basin

According to the UNECE Bug River Inception Report, diffuse sources are the main contributors to nitrogen pollution. In the Bug River basin, 79 % of nitrogen discharged into surface waters comes from diffuse sources.

	Daugava		Total load t/a	Total load at border compared to total load into the Baltic Sea
	t/a at the border	load at border/ load at river mouth		
	25590	63%	40153	5 %
	841	60%	1895	5 %
	104	105%	192	6 %
	0.7	59%	0.7	1 %
	52	172%	68	6 %
	-		0	-
	6.7	67%	14	3 %
	-		0	0 %

Most municipal wastewater treatment plants have sufficient capacity, but in general the technology is outdated and many plants have problems with high concentrations of pollutants in wastewaters coming from industrial plants in the system. 75 % of the population is connected to sewerage systems in the Bug River basin.

Daugava River basin

Municipal, household and industrial waste discharges are major point sources of pollution. Most pollutants are discharged in the cities of Novopolotsk, Vitebsk and Polotsk. Industries such as thermoelectric power stations, oil processing facilities, light and food industries are the most significant dischargers of wastewaters in the Belarusian part of the basin. The wastewater discharge contains considerable quantities of organic matter, oil products, nitrogen, iron, nickel, zinc and other pollutants.

In the mid 1990s, thirty per cent of the catchment area in the Belarusian part of the basin was cultivated. Meadows and pastures covered 277,000 hectares while green plantations occupied 3,000 hectares. 14 cattle farms and 17 pig farms housing 57,000 heads of cattle and 200,000 pigs operated in the Daugava River basin.

The area of reclaimed lands was significant, 495,000 hectares, while irrigated and moistened fields are scarce – roughly 10,000 hectares. Following an economic recession, the area of irrigated lands shrank to 2,000 hectares.

Ukraine

11,170 km^2 of the Ukraine is situated in the Baltic Sea catchment area, which in turn comprises roughly 6 % of the Vistula sub-catchment. The Bug River is a tributary of the Vistula River, which discharges into the Baltic Sea via Poland, and originates in the Carpathian Mountains in the Lviv region of Ukraine.

The total riverine load of nitrogen and phosphorus from the Ukraine to Poland is less than 1 % compared to the total load to the Baltic Sea without taking into account riverine retention. The corresponding proportion of cadmium and lead is 7 % compared to the total load reported in PLC-4, while the measurement for other selected heavy metals is 1-2 %.

Sources of pollution

There is one JCP Hot Spot in Ukraine: **Hot Spot No. 94, Lviv** (Municipal wastewater treatment plant). The wastewater treatment plant in Lviv is a significant polluter with roughly 50 % of the incoming wastewater emanating from industries such as food, and construction, although some industries are not currently active. Approximately 95 % of the population is connected to the sewerage system.

The sewerage system in Lviv is in need of renovation. The presence of a number of leakages in the system means that only part of the wastewater is treated and that the groundwater is in danger of becoming polluted. Additionally, there are metal concentrations in the wastewater (mainly iron and copper).

Table 3. Riverine loads flowing from Ukraine into Poland via the Bug River in the Vistula sub-catchment area.

Parameter	Load from Ukraine (t/a)	Load at Vistula river mouth	Total load from Poland into the Baltic Sea (PLC-4)
Nitrogen	5307	117021	190811
Phosphorus	311	7490	12592
Zinc	42	566	695
Cadmium	3.8	3.9	6.8
Copper	26	52	92
Nickel	39	97	124.3
Lead	32	26.5	46
Mercury	0.4	40	43

According to the UN/ECE Bug River Inception Report diffuse sources are the main contributors to nutrient pollution in the Bug River basin, accounting for 84 % of the total nitrogen pollution and 68 % of the phosphorus pollution.

Approximately half of the diffuse nutrient pollution comes from livestock breeding, 30 % from arable land and the rest from non-sewered sanitation systems. Furthermore, only 46 % of the population is connected to sewerage systems and chlorinated pesticides are still used in the area.

There are 16 municipal wastewater treatment plants in the Ukrainian part of the Bug River basin, each with a processing capacity of more than 150 m^3/day. The plants were constructed during the 1970s and early 1980s, therefore the technology is outdated and the plants are in many cases overloaded. According to the UN/ECE report, it is estimated that within 10 years nearly all of the existing plants will be unable to provide adequate treatment.

Some 80 % of the point source organic pollution load flowing into the Bug basin originates in Ukraine, particularly the Lviv Oblast. As a result, it can be assumed that reducing pollution in the Lviv Oblast would have significantly beneficial effects on the water quality in the upper part of the Bug River. A World Bank - funded project is currently being conducted in the area.

	Percentage of load at the border compared Vistula river mouth load	Percentage compared to total loads from Poland into the Baltic Sea	Percentage compared to total loads into the Baltic Sea
	5 %	3 %	0.7 %
	4 %	2 %	0.9 %
	7 %	6 %	1.4 %
	98 %	56 %	7.2 %
	50 %	28 %	2.5 %
	40 %	31 %	-
	120 %	69 %	6.7 %
	1 %	1 %	1.0 %

Czech republic

The Czech Republic occupies 6 % of the Oder catchment area. Flowing along a distance of 855 km, the Odra River is the sixth largest river discharging into the Baltic Sea. The Odra River originates at the south-eastern part of the central Sudety mountain range in the Czech Republic, and power dams are situated at its headwaters.

The percentage of the total riverine loads of nitrogen and phosphorus from the Czech Republic to Poland is 1 % compared to the total load to the Baltic Sea, without taking into account riverine retention. The corresponding levels of cadmium and mercury are 6 % and 4 %, respectively, compared to the total load reported in PLC-4, while the levels of other selected heavy metals reached 2-3 %.

Sources of pollution

Three JCP Hot Spots were identified in the Oder Catchment area. Information on the status of the Hot Spots was considered during a meeting with representatives from the Czech authorities in Prague in October 2002. In general, good progress was made in modernising the wastewater treatment and industrial plants and in reducing the resulting pollution loads.

Hot Spot No. 109, Ostrava (Municipal & Industrial) The 15 most important municipal wastewater treatment plants in the Ostrava

Table 4. Riverine loads discharging from the Czech Republic into Poland via the River Oder in tonnes per year.

Parameter	Total load from Czech to Oder	Total load to Poland via Oder and Vistula (Belarus, Ukraine, Czech Republic, Slovakia)	Total load from Oder into Baltic Sea
Nitrogen	9063	18 172	55182
Phosphorus	509	941	3737
Zinc	80	152	76
Cadmium	3	7	0
Copper	17	56	30
Nickel	12	51	27.6
Lead	16	48	0
Mercury	2	3	0

area contributed to the identification of this region as a "Hot Spot" with their large discharges of nutrients and heavy metals.

Today there are 13 municipal wastewater treatment plants in this area with a capacity larger than 20,000 people equivalents (P.E.). Wastewater treatment plants with a capacity lower than 20,000 P.E. sometimes experience problems managing the discharged water quality, particularly with regard to nitrogen and phosphorous limits. All cities larger than 10,000 P.E. have biological treatment systems.

Hot Spot No, 110 Ostrava Area (Industry -Chemical, Pulp & Paper etc.) This Hot Spot is located near the borders of Poland and Slovakia. The environmental impact of the wastewater was mainly observed in high contents of chloride, organic material and phenols, and high emissions of sulphur oxides (SO_x) and nitrogen oxides (NO_x) were also characteristic. The volume of wastewater coming from the industrial activity in the Oder catchment area has declined significantly due to the closure of some factories and reduced production in others. In many cases the technology has changed and new wastewater treatment plants have been constructed. Furthermore, many of the coalmines have been closed down.

Production processes at the pulp and paper mill have been modernised and special treatment measures implemented. The

	Percentage of load coming from the Czech Republic compared to total load from Oder	Total load from Poland into the Baltic Sea (PLC-4)	Percentage of load from Czech of total riverine loads into the Baltic Sea from Poland	Percentage of load from Czech of total riverine loads into the Baltic Sea
	16 %	190811	5 %	1 %
	14 %	12592	4 %	1 %
	105 %	695	12 %	3 %
	-	6.8	44 %	6 %
	57 %	92	18 %	2 %
	43 %	124.3	10 %	-
	-	46	35 %	3 %
	-	43	5 %	4 %

technology has also changed so that chlorine is no longer used. Three metal industries have cut back on production and the wastewater treatment process has improved. In addition to this, the metal industries are currently complying with the permit requirements issued by the authorities. However, the coke plant at the chemical installation has had problems satisfying air emissions requirements.

Hot Spot No. 111 Upper Basin (Salt Control) This Hot Spot has been deleted from the HELCOM Hot Spot list since salt is not considered to be a problem for the Baltic Sea.

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