Interreg
Danube Transnational Programme
SIMONA

QUESTIONNAIRE FOR EXISTING SAMPLING, LABORATORY AND EVALUATION METHODS

0.0. Institute of Geology and Seismology, Republic of Moldova.
0.1. Ministry of Agriculture Territory Development and Environment.

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	HOTĂRÎRE GUVERNULUI Nr. 934 din 15.08.2007 cu privire la instituirea Sistemului informaţional automatizat „Registrul de stat al apelor minerale naturale, potabile şi băuturilor nealcoolice îmbuteliate”	GOVERNMENT DECISION Nr. 934 from 15.08.2007 on the establishment of the Automated Information System "State Register of natural mineral and potable waters, and bottled non-alcoholic beverages"	http://lex.justice.md/md/325013/ http://www.amac.md/Biblioteca/data/30/02/04.1.pdf	MD
2	HOTĂRÎRE GUVERNULUI Nr. 931 din 20.11.2013 pentru aprobarea Regulamentului cu privire la cerinţele de calitate a apelor subterane	GOVERNMENT DECISION Nr. 931 from 20.11.2013 for the approval of the "Regulation on Groundwater Quality Requirements "	http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=350466 http://www.amac.md/Biblioteca/data/30/02/27.1.pdf	MD
3	HOTĂRÎRE GUVERNULUI Nr 890 din 12.11.2013 pentru aprobarea „Regulamentului cu privire la cerinţele de calitate a mediului pentru apele de suprafaţă”.	GOVERNMENT DECISION Nr. 890 from 12.11.2013 for the approval of the “Regulation on Environmental Requirements for Surface Waters”	http://www.justice.gov.md/file/Centrul%20de%20armonizare%20a%20legislatiei/Baza%20de%20date/Materiale%202013/Acte/PNAL/HG_890_din_12.11.13.pdf http://www.amac.md/Biblioteca/data/30/02/28.1.pdf	MD
4	HOTĂRÎRE GUVERNULUI Nr.950 din 25.11.2013 pentru aprobarea Regulamentului privind cerinţele de colectare, epurare şi deversare a apelor uzate în sistemul de canalizare şi/sau în corpuri de apă pentru localităţile urbane şi rurale	GOVERNMENT DECISION Nr. 950 from 25.11.2013 for the approval of the “Regulation for the collection, treatment and discharging of waste water into sewerage systems and / or water bodies for urban and rural localities”	http://lex.justice.md/md/350537/ http://www.amac.md/Biblioteca/data/30/02/08.1.pdf http://www.amac.md/Buletine/Buletin_10.pdf	MD
5	HOTĂRÎRE GUVERNULUI Nr.932	GOVERNMENT DECISION Nr. 932 for the	http://lex.justice.md/index.php?action=view&view=doc&lang=1&i	MD

	pentru aprobarea Regulamentului privind monitorizarea şi evidenţa sistematică a stării apelor de suprafaţă şi a apelor subterane	approval of the "Regulation on the monitoring and systematic evidence of the status of surface waters and groundwater"	d=350467 http://www.amac.md/Biblioteca/data/30/02/30.1.pdf	
6	MINISTERUL MEDIULUI ŞI AMENAJĂRII TERITORIULUI REGULAMENT Nr. 100 din 18.01.2000 Provizoriu cu privire la estimarea despăgubirilor pentru prejudiciile cauzate mediului Publicat : 05.09.2000 în Monitorul Oficial Nr. 112	Ministry of Environment and Territory Arrangement Regulation Nr. 100 from 18.01.2000 "Indication on the estimation of environmental damages" publicated 05.09.2000 in Oficial Monitor nr. 112 – 114.	http://lex.justice.md/viewdoc.php?action=view&view=doc&id=313484&lang=1 http://amac.md/Biblioteca/data/03/02.14.1.pdf	MD
7	MINISTERUL ECOLOGIEI ŞI RESURSELOR NATURALE. INSTRUCŢIUNE Nr. 383 din 08.08.2004, privind evaluarea prejudiciului cauzat resurselor de sol	Ministry of Environment and Natural Resources, Instruction nr. 383 from 08.08.2004 for the Evaluation of the demage caused to soil resorces	http://lex.justice.md/index.php?action=view&view=doc&id=310719	MD

I.2List 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.

Alert threshold = concentrations of pollutants in air, water, soil or in emissions/discharges, which, when reached, warn the competent authorities on a potential impact on environment and trigger an additional monitoring and/or reduction of pollutant concentrations in emissions/discharges.
Intervention threshold = concentrations of pollutants in air, water, soil or in emissions/discharges, which, when reached, determine the competent authorities to order risk assessment studies and reduction of pollutant emissions from emissions/discharges.

Each country, please deliver the definition of specific terms in the respective law.

Table 1 Metal trace elements in soils

Trace Element	Levels in soils (mg/kg)					
metals	A - normal values*		B - alert threshold		C - intervention threshold	
Values based on use category	A1	A2	Sensitive B1	Less sensitive B2	Sensitive C1	Less sensitive C2
Hg, total*	0,10	0,2***	2,1	4	2	10
As, total	2,6	5,6	2.0			
Cd total	0,20	0,24	3,0			
Cr mobile**			6,0			
Cr $^{3+}$ total			90,0			
Cu mobile			3,0			
Cu total	18,0	25,0	140,0			
Ni total	35,0	45,0	75,0			
Ni mobile			4,0			
Pb mobile			6,0			
Pb total	16,0	20,0	32,0			
Zn mobile			23,0			
Zn total	60,0	68,0	300,0			
Co mobile			5,0			
Co total	12,0	15,0				
Mn mobile			700,0			
Mn total			1500,0			
V total			150,0			
Sn total			4,5			
Sb total			4,5			

* total concentration by acid digestion; **mobile – extraction by ammonium acetate buffer; *** interval for different type of soil.

Table 2 Metal trace elements in river water

Trace Element	Levels in river water (µg/l)					
metals	normal values		alert threshold		intervention threshold	
Values based on use category	A1	A2	Sensitive B1	Less sensitive B2	Sensitive C1	Less sensitive C2
Fe, total			20,0	100,0		
Mn, total			100,0	2000,0		
Mercury (Hg) total			1,00	2,0		
Mercury (Hg) dissolved			0,2	0,8		
As						
Cd total			1,0	5,0		
Cd dissolved			0,2	1,0		
Ni total			25,0	100,0		
Ni dissolved			20,0	40,0		
Pb total			50,0	50,0		
Pb dissolved			2,5	7,5		
Zn total			80,0	400,0		
Zn dissolved			30,0	120,0		

Table 3 Metal trace elements in drinking water

Trace Element	Levels in drinking water (µg/l)					
metals	A)normal values		B) alert threshold		C) intervention threshold	
Values based on use category	A1	A2	Sensitive B1	Less sensitive B2	Sensitive C1	Less sensitive C2
Al			200,0			
Fe			300,0			
Mn			50,0			
Mercur (Hg)			1,0			
As			10,0			
Cd			3,0			
Cr			50,0			
Cu			1000,0			
Ni			20,0			
Pb			10,0			
Se			10,0			
Sb			5,0			
Zn			3000,0			

Table 4 Non-metal trace elements in soils

Trace Element	Levels in soils (mg/kg)					
Non-metals	A)normal values		B)alert threshold		C)intervention threshold	
Values based on use category	A1	A2	Sensitive B1	Less sensitive B2	Sensitive C1	Less sensitive C2
F mobile			10,0			
NO3			130,0			
S			160,0			

Table 5 Non-metal trace elements in river water

Element	Levels in river water (mg/l)					
Non-metals	A)normal values		B)alert threshold		C)intervention threshold	
Values based on use category	A1	A2	Sensitive B1	Less sensitive B2	Sensitive C1	Less sensitive C2
Cl			150,0	300,0		
SO_4			150,0	350,0		
N total			1,5	20,0		
N, NO_3			3,0	11,3		
N, NO_2			0,06	0,30		
N, NH_4			0,4	3,1		
P total			0,2	1,0		
P, mineral			0,1	0,5		
Mg			50,0	100,0		
Hardness mmol/L			6,0	15,0		

Table 6 Non-metal trace elements in drinking water

Trace Element	Levels in drinking water (mg/l)					
Non-metals	A)normal values		B)alert threshold		C)intervention threshold	
Values based on use category	A1	A2	Sensitive B1	Less sensitive B2	Sensitive C1	Less sensitiveC2
F			1,5			
Cl total			250,0			
Cl, free			0,5			
SO_4			250,0			
Br			0,01			
B			0,50			
NO_3			50,0			
NO_2			0,50			
NH_4			0,50			

Table 7 of Polycyclic Aromatic Hydrocarbons –PAHs in soil,

Trace Element	Levels in soil (mg/kg)					
Non-metals	A) normal values		B) alert threshold		C) intervention threshold	
Values based on use category	A1	A2	Sensitive B1	Less sensitive B2	Sensitive C1	Less sensitiveC2
Benzo[a]pyrene			0,02			
Total PAHs			0,10			

Table 8 of Polycyclic Aromatic Hydrocarbons –PAHs in water.

Trace Element	Levels in drinking water (μg/L)					
Non-metals	A) normal values		B) alert threshold		C) intervention threshold	
Values based on use category	A1	A2	Sensitive B1	Less sensitive B2	Sensitive C1	Less sensitiveC2
Benzo[a]pyrene			0,02			
Total PAHs			0,10			

Table 9 of Persistent Organic Pollutants including PCBs in soil.

Trace Element	Levels in soil (mg/kg)					
Non-metals	A) normal values		B) alert threshold		C) intervention threshold	
Values based on use category	A1	A2	Sensitive B1	Less sensitive B2	Sensitive C1	Less sensitiveC2
DDTs metabolites			0,10			
HCHs metabolites			0,10			
Trichlorbiphenil			0,03			
Tetrachlorbiphenil			0,06			
Pentachlorbiphenil			0,10			
PCBs total			0,10			

Table 10 Persistent Organic Pollutants, including PCBs, in water.

Trace Element	Levels in drinking water (μg/L)					
Non-metals	A) normal values		B) alert threshold		C) intervention threshold	
Values based on use category	A1	A2	Sensitive B1	Less sensitive B2	Sensitive C1	Less sensitiveC2
DDTs metabolites			0,10			
HCHs metabolites			0,10			
Trichlorbiphenil			0,03			
Tetrachlorbiphenil			0,06			
Pentachlorbiphenil			0,10			
PCBs total			0,10			

Table 11 of Microbiological parameters in water

Parameter	**Maximal Admissible Level MAL**
Escherichia coli (E.coli)	0 / 250ml
Enterococi (Streptococi fecali)	0 / 250ml
Pseudomonas aeruginosa	0 / 250ml
Număr de colonii la 22^0C	100 / 1ml
Număr de colonii la 37^0C	20 / 1ml

Table 12 Other parameters in water that are provided in national legislations

Parameter	Maximal Admissible Level MAL	Units
Acrilamide	0,1	µg/l
Benzene	1,0	µg/l
Vinyl chloride	0,3	µg/l
Cianides total	50,0	µg/l
Cianides free	10,0	µg/l
Dichlorethane	3,0	µg/l
epichlorohydrin	0,1	µg/l
Microcistină LR	1,0	µg/l
Pesticides	0,1	µg/l
Pesticides total	0,5	µg/l
Tetracloretan şi tricloretenă	10,0	µg/l
Trihalometani total	100,0	µg/l
Tritium	100,0	Bq/l
Alfa activity	0,1	Bq/l
Beta activity	1,0	Bq/l

Table 13 Other parameters in soil that are provided in national legislations mg/kg (organic substances and pesticides).

Parameter	Maximal Admissible Level MAL
Aceiiit	0,5
Acrex	1,0
Aghelon	0,15
Agritox	0,04
Actelic	0,5
Acetic aldehyde	10,0
Aldehide formica	7,0
Alfametil stirena	0,5
Alufit	0,9
Antam	0,9
Arrivo	0,02
Atrazina	0,5
Bazudin	0,1
Eradicane extra	0,9
Fastac	0,03
Fenuron	1,8
Fozalon	0,5
Fosfamida	0,3
Ftalofos	0,1
Furadan	0,01
Furi	0,02
Furfurol	3,0
Gaucho	0,005
Ghesagard	0,04
Gliphogan	0,3
Hardona	1,4
Harness	0,5
Bayleton	0,03
Bayleton universal	0,02

Baileton + metabolit	0,03
Baifidan	0,02
Banvel D	0,25
Benzina	0,1
Benzen	0,3
Betanal AM	0,25
Bromotril	0,1
Carbophos	2,0
Cheltan	1,0
Cross	0,003
Covboi (after dicamba)	0,25
Ciclophos	0,03
Cineb	0,2
Cloramp	0,05
Clorophos	0,5
Cuprocina	1,0
Dalapon	0,5
Acidul 2.4-diclor - phenoxiacetic	0,1
2.4-diclorphenol	0,05
2.4 amina salt	0,25
Group Hterbutilic 2.4d	0,15
Group Etercrotilic 2.4d	0,15
Dezormon	0,2'5
Detis	0.01
Dialen (after 2-4D)	0,25
Dilor	0.5
Diuron	0.5
Dursban	0,2
Efal	0,9
Eptam	0,9
EPTC	0,9
Heterophos	0,05
Hlifosat	0,5
Izatrin	0,05
Izopropilbenzen	0,5
lodofenphos	0,5 ,
Lentagran	0,002
Limiron	1,0
Mezoranil	0,1
Merpan	10
Metation	1,0
Metaphos	0,1
Mirai	0,03
Moniron	0,3
Pirimor	0,3
Pyirinex	0,2
Politriazin	0,1
Policlorcamfen	0,5
Policlorpinen	0,5
Prometrin	0,5
Propanid	1,5
Raundup	0,5
Ridomil	0,05
Rincord	0,02
Ronit	0,8
Rubigan	0,04

Select 2 EC	0,1
Sevin	0,05
Semeron	0,1
Simazina	0,2
Sumicidina	0,02
Sumithion	0,1
Shcrpa	0,02
Stirena	0,1
Toluena	0,3
Valexona	1,0
Xilenele (orto-,meta-,para-)	0,3
Zencor	0,2
Abat	0,6
Ambus	0,05
Amiben	0,5
Antio	0,2
Arezina	0,7
Baileton	0,4
Baitex	0,4
Benlat	0,1
Biferan	0,5
BMC	0,1
Bromophos	0,2
Bronocot	0,5
Hemetrel	0,5
Herban	0,7
Hidrel	0,5
Dactal	0,1
DDVF	0,1
Dextrel	0,5
Dihidrel	0,5
Defenamid	0,25
Dropgh	0,05
Zelec	0,15
Campozan	0,5
Captan	1,0
Stomp	0,15
Sulfazin	0,1
Sutăn	0,6
Teporan	0,4
Herbacil	0,4
Tilam	0,6
Tiodan	0,1
Topsin-M	0,4
Treflan	0,1
Trialat	0,05
Caragard	0,4
Cotoran	0,03
Lenacil	1,0
Lontrel	0,1
Metazin	0,1
Metoxiclor	1,6,
Morfonol	0,15
Nitropirin+6HPC	0,2
Nitrofor	0,2
Ofunac	0,05
Piramin	0,7

Plictran	0,1
Plondrel	0,15
Policarbatin	0,6
Preparate A-1	0,5
Promed	0,01
Ramdon	0,2
Reglon	0,2
Revral	0,15
Sangor	0,04
Saprol	0,03
Solan	0,6
THAN	0,2
THM	0,1
Phtalan	0,3
Hostacvic	0,2
Cianox	0,4
Cidial	0,4
Etaphos	0,1
Euparen	0,2
lalan	0,9

I,3 Quality objectives for hazardous substances (please complete the tables of HSs according to national documents)

Dangerous substance (HS)	Water quality objective (µg/l)*	Quality target for sediment** (mg/kg)	Quality objective for biocenosis (mg/kg)
Mn, total	100,0 – 2000,0	1500,0	mollusks and fish
Mercury (Hg)	1,0 – 2,0	2,1	mollusks and fish,
As	10,0	2,0	mollusks and fish,
Cd	1,0 – 5,0	3,0	mollusks and fish,
Ni	25,0 – 100,0	75,0	mollusks and fish,
Pb total	50,0	32,0	mollusks and fish,
Zn total	80,0 – 400,0	300,0	mollusks and fish,
Pesticides individual	0,1	0,1	mollusks and fish
Pesticides total	0,5	0,5	mollusks and fish
DDTs metabolites	0,10	0,10	mollusks and fish,
HCHs metabolites	0,10	0,10	mollusks and fish,
Trichlorbiphenil	0,03	0,03	mollusks and fish
Tetrachlorbiphenil	0,06	0,06	mollusks and fish
Pentachlorbiphenil	0,10	0,10	mollusks and fish
PCBs total	0,10	0,10	mollusks and fish
Benzo[a]pyrene	0,02	0,02	mollusks and fish
Total PAHs	0,10	0,10	mollusks and fish

* Quality parameters for river water min and max value for different water classes;
** No specific national normative for sediments, MAL for soil is presented.

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

Element	National analytical standards*	International analytical standards	"in-house" developed methods"
Water			
pH	SM SR ISO 10523:2014		
Suspended matter	STAS 6953-81		
Biochemical oxygen consumption	SR EN 1899-2/2002		
Chemical oxygen consumption	SR ISO 6060-96		
Extractive substances with organic solvents (fats)	SR 7587-96		
Hardness	GOST 4151-72		
Ca, Mg	SM SR EN ISO 7890:2012; GOST 23268,5-78		
Na, K	GOST 23268,6-78; GOST 23268,7-78		
Ammoniac nitrogen	SR ISO 5664:2001 SR ISO 7150-1/2001		
Nitrates	GOST 18826-73		
Nitrites	GOST 4192-82		
Sulphates	GOST 4389-72; GOST 8601-70		
Phenols	SR ISO 6439:2001 SR ISO 8165/1/00		

Biodegradable synthetic anionic detergents	SR EN 903: 2003 SR ISO 7875/2-1996		
Fluoride	GOST 4386-89		
Se, As, Mn, Fe, Cd, Cu, Ni, Pb, Cr, Zn, Al	SM GOST R 51309:2006 SR EN ISO 5961:2002		
Co, Ni, Cu, Zn, Cd, Pb,	SM SR ISO 8288:2006;	SR EN 1233:2003 SR ISO 9174-98	
Cr	SM SR EN ISO 18412:2012		
Mercury (Hg)	GOST R 51212-98; EN ISO 12846:2012		
POPs,	SM GOST R 51209:2006; SM SR EN ISO 6468:2007	EPA Methods 505; 508; 551; 525; 1699; 8081B,	
PAHs		EPA Methods 8100 8270C; 8310; 8272; 525; 550 ISO 15680:2003; ISO 17993:2002 ISO 28540:2011	
BTEX		ISO 17943:2016 ASTM D 6889, D6520; EPA Methods 8020A; 8015B; 624; 524,3,	
Phenols		ISO/TS 13907:2012 GC-MS; ISO 14154:2005 GC-ECD ISO/DTS 17182 GC-MS	
Cl residual	SR EN ISO 7393-1:2002; SR EN ISO 7393-2:2002; SR EN ISO 7393-3:2002		
Chloride	STAS 8663-70		
Fluoride	SR ISO 10359-1:2001; SR ISO 10359-2:2001		
Soil (solid samples)			
Cd, Cr, Co, Cu, Pb, Mn, Ni, Zn	SM SR ISO 11047:2006		
As, Sb, Se		ISO 20280:2007	
POPs,	SM SR ISO 10382:2012	EPA Method 8081B; 1699	
PAHs		ISO 18287:2006; EPA method 8270C	
BTEX		EPA Methods 5021 5035; 8260B,	
Phenols		ISO/TS 13907:2012 GC-MS; ISO 14154:2005 GC-ECD ISO/DTS 17182 GC-MS	
Raw material and foodstuff			
Cd, Pb, Zn, Cu, Fe	GOST 30178-96		
Pb, Cd, Cr, Mo	SM SR EN 14083:2006		
Pb, Cd, Zn, Cu, Fe	SM SR EN 14084:2006		
Hg	SM SR EN 13806:2006		
POPs,	GOST 30349-96	EPA Method 8081B; 1699	
PAHs	ISO 18287:2006	EPA 8270C	

* Republic of Moldova adopt international standards

I,5, List of chronic or acute toxicity tests and determination of bioaccumulation or persistence in biota according to the specificity of the dangerous substance in the trophic chain (Ex: Microtox test - The potential ecological impacts of anaerobic degradation of vegetable oil on freshwater sediments; Hyalella Azteca etc),

No specific tests

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

Nr		sediment	soil	water
1	sampling	ISO 5667-15 Water quality - Sampling - Part 15: Guidance on the preservation and handling of sludge and sediment samples https://www,en-standard,eu/iso-5667-15-water-quality-sampling-part-15-guidance-on-the-preservation-and-handling-of-sludge-and-sediment-samples/	Alaska Department of Environmental Conservation, 2009, Draft Guidance on MULTI INCREMENT Soil Sampling, Division of Spill Preventions and Response, Contaminated Sites Program, www,itrcweb,org/ism-1/references/multi_increment,pdf	ISO 5667-3:2018 Water quality -- Sampling -- Part 3: Preservation and handling of water samples https://www,iso,org/standard/72370,html
		IAEA-TECDOC-1360 (2003) Collection and preparation of bottom sediment samples for analysis of radionuclides andtrace elements http://www-pub,iaea,org/MTCD/publications/PDF/te_1360_web,pdf	ASTM (2003) Standard Guide for Laboratory Sub-sampling of Media Related to Waste Management Activities, Method D 6323-98, www,astm,org/Standards/D6323,htm	ISO 5667-11:2009(en) Water quality — Sampling — Part 11: Guidance on sampling of groundwaters, https://www,iso,org/obp/ui/#iso:std:iso:5667:-11:ed-2:v1:en
		ISO 5667-19:2004 Water quality -- Sampling -- Part 19: Guidance on sampling of marine sediments	ASTM, 2006, Standard Guide for Sampling Strategies for Heterogeneous Wastes, Method D 5956-96, www,astm,org/Standards/D5956,htm	
		Water Quality Monitoring - A Practical Guide to the Design and Implementation of Freshwater Quality Studies and Monitoring Programmes, Chapter 13 Sediment measurements https://www,who,int/water_sanitation_health/re	ASTM, 2008, Standard Guide for Developing Conceptual Site Models for Contaminated Sites, Method E 1689-95, www,astm,org/Standards/E1689,htm	

		sourcesquality/wqmchap13,pdf		
			ASTM, 2009, Standard Guide for Representative Sampling for Management of Waste and Contaminated Media, Method D 6044-96, www,astm,org/Standards/D6044,htm	
			Data Quality Objectives Process for Hazardous Waste Site Investigations: Final Guidance, (USEPA 2000a),	
			FAO Assessing soil contamination, A reference manual http://www,fao,org/3/X2570E00,htm	
			Incremental Sampling Methodology (2012), Technical and Regulatory Guidance, Interstate Technology & Regulatory Council Incremental Sampling Methodology Team www,itrcweb,org	
			ISO 18400-104:2018 October 2018 Soil quality - Sampling - Part 104: Strategies	
			ISO 18400-101:2017 Soil quality -- Sampling -- Part 101: Framework for the preparation and application of a sampling plan https://www,iso,org/standard/62842,html	
			ISO 18400-102:2017 Soil quality -- Sampling -- Part 102: Selection and application of sampling techniques https://www,iso,org/standard/62843,html	
			ISO-10381-5 Soil quality, Part 5: Guidance on the procedure for the investigation of urban and industrial sites with regard to soil contamination https://www,twirpx,com/file/2071112/	

			http://www,complexdoc,ru/ntdpdf/534094/kachestvo_pochvy_otbor_prob_chast_5_rukovodstvo_po_izucheniyu_gorodskikh_i,pdf	

I,7 Specify the recommended remedy measures associated with the contents of the hazardous substances (alert threshold, intervention threshold)

No specific measures for the polluted sites remediation are regulated in normative documents for Republic of Moldova.
The procedure of the information of the local and central authorities, relevant institutions about the pollution cases and the calculation of taxes for environmental damages is regulated.

II PRACTICES, EXPERIENCES

II,1,Significant national, European, finalized or ongoing projects related to geochemistry of waters, soils, sediments in the Danube basin

No,	Project title (national language, if available)	Project Title (EN)	Year	Country	Project coordinators, Partners
1	Cooperare interdisciplinară transfrontalieră pentru prevenirea dezastrelor naturale și reducerea poluării mediului în Euroregiunea Dunărea de Jos MIS ETC 1676, Joint Operational programe Romania-Ukraine-Republic of Moldova, 2007 – 2013.	Cross-border interdisciplinary cooperation for the prevention of natural disasters and mitigation of environmental pollution in Lower Danube Euroregion. MIS ETC 1676, Joint Operational programe Romania-Ukraine-Republic of Moldova, 2007 – 2013.	2013 - 2015	Romania, Ukraine, Republic of Moldova	Lead Partner - University “Dunarea de Jos” from Galati, Romania, Partners: P1 - Institute of Institute of Zoology, Moldova; P2 Institute of Geology and Seismology, Moldova; P3 - Ukrainian Center for the Ecology of the Sea from Odessa, Ukraine
2	Reţea de cooperare interdisciplinară a bazinului Mării Negre pentru monitoringul în comun durabil al migraţiei substanţelor toxice pentru	Black Sea Basin interdisciplinary cooperation network for sustainable joint monitoring of environmental toxicants migration, improved	2017 - 2020	Romania, Republc of moldova Greece	Lead Partner 1 - University “Dunarea de Jos” from Galati, Romania, Partners: P2 - Institute of Institute of Zoology,

	mediu, evaluarea îmbunătăţită a impactului substanţelor periculoase asupra stării ecologice şi a sănătăţii umane şi prevenirea expunerii publice", MONITOX	evaluation of ecological state and human health impact of harmful substances, and public exposure prevention – MONITOX; eMSBSB27, Black Sea Cross border Cooperation			Moldova; P3 – Eastern Macedonia and Trace Institute of Technology, Greece; P4 Institute of Geology and Seismology, Moldova; P5 – Danube Delta National Institute for Research and development, Romania
3	Sistemul Național de Monitoring al Calității Mediului	National System of Environmental Quality Monitoring	2013 - 2015	Republic of Moldova	Hydro-Meteorological Service, Ministry of Environment

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		Environmental sampling and analysis – Methodological Guide. 117 p.	2016	Ukraine	Yurii Denga, Oleg Bogdevich
2	Starea solurilor pe teritoriului Republicii Moldova în anul 2015	Soil Status on the Territory of the Republic of Moldova in 2015	2015	Republic of Moldova, Annual Report, Hydro-Meteorological Service, Ministry of Environment	Gîcă G. (red), Cumanova A., Cozari L., Jechiu R.
3	Starea calității apelor de suprafață conform indicilor hidrochimice pe teritoriul Republicii Moldova în anul 2015	Surface water quality status according to hydrochemical indices on the territory of the Republic of Moldova in 2015	2015	Republic of Moldova, Annual Report, Hydro-Meteorological Service, Ministry of Environment	Gîcă G. (red), Zgîrcu N., Țurcan T., Jechiu I.
4	Starea calității apelor de suprafață conform elementelor hidrobiologice pe teritoriul Republicii Moldova	Surface water quality status according to hydrobiological elements on the territory of the Republic of Moldova	2015	Republic of Moldova, Annual Report, Hydro-Meteorological Service, Ministry of Environment	Gîcă G. (red), Zgîrcu N., Luchianova V., Borș M., Țutcan T., Jechiu I.

5		Integrated Water Management in the Republic of Moldova (2014) Management of Water Quality in Moldova	2014	Springer Switzerland	Duca Gh, Bogdevich O., Porubin D
6		The analysis of old pesticide and PAHs pollution sources in Low Danube Region.	2013	Journal of International Scientific Publications: Ecology & Safety. Vol. 7, Part 2, pp. 233 – 243, http://www.scientific-publications.net	Bogdevich O., Ene A., Cadocinicov O., Culighin E.
7		Levels and distribution of organochlorine pesticides (OCPs) and polycyclic aromatic hydrocarbons (PAHs) in topsoils from SE Romania	2012	Science of the Total Environment, 439, pp. 76-86	Ene A., Bogdevich O., Sion A.
8		The Determination of polycyclic aromatic hydrocarbons by gas chromatography-mass spectrometry in soils from Southeastern Romania.	2011	Microchemical Journal, Vol. 100, pp. 36 – 41	Ene A., Bogdevich O., Sion A., Spanos

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

Low Prut River Monitoring Stations

No,	Site	Country
1	Manta village – Manta Lake (Ramsar zone 1029)	MD
2	Slobozia Mare village, Baleu Lake (Ramsar zone 1029)	MD
3	Leova town, Prut River	MD
4	Cahul town, Prut River	MD
5	Brinza village, Prut River	MD
6	Giurgiulești village, Prut River confluence in Danube	MD

No,	Site coordinates (North, East) in WGS84 system (at least seven decimals points)	Project title (national languge)	Project title (EN)	Year	Country	Obs,(type of analysis, purpose of monitoring, sampling rate)
1	N 45,7864032 E 28,1722936 (Manta)	Programul Național de Monitoring	National monitoring program	2014 - 2015	Republic of Moldova	General characteristics of surface water and sediments, HSs analysis in water and sediments (POPs, PAHs, Heavy metals), Reports for Environmental status of Republic of Moldova 2015
2	N 45,5901561 E 28,1566450 (Slobozia Mare)					
3	N 46,4996397 E 28,2317321 Leova					
4	N 45,9156753 E 28,1210543 Cahul					
5	N 45,6663482 E 28,1650733 Brinza					
6	N 45,4688420 E 28,1211807 Giurgiulești,					

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,

The annual reports for the environmental status on the territory of Republic of Moldova are available from the site of State Hydrometeorological Service http://www.meteo.md/index.php/calitatea-mediului/c/
The River Basin Management Plan for the Danube-Prut and Black Sea pilot river basin district in the limits of the Republic of Moldova is available fom the site of European Union Water Initiative Plus for the Eastern Partnership
https://www.euneighbours.eu/en/east/stay-informed/news/moldova-eu-supported-management-plan-danube-prut-and-black-sea-river-basin
The database of POPs polluted sites from the territory of Republic of Moldova was available on-line from site http://pops.mediu.gov.md. Now this resource is not working and all needed information and raw data is located in Institute of Geology and Seismology.

II,5, Problems of current monitoring procedures in DRB

The national monitoring program in Republic of Moldova is not working now on the regular basis by the case of the government reforming and lack of funding. There are several regional projects that can be as a scientific support of the environmental monitoring in Republic of Moldova.

III,INVENTORY OF SAMPLING METHODOLOGIES

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?

The sampling design for surface and groundwater sampling for the environmental monitoring is elaborated for the every reporting period focusing first of all on previous regular monitoring sites. The number of samples for the analysis depends of the founding allocated for this purpose. The study of surface water bodies is made both for water and sediment samples. Water samples are collected first and then sediments to minimize effects from suspended bed materials.
For shallow surface water in a stream, start sampling downstream and work upstream to minimize the effects of sediment due to sampling disturbance. If you collect a sediment sample while standing in the water, be sure to stand downstream of the collecting point. For deep waters, the collection sequence from downstream to upstream is less important.
If sampling at different water depths is needed, collect surface water samples first and then proceed to a deeper interval.
Always collect VOCs first, followed by Semi VOCs such as extractable organics (PCBs, pesticide), oil and grease, and total petroleum hydrocarbons (TPHs). Then proceed to other parameters in the order of total metals, dissolved metals, microbiological samples, and inorganic nonmetals.
The sample amount depends on the concentration of the analytes present in sample matrices. The sample volume should be sufficient to perform all required laboratory analyses. Minimal liquid sample volume varies considerably in the range of 5 mL for total petroleum hydrocarbons in liquid wastes, 100 mL for total metals, and 1 L for trace organics such as pesticides. This bulk estimate of sample size represents a volume sufficient to perform one analysis only, and as a general guide, the minimum volume collected should be three to four times the amount required for the analysis.

III,1,2, Which parameters of water **quality**/**quantity** are measured ***in situ***?

The water quality parameters for in situ measures are pH, Conductivity/TDS, Temperature, and Dissolved Oxygen. The water debit for surface water and groundwater levels for groundwater are measured in situ on monitoring sites.

III,1,3, Which **instruments** are used for ***in situ*** measurements (include manufacturer and type)?

Multifunctional analyzers (potentiometers) Multi 350i, Consort 600C.

III,1,4, Please, describe **methodology** for ***in situ*** measurements,

Potentiometry is used mostly for water quality measures in situ

III,1,5, Which **tools** are used for collecting samples for **laboratory** measurements (include manufacturer and type)?

The water sample container should to be compatible to the analytes in a particular matrix. Glass containers are generally used for organic compounds, and plastic containers are used for inorganic metals. For trace organics, the cap and liner should be made of inert materials so that

sorption and diffusion will not be a potential problem. In cases when either plastic or glass can be used, plastic is preferred because it is easier to transport and less likely to break. Plastic containers are used for physical properties, inorganic minerals, and metals.
The pond sampler is used for surface- and wastewater sampling. The pond sampler is used in conditions of near shore sampling, sampling from outfall pipe, along disposal pond, lagoon and pit bank where direct access is limited.
The weighted bottle sampler is used to collect samples in water at a predetermined depth. The Kemmerer bottle is used when access is from a boat or structure such as a bridge or pier, and where discrete samples at specific depths are required. Mostly this equipment is old of Soviet time or homemade.
The filters of 45 μm are used for the water filtration for heavy metal analysis.
Water samples are separated in different types: freshwater (rivers, streams, lakes, ponds, estuaries); precipitation (rain, fog, show, ice tec.); wastewaters. These waters are different characteristics and sampling approach must be adapted for every object.

III,1,6 Sample preservation (samples chemical preservation according to their type and used analysis method),

The preservation is used for the minimization of any physical, chemical, and/or biological changes that may take place in a sample from the time of sample collection to the time of sample analysis. Three approaches are used to minimize such changes: refrigeration, addition of preserving chemicals, and utilization of proper sample container. Refrigeration (including freezing) is a universally applicable method to slow down all loss processes. The only exception that refrigeration does not help is when acidified water samples are preserved for metal analysis. Cold storage will adversely reduce metal solubility and enhance precipitation in the solution.
Colored (amber) bottles help preserve photosensitive chemicals such as PAHs. The addition of chemicals is essential to some parameters for their losses due to chemical reaction and bacterial degradation. Chemical addition or pH change can also be effective to reduce metal adsorption to glass container walls.
Different parameters have different holding time before the analysis. The maximum holding time for different analytes collected from sampling guides, which is used in laboratory practice, is presented in table.

ASAP	6 – 48 h	7 – 28 days	6 months
pH, Salinity, Cl_2, ClO_2, CO_2, I_2, O_3, temperature	Color, PO_4, NO_3, Surfactants, Chlorophyll, Acidity/alkalinity, (48h) CN, Cr^{6+}, Turbidity (24h) BOD, DO (6h)	Oil and grease Total P, F, S, SO_2, B, Si, Hg, Conductivity, (28 d) Solids, Pesticides, Purgeable hydrocarbons, NH_3, TOC, COD (7 d).	Metals, hardness

BOD – biochemical oxygen demand; DO – dissolved oxygen; COD – chemical oxygen demand; TOC – total organic carbon.

III,1,7 Please, describe a **methodology** for collecting samples

Water samples are collected according to the elaborated sampling plan for every water object and planed analytes. The bottles are cleaned and stored in respective boxes. After the sampling the preservation procedures are effectuated and samples are placed in the refrigerator. Samples are transported in the laboratory asap for the following sample treatment.

Reference methods and guides for sampling are indicated in table of cap I.6

III,2 Sediment

III,2,1, Which type(s) of sediment do you sample/measure **bottom**, **suspended**, **floodplain**?

All types of sediments

III,2,2, Sampling design strategy, How do you choose sampling locations?
How do you decide about temporal frequency of collecting samples?

Sampling location are established monitoring sites (continues monitoring), important water bodies (wetlands, lakes, polluted sites etc.). The temporal frequency depends of the project:
monitoring sites – every year;
important water objects – by specific projects or after contamination events and if the remediation actions are planned.

III,2,3, Which parameters of sediment **quality**/**quantity** are measured ***in situ***?

No measures

III,2,4, Which appropriate sampling devices (e,g, GRAIFER, CAROTIER etc,) and instruments are used for ***in situ*** measurements (include manufacturer and type)?

No measures

III,2,5, Please, describe **methodology** for ***in situ*** measurements,

No measures

III, 2,6, Which **tools** are used for collecting samples for **laboratory** measurements (include manufacturer and type)?

Scoops or trowels are used for soft surficial sediment and soil samples (local producers or homemade). Scoops and trowels, which are used in soil sampling, can be used for surface sediments around shoreline for shallow and slow-moving waters. The Ekman dredge is used for soft sediments on deeper water sites. Tube samplers are used at depths of 10 – 30 cm of soft sediment or soil samples (homemade). Auger samplers are used to take deeper sediment or soil samples (Soil sampling kit Burkle 5350-1005, Germany). The water depth should to be near 1,0 m for the sediment sampling by usual auger samplers. The split-spoon sampler is used for hard sediment or soil profile. It may be used in conjunction with drilling rigs for obtaining deep core soil profiles (old Soviet equipment).

III,2,7, Please, describe a **methodology** for collecting samples for **laboratory** measurements,

The minimum volume of sediment sample is 200 g for the assurance of representative sampling and contamination analysis. 5 – 100 g of homogenized sediment sample soil is sufficient for microelements determination. The natural sites with low contamination level can be sampled by more samples (up to 2 kg). Wide-mouth containers are used for soil samples. If soils or sediments are anaerobic, they should not be exposed to air. Sediment and soil samples need low-temperature storage after the sampling.

The selection of the soil sampling equipment depends of the sampling depth and sampling plan for the study of polluted or non polluted sites.
Reference methods and guides for sampling are indicated in table of cap I.6

III,2,8, Please, describe a **transport** methodology for samples intended for laboratory measurements,

The transportation of collected samples is ASAP in field refrigerators

III,2,9, Do you **archive** samples? If yes, please describe how,

Yes, as usual laboratory leaves dried and homogenized sediment or soil samples for the collection. These samples are marked and stored in special place.

III,3 , **Biota**
III,3,1, Which type(s) of **biota** do you sample/measure: **flora**, **fauna** (name species)?

Institute of Geology and Seismology takes bio samples as plants, agriculture crops, fish, milk, eggs, and meat for the risk assessment of the pollution, but not specific investigation for the ecosystem status evaluation.
Centre of Environmental Quality Monitoring (CEQM) of Hydro-meteorological Service of Republic of Moldova performs hydro-biological monitoring in Danube – Prut river basin by 6 groups of hydro-biologic indicators (annual report 2015):

1. bacterioplancton: total bacterial count, number of saprophytes, total coliforms, faeces coliforms and total germs;
2. phytoplankton: chlorophyll content - "a", number of species; number of cells/ml, biological mass, saprobic index, quality class;
3. zooplankton: number of species, number of individuals/l, biological mass, saprobic index, quality class;
4. phitobentos: number of species, frequency according to visual scale, saprobic index, quality class;
5. macrozoobentos: number of species, number of individuals/m^2, biological mass, saprobic index, quality class;
6. macrophytes: number of species, abundance.

Institute of Zoology also made this monitoring for scientific projects on territory of Republic of Moldova including Danube – Prut river basin.

III,3,2, Sampling design strategy, How do you choose sampling locations? How do you decide about temporal frequency of collecting samples?

Sampling strategy is elaborated individually for every project depends of tasks. As usual biological samples are planned for the Environmental risk assessment procedure and evaluation of the impact from polluted sites.

III,3,3, Which parameters of biota **quality**/**quantity** are measured ***in situ***?

No specific measurements in situ.

III,3,4, Which **instruments** are used for ***in situ*** measurements (include manufacturer and type)?

No specific measurements in situ

III,3,5, Please, describe **methodology** for ***in situ*** measurements,

No specific measurements in situ

III,3,6, Which **tools** are used for collecting samples for **laboratory** measurements (include manufacturer and type)?

No specific tools. Usual knifes, spoons, bottles are used for biological samples collection.

III,3,7, Please, describe a **methodology** for collecting samples for **laboratory** measurements,

Samples for hydrobiological measurements are made according to respective normative documents: SR EN 27828 ISO 7828 ”Calitatea apei. Metode de prelevarea biologic. Ghid pentru prelevarea macro-nevertebratelor bentice cu ciorpacul”; SM SR ISO 10230:2007. ”Calitatea apei. Măsurarea parametrilor biochimici”; GOST 17.13.07. – 82 Protection of Nature. Hydrosphere. Water Control Rules, M. 1982 (in Russian); Guidance on the methods of hydrobiological analysis of surface water and bottom sediments. Hydrometeoizdat. – Leningrad. 1983 (in Russian); Unified methods for the study of water. – M.1977 (in Russian).

Reference Methods and guides for HSs analysis in biological samples are indicated in table of cap I.6.

III,3,8, Please, describe a **transport** methodology for samples intended for laboratory measurements,

The transportation of collected samples is ASAP in field refrigerators

III,3,9, Do you **archive** samples? If yes, please describe how,

Yes, as usual laboratory leaves dried and homogenized biological samples for the collection. These samples are marked and stored in refrigerators.

[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 is treated according to the methodology of analysis: filtrated, conserved, extracted etc.
b) sediment samples are treated according to the respective recommendations for analytical methods: dried, sieved, homogenized, ashing;
c) biological samples are treated according to the respective methodologies for HSs analysis.

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

SOPs were elaborated according to ISO 17025 in accredited laboratory "GEOLAB" in Moldavian Accreditation System http://www.acreditare.md/public/files/registre/1-Registru-LI-28.12.2018.pdf . The list of SOP is presented in annex 1 (it is not translated).

IV,2,1, Organic matter, What is the **procedure** for **organic matter** content determination in water and sediment?

No TOC analyser for water samples. Soil and sediments are analyzed for organic matter by GOST 23740-2016 Methods for the determination of organic matter (in Russian). The content of organic matter (humus) in the soil is established by calcining to constant weight.

IV,2,2, ICP-MS, ICP-AES systems –

No such equipment in Institute of Geology and Seismology

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,

Equipment AAnalyst800, Perkin Elmer Inc, 2000 year production equipped by Plame, THGA and Hydride Generation System (FIAS400)

IV,2,3,2, Which **elements (HSs)** do you measure by AAS? Please, state **detection limits** for measured elements (HSs),

Detection Limit, Quantification Limit, and uncertainty for AAS, THGA

Soil, sediments			
Analit	**DL mcg/l**	**QL mcg/l**	**uncertainty**
Cu	2.06	6.86	0,084
Mn	0.73	2.43	0,141
Ni	9.3	30.9	0,088
Pb	5.94	18.0	0,016

Cr	0.86	2.86	0,078
Cd	0.03	0.15	0,103

AAS Flame

Soil, sediments			
Analit	**DL mcg/l**	**QL mcg/l**	**uncertainty**
Cu	0.10	0.40	0,056
Mn	0.10	0.47	0,14
Zn	0.08	0.26	0,175
Ni	0.40	1.20	0,088
Pb	1.0	3.40	0,141
Cr	0.36	1.19	0,078
Cd	1.0	3.40	0,105
Fe	0.15	0.44	0,114

AAS THGA

Water			
Analit	**DL mcg/l**	**QL mcg/l**	**uncertainty**
Cu	1.68	5.6	0.0191
Mn	0.73	2.43	
Ni	1.19	3.6	
Pb	0.83	2.5	
Cd	0.03	0.15	
Cr	0.94	2.86	
As	0.84	2.56	0,033
Se	0.995	3.02	0,0285

AAS Flame

Water			
Analit	**DL mcg/l**	**QL mcg/l**	**uncertainty**
Cu	0.143	0.43	0,0194
Mn	0.1	0.47	
Zn	0.08	0.26	
Ni	0.40	1.2	
Pb	2.0	6.8	
Mg	0.02	0.07	0,01937
Ca	0.15	0.5	
Cd	1.0	3.4	0,0194
Cr	0.36	1.19	
Fe	0.145	0.48	
Sr	0.81	2.7	
K	1.80	5.44	
Na	1.84	6.15	

IV,2,3,3, Please, describe **sample preparation and procedure** for AAS measurements (dissolution, radiation source, source temperature, wavelengths, etc.),

The analytical procedures are described in SOP elaborated in TL “GEOLAB”:

- SOP 5.4/26 Determination of Cu, Pb, Cd, Mn and Ni in water by electrothermal method.
- SOP 5.4/30 Heavy metal extraction from soil by microwave extraction system.
- SOP 5.4/33 Heavy metal extraction from soil by “Aqua Regia”.
- SOP 5.4/34 Determination of copper, lead, cadmium, manganese, nickel and zinc in water by flame atomization.
- SOP 5.4/36 Determination of cadmium, chromium, copper, lead, manganese, nickel and zinc in soils by flame atomization.
- SOP 5.4/38 Determination of cadmium, chromium, copper, lead, manganese, nickel and zinc in plants by flame atomization.
- SOP 5.4/39 Extraction of acids soluble forms of heavy metals from soil and sediments by nitric acid.
- SOP 5.4/45 Determination of calcium and magnesium in water and aqueous solutions by flame atomization.
- SOP 5.4/46 Determination of potassium and sodium in water and aqueous solutions by flame atomization (emission).
- SOP 5.4/47 Determination of strontium in water and aqueous solutions by atomization in a flame (emission).
- SOP 5.4/48 Method for determination of copper, zinc and lead in soils and sediments.
- SOP 5.4/50 Method for determination of heavy metals in bee products.
- SOP 5.4/51 Determination of selenium and arsenic in water and aqueous solutions by thermal atomization.

IV,2,3,4, How do you calculate **accuracy and precision** (references)?

1. SM SR ISO 5725:1-2002. Exactitatea (justeţea şi fidelitatea) metodelor de măsurare şi a rezultatelor măsurărilor. Partea 1. Principii generale şi definiţii
2. ISO 8466:1990 Water quality - Calibration and evaluation of analytical methods and estimation of performance characteristics.
3. ISO 8466:2001 Water quality - Calibration and evaluation of analytical methods and estimation of performance characteristics — Part 2: Calibration strategy for non-linear second order calibration functions.
4. ISO 11843-2:2000 Capability of detection — Part 2: Methodology in the linear calibration case
5. EURACHEM. Quantifying Uncertainty in Analytical Measurement. LGC, 1995. ISBN 0-948926-08-2.
6. Mandel J., The statistical analysis of experimental data, Interscience Publ., J. Wiley & Sons,(1964), New York
7. 2007 ALACC Guide “How to meet ISO 17025 requirements for method verification”
8. Test methodic validation. СТБ 1436-2004. Gosstandard, Minsk, 2004 (in Russian).
9. K. Doerfeli. The statistics in analytical chemistry. “Mir”, 1969 (in Russian).
10. A.G. Orlov. Calculation methods in quantitative spectral analysis.“Nedra”, 1977 (in Russian).

IV,2,4, XRF

No XRF equipment in Institute of Geology and Seismology

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?

The list of reference methods for HSs determination in different matrixes:
Water

Method abreviation	Method name (original language)
SM GOST R 51209:2006	Apă potabilă. Metoda de determinare a conţinutului de pesticide organoclorurate prin cromatografie gaz - lichid
SM SR EN ISO 6468:2007	Calitatea apei. Determinarea unor insecticide organoclorurate, bifenili policloruraţi şi clorobenzeni. Metoda prin cromatografie gaz-lichid
EPA Method 505	Analysis of Organohalide Pesticides and Commercial Polychlorinated Biphenyl (Pcb) Products in Water by Microextraction and Gas Chromatography
EPA Method 508	Determination of Chlorinated Pesticides in Water by gas Chromatography with an Electron Capture Detector
EPA Method 551	Determination of chlorination disinfection byproducts and chlorinated solvents in drinking water by liquid-liquid extraction and gas chromatography with electron-capture detection
EPA Method 525.3	Determination of Semivolatile Organic Chemicals in Drinking water by Solid Phase Extraction and Capillary Column Gas Chromatography/Mass Spectrometry (GC/MS)
EPA Method 1699	Pesticides in Water, Soil, Sediment, Biosolids, and Tissue by HRGC/HRMS
EPA 8081B	Organochlorine pesticides by Gas Chromatography
EPA Method 8100	Polynuclear aromatic hydrocarbons

EPA Method 8270d	Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)
EPA Method 8272	Parent and Alkyl Polycyclic Aromatics in Sediment Pore Water by Solid-Phase Microextraction and Gas Chromatography/Mass Spectrometry in Selected Ion Monitoring Mode
ISO 15680:2003	Water quality. Gas-chromatographic determination of a number of monocyclic aromatic hydrocarbons, naphthalene and several chlorinated compounds using purge-and-trap and thermal desorption
ISO 28540:2011	Water quality - Determination of 16 polycyclic aromatic hydrocarbons (PAH) in water -- Method using gas chromatography with mass spectrometric detection (GC-MS)
EPA Method 8020A	Aromatic Volatile Organics by Gas Chromatography
EPA Method 8015C	Nonhalogenated Organics by Gas Chromatography
EPA Method 524.3	VOCs by GC/MS
ISO 11423-1:1997	Water quality - Determination of benzene and some derivatives - Part 1: Head-space gas chromatographic method
ISO 17943:2016	Water quality -- Determination of volatile organic compounds in water -- Method using headspace solid-phase micro-extraction (HS-SPME) followed by gas chromatography-mass spectrometry (GC-MS)
EPA Method 527	Determination of selected pesticides and flame retardants in drinking water by solid phase extraction and capillary column gas chromatography/mass spectrometry (GC/MS)
EPA Method 526	Determination of selected semivolatile organic compounds in drinking water by solid phase extraction and capillary column gas chromatography/ mass spectrometry (GC/MS)
EPA Method 619	The determination of triazine pesticides in municipal and industrial wastewater

Solid samples (soil, sediments,waste, biological objects)

Method abreviation	Method name (original language)
SM SR ISO 10382:2012	Calitatea solului. Determinarea pesticidelor organoclorurate şi a bifenililor policloruraţi. Metoda gaz cromatografică cu detecţie prin captură de electroni
ISO 10382:2002	Soil quality -- Determination of organochlorine pesticides and polychlorinated biphenyls -- Gas-chromatographic method with electron capture detection
EPA Method 1699	Pesticides in Water, Soil, Sediment, Biosolids, and Tissue by HRGC/HRMS
EPA 8081B	Organochlorine pesticides by Gas Chromatography
GOST 30349-96	Плоды, овощи и продукты их переработки. Методы определения остаточных количеств хлорорганических пестицидов

EPA Method 608	Organochlorine Pesticides and PCBs
EPA Method 617	The Determination of Organohalide Pesticides and PCBs in Municipal and Industrial Wastewater
EPA Method 8270d	Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)
ISO 18287:2006	Soil quality -- Determination of polycyclic aromatic hydrocarbons (PAH) -- Gas chromatographic method with mass spectrometric detection (GC-MS)
EPA Method 8270d	Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)
ISO/CD TR 24054	Animal and vegetable fats and oils - Determination of polycyclic aromatic hydrocarbons (PAH) - Method using gas chromatography/mass spectrometry (GC/MS)
EPA Method 5021	Volatile organic compounds in soils and other solid matrices using equilibrium headspace analysis
EPA Method 8260B	Volatile organic compounds by gas chromatography/mass spectrometry (GC/MS)
EPA Method 624	Methods for organic chemical analysis of municipal and industrial wastewater. Purgeables

IV,2,7,2, **Which organic compounds (HSs)** do you measure?
Please, state **detection limits** for measured organic compounds (HSs),

The list of detection limits for organic HSs

Analite	**DL(mcg/л)**	**QL (mcg/l)**	**uncertainty**
α HCH	0,003	0,008	0,071
β-HCH	0,014	0,041	0,0718
γ-HCH	0,004	0,012	0,0709
PCB18	0,039	0,117	0.0795
PCB28	0,04	0,125	0.0715
PCB31	0,057	0,173	0.0909
Heptachlor	0,003	0,009	0,071
PCB52	0,047	0,143	0.1099
Aldrin	0,012	0,037	0,0708
PCB44	0,040	0,123	0.1312
Heptaclor epoxid izomer B	0,016	0,047	0,0708
PCB101	0,039	0,118	0.1105
4,4-DDE	0,013	0,041	0,0707
endrin	0,014	0,042	0,0709
2,4-DDD	0,043	0,130	0,0708
PCB149	0,100	0,333	0.0716
PCB118	0,080	0,241	0.0891
4,4-DDD	0,025	0,077	0,0710

2,4-DDT	0,014	0,041	0,0711
PCB154	0,058	0,175	0.0739
4,4-DDT	0,021	0,065	0,0712
PCB138	0,030	0,092	0.0777
PCB180	0,05	0,151	0.0777
PCB194	0,069	0,208	0.0815

IV,2,7,3, How do you calculate **accuracy and precision** (references)?

1. SM SR ISO 5725:1-2002. Exactitatea (justeţea şi fidelitatea) metodelor de măsurare şi a rezultatelor măsurărilor. Partea 1. Principii generale şi definiţii
2. ISO 8466:1990 Water quality - Calibration and evaluation of analytical methods and estimation of performance characteristics.
3. ISO 8466:2001 Water quality - Calibration and evaluation of analytical methods and estimation of performance characteristics — Part 2: Calibration strategy for non-linear second order calibration functions.
4. ISO 11843-2:2000 Capability of detection — Part 2: Methodology in the linear calibration case
5. EURACHEM. Quantifying Uncertainty in Analytical Measurement. LGC, 1995. ISBN 0-948926-08-2.
6. Mandel J., The statistical analysis of experimental data, Interscience Publ., J. Wiley & Sons,(1964), New York
7. 2007 ALACC Guide “How to meet ISO 17025 requirements for method verification”
8. Test methodic validation. СТБ 1436-2004. Gosstandard, Minsk, 2004 (in Russian).
9. K. Doerfeli. The statistics in analytical chemistry. “Mir”, 1969 (in Russian).
10. A.G. Orlov. Calculation methods in quantitative spectral analysis.“Nedra”, 1977 (in Russian).

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,

The list of Moldavian accredited laboratories, where HSs are analyzed, is presented in national language on site http://www.acreditare.md/public/files/registre/1-Registru-LI-28.12.2018.pdf

The extract from this list of accredited laboratories in Moldavian system of accreditation, where HS are analyzed, is presented below:

Nr	Laboratory name in national language	Laboratory name in English	Adress, contact person	Accreditation area
1	LÎ a Produselor	TL Food Products of	MD-2051, mun. Chişinău str.	Animal

	Alimentare de Origine Animală din cadrul I.P. „Centrul Republican de Diagnostică Veterinară” (CRDV)	Animal Origin of Republican Center for Veterinary Diagnosis	Murelor, 3, Curchi Diana crdv@rambler.ru, curchi_diana@mail.ru	products
2	Centrul investigaţii ecologice al Agenţiei Ecologice Chişinău	Ecological Investigation Center of the Chişinău Ecological Agency	MD-2028, mun. Chișinău, Str. Gh. Tudor, 3, Leahu Arcadie, arcadieleahu@gmail.com	Environmental objects
3	Centru investigaţii ecologice al Agenţiei Ecologice Cahul	Ecological Investigation Center of Cahul Ecological Agency	MD-3901, or. Cahul, Șos. Grivitei,26 Zagorscaia Natalia labinc@mail.ru	Environmental objects
4	Centru investigaţii ecologice al Agenţiei Ecologice Balti	Ecological Investigation Center of Balti Ecological Agency	MD-7106, or. Otaci, str. Uzinelor ,5a Gandzii Raisa rgandzii@gmail.com	Environmental objects
5	Centrele Monitoring al Serviciului Hidrometeorologic de Stat	Monitoring Centers of the State Hydrometeorological Service	MD-2043, mun. Chişinău str. Grenoble, 134, Gîlcă Gavril, hidrometeo@meteo.gov.md www.meteo.md	Environmental objects
6	Laboratorul ape uzate agenţi economici al SA „Apă–Canal Chişinău”	Waste Water Laboratory of the "Apă-Canal" SA, Chisinau	MD-2005, mun. Chişinău str. Albişoara, 38, Ghirghiligiinic Nelli, lauae.sl@gmail.com acc@mtc.md www.acc.md	Waste water
7	LÎ „Atestarea şi controlul calităţii pesticidelor” din cadrul Centrului de Stat pentru Atestarea şi Omologarea produselor de uz fitosanitar şi al Fertilizanţilor	TL Certification and Quality Control of Pesticides of the State Center for the Attestation and Approval of Phytosanitary and Fertilizer Products	MD-2032, mun. Chişinău str. Sarmizegetusa, 16a, Sireţanu Ludmila centrulp@mtc.md www.pesticide-md.com	Plant protection products
8	LÎ apa potabilă al SA ,,Apă-Canal Chişinău”	TL Potable Water of “Apa-Canal” SA, Chisinau	MD-2046, or. Vadul lui Vodă, str. Ştefan cel Mare, 153, Elena Vasiliu, evasiliu@acc.md elenavasiliu@yandex.ru	Potable water
9	Laboratorul apă uzată Serviciul Exploatarea Staţiilor de Epurare al SA „Apa–Canal Chişinău”	Waste Water Laboratory of the Wastewater Treatment Plant of "Apa-Canal Chişinău"	MD-2002, or. Chişinău str. Lunca Bîcului, 24, Sireteanu Diana, lausese@acc.md	Waste water
10	LÎ produse agroalimentare al ÎS „Centrul de Metrologie Aplicată şi Certificare”	TL Agro-food products of the "Applied Metrology Center and Certification"	MD-2002, mun. Chişinău str. Munceşti, 162a, Cecico Galina, office@cmac.md cegalka@inbox.ru	Agro-food products, cosmetics, materials and clothing for wooden constructions (radiology)

11	Laboratorul de spectroscopie atomică al Institutului de Chimie	Laboratory of Atomic Spectroscopy of the Institute of Chemistry	MD-2028, mun. Chişinău str. Academiei, 3, Mitina Tatiana ichem@asm.md mitina_tatiana@mail.ru	Potable water
12	Laboratorul de Încercări ,,Geolab" din cadrul Institutului de Chimie	Test Laboratory "GEOLAB" of Institute of Chemitsry	MD-2028, mun. Chişinău str. Academiei, 3, Bogdevici Oleg, bogdevicholeg@yahoo.com	Environmental objects

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 internationals projects which had developed the Protocols,

The intercomparison and intercalibration protocols were developed according to the inctruction of the organizers. Test laboratory "GEOLAB" participated in national schemes of intercomparison exercises (IE). The list of these exercises is presented below.

Name of IE	Object	Methods	Name of IE organizers	Year of participation	Result
Determination of cadmium, copper, nickel, iron, lead, manganese, chromium, zinc	Soil, rocks, plants	SM SR ISO 11047:2006	Institute of Chemistry	2016	Positive
Determination of organochlorinated pesticides and polychlorobiphenyls	Soil, rocks, plants	SM SR ISO 10382:2012	Institute of Chemistry	2016	Positive
Determination of ammonia and nitrite content	Water	GOST 4192-82	Institute of Chemistry	2016	Positive
Determination of nitrate content	Water	GOST 18826-73	Institute of Chemistry	2016	Positive
Determination of sulphates, hardness, chloride, bicarbonates	Water	GOST 4389-72; GOST 4151-72; GOST 4245-72; GOST 23268.3-78; SM SR EN ISO 9963-1:2007	Institute of Chemistry	2016	Positive
Determination of Calcium and Magnesium	Water	SM SR EN ISO 7980:2012; GOST 23268.5-78	Institute of Chemistry	2016, 2017	Positive
Determination of Chromium	Water	SM ISO 9174:2014	Institute of Chemistry	2016, 2018	Positive
Determination of strontium	Water	GOST 23950-88	Institute of Chemistry	2018	Positive
Determination of Sodium and Potassium	Water	GOST 23268.6-78; GOST	Institute of Chemistry	2016, 2018	Positive

		23268.7-78			
Determination of organochlorinated pesticides and polychlorobiphenyls	Water	SM GOST R 51209:2006, SM SR EN ISO 6468:2007	Institute of Chemistry LGC Aquateck	2016, 2017	Positive
Determination of organochlorinated pesticides and polychlorobiphenyls	Raw materials and food	SM SR EN ISO 16468:2014; GOST 30349-96	LGC Aquateck	2018	Positive
pH determonation	Water	SM SR EN ISO 10523:2014	Institute of Chemistry	2016, 2018	Positive
Dry residue determination	Water	GOST 18164-72	Institute of Chemistry	2016, 2018	Positive

[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,),

The threshold values for soil were set for our territory after the analysis of publications about the analysis of trace elements in different objects. This work was made in Soviet time for all regions of former UdSSR including Republic of Moldova. Other source for trace elements threshold value evaluation is reference sources as Klark values.

The organic HSs should to be on zero level, because it is artificial substances.

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

The threshold value were evaluated for different type of soil depends of granulometric and organic content.

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

Yes, the additional analysis is made: granulometry, organic content

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?

The total content and different mobility forms of inorganic HSs were analysed for different type of soils for our area in the past.

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

No reflects. It is studied in scientific projects and publications.

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

Yes, our legislation determines classes for water objects.

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

Classes of water objects are determined in GOVERNMENT DECISION Nr. 890 from 12.11.2013 for the approval of the “Regulation on Environmental Requirements for Surface Waters”

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

The algorithm is described in GOVERNMENT DECISION Nr. 890 from 12.11.2013 for the approval of the “Regulation on Environmental Requirements for Surface Waters

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

No specific definition in legislative documents.

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

Yes, we relate specific HSs contamination with specific pollution sources: agriculture, industry, polluted sites, dups, etc. The desktop analysis of the history of landuse, location of possible pollution sources etc.

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

The actions are information of local and central authorities, owners of studied site, populations. The respective institutions calculate taxes for polluters, if it is determined.

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?

The mode of the presentation are different:

- Form of the approved test report for beneficiary of analysis;
- Scientific presentation;
- Simple presentation for population and civil society

Does the report include methodology, full results, QA/QC, models? Are these results public or can be obtained by request?

Reports by specific projects financed from public sources are available free from internet. Test report of the private beneficiary is available after the permission of the beneficiary. Scientific publication are available depends of publishing rules.

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

The specific procedure of Environmental Risk Assessment is elaborated by our scientific group for polluted sites study on the base of the compilation of recommendations from different guides.

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

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G. Allen Burton (2002) Sediment quality criteria in use around the world. Limnology, 3: 65-75.

Canadian Sediment Quality Guidelines for the Protection of Aquatic Life. Canadian Council of Ministers of the Environment 1995 CCME EPC-98E http://ceqg-rcqe.ccme.ca/download/en/226/

Canadian Sediment Quality Guidelines for the Protection of Aquatic Life, Summary Tables https://www.elaw.org/system/files/sediment_summary_table.pdf

GOVERNMENT DECISION Nr. 934 from 15.08.2007 on the establishment of the Automated Information System "State Register of natural mineral and potable waters, and bottled non-alcoholic beverages. http://www.amac.md/Biblioteca/data/30/02/04.1.pdf

GOVERNMENT DECISION Nr. 931 from 20.11.2013 for the approval of the "Regulation on Groundwater Quality Requirements. http://www.amac.md/Biblioteca/data/30/02/27.1.pdf

GOVERNMENT DECISION Nr. 890 from 12.11.2013 for the approval of the “Regulation on Environmental Requirements for Surface Waters”. http://www.amac.md/Biblioteca/data/30/02/28.1.pdf

GOVERNMENT DECISION Nr. 950 from 25.11.2013 for the approval of the “Regulation for the collection, treatment and discharging of waste water into sewerage systems and / or water bodies for urban and rural localities”. http://www.amac.md/Buletine/Buletin_10.pdf

GOVERNMENT DECISION Nr. 932 for the approval of the “Regulation on the monitoring and systematic evidence of the status of surface waters and groundwater”.
http://www.amac.md/Biblioteca/data/30/02/30.1.pdf.

Ministry of Environment and Territory Arrangement Regulation Nr. 100 from 18.01.2000 “Indication on the estimation of environmental damages” publicated 05.09.2000 in Oficial Monitor nr. 112 – 114.
http://amac.md/Biblioteca/data/03/02.14.1.pdf

Ministry of Environment and Natural Resources, Instruction nr. 383 from 08.08.2004 for the Evaluation of the demage caused to soil resorces. http://lex.justice.md/index.php?action=view&view=doc&id=310719

Rachel Thompson and Hannah Wasserman, Sediment Quality Guidelines (SQGs): A Review and Their Use in Practice https://www.geoengineer.org/education/web-based-class-projects/geoenvironmental-engineering/sediment-quality-guidelines-sqgs-a-review-and-their-use-in-practice?showall=1&limitstart=

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http://www.meteo.md/images/uploads/pages_downloads/Anuar_Sol_2015.pdf

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http://www.meteo.md/images/uploads/pages_downloads/Anuar_biologie_2015.pdf

Stuart L Simpson, Graeme E Batley, Anthony A Chariton, Jenny L Stauber, Catherine K King, John C Chapman, Ross V Hyne, Sharyn A Gale, Anthony C Roach, William A Maher Handbook for Sediment Quality Assessment, Centre for Environmental Contaminants Research,
http://www.clw.csiro.au/publications/cecr/handbook_sediment_quality_assessment.pdf