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Surface Water and Sediment Contamination by Heavy Metals in the Střela River Basin

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Abstract

The paper presents the results of the research of the dynamics and spatial differentiation of surface water and sediment pollution by heavy metals in the Střela River Basin in Czech Republic. The analysis is based on analysis of surfacce water and sediment chemistry data from the longterm regular monitoring network completed by the own samples taken on the network of profiles set up within the research project. The standard methods were used to analyze the sediment chemistry – water quality classification using the CSN 757221 standard, sediment contamination classification using the geoaccumulation index and comparizon of observed concentrations of heavy metals in sediments with the background values according Turekian and Wedepohl.

From the results it is obvious that the water and sediment pollution loads are mainly originating in the down part of the river basin in the region of Kaznějov where the chemical industry is concentrated. The most critical is the pollution by the cadmium whose concentrations are reaching extreme levels in the surface water and sediments. A drop in the pollution loads after 2000 was found as a positive trend that can be ascribed to the intensification of the waste water treatment plant of the main polluter – chemical factory of Aktiva Kaznějov.

The monitoring on the own sampling sites allowed analysis of effect of the extreme flood in August 2002 on the changes in the sediment pollution loads. Unlike numerous water basins where the contaminated sediments were washed out and the pollution load levels dropped, the Střela River Basin did not record significant changes in pollution level related to the flood.

Key words: Water quality, specific contamination, sediment, cadmium, floods

1. Introduction

Heavy metals represent important elements of the environment. In trace concentrations most of heavy metals are essential for the metabolic processes of living organisms; however at elevated concentrations they can become toxical. Moreover, the heavy metals are specific by the ability of accummulation in the sediments as well as in the bodies of organisms and thus their toxical effects are of long-term nature. The anthropogenic contamination by heavy metals mainly comes from the waste waters from the quarrying and industrial areas, sewage, infiltration from the waste dumps, washouts from the farming land, as well as rainfalls (Hátle, Čihalík, 1985; Mohaupt et al., 1998).

The worldwide systematic monitoring of evironemtnal pollution by heavy metals began since the 1960s (Müller, 1979; Salomons, 1993). A primary impulse that initiated the detection of heavy metal concentrations in surface water and sediments came after the events of intoxication of the population by cadmium in the Jintu River in Japan in 1955 which became known as the Itai-Itai disease (MEGJ, 1994; Rath, 1990). However the current information on the water and sediment contamination even in the large river basins is still limited. The time series of measurements are often short and range of sample-taking profiles is limited (Langhammer, 2004). This applies mainly to the information on the contamination of sediment – the network of regular monitoring is scarce and the profiles are mostly located on the major streams. The information on contamination process in the small river basins on the headwaters of large river basins is still lacking. (Langhammer and Matoušková, 2004; Mohaupt et al., 1998; Rudiš, 2003; Thyssen, 2000).

The paper presents the results gained from the monitoring and analysis of the current state and dynamics of surface water and sediment contamination by heavy metals in the Střela River Basin. The research was carried out in the framework of the grant project assessing the the water contamination levels with the specific pollutants in the Berounka River Basin (Kaplická, 2004; Langhammer, 2005).

2. Materials and Methods

In the water environment the heavy metals are subject to a variety of the physical and chemical processes that lead to a drop in the insoluble stuff concentration levels, an increased proportion of the heavy metals bound to the water-transported non-dissolved substances, and further the heavy metals get accummulated in the bottom sediments. The pollution loads accumulated in the sediments are source of secondary threat as they can be reactivated e.g. by floods or human activities in riverbed can again released back to the water and become the source of contamination. The sediments are suitable for studying the environmental pollution by heavy metals also because the concentrations of metals in sediments are several orders higher compared to the surface water and thus they offer better conditions for their detection and analysis (Hátle, Čihalík, 1985; Nondek, 1994).

2.1 Water Quality and Sediment Contamination Data

The analysis of the surface water and sediment pollutions loading with heavy metals in the Střela River Basin is based on a variety of the data sources. The basic data source represented the time series of pollution concentrations from the long-term monitoring network in the river basin, provided by the Vltava River

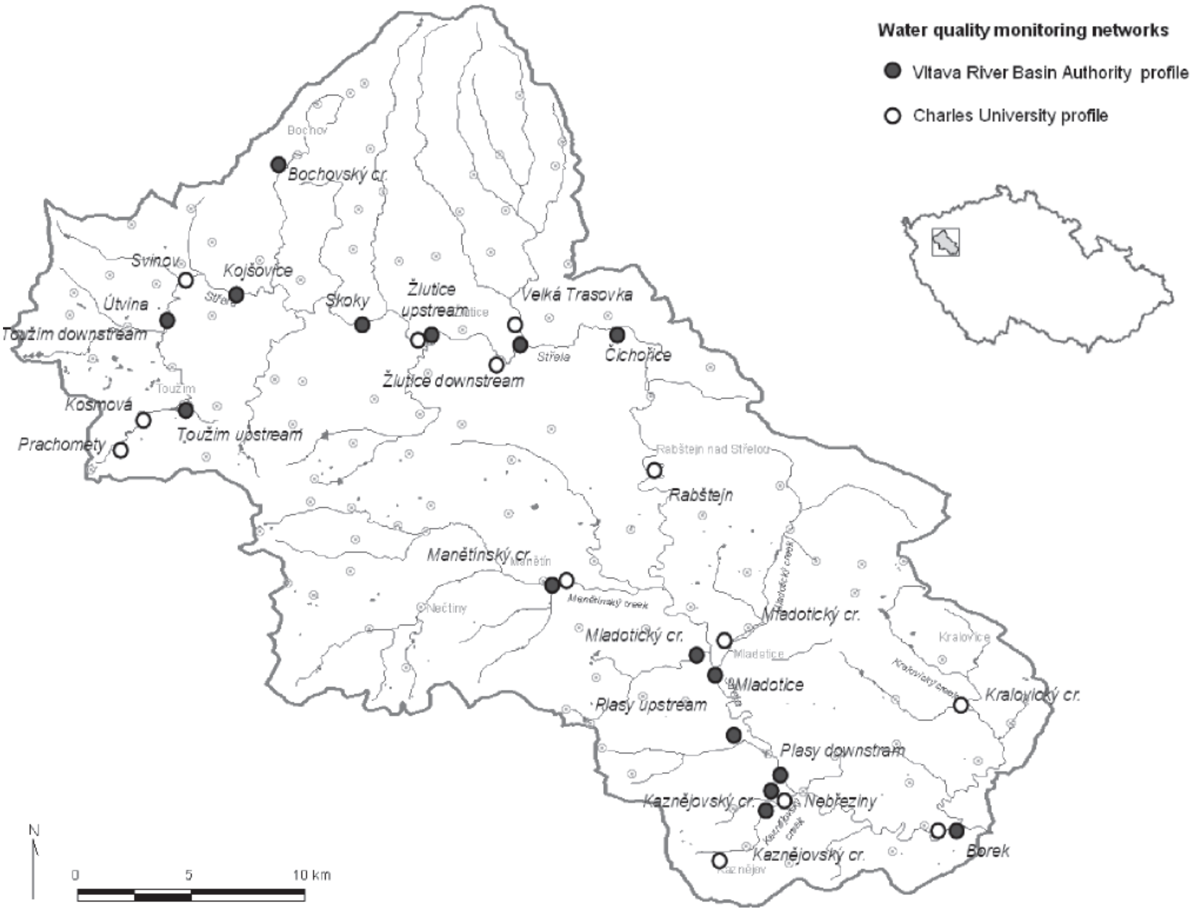

Fig. 1 Water quality monitoring networks in the Střela River basin

Basin Authority and by the Czech Hydro-Meteorological Institute (CHMI). These data were completed by the sampling network set up in the framework of the research project.

The Vltava River Basin Authority is monitoring water quality on 12 profiles on the Střela River and its tributaries. The own monitoring network consists of 13 profiles located along the expected major pollution sources and in the river segments reflecting important changes in water quality in the longitudinal profile. (Figure 1)

2.2 Surface Water and Sediment Sample-Taking and Analysis

Within the own monitoring network *the surface water* samples were taken and analyzed in two time horizons – May 12, 2003 and January 18, 2004. The analysis was carried out in a laboratory of the Environmental Institute of the Faculty of Natural Sciences, Charles University, in Prague. The analysis was focused on following parameters: COD_{Mn}, COD_{Cr}, pH, conductivity, N-NH_4^+, N-NO_2^-, N-NO_3^- and PO_4^{3-}.

Various approaches were employed for the surface water quality assessment. Long-term trends in the surface water pollution loads were placed under analysis and the results broken down into the individual quality classes as required by ČSN 75 7221. Hydrochemical and hydrobiological indicators, heavy metals, and specific organic substances were evaluated.

As for the *sediment* samples, they were also taken in two horizons of time – November 29, 2002 and May 12, 2003. Within a single profile the sample-taking took place in several points for better representativeness of the samples taken. The samples were analyzed in the Laboratories of the Geological Institutes of the Faculty of Natural Sciences, Charles University, in Prague. The sediment samples were dried at 105 °C, further sieved for the fractions 250 μm, 125 μm, and 63 μm. The finest fraction (particles < 63 μm) was used to determine the heavy metal concentration levels.

Using the methodology compliant to the technical standard ČSN EN 13346 the samples were extracted while boiled with the mixture of the hydrochloric and nitrous acids, the pre-selected hydrocarbon contents were determined by the AAS. The concentration levels were determined for following metals: Cu, Mn, Ni, Cr, Fe, Cd, Pb, Zn and As. The finest available fraction (< 63 μm) was used for the analysis of the sediment pollution by heavy metals. This comes from the assumption that most toxic metals, mainly the heavy metals, are bound in this sediment fraction. Even some of the amphoteric elements, such as selenium and arsenic, are ranked among the heavy metals because of their toxicity.

The element contents found out in the sediments (both within our own sample-taking and resulted from the data provided by the Vltava River Basin Authority) were matched against the values of background concentrations that reflect the natural environment condition, undisturbed by anthropogenic influences. They are the relative values by Turekian and Wedepohl (1965) – globally applicable concentrations, determined for the clay bedrock and the background values by Prange, determined for the Elbe Basin (MKOL, 1996, 2000).

The classification system based on the geoaccumulation index Igeo by (Müller, 1979) was used to evaluate the anthropogenic river sediment pollution with the trace elements.

The Igeo value is calculated as follows:

$$I_{geo} = \ln_2 \times \left(\frac{C_x}{1.5 \times C_p} \right),$$

where:
C_x is the actual content of the given element in the sediment,
C_p is the natural level of the natural geogenic background.

The resulting I_{geo} values are ranked into 7 classes, while $I_{geo} = 0$ applies to the non-contaminated sediment and the $I_{geo} > 5$ represents the highly contaminated sediment.

2.3 Study Area

The analysis was carried out for the Střela River Basin, representing the left-side tributary to the Berounka River in the central Bohemia, Czech Republic. The toal area of the Sřela river basin is 922.6 km^2. The major watercourse is the Sřela River; its most important tributaries are Manětínský creek, Velká Trasovka, Mladotický creek and Kaznějovský creek. (Figure 1). The Střela River basin is situated in a region with under-average precipitation volumes – the mean yearly precipitation in the different stations in the river basin varies from 468–608 mm (Kaplická, 2004).

However the agricultural land predominates in the total river basin area landuse structure, there are large unspoilt areas on the upper and down part of the basin covered by the coniferous and mixed forests with minimum human impact and very low level of ecological loads.

The population is concentrated in smaller communities located near the major watercourses. The area of most intense anthropogenic transformation is the Kaznějovský creek catchment where the large kaolin exploiting facilities and industrial plants are located. This industrial regiion constitute the crucial source of the surface water pollution loads that reach beyond the region in their significance (Figure 2).

Fig. 2 Kaolin quarries around Horní Bříza in Kaznějov region. Photo by J. Langhammer, 1999

3. Results

3.1 Analysis of the Surface Water and Sediment Pollution Sources

Except the Kaznějov region there are actually no importan industrial and urban centers affecting significantly the surface water quality in the regional scale. Most of municipal and smlall industrial sources spread in the river basin are of the local impact and are not included in the database of polluters (Water Balance, 2006).

The key *point pollution sources* in the river basin are concentrated in the Kaznějov region. This traditional industrial zone is built near kaolin quarries and is predominated by the chemical industry. The kaolin quarrying changed a lot the face of the landscape of the region (Figure 2), but the surface water pollution loads come from the related ceramic idustrial facilites of Keramika Horní Bříza and Kaolín Kaznějov.

The most critical pollution source represents the biochemical factory of AKTIVA Kaznějov located in the same industrial zone. The heavily polluted waste waters are inefficiently treated and are discharged into recipient with usufficient capacity – the Kaznějovský creek with its yearly average discharge below 0.2 m^3/s. The concentrated wastewater is causing here a serious pollution of the consequent watercourses of the Střela and Berounka. As indicated by the data from the Water Balance database the Aktiva Kaznějov is among the most significant surface water polluters not only within the Střela and Berounka River Basin, but also in the of whole Czech part of the Elbe Basin.

As for the *non-point and dispersed sources* of pollution, high portion of the farming land – making up nearly 60% of the total ground space of the region – is pivotal. Animal breeding is also a major part of these ecological loads. One of the most problematic polluters was ever the large-capacity piggery in Velká Černá Hať, being a part of the Mladotický creek catchment. This source was recorded in the Water Balance database with its emission rates commensurate with those of the key industrial polluters. After 2000, a complete application of the biologic wastes (muck, slurry) onto the adjacent areas was tackled and the large-capacity piggery is not registered as an important source of pollution any more (personal communication by M. Vaňourek, head of the Velká Černá Hať piggery). Even when there was really a change in the biological wastes discharging system, the whole output is deposited onto a limited area in the Mladotický creek catchment, being then transported into its watercourse. The wastes output is still tremendous – in 2003, 8000 pigs, producing 80 m^3 of slurry a day, were bred here.

A major problem because of which the quality of the minor water courses has to be compromised is a high portion of the settlements without any sewerage systems and waste water treatment plants. Wasterwater treatment facilities are missing even in case of the medium-sized communities, such as Manětín (1.316 inhabitants) or Mladotice (578 inhabitants), situated on the same recipient as the large capacity piggery in Velká Černá Hať.

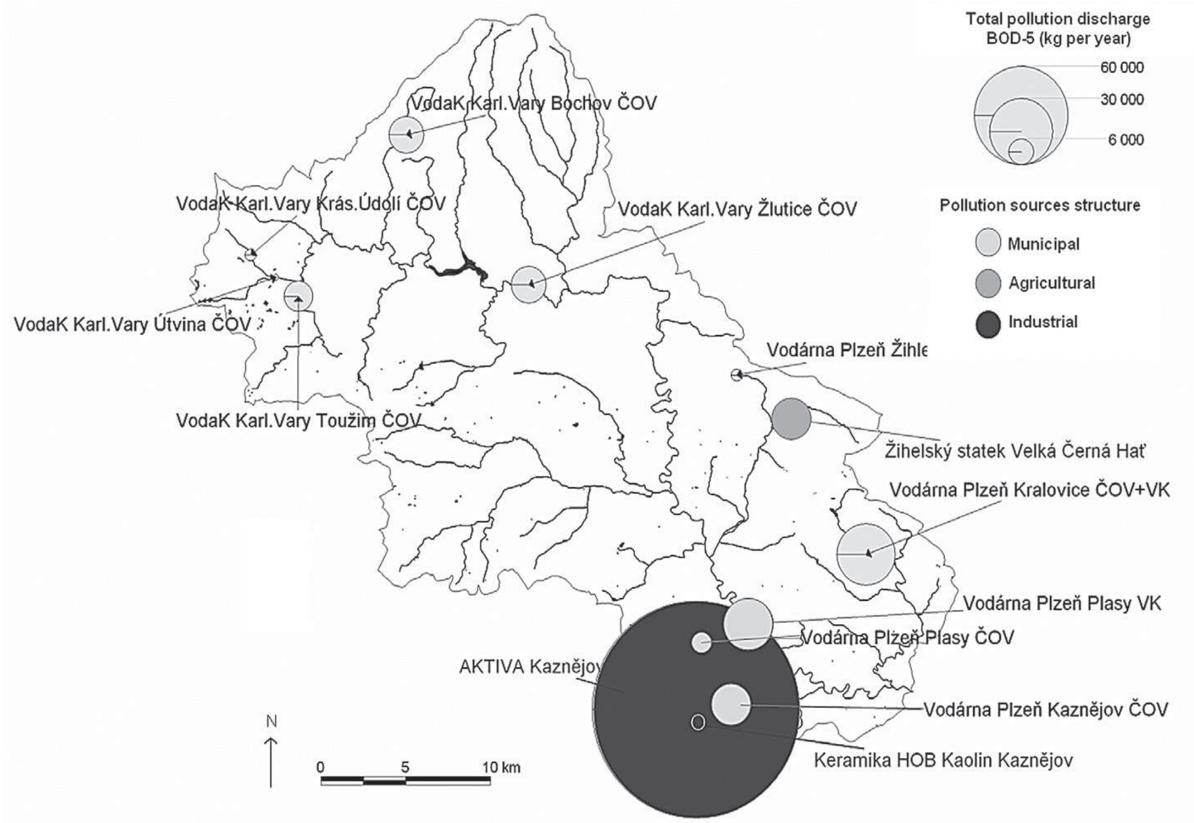

Fig. 3 Point pollution sources in the Střela River Basin registered in the Water Balance database. Data: Water Research Institute TGM, Prague

3.2 Long-term Surface Water Quality Changes in the Střela River Basin

The long-term trends of surface water pollution display the improvements in most of standard parameters of water quality reflecting the point pollution sources. In the mouth profile of the river basin Střela – Borek there is apparent a significant drop in the BOD_5 concentrations in the 1980s and 1990s in comparison with the 1960s and 1970s as well as the decline in the total phosphorus concentrations from the mid-nineties (Figure 4). On the contrary, the nitrate nitrogen concentration levels, mainly ascribable to the agricultural activities, saw a growth in the seventies, with the high concentrations persisitng until now.

Analysis of the changes in the selected hydrochemical and hydrobiological surface water parameters along the longitudinal helped to identify the most intensively polluted areas. It concerns the region of Toužim and Bochov in the upper part of the river basin and the region of Kaznějov on the down part of the river basin. In the case of Toužim and Bochov, the municipal sources form a prevailing cause of pollution, important role plays here the fishpond cultivation. Around Kaznějov, it is a concentration of industrial sources what matters with the main ecological loads where the key role plays the above mentioned facilities of Aktiva Kaznějov, Keramika Horní Bříza and Kaolin Kaznějov.

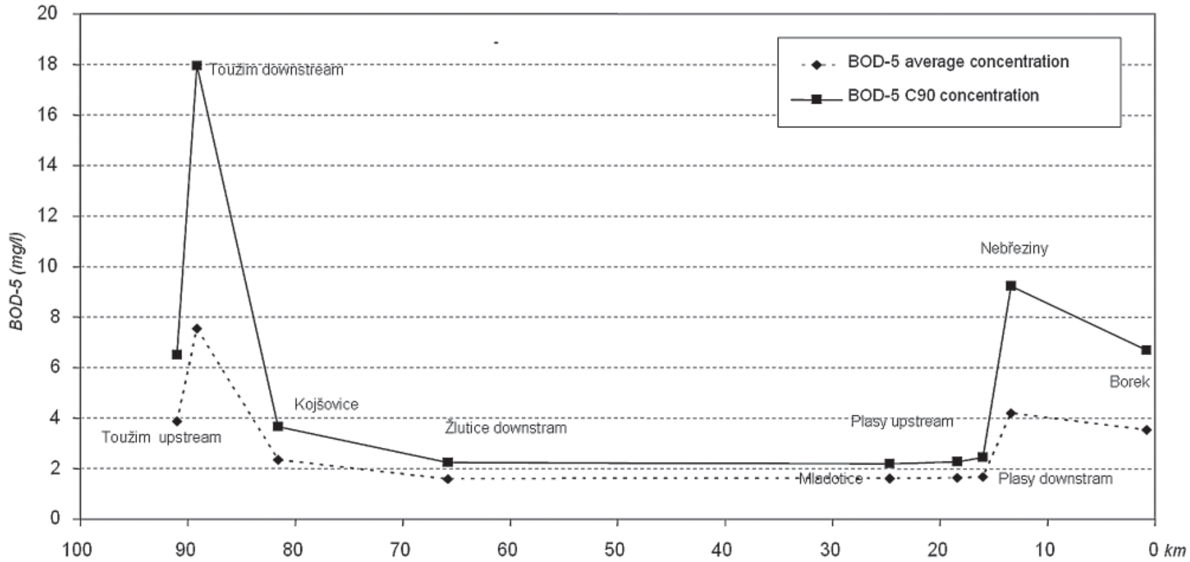

Fig. 4 The Střela water quality in the longitudinal profile. BOD-5 parameter expressed in average and characteristic (C_{90}) values for period 2001–2002. Data: Vltava River Basin Authority

3.3 Surface Water Contamination with Heavy Metals

In case of all the surface water heavy metal pollution indicators under study a drop and/or stagnation can be reported in the mouth profile Střela-Borek during the second half of the 1990's. These trends were most likely influenced by the newly constructed and refurbished waste water treatment plants.

From the viewpoint of the pollution load by heavy metals the river basin can be divided in two substantially different regions – the upper and medium part of the river basin and the industrial region along the Kaznějov Stream (Table 1).

Concerning the upper and medium reaches of the river basin, the heavy metal concentrations in the watercourse reflect the Quality Class I to II in most of parameters. The only exception is the Quality Class III in the Toužim profile in case of the mercury concentrations and in the Nebřeziny profile for the lead. All of these profiles under study can be assessed as relatively low-loaded and the causal sources of pollution as insignificant and of local impact.

On the contrary, the industrial region on the Kaznějov Stream is showing the worst water quality (Quality Classes IV and V) in almost all the parameters studied, with the pollutant concentration levels higher in their orders than in the remaining parts of the river basin. This region represents a centre of surface water contamination with impact exceeding the limits of the river basin.

3.4 Assessment of the Sediment Pollution with Heavy Metals

The study of the sediment pollution with heavy metals proved the Kaznějov industrial zone to be the dominant source of pollution by heavy metals in the river

Tab. 1 Surface water contamination with heavy metals in the Střela River Basin – characteristic values and water quality classes according ČSN 75 7221.

Profile	Hg ug/	Class	Cd ug/	class	Pb ug/	class	As ug/	class	Cu ug/	class	Cr ug/	class	Ni ug/	class	Zn ug/	class
Toužim pod	0.10	III.	0.10	II.	2.67	I.	2.12	II.	2.77	I.	1.04	I.	15.22	II.	8.68	I.
Plasy pod	0.05	II.	0.20	II.	2.81	I.	1.30	II.	3.66	I.	2.16	I.	5.83	II.	25.00	II.
Kaznějov. p.	0.12	III.	3.21	V.	72.2	V.	24.30	IV.	439.37	V.	107.01	V.	80.14	IV.	179.36	IV.
Nebřeziny	0.05	II.	0.38	II.	8.12	III.	1.88	II.	11.06	II.	5.01	II.	6.93	II.	16.16	II.
Borek	0.05	II.	0.13	II.	2.93	I.	2.35	II.	12.54	II.	5.10	II.	7.05	II.	12.26	I.

Data: CHMI, Vltava River Basin Authority.

basin. The most critical load levels are found mainly in the indicators of cadmium, copper, and partly lead (Table 2).

The maximum concentrations of pollution are found on the Kaznějovský creek – Nebřeziny profile in 2000, while a substantial decline of pollution is apparent in 2001. This finding could be related to the intensification of the waste water treatment plant of Aktiva Kaznějov realised to to fulfill the discharge limits set out by the existing Czech and European standards in 2005.

Unfortunately, the Vltava River Basin Authority stopped to monitoring this profile in 2002 and thus it is not possible to follow the trend that signaled a major drop in the ecological loads from 2000 to 2001.

The own sample-taking and analysis of the sediment contamination confirmed the high concentration levels in the profiles of the Kaznějov Stream and Střela Nebřeziny for all of the assessed parameters except for manganese and iron. The sediment was assessed here as “strongly loaded” with cadmium, “slightly to strongly loaded” with lead and partly with arsenic. The high loads with cadmium were detected also in the mouth profile Střela-Borek as a result of contamination coming from the Kaznějovský creek.

The sediment “slightly to strongly loaded” with cadmium was detected also on the Prachomety profile in the upper part of the river basin. As there are no potential sources of direct pollution the contamination here can be related to the geogenic background or the old ecological loads. In the upper part of the basin there are found higher contents of several more metals are found – especially of zinc, manganese and iron. Due to the lack of anthropogenic sources the occurrence of elevated concentrations here should be related to the geogenic backround and specific geological conditions.

4. Discussion

The own monitoring network proved to be important compliment to the data from standard monitoring network. The sample-taking network was designed to dectect the impacts of expected pollution sources even in the regions that are not subject of long-term monitoring. The results of our own monitoring confirmed the trends indicated by the long-term monitoring data, but also brought some new findings. The analysis of

Tab. 2 Heavy metals in the sediments of the Střela River Basin – classification according Igeo. In bold are marked samples with Igeo value 3 and higher. Data: Vltava River Basin Authority.

Datum	Místo odběru	Cd	Pb	As	Cu	Cr	Ni	Zn	Hg
19. 5. 1997	Střela Toužim pod	0	1		3	0	0	2	1
	Střela Kojšovice	0	1		2	0	0	2	1
	Velká Trasovka Protivec	0	1		2	0	0	1	1
	Manětín. p. Manětín pod	0	1		1	0	0	**3**	2
	Střela Mladotice	0	0		**3**	0	0	2	1
	Střela Plasy nad	0	1		2	0	0	2	1
	Kaznějov. p. Nebřeziny	**6**	**3**		**5**	2	**3**	**3**	2
	Střela Nebřeziny	**5**	2		**4**	1	2	2	1
	Střela Borek	**3**	1		**3**	1	0	2	1
12. 5. 1998	Střela Kojšovice	2	0		1	0	0	1	0
	Velká Trasovka Protivec	0	0		3	0	0	1	1
	Manětín. p. Manětín pod	1	0		0	0	0	**3**	1
	Střela Mladotice	0	0		1	0	0	1	1
	Střela Plasy nad	2	1		**4**	0	0	2	2
	Kaznějov. p. Nebřeziny	**3**	2		**6**	1	0	2	2
	Střela Borek	**3**	1		**5**	1	0	2	1
3. 5. 1999	Střela Toužim pod	1	1		2	0	0	2	0
	Střela Kojšovice	**3**	1		2	0	0	2	0
	Manětín. p. Manětín pod	2	0		0	0	0	**3**	1
	Střela Mladotice	1	1		1	0	0	2	1
	Střela Plasy nad	1	1		1	0	0	1	0
	Kaznějov. p. Nebřeziny	**4**	2		**4**	0	1	2	0
	Střela Nebřeziny	**3**	1		**3**	0	0	2	0
	Střela Borek	2	1		2	0	0	2	0
11. 5. 2000	Střela Toužim pod	0	1		1	0	0	2	0
	Střela Kojšovice	2	0		1	0	0	2	0
	Střela Plasy pod	1	1		1	0	0	2	0
	Kaznějov. p. Nebřeziny	**5**	**3**		**4**	2	2	**3**	2
	Střela Nebřeziny	1	0		1	0	0	2	1
	Střela Borek	**3**	1		**3**	0	0	2	0
21. 5. 2001	Střela Kojšovice	1	0		0	0	0	1	0
	Střela Plasy pod	0	0		1	0	0	2	0
	Kaznějov. p. Nebřeziny	**3**	2		**3**	0	1	2	0
	Střela Nebřeziny	1	0		1	0	0	1	0
	Střela Borek	1	1		2	0	0	2	0
26. 4. 2002	Střela Nebřeziny	2	1	0	1	0	0	2	0
12. 6. 2003	Střela Nebřeziny	2	1	0	1	0	0	1	0

samples from 2002 and 2003 confirmed the decline of load in Kaznějov industrial area where the regular monitoring has been stopped in 2001 (Table 3).

The sediment sample taking which took place after the extreme flood in August 2002 made it possible to assess the impact of the flood on the sediment pollution loads. Unlike most of other catchments affected by the flod where a drop in the heavy metal contents was documented in the sediments as a result of their mobilization during the floods as well as their restoration to their original values (VÚV,

Tab. 3 Sediment contamination in the Střela River Basin, classification according Igeo. In bold are marked samples with Igeo value 3 and higher.

	Cd		Pb		Cu		Mn		Ni		Cr		Fe		Zn	
Profile	2002	2003	2002	2003	2002	2003	2002	2003	2002	2003	2002	2003	2002	2003	2002	2003
Prachomety	**3**	1	1	0	0	0	2	2	0	0	0	0	0	1	2	1
Kosmová	2	1	0	0	0	0	0	2	0	0	0	0	0	0	1	1
Svinov	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	1
Žlutice – nad městem	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	1
Žlutice – pod městem	0	0	0	0	0	0	2	2	0	0	0	0	0	0	1	1
Velká Trasovka	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
Rabštejn n. S.	0	0	0	0	0	0	0	2	0	0	0	0	0	0	1	0
Manětínský p.	1	1	1	0	0	0	2	1	0	0	0	0	0	0	2	2
Mladotický p.	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0
Kaznějovský p.	2	**3**	**3**	2	1	1	0	0	0	0	1	1	0	0	1	1
Nebřeziny	**4**	**3**	**3**	2	2	1	0	0	1	0	1	0	0	0	2	2
Kralovický p.	0	0	1	0	0	0	1	0	0	0	0	0	0	0	1	1
Borek	2	**3**	0	1	0	0	0	0	0	0	0	0	0	0	0	1

Data: Sample-taking, Charles University in Prague.

2004; Langhammer, Matoušková, 2004) this process is not apparent in the Střela River Basin. The changes are detectable only in some parameters – copper, manganese, nickel, and iron. Here, the contents determined on Nov. 29, 2002 on all the profiles were lower than their counterparts measured up on May 12, 2003, probably as a result of the polluted sediments washed out by the flood waters. However, there are no significant changes for cadmium, lead, zinc, chromium, and arsenic that are most critical in terms of environmental pollution.

The analyses pointed to a difference between the surface water and sediment contamination levels. The most striking example present the chromium and mercury concentrations in the Kaznějov Stream where the sediment is classified as "unloaded" while the surface waters as "very strongly polluted" with chromium, or "polluted" with mercury. These differences come from the different nature on the pollution loads, transported by the water and/or particular component. While the surface water analysis relates to the current pollution loads, the sediment analysis gives account of the long-term ecological loads. Higher concentration levels in the case of the surface waters are therefore signaling a rather adverse trend – current rise of pollution loads which is, especially in case of heavy polluted Kaznějovský creek, strongly unwelcome trend.

5. Conclusion

The objective of this research was to evaluate the present state and the long-term trends in the surface water and river sediment contamination by heavy metals in the Střela River Basin. The analyses were based on the results of long-term monitoring in the network maintained by the Vltava River Basin Authority, extended by the own network of sample-taking profiles.

The main pollution areas were delineated and the key pollution sources were identified. The analysis proved the Kaznějov industrial zone, situated in the down part of the river basin, to be the decisive centre of emmissions by heavy metals in the river basin. A strong contamination in this region of finds moreover its reflection in the increased pollution levels even on the medium course of the Berounka river, the superior-order stream where the Sřela River is discharging itself.

Water and sediment contamination with heavy metals is critical on the Kazněјov Stream – the surface water contamination in most of parameters ranges correspond to the worst quality classes. The contamination levels were found most critical for cadmium and copper – the concentration levels are here even ten-times higher than their counterparts determined on the other profiles within this water basin. From the long-term monitoring results is clear that the critical levels of the sediment pollution in the most exposed areas of the water basin saw a substantial decrease. While in the period since 1997 until 2000 the cadmium concentration levels on the Kazněјov Stream were reaching the 5^{th} to 6^{th} Igeo class, they have been ranging between the Classes III and II since 2001 on. The reduced pollution loads are ascribable to the intensification of waste-water treatment in the main polluter, the chemical factory of Aktiva Kazněјov.

The evaluation did not proved any significant impact of the extreme flood in August 2002 on the contaminated sediments washout which would manifest itself as a reduced as it was the case in a variety of water basins in the Czech Republic.

The parallel water and sediment pollution analyses highlighted a different dynamics in the pollution development trends between these components and allowed the assessment of the indicators where an adverse development takes place. The evidence again rests in the Kazněјov Stream where the current high concentration levels of mercury and chromium in the surface water fail to match the low levels of the sediment pollution loads, signaling thus a rise of contamination level.

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Résumé

Kontaminace povrchových vod a sedimentů těžkými kovy v povodí řeky Střely

Článek představuje výsledky výzkumu dynamiky a prostorové diferenciace znečištění povrchových vod a sedimentů těžkými kovy v povodí řeky Střely v České republice. Analýza je založena na dlouhodobém pravidelném monitorování sítě doplněném vlastními vzorky odebranými v měrné síti založené v rámci zastřešujícího výzkumného projektu. Pro analýzu chemismu sedimentů byly použity standardní metody – klasifikace kvality vody podle normy ČSN 757221, klasifikace znečištění sedimentů za použití indexu geoakumulace a porovnání zjištěného znečištění těžkými kovy v sedimentech se vztažnými hodnotami podle Turekiana a Wedepohla.

Z výsledků provedených analýz je zřejmé, že znečištění vody a sedimentů pochází především z dolní části povodí v regionu Kaznějova, kde je koncentrována chemická výroba. Nejkritičtější je znečištění kadmiem, jehož koncentrace v povrchové vodě a sedimentech dosahuje extrémních hodnot. Pokles v hodnotách znečištění po roce 2000 je jednoznačně pozitivním trendem a může být připisován intenzivnímu čištění vody u hlavního znečišťovatele – chemické továrny Aktiva Kaznějov.

Monitoring a odběr vzorků ve vybraných lokalitách umožnil analýzu dopadů extrémních povodní v srpnu 2002 na změny v hodnotách znečištění sedimentů. Na rozdíl od jiných povodí, kde byly kontaminované sedimenty odplaveny a hodnoty znečištění poklesly, v případě povodí řeky Střely nebyly zaznamenány žádné signifikantní změny v hodnotách znečištění v souvislosti s povodněmi.