

QUESTIONNAIRE FOR EXISTING SAMPLING, LABORATORY AND EVALUATION METHODS

0.0. State your institution and country.

Croatian Geological Survey.

0.1. State institution(s) from which you got data to fill this questionnaire.

Javna ustanova "Vode Srpske" (water management public authority).

I.LEGISLATIVE FRAMEWORK

I.1 Enumeration of national or European legislation (laws, governmental orders, emergency ordinances) that regulates the concentrations of dangerous substances posing a risk to the health of the population or aquatic life, in soils, surface waters, drinking water, river sediments, marine sediments, sewage, therapeutic sludge, air and biota.

[PLEASE, SUPPORT YOUR ANSWERS WITH REFERENCES (NATIONAL LEGISLATIVE DOCUMENTS AND/OR WEB LINKS)]

No.	Title (in national language)	Title (in English)	Link	Country
1	Pravilnik o uslovima za ispuštanje otpadnih voda u javnu kanalizaciju (Službeni glasnik Republike Srpske broj 44/01)	Regulations on the terms of release wastewater into the public sewerage system ("Official Gazette of RS", No. 44/01)	http://www.vladars.net/sr-SP-Cyrl/Vlada/Ministva/mps/Documents/Pravilnik_o_uslovima_za_izpuštanje_otpadnih_voda_u_javnu_kanalizaciju_44_2001.pdf	Bosnia and Herzegovina, Republika Srpska
2	Zakon o vodama (Službeni glasnik Republike Srpske broj 50/06, 92/09,121/12, 74/17)	Law on water (Official Gazette of Republic of Srpska 50/06, 92/09,121/1, 74/17)	http://www.voders.org/images/PDF/zakoni/zakon_o_vodama_preciscen.pdf	Bosnia and Herzegovina, Republika Srpska
3	Zakon o zaštiti vazduha (Službeni glasnik Republike Srpske broj 124/11, 46/17)	Law on air (Official Gazette of Republic of Srpska 124/11, 46/17)	http://www.narodnaskupstinars.net/?q=la/akti/usvojenizakoni/zakon-o-za%C5%A1titi-vazduha	Bosnia and Herzegovina, Republika Srpska
4	Zakon o zaštiti životne sredine (Službeni glasnik Republike Srpske)	Law on environment (Official Gazette of Republic of Srpska)	http://www.narodnaskupstinars.net/?q=la/akti/usvojenizakoni/zakon-o-	Bosnia and Herzegovina, Republika Srpska

	broj 71/12, 79/15)	71/12, 79/15)	za%C5%A1titi-%C5%BEivotne-sredine	
5	Pravilnik o zdravstvenoj ispravnosti vode namijenjene za ljudsku potrošnju („Službeni glasnik Republike Srpske“, broj 88/17)	Ordinance on drinking water health quality for human use („Official Gazette Republika Srpska“, no 88/17)	http://www.vladars.net/sr-SP-Cyrl/Vlada/Ministartva/MZSZ/Documents/%D0%9F%D1%80%D0%B0%D0%B2%D0%B8%D0%BB%D0%BD%D0%B8%D0%BA%20%D0%BE%20%D0%B7%D0%B4%D1%80%D0%B0%D0%B2%D1%81%D1%82%D0%B2%D0%B5%D0%BD%D0%BE%D1%98%20%D0%B8%D1%81%D0%BF%D1%80%D0%B0%D0%B2%D0%BD%D0%BE%D1%81%D1%82%D0%B8%20%D0%B2%D0%BE%D0%B4%D0%B5%20%D0%B7%D0%B0%20%D0%BF%D0%B8%D1%9B%D0%B5.pdf	Bosnia and Herzegovina, Republika Srpska
6	Pravilnik o tretmanu I odvodnji otpadnih voda za područje gradova I naselja gdje nema javne kanalizacije (Službeni glasnik Republike Srpske broj 68/01)	Rulebook on treatment and waste water disposal in the cities and towns where there is no public sewage system (“Official Gazette of RS”, 68/01)	http://www.voders.org/images/PDF/pravilnici/Pravilnik_o_odvodnji_otpadnih_gde_nema_javne_kanalizacije_PRAVI.pdf?lang=lat	Bosnia and Herzegovina, Republika Srpska
7	<u>Pravilnik o uslovima ispuštanja otpadnih voda u površinske vode („Sl. glasnik RS“ broj 44/01)</u>	Rulebook on conditions for discharging wastewater into surface waters (“Official Gazette of RS”, 44/01)	http://www.voders.org/images/PDF/pravilnici/Pravilnik_o_ispuštanju_otpada_u_povrsinske_vode_44_01.pdf?lang=lat	Bosnia and Herzegovina, Republika Srpska

8	Uredba o klasifikaciji voda i kategorijaciji vodotoka (Službeni glasnik Republike Srpske broj 41/01)	Regulation on water classification and categorization of water courses (Official Gazette of Republika Srpska 41/01)	http://www.voders.org/images/PDF/uredbe/uredba_o_klasifikaciji_vodotoka.pdf?lang=lat	Bosnia and Herzegovina, Republika Srpska
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I.2 List of dangerous (hazardous) substances (metals, non-metals, PAHs, PCBs, other parameters) concentration levels, their significance (*definition of terms used for thresholds*) in waters, solids or biota, in accordance with the national legislative framework.

Name of substance	Annual average for inland surface water environmental quality standard ($\mu\text{g/L}$)
Alachlor	0.3
Anthracene	0.1
Atrazine	0.6
Benzene	10
Cadmium and its compounds	≤ 0.08 (category 1)
	0.08 (category 2)
	0.09 (category 3)
	0.15 (category 4)
	0.25 (category 5)
Chlorfenvinphos	0.1
Chlorpyrifos	0.03
Aldrin	
Dieldrin	$\Sigma=0.005$
Endrin	
DDT total	0.025
Para-para-DDT	0.01
1,2-dichloroethane	10
Dichloromethane	20
Di(2-ethylhexyl) phthalate	1.3
Diuron	0.2
Endosulfan	0.005
Fluoranthene	0.1
Hexachlorbenzene	0.01
Hexachlorbutadiene	0.1
Hexachlorocyclohexane gamma isomer, Lindane	0.02
Izoproturon	0.3
Lead	7.2
Mercury	0.05

Naphtalene	2.4
Nickel	20
Nonilphenols	0.3
Octylphenol	0.1
Pentachlorobenzene	0.07
Pentachlorophenol	0.4
PAHs	
Benzo(a)pyrene	0.05
Benzo(b)fluoranthene	∑0.03
Benzo(g, h, i)perylene	∑0.002
Benzo(k)fluoranthene	∑0.03
Indeno(1,2,3-CD)pyrene	∑0.002
Simazine	1
Trichloromethane	2.5
Trifluralin	0.03

Table 1 Standard quality concentrations for surface water in Republika Srpska (from Directive 2008/105/EC)

Zrak [mg/m ³]	SO ₂	NO _x	Solid particles
New factories	400	650	50

Table 2 Hazardous substances emissions into the air from factories

Indicator	Purified and disinfected water [n/100 ml]	Drinking water from other sources, not purified
Bacteria Salmonella, Shigella, Vibrio kolera and other pathogen microorganisms, termotolerable Coliform bacteria, Enterococcus, Proteus species, Pseudomonas aeruginosa	0	0
Total Coliform bacteria	0	10
Escherichia coli	0	10

Sulphite-reducing Clostridium perfringens, including spores	0	1
Number of colonies 22 +/-2 °C	100	300
Number of colonies 36 +/-2 °C	20	100
Pulmonary protozoa, gut helminths and their forms	0	0
Number of infectious enteroviruses in 10 l of water	0	0
Vibrio	0	0
Bacteriophages	0	0

Table 3 Microbiological parameters and threshold concentrations in drinking water

Indicator	Threshold values	Unit
NH ₄ ⁺	0.5	mg/l
Sb	5	µg/l
As	10	µg/l
Cu	2	mg/l
Benzene	1	µg/l
Benzo(a)pyrene	0.01	µg/l
B	1	mg/l
CN	50	µg/l
Zn	3	mg/l
1,2-Dichloroethane	3	µg/l
Anionic detergents	200	µg/l
Electroconductivity (20 °C)	2500	µS/cm
F	1.5	mg/l
Chlorides	250	mg/l
Cr	50	µg/l
Cd	5	µg/l
Ca	200	mg/l
pH	6.5-9.5	
Mg	50	mg/l

Mn	50	µg/l
Mineral oils	20	µg/l
Fuzziness	1	NTU
Na	200	mg/l
Ni	20	µg/l
NO ₃	50	mg/l
NO ₂	0.5	mg/l
Pb	10	µg/l
PO ₄	0.15	mg/l
Pesticides individually	0.1	µg/l
Total pesticides	0.5	µg/l
PAH	0.1	µg/l
Soluble oxygen	50	%
Se	10	µg/l
SO ₄	250	mg/l
Tetrahaloroethene and trichloroethene	10	µg/l
KMnO ₄	5	mg/l O ₂
Vinyl chloride	0.5	µg/l
Hg	1	µg/l
Al	200	µg/l
Fe	200	µg/l
Acrylamide	0.1	µg/l
Epichlorohydrin	0.1	µg/l
Total Trihalomethanes	100	µg/l
Bromates	10	µg/l
Free chlorine	0.1-0.5	mg/l

Table 4 Threshold values for physical, chemical and physico-chemical parameters in drinking water

Indicator	Threshold value	Unit
Tricij	100	Bq/l
Total radioactive dose	0.1	mSv/year
Alpha particles activity	0.1	Bq/l
Beta particles activity	1	Bq/l

Table 5 Threshold values of radioactivity in drinking water

I.4 Listing of analytical standards (national analytics and international e.g. USEPA, ASTM, etc.) recommended in documents for chemical, physical, microbiological analyzes of samples

Arsenic	Standard Methods 3113-B, APHA-AWWA-WEF 2005.
Copper	Standard Methods 3113-B, APHA-AWWA-WEF 2005.
Chromium	BAS ISO 9174
Zinc	Standard Methods 3113-B, APHA-AWWA-WEF 2005

Table 6 Specific substances of contamination with method of determination

Alachlor	EPA 525.2:1994
Anthracene	EPA 550.1
Atrazine	EPA 525.2:1994
Benzene	BAS EN ISO 11423-2:2003
Cadmium and its compounds	Standard Methods 3113-B, issued by APHA-AWWA-WEF 2005
Chlorfenvinphos	EPA 525.2:1994
Chlorpyrifos	EPA 525.2:1994
Aldrin	EPA 508.1:1994
Dieldrin	
Endrin	
DDT total	EPA 508.1:1994
Para-para-DDT	EPA 508.1:1994
1,2-dichloroethane	StaticHeadspace/GC/Theory &Practice
Dichloromethane	StaticHeadspace/GC/Theory &Practice
Di(2-ethylhexyl) phthalate	EPA 525.2:1994
Diuron	BAS EN ISO 11369:2002
Endosulfan	EPA 508.1:1994
Fluoranthene	EPA 550.1
Hexachlorbenzene	EPA 525.2:1994
Hexachlorbutadiene	EPA 525.2
Hexachlorocyclohexane gamma isomer, Lindane	EPA 508.1:1994
Izoproturon	BAS EN ISO 11369:2002
Lead	Standard Methods 3113-B, izdat od

	strane APHA-AWWA-WEF 2005.
Mercury	AMA 254, Advanced Mercury Analyser, Operating Manual
Naphtalene	EPA 550.1
Nickel	Standard Methods 3113-B, izdat od strane APHA-AWWA-WEF 2005.
Nonilphenols	EPA 8040
Octylphenol	EPA 8040
Pentachlorobenzene	BAS EN ISO 6468:2000
Pentachlorophenol	EPA 525.2:1994
PAHs	
Benzo(a)pyrene	EPA 550.1:1994
Benzo(b)fluoranthene	EPA 550.1:1994
Benzo(g, h, i)perylene	EPA 550.1:1994
Benzo(k)fluoranthene	EPA 550.1:1994
Indeno(1,2,3-CD)pyrene	EPA 550.1:1994
Simazine	EPA 525.2:1994
Trichloromethane	StaticHeadspace/GC/Theory &Practice
Trifluralin	EPA 525.2:1994

Table 7 List of priority substances with method of determination

Element	Analytical standards
Water temperature *	Standard Methods 2550 B, published from: APHA-AWWA-WEF, 2005
Suspended mater	BAS ISO 11923:2002
Dissolved oxygen*	BAS EN 25814:2000
pH of water*	BAS ISO 10523:2002
Conductivity*	BAS EN 27888:2002
Determination of biochemical oxygen demand, 5 days (BOD5)	BAS EN 1899-1:2002
Determination of biochemical oxygen demand, 5 days (COD)	BAS EN 1899-2:2002
Determination of chemical usage of oxygen	Standard Methods 5220 D, published by APHA-AWWA-WEF, 2005
Determination of alkalinity	BAS EN ISO 9963-1:2000
Determination of Ca and Mg sum	BAS ISO 6059:2000
Determination of ammonium ion	BAS ISO 7150-1:2002
Determination of nitrate	BAS EN ISO 10304-1:2010
Determination of nitrite	BAS EN 26777:2002
Determination of Kjeldahl nitrogen	BAS EN 25663:2000

Total nitrogen	By calculation
Determination of chlorine	BAS EN ISO 10304-1:2010
Determination of phosphorus	BAS ISO 6878:2002
Determination of orthophosphate	BAS ISO 6878:2002
Determination of dissolved phosphorus	BAS ISO 6878:2002
Determination of calcium	Standard methods 3500 (B), published by APHA-AWWA-WEF 2005
Determination of magnesium	Calculation
Determination of % oxygen saturation	Electrochemical
Determination of chemical oxygen demand (permanganate)	Standard methods for chemical safety testing, SZZZ Belgrade 1990

Table 8 General physico-chemical parameters of water quality for rivers and methods of their determination

I.6 List of national, and international guides of techniques on the design of sampling, transport, storage, samples preparation (sieving, fraction extraction, separation, etc.) recommended in documents

No.		sediment	water
1	sampling design, sampling, transport, storage		BAS EN 5667-1:2008 BAS ISO 5667-3:2005 BAS ISO 5667-6:2000

II PRACTICES, EXPERIENCES

II.2. Significant scientific papers, books, related to geochemistry of waters, soils, sediments in the Danube basin

No.	Paper title (national language, if available)	Title (EN)	Year	Country	Authors
1		CONSIDERATIONS ON RESERVOIR SEDIMENTATION AND HEAVY METALS CONTENT WITHIN THE DRENOVA RESERVOIR (B&H)	2013	Bosnia and Herzegovina, Republika Srpska	Radislav TOŠIĆ, Slavoljub DRAGIČEVIĆ, Snežana BELANOVIĆ, Ilija BRČESKI & Novica LOVRIĆ

II.3 Existing waterbodies and sampling sites (Ramsar, Natura2000 etc.) and current quality monitoring stations of the Danube River

Coordinates are approximate. We are still waiting for precise coordinates. As soon as we get them, we will forward them to you in order to update these ones. Anyways, these coordinates should suffice constructing a map.

No.	X	Y	River	Site	Country
Ukrina					
1	44.979538	17.845520	Ukrina	Lužani	BA_RS
2	44.905405	17.746899	Vijaka	Palačkovci	BA_RS
3	44.764658	17.770631	Mala Ukrina	Dragalovci	BA_RS
4	44.744369	17.767959	Mala Ukrina		BA_RS
5	44.742932	17.791646	Radnja		BA_RS
6	44.745596	17.787698	Radnja		BA_RS
7	44.706632	17.498048	Šnjegotina		BA_RS
8	44.654315	18.801890	Vijaka	Mačkovac	BA_RS
Una					
1	45.184528	16.812577	Una	Kozarska Dubica	BA_RS
2	45.023480	16.359931	Una	Novi Grad_uzv	BA_RS
3	45.036137	16.422536	Sana	Novi Grad_S	BA_RS
4	44.974035	16.702027	Sana	Prijedor	BA_RS
5	44.463186	16.823669	Sana	Ribnik	BA_RS
6	44.748098	18.451940	Moštanica		BA_RS
7	44.959153	16.713160	Gomjenica	Orlovača	BA_RS
8	45.107574	16.601844	Strigova		BA_RS
9	44.924457	16.311929	Vojskova		BA_RS
Vrbas					
1	45.063729	17.457177	Vrbas	Razboj	BA_RS
2	44.801622	17.225436	Vrbas	Delibašino Selo	BA_RS
3	44.738582	17.155918	Vrbas	Novoselije	BA_RS
4	44.443732	17.162614	Crna Rijeka	Bjelajci	BA_RS
5	44.394673	17.451888	Ugar	Ugar	BA_RS
6	44.748303	17.252373	Vrbanja	Debeljaci	BA_RS
7	44.260775	17.042260	Pliva	Jezero	BA_RS
8	44.124318	17.209542	Kupreška ri.	Vagan	BA_RS
9	45.070909	17.499655	Povelič	Povelič	BA_RS
10	45.076862	17.443976	Osorna	Gličevka	BA_RS
11	44.725099	17.320206	Vrbanja	Čelinac	BA_RS
12	44.236716	17.104110	Janj	Mujundići	BA_RS

13	44.615063	17.149426	Vrbas	Krupa	BA_RS
14	44.388575	17.520436	Ilomska rijeka	Imljani	BA_RS
15	45.033424	17.566289	Lepenica	Sitneš	BA_RS
16	44.815118	17.435959	Turjanica	LjUbatovac	BA_RS
17	44.941382	17.360899	Mahovljanska rijeka	Maglajani	BA_RS
18	44.564326	17.534228	Kruševica	Maslovare	BA_RS
19	44.764165	17.320243	Gozna	Štrbe	BA_RS
20	44.466499	17.564447	Vrbanja	Šiprage	BA_RS
21	44.877032	17.384586	Crkvena	Drugovići	BA_RS
22	44.435992	17.009388	Ponor	Podrašničko	BA_RS
23	44.807392	17.197554	Široka rijeka	Drakulić	BA_RS
24	44.661182	17.340755	Tovladić	Podbrđe	BA_RS
25	44.283867	17.083569	Lubovačka r.	Vražić	BA_RS
26	44.794519	17.149918	Crkvena	Pavlovac	BA_RS
27	44.564193	17.424734	Cvrcka	Markovići	BA_RS
28	44.875760	17.220576	Bukovica	Bukovica	BA_RS
29	44.852498	17.149782	Dragočaj	Kuljani	BA_RS
Bosna					
1	44.970107	18.299598	Bosna	Modriča	BA_RS
2	44.699184	18.068186	Bosna	Usora	BA_RS
3	44.761006	18.042260	Bosna*	Rudanka	BA_RS
4	44.732237	18.108153	Spreča	Stanić Rijeka	BA_RS
5	44.700248	18.041996	Usora	Matuzići	BA_RS
6	43.812458	18.535692	Paljanska Miljacka		BA_RS
7	43.870959	18.560630	Mokranjska Miljacka		BA_RS
8	44.596061	17.738851	Mala Usora		BA_RS
9	44.555006	17.621305	Penava		BA_RS
10	44.455056	17.709209	Studena		BA_RS
Drina					
1	44.775549	19.340778	Drina	Pavlovića m.	BA_RS
2	43.787437	19.292961	Drina	Višegrad	BA_RS
3	43.508901	18.772909	Drina	Foča	BA_RS
4	43.612675	19.367362	Lim	Rudo	BA_RS
5	43.489638	18.813947	Ćeotina	Brioni	BA_RS
6	44.666858	19.256399	Janja	Janja	BA_RS

7	44.532641	18.874988	Janja		BA_RS
8	43.352348	18.690355	Sutjeska	Tjentište	BA_RS
9	43.213655	18.672266	Sutjeska		BA_RS
10	44.279061	19.106411	Drinjača	Raševo	BA_RS
11	44.277991	19.107644	Jadar	Pilana	BA_RS
12	43.781899	19.294309	Rzav	Višegrad	BA_RS
13	43.513842	18.645708	Bistrica	Gunjak	BA_RS
14	43.491219	18.741347	Bistrica		BA_RS
15	43.650292	19.083857	Janjina	Međuriječje	BA_RS
16	44.184118	19.339026	Križevica	Bratunac	BA_RS
17	43.954241	19.121462	Žepa	Žepa	BA_RS
18	43.748435	19.003213	Rakitnica	Sastavci	BA_RS
19	43.755566	18.700701	Prača	Podgrab	BA_RS
20	44.494551	19.002269	Sapna		BA_RS
21	43.320705	18.577728	Jabušnica		BA_RS
Sava					
1	45.201957	17.049302	Sava	Rača	BA_RS
2	45.147979	17.992407	Sava	Brod	BA_RS
3	45.147497	17.247801	Sava	Gradiška	BA_RS
4	45.144945	17.196544	Jablanica		BA_RS
5	45.156596	16.996810	Jablanica		BA_RS
6	45.070101	17.793850	Crna rijeka		BA_RS
7	44.807230	19.199012	Drina-Dašnica	AWB; Gradac	BA_RS
8	44.838101	19.044074	Lukavac Gnjica	Novi	BA_RS

Table 9 Danube River Basin Monitoring Stations in Republika Srpska

II.4.Data and metadata availability (including information on ambient or natural concentrations of HSs for establishing intervention measures)

The list of past or current economic polluters referring to the direct effect on the quality of sediment in the Danube (the HSs whose possible concentrations are likely to be exceeded), information on the HSs biological effects, evidence of impact of anthropogenic activities.

II.5.Problems of current monitoring procedures in DRB

The problem lies in the lack of financial resources, inadequate laboratory capacities, and lack of appropriate laboratory equipment and devices.

Republika Srpska does not have regulations or criteria for including/excluding parameters from monitoring programme for priority substances, which would allow more efficient way to use budget resources.

Until today, systematic investigations of priority substances concentrations in samples of biota and sediment were not conducted.

III. INVENTORY OF SAMPLING METHODOLOGIES

Sampling and further procedures are done according to ISO 5667 norms.

III.1. Water

III.1.1. Sampling design strategy. How do you choose sampling locations, number of sites, sampling position within the national Danube sector, distance from confluence points, distance from point industry/agriculture polluters, distance from big cities, sampling depth, distance from the water course/bodies banks? How do you decide about temporal frequency of collecting samples?

Sampling locations for trend analysis: upstream/downstream of the country border, near the confluence points of bigger streams, downstream of larger contamination sources.

Sampling locations for ecological and chemical status of certain water bodies and sampling locations for background concentrations are situated at specific locations, different from those for trend monitoring.

Indicator	Rivers	Lakes
<i>Biological</i>		
Phytoplankton	6 months	6 months
Other water flora	3 years	3 years
Macroinvertebrate	3 years	3 years
Fish	3 years	3 years
<i>Hydromorphological</i>		
Continuity	6 years	6 years
Hidrology	in continuity	1 month
Morphology	6 years	6 years
<i>Physico-chemical</i>		
Termal conditions	3 months	3 months
Oxygen state	3 months	3 months
Salinity	3 months	3 months
Nutrients state	3 months	3 months
Acidification state	3 months	3 months
Other contaminants	3 months	3 months
Priority substances	1 month	1 month

Table 10 Minimal temporal frequency for surveillance monitoring of surface water

III.1.2. Which parameters of water **quality/quantity** are measured *in situ*?

Temperature, dissolved oxygen, pH and electroconductivity.

III.1.3. Which **instruments** are used for *in situ* measurements (include manufacturer and type)?

WTW (<https://www.wtw.com>).

III.1.4. Please, describe **methodology** for *in situ* measurements.

Temperature – Standard Methods 2550 B, issued by APHA-AWWA-WEF, 2005

Dissolved oxygen – EN ISO 25814:2014

pH – BAS ISO 10523:2013

Electroconductivity – EN 27888:2002.

III.1.5. Which **tools** are used for collecting samples for **laboratory** measurements (include manufacturer and type)?

III.1.6 Sample preservation (samples chemical preservation according to their type and used analysis method).

III.1.7 Please, describe a **methodology** for collecting samples

Answers on questions from III.1.5. to III.1.7. can be found in 5667 norms stated earlier in the questionnaire.

III.2 Sediment

III.2.1. Which type(s) of sediment do you sample/measure **bottom, suspended, floodplain**?

III.2.2. Sampling design strategy. How do you choose sampling locations?

How do you decide about temporal frequency of collecting samples?

III.2.3. Which parameters of sediment **quality/quantity** are measured *in situ*?

III.2.4. Which appropriate sampling devices (e.g. GRAIFER, CAROTIER etc.) and instruments are used for *in situ* measurements (include manufacturer and type)?

III.2.5. Please, describe **methodology** for *in situ* measurements.

III.2.6. Which **tools** are used for collecting samples for **laboratory** measurements (include manufacturer and type)?

III.2.7. Please, describe a **methodology** for collecting samples for **laboratory** measurements.

III.2.8. Please, describe a **transport** methodology for samples intended for laboratory measurements.

III.2.9. Do you **archive** samples? If yes, please describe how.

There are no data on sediment.

III.3 . Biota

III.3.1. Which type(s) of **biota** do you sample/measure: **flora, fauna** (name species)?

Phytoplankton, phytobenthic, macrophytic, benthic invertebrate and ichtiofauna.

III.3.2. Sampling design strategy. How do you choose sampling locations? How do you decide about temporal frequency of collecting samples?

BAS ISO 5667-1 and BAS ISO 5667-2. Frequency stated in **Table 10**.

III.3.3. Which parameters of biota **quality/quantity** are measured *in situ*?

None.

III.3.4. Which **instruments** are used for *in situ* measurements (include manufacturer and type)?

None.

III.3.5. Please, describe **methodology** for *in situ* measurements.

Not applicable.

III.3.6. Which **tools** are used for collecting samples for **laboratory** measurements (include manufacturer and type)?

Plankton net, EFE and GB nets, made from Monodur Nyltal with pores of 20 µm.

Collecting algae and other suspended matter by filtration. ISO 10 260:2002.

Phytobenthic organisms by BAS EN 13946:2003.

Benthic invertebrate by hand net with 250 µm pores, Ekman-Birge sediment sampler, and dredge depending on the substrate, river bed morphology, depth and velocity of stream.

III.3.7. Please, describe a **methodology** for collecting samples for **laboratory** measurements.

III.3.8. Please, describe a **transport** methodology for samples intended for laboratory measurements.

III.3.9. Do you **archive** samples? If yes, please describe how.

Answers to questions from III.3.7. to III.3.9. are stated in norms.

[PLEASE, SUPPORT YOUR ANSWERS WITH REFERENCES (NATIONAL LEGISLATIVE DOCUMENTS AND/OR WEB LINKS)]

IV. INVENTORY OF LABORATORY METHODOLOGIES

IV.1. How do you **mechanically prepare samples** for measurement (drying, sieving, grinding, homogenization, etc.)?

a) water

b) sediment

c) biota?

IV.2 Chemicals. Granulometric analysis (information on the correlation of particle sizes and the absorption of toxic metals or metal compounds in sediments). Analytical methods (including sample preparation: e.g. acid digestion, etc.) for the hazardous substance analyzed in agreement with the matrix in which it is being analyzed (water, sediment, sludge). Type of analytical equipments. Description of internal procedures.

Water samples are prepared in line with requirements of the standard methods used for certain analyses. All methods are certified according to ISO/IEC 17025.

Equipment: GC (gas chromatography) Thermo Finnigan – Trace GC Ultra and Shimadzu GCMS (GC-2010, GCMS-QC 2010S).

IV.2.1. Organic matter. What is the **procedure** for **organic matter** content determination in water and sediment?

All methods used for organic matter content determination in water are stated in **Table 7**.

IV.2.2. ICP-MS, ICP-AES systems

IV.2.2.1. Which system of analysis do you use (ICP-MS, ICP-AES, etc.)? Please, include manufacturer and type.

IV.2.2.2. Which **elements (HSs)** do you measure by this system? Please, state **detection limits** for measured elements (HSs).

IV.2.2.3. Please, describe **sample preparation and procedure** for these measurements (microwave acid digestion, another disintegration procedure, gas velocity, temperature of atomization, mirrors position, nebulizer type, excitation power, wavelengths etc.).

IV.2.2.4. How do you calculate **accuracy and precision** (references)?

IV.2.3. AAS systems

IV.2.3.1. Please, state manufacturer and type of AAS(F-AAS,GF-AAS) instrument you use.

AAS, flame and graphite technique, Shimadzu FAAS AA6300 and Hg analyser AMA 254.

IV.2.3.2. Which **elements (HSs)** do you measure by AAS? Please, state **detection limits** for measured elements (HSs).

Element	Detection limit [µg/L]
Ni	0.5
Cd	0.05
Pb	0.1
Cr	0.5
As	0.5
Cu	0.2
Zn	0.002
Hg	0.1

Table 11 Detection limits for elements measured by AAS

IV.2.3.3. Please, describe **sample preparation and procedure** for AAS measurements (dissolution, radiation source, source temperature, wavelengths, etc.).

All methods used for heavy metals determination in water are stated in the **Tables 6 and 7**.

IV.2.3.4. How do you calculate **accuracy and precision** (references)?

All applied methods are certified according to ISO/IEC 17025.

IV.2.4. XRF

IV.2.4.1. Please, state manufacturer and type of XRF(EDXRF,WDXRF) instrument you use.

IV.2.4.2. Which **elements and/or compounds** (HSs) do you measure by **XRF**? Please, state **detection limits** for measured elements and/or compounds (HSs).

IV.2.4.3. Please, describe **preparation of the sample and procedure** for XRF measurements.

IV.2.4.4. How do you calculate **accuracy and precision** (references)?

IV.2.5 DC-arc –AES

IV.2.5.1. Please, state manufacturer and type of instrument you use (type of detectors etc.).

IV.2.5.2. Which **elements and/or compounds** (HSs) do you measure by **DC-arc-AES**? Please, state **detection limits** for measured elements and/or compounds (HSs).

IV.2.5.3. Please, describe **preparation of the sample and procedure** for DC-arc-AES measurements.

IV.2.5.4. How do you calculate **accuracy and precision** (references)?

IV.2.6. Radionuclides

IV.2.6.1. **Which instrumental method(s)** you use to detect radionuclides in water, sediment and/or biota? Please, state manufacturer and type of radionuclide detection instrument you use.

IV.2.6.2. **Which radionuclides** do you measure? Please, state **detection limits** for measured radionuclides.

IV.2.6.3. How do you calculate **accuracy and precision** (references)?

IV.2.7. Organic compounds (HSs)

IV.2.7.1. **Which instrumental method(s)** you use to detect organic compounds (HSs) in water, sediment and/or biota?

All methods used for organic matter content determination in water are stated in **Table 7**.

IV.2.7.2. **Which organic compounds (HSs)** do you measure?

Please, state **detection limits** for measured organic compounds (HSs).

Organic compounds which are analysed in water samples are stated in **Table 1**.

Name of substance	LOD (µ/L)	LOQ (µ/L)
benzen	1	1
anthracene	0.013	0.039
benzo (a)piren	0.015	0.045
benzo (g,h,i)perilen	0.002	0.002

benzo (b)fluoranten	0.008	0.025
benzo (k)fluoranten	0.008	0.023
fluoranten	0.013	0.038
indenol (1,2,3-d)piren	0.001	0.002
naftalen	0.016	0.049
Atrazin	0.04	0.14
Simazin	0.04	0.14
hlorfenvinfos	0.1	0.01
hlorpirifos	0.02	0.08
alahlor	0.05	0.16
Diuron	0.01	0.15
izoproturon	0.1	
pentahlorfenol	0.05	0.17
endosulfan	0.01	0.02
heksahlorobenzen	0.01	0.02
pp DDT	0.01	0.02
lindan	0.01	0.02
aldrin	0.01	0.03
dieldrin	0.01	0.03
endrin	0.01	0.03
izodrin	0.01	0.03
Trifluralin	0.01	0.03

Table 12 Detection limits in organic compounds analysis

IV.2.7.3. How do you calculate **accuracy and precision** (references)?

All applied methods are certified according to ISO/IEC 17025.

IV.2.8. XRD

IV.2.8.1. Please, state manufacturer and type of XRD instrument you use.

IV.2.8.2. Do you use **XRD for sediment analysis**?

IV.2.8.3. Please, describe **preparation of the sample and procedure** for XRD measurements

IV.3 Inventory of national laboratories where dangerous substances are analyzed, specifying whether they have accreditations on the quality of analyzes (certificate issued by the national body attesting the quality of the analyzes), price and time of analyses.

Quality control according to EN ISO/IEC 17025. Laboratory check according to EN ISO/IEC 17043. Analytical control of all parameters according to ISO 17 025.

IV.4 Description of "good practices" in laboratory and "in situ" analysis. For example, ways to convert analytical data obtained from sediment analysis to water quality assessments (taking into account the high cost of water analysis compared to the sediment).

IV.5 Description of protocols for intercomparison and intercalibration between laboratories. List of national and international projects which had developed the Protocols.

[PLEASE, SUPPORT YOUR ANSWERS WITH REFERENCES (NATIONAL LEGISLATIVE DOCUMENTS AND/OR WEB LINKS)]

V .INVENTORY OF EVALUATION METHODS

V.1. How **threshold values** for HSs are set in each type of media (sediment, water, biota)? (e.g. average of the last measured values, average with the treatment of outliers, average of the values measured in areas without anthropogenic influence, enrichment factor, conservative **elements** for normalization, etc.).

Threshold values are harmonised with WFD, which means that there were no investigations which would set specific threshold values.

Threshold values for HSs are set only for water samples, which is stated in Regulation on water classification and categorization of water courses (Official Gazette of Republika Srpska 41/01), and available at <http://www.voders.org/propisi-i-obrasci/pravna-regulativa/>.

V.2. Are **threshold values fixed or variable** and do they depend on the sample form, drainage basin lithology, time of the year, etc.?

Threshold values are fixed, although some of them cover specific range.

V.3. Do you use **corrections for threshold values**? (amount of **quartz, organic matter** etc.).

No.

V.4 The environmental quality objectives are based on measuring the total metal concentration and / or some dangerous compounds of that metal in different valence states?

Only total metal concentrations are measured. It seems that there are no differentiation between concentrations of geogenic and anthropogenic origin. For example, strongly bounded metals vs weakly bounded metals.

V.5 How the legislation reflects the phenomenon of “bioaccumulation”? Is the type of biota correlated with the ecosystem?

No.

V.6. Does your national legislative find **categories of environment quality** based on deviations from threshold values?

No, it doesn't.

V.7. Can these categories be **defined by quality of more than one medium**?

No.

V.8. Please, describe **algorithm** for **defining** these **categories**? (e.g. weight coefficients).

N/A.

V.9. How does your legislative framework define **difference** between **contamination** and **pollution**?

It doesn't.

V.10. Do you **relate specific HSs** with **sources of contamination and pollution** and how?

No, we don't.

V.11. Please, describe **actions** in case of contamination and pollution.

N/A.

V.12. How do you **present results** in your **reports**, e.g. do you use complex representation for scientific community or simple representation for target groups? Does the report include methodology, full results, QA/QC, models? Are these results public or can be obtained by request?

Results are presented as a simple representation and the final report includes methodology, full results, QA/QC and models. Results can be obtained by request.

V.13. Do you have a method for **space-time risk assessment** after determination of contamination and/or pollution?

No, we don't.

[PLEASE, SUPPORT YOUR ANSWERS WITH REFERENCES (NATIONAL LEGISLATIVE DOCUMENTS AND/OR WEB LINKS)]

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