Action Programme to Improve Transboundary Cooperation and Sustainable Management of the Dniester River Basin (Dniester – III)

Transboundary monitoring of the Dniester River
Assessment and evaluation

ENVSEC Initiative

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Abbreviations and acronyms

BOD_5	biochemical oxygen demand, five days
BOD_{full}	biochemical oxygen demand, full (twenty days)
Cd	cadmium
CEN	European Committee for Standardization
CHE	Centre of Hygiene and Epidemiology
COD	chemical oxygen demand
COD_{Cr}	chemical oxygen demand, potassium dichromate ($K_2Cr_2O_7$) method
CPM	Centre of Preventive Medicine
Cu	copper
Cl	chloride
DPBA	Dniester-Prut Basin Administration
EI	Environmental Inspectorate
ENVSEC	Environment and Security initiative
EQS	environmental quality standard
EU	European Union
Fe	iron
GC	gas chromatograph
HC	Hydrometeorological Centre
HCBSSA	Hydrometeorological Centre for the Black Sea and the Sea of Azov
ISO	International Standards Organisation
LC	liquid chromatograph
MAC	maximum allowable concentration
MD	Moldova
Mn	manganese
MS	mass spectrometry
NH_4	ammonium
NO_2	nitrite
NO_3	nitrate
NSPCPM	National Scientific Practical Centre of Preventive Medicine
O_2	dissolved oxygen
OSCE	Organisation for Security and Co-operation in Europe
Pb	lead
PO_4	ortho-phosphate
RBMP	river basin management plan
SCWM	State Committee on Water Management
SES	Sanitary-epidemiological Service
SHS	State Hydrometeorological Service
SO_4	sulphate
UA	Ukraine
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
WFD	Water Framework Directive
Zn	zinc

Acknowledgements

This report could not have been prepared without the information obtained during the interviews. Therefore, we would like to thank all interviewees for their willingness to share their expertise and knowledge, while making -often: scarce- time available for the meetings. Most information would not have been received properly without the help of our interpreters, who not always had an easy task during the vivid discussions. We also would like to thank our local co-ordinators for arranging the meetings and other logistical support.

Furthermore, we would like to thank the participants of the 4th meeting of the Dniester-III project in Odessa, June 2010, and the people who submitted written comments to the draft report for their feedback.

Preface

Evidently sound decisions need good information. Yet until recently there had been no systematic assessment of monitoring of the Dniester as a transboundary basin. This report was prepared within the Dniester III project of the Environment and Security initiative (ENVSEC) in order to map directions for how monitoring of the Dniester can be improved to better protect and manage natural resources of the basin. We hope that this work will help continue and strengthen cooperation between Moldova and Ukraine in resolving Dniester environmental problems.

Nickolai Denisov, Regional desk officer for Eastern Europe Environment and Security initiative

1 Introduction

In international river basins, countries often are aligned in an upstream-downstream direction. The Dniester River is a specific case from this point of view; Ukraine and Moldova are both their upstream and downstream neighbours[1].

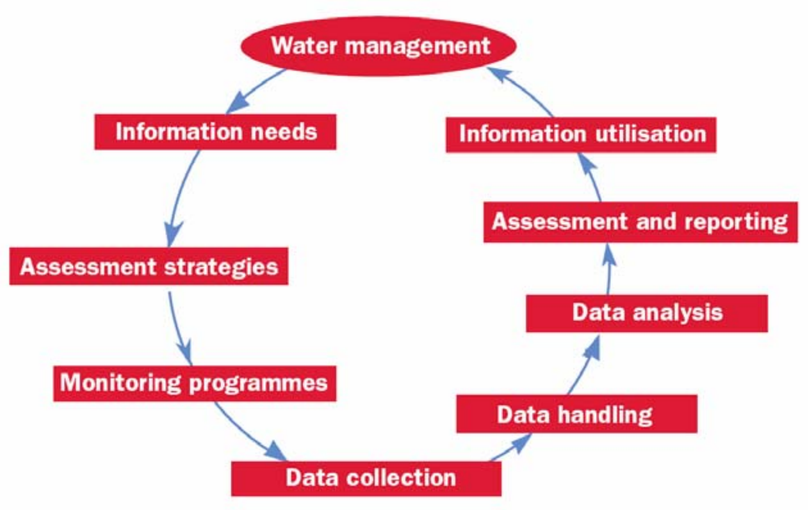
A good example of mutual dependency is the abstraction of water from the Dniester River for the preparation of drinking water. In Ukraine, water is abstracted from the Dniester River at Mitkiv (for the drinking water supply of Chernivtsi) and Prigorodok (drinking water supply Khatin). Moldova abstracts water near Soroca for the drinking water supply to the towns of Soroca and Bălți. The Dniester River is furthermore a source for drinking water of Chişinău. After returning into Ukrainian territory, river water is abstracted at Belyaevka for the drinking water supply of, among others, the city of Odessa.

Other shared interests concerning the Dniester River include fishery, recreation, irrigation, ecosystem functioning, hydropower generation and flood prevention/control.

1.1 Monitoring and management

The above settings emphasise the need for joint management of the Dniester River Basin. Monitoring the water quality and -quantity is an essential tool for river basin management. This is clearly illustrated in the Monitoring Cycle [UNECE, 2000][2,3].

Figure 1 UNECE Monitoring Cycle



[1] As well as adjacent neighbours along the upstream border.
[2] The United Nations Economic Commission for Europe (UNECE) has published a series of guidelines concerning monitoring of transboudary surface waters and groundwaters. These guidelines are to support countries in fulfilling their tasks and obligations under the CONVENTION ON THE PROTECTION AND USE OF TRANSBOUNDARY WATERCOURSES AND INTERNATIONAL LAKES (done at Helsinki, on 17 March 1992). Ukraine and Moldova have ratified and are Parties to the Convention.
[3] Despite the UNECE using 'Monitoring cycle' as the overall qualifier, not the whole Monitoring cycle is about monitoring. The cycle first of all positions "monitoring" in a broader context. The underlying study mainly focuses on the "Monitoring programmes" component of the monitoring cycle, while providing with links to other components.

Monitoring can provide water managers with information like: is the water quality of the river such that it can be used for drinking water preparation; is the water quality safe for bathing; are certain fish species still present; what is the flow of the river during the summer; et cetera, et cetera. Monitoring furthermore can provide feedback to water managers about the effectiveness of their river basin mangement plans. For example, did the river water quality indeed improve because of the programme of measures?

Transboundary river basins add some specific information needs. This can range from a rather straightforward question like "is the pollution caused by the neighbouring country?" to "did we achieve the jointly agreed water quality targets?".

1.2 Transboundary monitoring

Within the context of the underlying report, transboundary monitoring refers to monitoring at transboundary locations. Sections where the river crosses the territory of the one country to the other country are of special interest, if only as a reference point. It is of utmost importance that the monitoring programmes of the neighbouring countries at such sections will produce comparable results[4]. The latter furthermore instigates mechanisms for exchanging data and information in order to be able to verify whether results indeed are comparable.

It is obvious that monitoring at the transboundary locations/sections does not suffice for monitoring of a transboundary water body like the Dniester River as a whole. Furthermore, monitoring at transboundary locations cannot be considered in isolation from the rest of the (national) surface water monitoring programmes. The time and resources available for the underlying study did not allow for an evaluation of the overall national surface water monitoring programmes for the Dniester River. Nevertheless, several findings of the underlying study could be transposed as such.

1.3 Study objective

The project "Transboundary cooperation and sustainable management in the Dniester River Basin" was launched in 2004. The project is implemented by OSCE, UNECE and UNEP in close collaboration with authorities and NGOs from Moldova and Ukraine. The aim of the project is to improve cooperation between Moldova and Ukraine on joint management of the Dniester River basin[5]. Meanwhile, the programme has reached its third stage. In 2009, "Phase III - Implementation of the Action Programme" (Dniester III) was started in the framework of the international Environment and Security initiative. The underlying study has been initiated in the framework of Dniester-III.

The major objective of this study is to identify gaps between the current transboundary monitoring of Dniester River, versus the needs and expectations from the perspective of transboundary management of the Dniester basin.

The results of this assessment can become a basis for future enhancement of the Moldovan and Ukrainian monitoring programmes and cooperation on the Dniester. They can also provide inputs to Dniester III Working Groups, in particular on information exchange and sanitary-epidemiological

[4] From a monitoring (and assessment) point of view, stretches where the river is actually the boundary between two countries introduce some additional complications.
[5] Refer to http://dniester.org/ for more details.

cooperation, as well as to the planning of activities towards adaptation to climate change and the management of extreme floods.

1.4 Approach

In order to obtain up-to-date information, it was decided to conduct interviews among a wide audience of stakeholders. Annex 5 contains the list of organisations and people interviewed; the itinerary is included in Annex 6. Interviewees remained co-operative by providing additional information requested also after the interviews. Furthermore, knowledge and experiences obtained in other projects[6] in the region were used while compiling this report.

A summary of the draft report has been presented and discussed during the 4th meeting of the Dniester-III project in Odessa, June 2010. Written comments were submitted by the State Hydrometeorological Service, Chernivtsi and the Odessa National I.I. Mechnikov University. To the possible extent these comments were taken into consideration while finalising the report.

1.5 Report outline

Chapter 2 provides basic information about the Dniester Basin, the organisations involved in monitoring the river, and bilateral agreements that involve joint monitoring. Chapter 3 gives an overview of key features of the monitoring in/near the transboundary sections of the Dniester River. These monitoring programmes are assessed in Chapter 4, which furthermore includes a series of topics and issues that were raised during the interviews. Chapter 5 is used for a discussion of the overall findings and observations of the underlying study. The main conclusions and recommendations are summarised in Chapter 6.

[6] Notably the EU Tacis projects “Technical assistance for the Lower Dnister River Basin Management Planning” and “Water Governance in the western EECCA”.

2 General information

2.1 The Dniester River Basin

The Dniester River[7] has its source in the Carpathian Mountains in Ukraine, flowing south and east along the territory of Moldova, and re-entering Ukraine near the Black Sea coast. The Dniester Basin is surrounded by the Carpathian Mountains from the west. From the north-west, north, southeast and west, the Basin is limited by the Sano-Dniester, Rostochie, Dniester-Bug, Dniester-Prut and Dniester-Black Sea water divides. The upper and lower reaches of the Dniester River flow within Ukraine over the total length of 629 km, a 225 km river section is shared between Ukraine and Moldova, and 475 km of its length lie within the borders of Moldova.

Figure 2 The Dniester Basin

The total population in the basin amounts to nearly 8 million inhabitants. About 65% of the total population in the Dniester basin lives inside Ukraine.

[7] Much of the information incorporated in this chapter has been derived from the report "Transboundary Diagnostic Study for the Dniester River Basin" [OSCE/UNECE, 2005].

Intermezzo: the Transnistrian Region of the Republic of Moldova

Moldova faces a still unresolved territorial conflict. The area situated at the left bank part of the Dniester River claims autonomy and independence of the Republic of Moldova (some of the area, including the city of Bendery, is situated at the right bank). The *Pridnistrovskaia Moldavskaia Respublica*, however, is not acknowledged as an independent state by the international community.

Out of 2.7 mln inhabitants living inside the Dniester Basin part of Moldova, about 555 thousand inhabitants[8] (or 20%) live in the Transnistrian Region, with larger cities like Tiraspol and Bender situated relatively close to the Ukrainian part of the Lower Dniester. The Kuchurgan lyman is a transboundary water with Ukraine, with the MGRES Power Plant situated in the town of Dnistrovsk.

In practice, the Transnistrian Region of Moldova falls outside the reach of the authorities in Chisinau, including laws and policies in the sphere of water management. Any arrangements agreed with and by Moldova's government will not automatically be effectuated in the Transnistrian Region.

The basin's hydrographic network is dominated by over 14,000 small rivers, which are up to 10 km long. The lack of large tributaries and presence of numerous small streams is a characteristic hydrographic feature of the Dniester Basin. The river network densities vary significantly across the Basin.

Two major reservoirs, Dnistrovsky and Dubasari, have been constructed in the middle reaches of the Dniester River. The *Dnistrovsky reservoir* is one of the largest hydropower reservoirs constructed in Ukraine in the 1980s to regulate the Dniester flow, first on a yearly basis, with subsequent transition to a multi-year flow regulation pattern. The reservoir has a length of 204 km, extending along the narrow, canyon-shape valley with steep banks. The reservoir has a full storage capacity of 3 km^3 and effective storage capacity of 2 km^3. The *Dubasari Reservoir* is located 351 km from the river mouth, with the associated upstream catchment area of 53,590 km^3. The 128 km long Dubasari reservoir (established in 1954) is located within the borders of Moldova, between the Camenca village and Dubasari town. It has an area of 68 km^2, with a full storage capacity of 0.5 km^3 and effective storage capacity of 0.2 km^3.

2.2 Major governmental organisations involved in monitoring of the Dniester River

2.2.1 Ukraine

MINISTRY OF ENVIRONMENT AND NATURAL RESOURCES

Surface water monitoring is conducted by the Ecological Inspectorates (until recently, parts of Ecology Departments) in the various oblasts[9]. The Ecological Inspectorates take care of the actual sampling and analysis, the latter comprising physico-chemical parameters.

[8] http://www.pridnistrovie.net/2004census.html

[9] The Ecological Inspections used to be part of the Ecology Departments, but became independent about two years ago.

MINISTRY OF EMERGENCY SITUATIONS AND CHERNOBYL AFFAIRS

The State Hydrometeorological Service (SHS) conducts surface water monitoring for the following parameters: physico-chemical, hydrobiological, radiological and hydrological parameters. Monitoring is conducted by the departments in each of the oblasts.

MINISTRY OF HEALTH

Monitoring of surface waters is conducted by the State Sanitary-Epidemiological Services (SES) in each of the oblasts. Analyses include physico-chemical parameters, bacteria, parasites and viruses.

STATE COMMITTEE ON WATER MANAGEMENT

The surface water monitoring programmes of the State Committee on Water Management (SCWM) comprises both quality (physico-chemical parameters) and quantity (water levels). The actual monitoring is conducted by the departments in the various oblasts.

2.2.2 Moldova

MINISTRY OF ENVIRONMENT

The State Hydrometeorological Service (SHS) in Chisinau is the major organisation within the Ministry of Environment involved in the monitoring of surface waters. The monitoring programmes include physico-chemical, hydrobiological and hydrological parameters.

The State Environmental Inspectorate also takes samples from surface waters. However, this sampling focuses on locations with discharges of wastewater. For the purpose of compliance checking, surface water samples are taken upstream and downstream the wastewater discharge.

MINISTRY OF HEALTH

Surface water monitoring is conducted by the regional Centres of Preventive Medicine (CPM). The monitoring activities are co-ordinated by the National Scientific Practical Centre of Preventive Medicine (NSPCPM) in Chisinau, which also conducts sampling and analysis. The laboratory of the NSPCPM is equipped for more advanced analyses; the regional CPM laboratories are capable to analyse more basic sets of parameters. Overall analyses include physico-chemical parameters, bacteria, parasites and viruses.

THE TRANSNISTRIAN REGION

The Hydrometeorological Centre (HC) in Tiraspol maintains eight posts along the Dniester River and six posts along the various tributaries. The monitoring programme includes both hydrological (water level) and, since January 2010, physico-chemical quality elements.

The Centres of Hygiene and Epidemiology (CHE) analyse water samples for physico-chemical parameters, bacteria, parasites and viruses. None of the sites sampled by the CHEs are situated in the border zones between Moldova and Ukraine.

2.3 Bilateral agreements

2.3.1 Agreement on the Joint Management and Protection of the Cross-Border Waters

In 1994, the Agreement between the Government of the Republic of Moldova and the Government of Ukraine on the Joint Management and Protection of the Cross-Border Waters was signed. Article 6 of this agreement contains several provisions in relation to monitoring and data exchange (see textbox below).

Intermezzo: Article 6 of the 1994 Agreement

The competent authorities of the Contracting Parties define the principles of cooperation with respect to the regular exchange of information, hydrological and water quality forecasts for cross-border water systems; and specify the scope and programme of measurements and observations, relevant measurement techniques and data processing methods, locations and timeframes for these activities.

To facilitate the assessment of water quality and monitoring of pollution levels on the basis of the agreed upon list of parameters and monitoring programme, each Contracting Party shall organize and undertake monitoring in the jointly identified monitoring locations within the cross-border sections.

The Contracting Parties shall jointly identify the list of locations and water quality parameters, for which the organization of monitoring is deemed feasible. The lists of specified monitoring locations and water quality parameters may be updated and amended by the Contracting Parties.

Within three months following the entry into force of the present Agreement, the Contracting Parties shall develop and agree upon the common monitoring programme, unified analytical techniques and methods for the assessment of actual water quality and trends in order to ensure the comparability of monitoring data on cross-border water quality. The programme and relevant methodological framework shall specify the locations, timing and frequency of water sampling activities, analytical techniques, and methods for assessing the actual water quality and trends.

In the event of water contamination due to emergency situation, the Contracting Parties shall immediately notify each other and take all necessary measures within their respective jurisdictions in order to eliminate the causes of such contamination and minimize associated damage.

2.3.2 Regulation of the Ukrainian-Moldovan cooperation on water and environmental monitoring and control of water quality

The Regulation *of the Ukrainian-Moldovan cooperation on water and environmental monitoring and control of water quality* has been established in accordance with Article 6 of the 1994 Agreement. The annexes of this Regulation contain, among others: a list with sampling locations (including tributaries) and sampling frequencies, a template for reporting the results of analysis, a list with water quality indicators with five classes of concentrations for classification purposes, and a list with methods of analysis. Annual reports are published, separately for Moldova and Ukraine.

The following organisations participate in the sampling and analysis:

- Ukraine
  - Dniester-Prut Basin Administration (SCWM)
  - Odessa Regional Water Management Department (SCWM)
- Moldova
  - State Hydrometeorological Service

In 2009, the organisations managed to conduct joint sampling four times, upstream at Mohyliv-Podil's'kyi and downstream in the neutral zone Palanca-Mayaki at km 48 of the road Odessa – Reni.

2.3.3 Regulation on cooperation on sanitary-epidemiological control of water quality in the transboundary Moldovan-Ukrainian section of the Dniester River basin and the transboundary rivers of the Black Sea basin

The preparation of the (draft) Regulation *on cooperation on sanitary-epidemiological control of water quality in the transboundary Moldovan-Ukrainian section of the Dniester River basin and the transboundary rivers of the Black Sea basin* commenced in the Dniester-II project and is expected to be finalised under Dniester-III project . The Regulation is based on Article 6 of the Agreement between the Cabinet of Ministers of Ukraine and the Government of the Republic of Moldova on the Joint Management and Protection of the Cross-Border Waters signed on October 19, 1994, the Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Helsinki, 1992) and the Health and Environment Protocol (London, 1999).

In broad lines, the contents follow the regulation mentioned above in section 2.3.2, but differ in several details. For example, other lists with parameters and assessment criteria are inserted, tailored to the specific sanitary/hygienic tasks of the participating health organisations.

The following organisations participate in the sampling and analysis:

- Ukraine
  - Sanitary-epidemiological Services of Chernivtsi, Vinnitsa (upstream) and Odessa (downstream)
- Moldova
  - National Scientific Practical Centre of Preventive Medicine, Chisinau (both upstream and downstream), plus the Centre of Preventive Medicine in Ocnița, Soroca (upstream) and Ştefan-Vodă (downstream)
  - Centre of Hygiene and Epidemiology, Tiraspol (downstream)

In the past years, several joint sampling campaigns have been conducted; the last three took place in December 2009, February and April 2010.

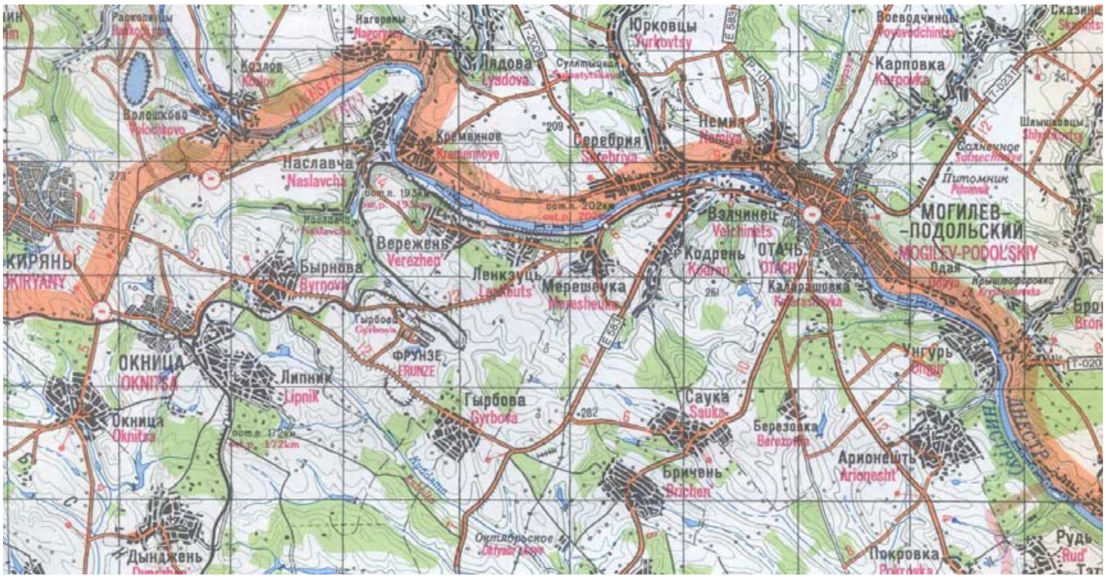
3 Overview of the current monitoring programmes in the transboundary zones

This chapter provides an overview of the following key features of the monitoring in/near the transboundary zones of the Dniester River: sampling locations, organisations, parameters, and sampling frequencies.

3.1 Upstream border

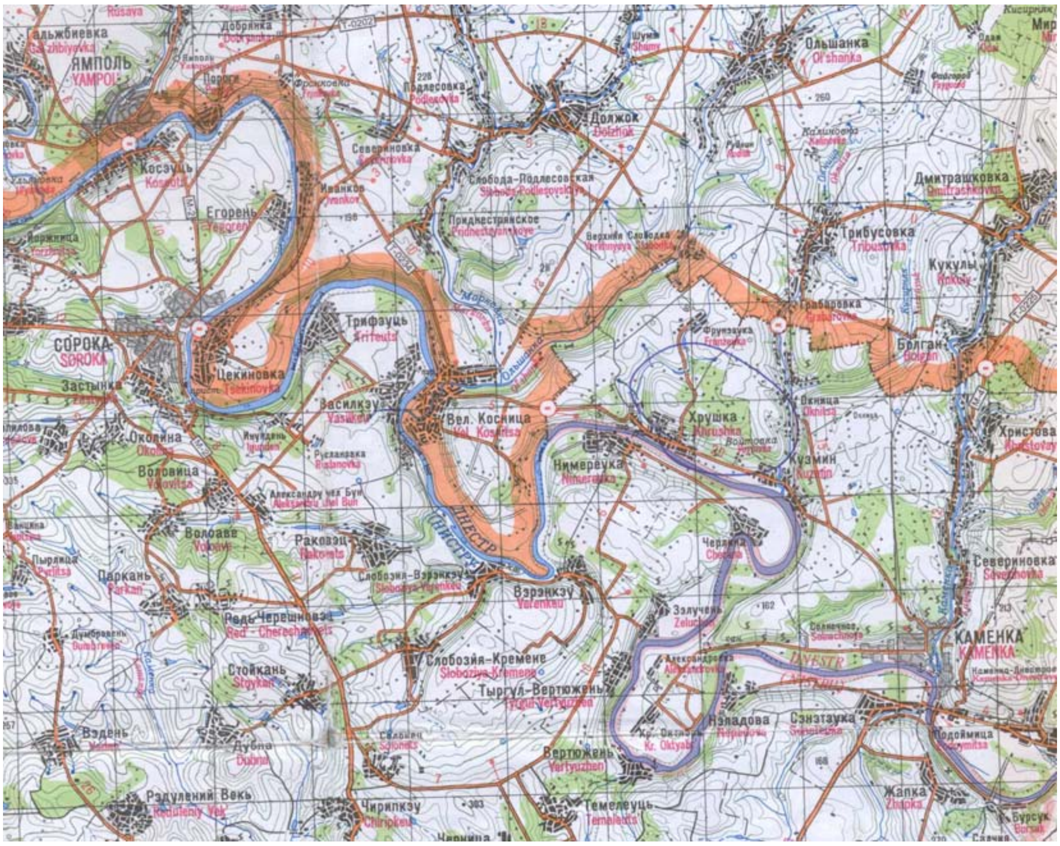
The Dniester River enters Moldovan territory near Voloshkovo (UA) / Naslavcha (MD).

Figure 3 The Dniester River entering Moldova near Voloshkovo (UA) / Naslavcha (MD)



The river shapes the border between Moldova and Ukraine along the next 200 km. The Dniester River exits the Ukrainian territory near Velika Kosnitsa (UA) / Grushka (MD).

Figure 4 The Dniester River exiting Ukraine near Velika Kosnitsa (UA) / Grushka (MD)



The following organisations are involved in monitoring of the river along this stretch near/at the borders:

- Moldova
  - Centre of Preventive Medicine, Ocnița and Soroca rayons
  - National Scientific Practical Centre of Preventive Medicine, Chisinau
  - State Hydrometeorological Service, Chisinau
  - Hydrometeorological Centre, Tiraspol
- Ukraine
  - Dniester-Prut Basin Administration (State Committee for Water Management)
  - Ecological Inspectorate, Chernivtsi and Vinnitsa oblast
  - Sanitary-Epidemiological Service, Vinnitsa oblast
  - State Hydrometeorological Service, Chernivtsi oblast

3.1.1 Water quality

Table 1 contains an overview of the routine sampling locations along this stretch. Not all of these locations are necessarily deployed for the purposes of transboundary monitoring. For example, the CPM takes samples upstream and downstream of the wastewater discharge of the city of Otaci, four samples per year. Near Soroca, the CPM takes samples at the abstraction point for the drinking water supply of the cities of Soroca and Bălți (monthly), and near the beach (two times per year; monthly during the bathing season). The sampling by the CPM at Naslavcha is related to the drinking water abstraction at Soroca (perimeter II-III of the sanitary protection zone).

Table 1 Routine sampling locations along the upstream border

		Entry Moldova					Exit Ukraine			
		Voloshkovo	Kozliv	Naslavcha	Otaci	Mohyliv-Podil's'kyi	Yampil	Soroca	Velika Kosnitsa	Grushka
Moldova	CPM*	-	-	√	√	-	-	√	-	-
	HC	-	-	-	-	-	-	-	-	√
	SHS	-	-	√	√	-	-	√ [3)]	-	-
Ukraine	EI	√ [1)]	√ [2)]	-	-	√	-	-	√	-
	SHS	-	-	-	-	√	-	-	-	-
	SES	-	-	-	-	√	√	-	-	-
	SCWM	-		√ [4)]	-	√	-	-	-	-

Note: the joint sampling locations following the 1994 agreement are not included in the table

* Including the National Scientific Practical Centre of Preventive Medicine

1) Chernivtsi

2) Vinnitsa

3) Two sections, upstream and downstream Soroca town

4) Left bank

The sampling frequencies are mentioned in Table 2. It should be noticed that these frequencies represent the scheduled number of samples. Due to financial problems in the recent years, many organisations met difficulties in realising the scheduled amount of samples. Furthermore, it has to be noticed that not all parameters are analysed with the same frequency. For example, parameters like dissolved oxygen (O_2) or ammonium (NH_4) normally are analysed in all samples, whereas heavy metals or organochlorinated pesticides often are analysed in a smaller number of samples.

Table 2 Sampling frequencies at the routine sampling locations along the upstream border [№ per year]

		Entry Moldova					Exit Ukraine			
		Voloshkovo	Kozliv	Naslavcha	Otaci	Mohyliv-Podil's'kyi	Yampil	Soroca	Velika Kosnitsa	Grushka
Moldova	CPM*	-	-	4	4	-	-	12 [1)]	-	-
	HC	-	-	-	-	-	-	-	-	24
	SHS	-	-	12	4	-	-	12	-	-
Ukraine	EI	7	4	-	-	4	-	-	4	-
	SHS	-	-	-	-	12	-	-	-	-
	SES	-	-	-	-	4	4	-	-	-
	SCWM	-		12	-	12	-	-	-	-

12 = monthly sampling; 4 = quarterly sampling

* Including the National Scientific Practical Centre of Preventive Medicine

1) Applies to sampling frequency near the abstraction point for the drinking water supply Soroca and Bălți

The parameters analysed by the laboratories of the various organisations are enumerated in Annex 2. It should be emphasised that not all parameters actually are analysed for each location.

3.1.2 Hydrology

There are three hydrological posts situated in the upstream transboundary section (Table 3). At all three posts the (changes in) water levels are measured, with daily readings.

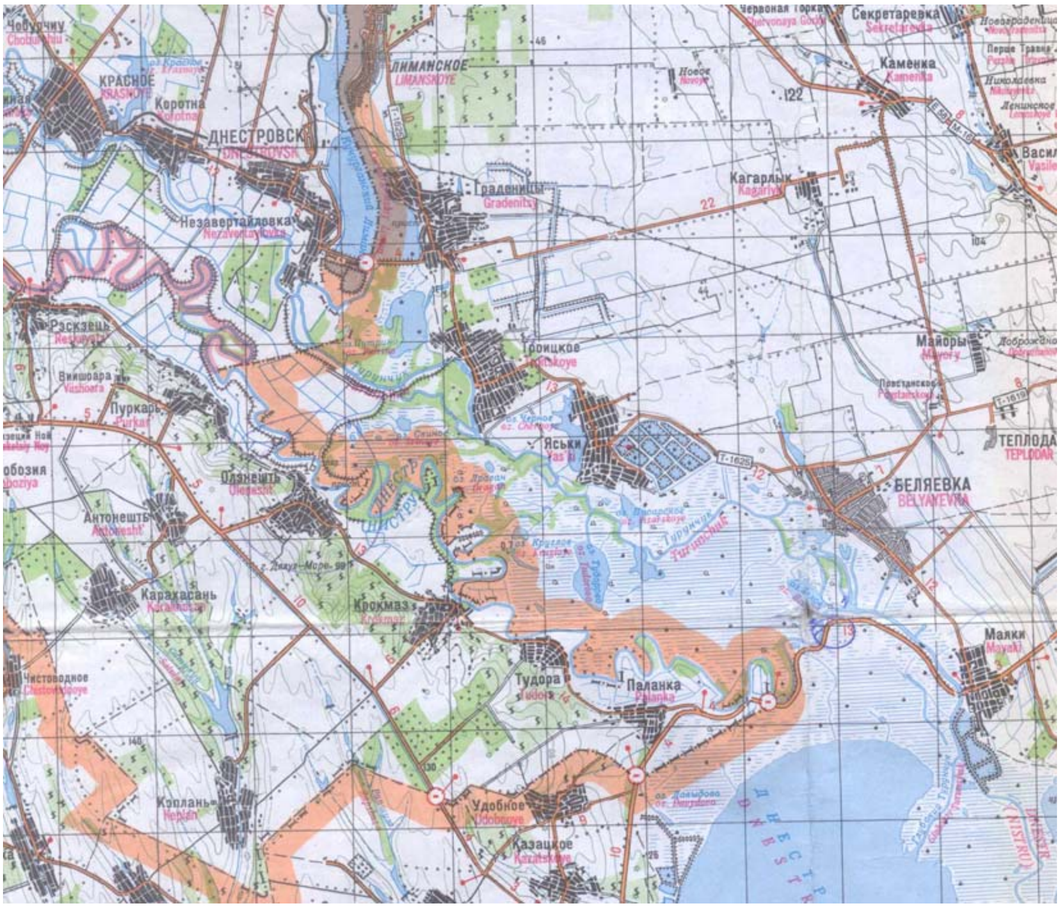
Table 3 Hydrological monitoring locations in the upstream border section

	Ukraine	Moldova
Mohyliv-Podil's'kyi	SHS Chernivtsi	-
Soroca	-	SHS Chisinau
Grushka	-	HC Tiraspol

3.2 Downstream border

The Dniester enters Ukraine via two branches. Near the Ciobruci Village in Moldova (148 km from the mouth), the Dniester River bifurcates into the Turunchuk and the Dniester. The Turunchuk and Dniester branches rejoin near Belyaevka village (21 km from the mouth).

Figure 5 The Dniester River entering Ukraine



3.2.1 Water quality

The following organisations are involved in monitoring near the borders along this stretch:

- Moldova
  - Centre of Preventive Medicine, Ştefan-Vodă
  - Hydrometeorological Centre
  - National Scientific Practical Centre of Preventive Medicine
  - State Hydrometeorological Service
- Ukraine
  - Odessa Regional Water Management Department
  - Ecological Inspectorate, Odessa
  - Sanitary-Epidemiological Service, Odessa

- o Hydrometeorological Centre for the Black Sea and the Sea of Azov (State Hydrometeorological Service)

Table 4 Routine sampling locations along the downstream border

		Dniester branch		Turunchuk branch		Dniester after confluence	
		Olaneshti	Palanca	Nezarvertaylovka	Troytskoye	Belyaevka	Mayaki
Moldova	CPM*	√	√	-	-	-	-
	HC	-	-	√ 1)	-	-	-
	SHS	√	-	-	-	-	-
Ukraine	EI	-	√	-	√	√	√
	SHS	-	-	-	-	-	-
	SES	-	-	-	√	√	√
	SCWM	-	-	-	√	√	√

* Including the National Scientific Practical Centre of Preventive Medicine

1) Per January 2010

Table 5 Sampling frequencies at the routine sampling locations along the downstream border [№ per year]

		Dniester branch		Turunchuk branch		Dniester after confluence	
		Olaneshti	Palanca	Nezarvertaylovka	Troytskoye	Belyaevka	Mayaki
Moldova	CPM*	**	4	-	-	-	-
	HC	-	-	24	-	-	-
	SHS	12	-	-	-	-	-
Ukraine	EI	-		-	12	12	12
	SHS	-	-	-	-	-	-
	SES	-	-	-	4	4	4
	SCWM	-	-	-	4	12	12

* Including the National Scientific Practical Centre of Preventive Medicine

** The CPM Ştefan-Vodă takes samples two times before the bathing season, monthly during the bathing season

The parameters that can be analysed by the laboratories of the various organisations are enumerated in Annex 2. Again, it should be emphasised that this first of all represents the overall set; not all parameters are analysed at each location.

3.2.2 Hydrology

In Moldova, hydrological posts are deployed in both the Dniester and the Turunchuk branches. The post at Olaneshti is situated about 45 km from the actual border at Palanca, but the flow does not change significantly between both locations.

Table 6 Hydrological monitoring locations in the downstream border section

	Moldova	Ukraine
Olaneshti (Dniester branch)	SHS	-
Palanca (Dniester branch)	-	SCWM 1)
Nezarvertaylovka (Turunchuk branch)	HC	-
Troytskoye (Turunchuk branch)	-	*SCWM (scheduled)* 2)
Mayaki	-	• *university/ HCBSSA* 2) • *SCWM (scheduled)* 2)

1) Installed in 2009

2) See text

The post at Mayaki is primarily used by the university for educational purposes. The Hydrometeorological Centre for the Black Sea and the Sea of Azov (HCBSSA) participates, but has not been able to update the Q_h curves[10] for many years, due to the lack of (financial) resources. Following the 2008 flooding, the Odessa Oblast Board on Water Management of the SCWM decided to establish three hydrological posts. The post at Palanca has been installed in 2009; the posts at Troytskoye and Mayaki are expected to be established in 2010 or 2011.

3.3 Synthesis

There are quite some monitoring activities in the transboundary sections of the Dniester River, as can be derived from chapter 3. Multiple organisations and laboratories are involved. The key players are:

- Moldova
  - Centres of Preventive Medicine, including the National Scientific Practical Centre of Preventive Medicine
  - Hydrometeorological Centre
  - State Hydrometeorological Service
- Ukraine
  - Environmental Inspectorates
  - Sanitary-epidemiological Services
  - State Committee for Water Management
  - State Hydrometeorological Service

In Ukraine, the four organisations have departments in the various oblasts. The situation in Moldova is a bit different. Here, the diversity in laboratories mainly exists with the various rayon CPMs. The laboratory of the NSPCPM is involved in sampling and analysis at both the upstream and the downstream border. Teams from SHS take the samples at all locations, which are analysed at the laboratory in Chisinau. The unresolved conflict about the Transnistrian Region led to a certain compartmentalisation, with Hydrometeorological Centre and Centres of Hygiene and Epidemiology[11] monitoring at locations that are no longer accessible for the organisations in Chisinau.

Annex 2 shows that certain core parameters -like oxygen regime, nitrogen compounds, major ions, etc- are analysed by virtually all laboratories. However, the SES, CPM and CHE laboratories are more exclusive with their analyses for bacteria, viruses and/or parasites.

Table 1 and Table 4 indicate that organisations often take samples at/near the same locations. The ultimate example is Mohyliv-Podil's'kyi, with all four Ukrainian state organisations sampling. Similarly, at the left bank in Otaci both SHS and CPM/NSPCPM take samples. On the other hand, at Palanca, the border between Ukraine and Moldova for the Dniester branch, samples are only taken by the Environmental Inspectorate of Odessa and by the CPM Ştefan-Vodă (in conjunction with the NSPCPM).

Sampling frequencies differ among organisations and locations, with monthly or quarterly sampling prevailing.

[10] Q_h relations allow for inferring the river's discharge from the water level. Such relations are established via measurements of the current velocities over the cross-section during different discharges.
[11] Besides the central laboratory in Tiraspol, there are furthermore several regional CHE laboratories.

4 Assessment

Most topics addressed in this chapter were raised during the interviews; the author of this report introduces some more topics. Most sections deal with water quality, but section 4.5 is dedicated to hydrological issues. The sequence in presenting the topics does not reflect their priority.

4.1 General introduction

'Monitoring of the Dniester at the Moldovan/Ukrainian border' may sound rather straightforward, but in reality introduces several complications.

4.1.1 Factors influencing the results of monitoring

Monitoring results are influenced by multiple factors, the major variables being:

a) Sampling location
b) Date and time of sampling, sampling frequency
c) Sampling method
d) Sample bottles, pre-treatment, storage, transport
e) Laboratory analysis: equipment, method of analysis, reagents, analytical staff

AD A) SAMPLING LOCATION

The conditions of a river change along its course. Water quality can be affected by the inflow of tributaries and discharges of wastewater, as well as by natural processes like self-purification and sedimentation of certain pollutants. Therefore, representativeness is an important feature of sampling locations. For example, sampling sites situated relatively downstream near wastewater discharges or inflowing tributaries may not be representative for the overall river's water quality at that cross-section[12].

AD B) DATE AND TIME OF SAMPLING, SAMPLING FREQUENCY

Rivers are dynamic systems with the water quality and discharge varying over time. Some parameters vary throughout the seasons, like dissolved oxygen, BOD_5 and NH_4 (refer to section 4.3 for these examples). Dissolved oxygen is an example of a parameter where even the time of measurement can be important for the outcome. Such diurnal variation is related to plant growth, light intensity and temperature. For example, the amount of dissolved oxygen can rise to a maximum during the day because of photosynthesis occurring in daylight.

AD C) SAMPLING METHOD

Buckets are commonly used devices for taking water samples, but only sample the part near surface. Ruttner samplers can be lowered to a certain depth for taking samples. Indicating that device used collecting the water samples already can affect the results.

AD D) SAMPLE BOTTLES, PRE-TREATMENT, STORAGE, TRANSPORT

Samples collected for the determination of heavy metals require plastic (polyethylene) bottles, whereas samples for the determination of organic micro-pollutants should be in glass or stainless steel. This, because heavy metals could be absorbed by glass material; plastic can release certain organic micro-

[12] In a river like the Dniester, it may take several (tens of) kilometers for homogeneous mixing of discharges of wastewater or inflowing tributaries.

pollutants, this contaminating the water sample. Samples for bacteriological analysis must be taken in sterile glass or non-toxic plastic bottles and all subsequent handling of the samples must be done under sterile conditions.
The latter indicates the possible influence of what further can happen after a water sample is taken, like:

- *Filtration*. When filtering the water sample, the fraction of pollutants absorbed to the suspended solids is removed.
- *Preservation agents*. Nitric acid is often used for preservation of water samples to be analysed on heavy metals. Acidification with H_2SO_4 also can be important for preservation of samples to be analysed for ammonium (NH_4).
- *Storage*. Storing samples in a cool (4 ^{o}C) and dark place will reduce biological and chemical processes that can change the composition of the water sample.
- *Transport*. The time between sampling and analysis is an important factor for parameters like NO_2, NH_4, BOD and bacteria. The best results are obtained when samples are analysed quickly (within hours) after sampling. By adding preservation agents and storing the samples in a cool and dark place, the effects of a delay between time of sampling and analysis can be reduced.

AD E) LABORATORY ANALYSIS: EQUIPMENT, METHOD OF ANALYSIS, REAGENTS, ANALYTICAL STAFF

The laboratory is a very important, if not decisive, factor in the chain. The outcome of the analysis of the same sample can differ substantially depending on which analytical techniques and analytical methods are applied. In addition, the specific reagents used during the analysis can affect the results. Even the specific staff member conducting the analysis can influence the results, for example with colorimetric techniques.

A combination of the above factors will play a role in the monitoring in the transboundary sections. Not all of them could not be addressed in-depth by the underlying activity, but for some factors there was sufficient information for a preliminary assessment.

4.1.2 Example 1: monitoring data at Belyaevka in the years 2004 and 2005

No systematic collection of monitoring data for this study was envisaged. Nevertheless, some data sets were already available to illustrate cases that can be expected to apply more generally. Raw monitoring data were available for Belyaevka over the period 2001 - 2005 (this location is situated at the intake of the drinking water supply for Odessa). Besides EI, SCWM and SES, at this site samples are also taken by "Infoxvodokanal", the company abstracting water from the Dniester River for the drinking water supply. The results for chloride, NH_4 and BOD_5 for the years 2004 and 2005 are reviewed in this section.

Referring to the possible factors influencing the monitoring results (section 4.1), one variable is at least the same: the sampling location. All organisations take the samples at the same spot. The regular sampling frequencies differed from 4 to 12 samples per year. None of the organisations took samples on the same day; days of sampling were scattered throughout the month.

The results for chloride are plotted in Figure 6 and summarised in Table 7. Laboratory 4 collected relatively few samples, the results sometimes comparable to the other labs, sometimes different (e.g. for August 2005). Overall, there is a pretty good agreement between the results of the laboratories 1, 2 and 3. However, some striking differences can be recognised. Laboratory 1 reported lower concentrations during the period March – June 2004. There are two (relative) peak concentrations in the results of laboratory 3 (October 2004 and March 2005), which do not recur in the results of the other laboratories. This could indicate either temporary higher chloride concentrations in the river, or certain effects of sampling and/or analysis.

Figure 6 Monthly chloride concentrations in the Dniester River at Belyaevka for the years 2004 and 2005 [mg/l]

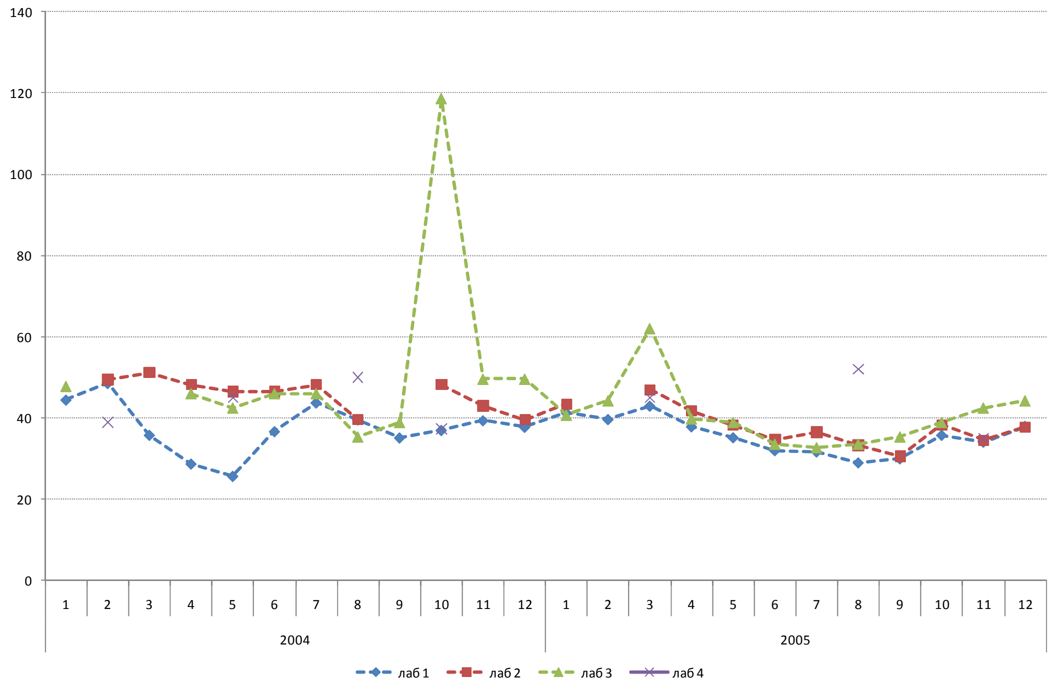


Table 7 Summary statistics for chloride in the Dniester River at Belyaevka, years 2004 and 2005

year	statistic	unit	лаб 1	лаб 2	лаб 3	лаб 4
2004	N	[-]	12	10	10	4
	minimum	[mg/l]	26	40	35	37
	maximum	[mg/l]	49	51	119	50
	average	[mg/l]	38	46	52	43
2005	N	[-]	12	11	12	3
	minimum	[mg/l]	29	31	33	35
	maximum	[mg/l]	43	47	62	52
	average	[mg/l]	36	38	41	44

The overall picture for NH_4 (Figure 7 and Table 8) is more diverse. The annual average concentrations are quite comparable, but the monthly results can differ up to a factor 2. Intriguing are the results for 2005. The former Soviet maximum allowable concentration (MAC) for fishery, 0.39 mg N/l, is exceeded by the maximum concentrations of the labs 3 and 4, but not by the maximum concentrations of the laboratories 1 and 2.

Figure 7 Monthly NH_4 concentrations in the Dniester River at Belyaevka for the years 2004 and 2005 [mg N/l]

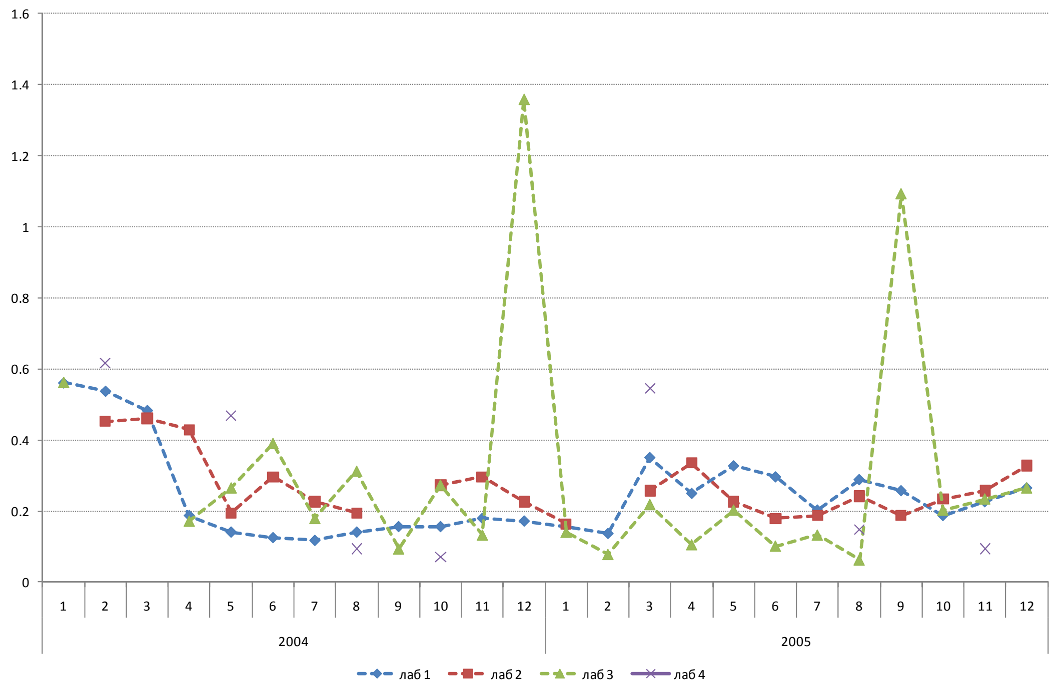


Table 8 Summary statistics for NH_4 in the Dniester River at Belyaevka, years 2004 and 2005

year	statistic	unit	лаб 1	лаб 2	лаб 3	лаб 4
2004	N	[-]	12	10	10	4
	minimum	[mg N/l]	0.12	0.20	0.09	0.07
	maximum	[mg N/l]	0.56	0.46	1.36	0.62
	average	[mg N/l]	0.25	0.30	0.37	0.31
2005	N	[-]	12	11	12	3
	minimum	[mg N/l]	0.14	0.16	0.06	0.09
	maximum	[mg N/l]	0.35	0.34	1.09	0.55
	average	[mg N/l]	0.25	0.24	0.24	0.26

Data for BOD_5 were available for the labs 1-3 (laboratory 4 analysed BOD_{20}). The results for the year 2004 and 2005 were quite different (Figure 8 and Table 9), with laboratory 3 reporting on average the highest concentrations.

Figure 8 Monthly BOD_5 concentrations in the Dniester River at Belyaevka for the years 2004 and 2005 [mg O_2/l]

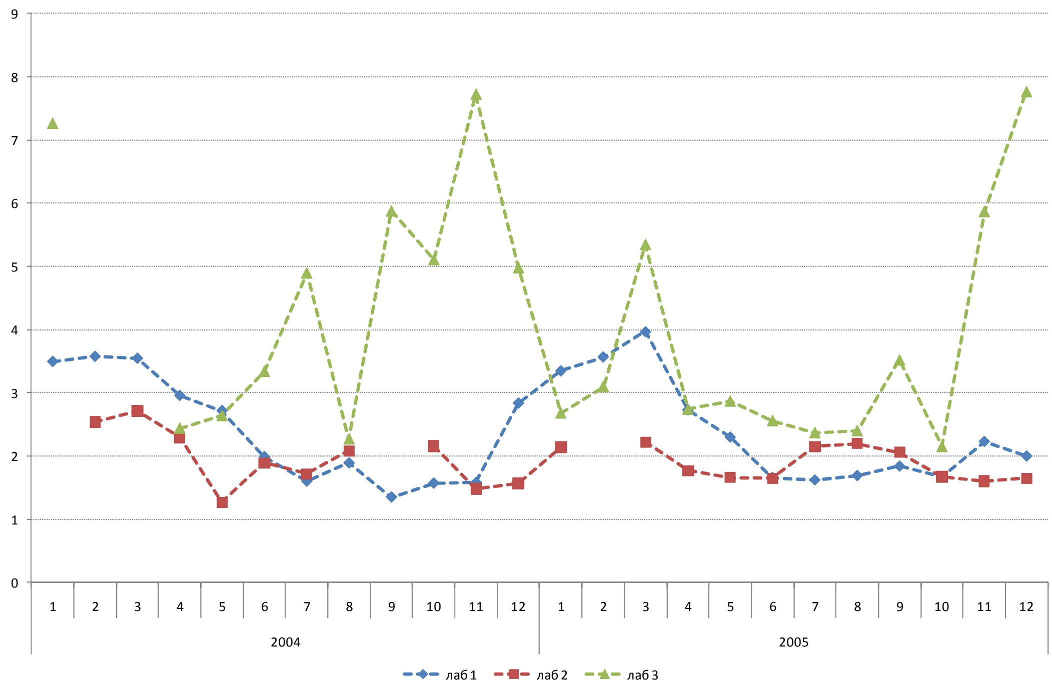


Table 9 Summary statistics for BOD_5 in the Dniester River at Belyaevka, years 2004 and 2005

year	statistic	unit	лаб 1	лаб 2	лаб 3
2004	N	[-]	12	10	10
	minimum	[mg/l]	1.4	1.3	2.3
	maximum	[mg/l]	3.6	2.7	7.7
	average	[mg/l]	2.4	2.0	4.7
2005	N	[-]	12	11	12
	minimum	[mg/l]	1.6	1.6	2.2
	maximum	[mg/l]	4.0	2.2	7.8
	average	[mg/l]	2.4	1.9	3.6

The three examples above illustrate and underline an important feature. When assessing “the water quality of the Dniester River at Belyaevka”, the outcome can be quite different, depending on which set of data is used. Moreover, this is what actually happens, since each organisation tends to use only its own monitoring data for assessments.

There is no reason to assume that the situation in other parts of the basin will be different, for example at Mohyliv-Podil’s’kyi where four different Ukrainian organisations take samples from the Dniester River. Furthermore, such kinds of differences can be anticipated between the various Moldovan monitoring organisations and between Moldovan and Ukrainian laboratories.

4.1.3 Example 2: results of joint sampling in December 2009 and February 2010

The health laboratories have conducted several joint sampling exercises in the framework of the (draft) Regulation *on cooperation on sanitary-epidemiological control of water quality in the transboundary Moldovan-Ukrainian section of the Dniester River basin and the transboundary rivers of the Black Sea basin*. This joint sampling is not (yet) part of the routine monitoring programmes of the health organisations, but still a pilot under development under the auspices of the Dniester-III project. The results of the joint sampling in December 2009 and February 2010 are included in Annex 1. Contrary to the previous example, these samples were taken on the same day at each of the locations. Implying that possible differences would be due to the factors d) *Sample bottles, pre-treatment, storage, transport* and/or e) *Laboratory analysis (equipment, method of analysis, reagents, analytical staff)*.

First of all, it can be noticed that none of the laboratories reported all parameters that are included in annex 3 of the draft Regulation (refer to section 4.4.1 for more details).

For the purposes of this report, results are earmarked as deviating in case (one of) the paired results differ with more than 50%. Only for two parameters there is a good agreement between paired results, pH and total hardness. For the other parameters there is a difference of more than 50% in one or more sets of paired samples. This includes traditional parameters like chloride (Cl) and sulphates (SO_4).

Results below the detection limit are special cases for the assessment. For example, the paired results for pesticides at Voloshkovo of <0.005 and <0.0001 are consistent, but it is important to notice that the lower detection limit is a factor 50 smaller.

4.2 Sampling locations

There is no such thing as *the* transboundary location in the Dniester River, neither at the upstream border nor at the downstream border. The Dniester River enters Moldovan territory near Voloshkovo / Naslavcha, but actually remains transboundary for the next 200 kilometres. Conditions will change along this stretch, for example because of discharges of wastewater (like from the municipalities Mohyliv-Podil's'kyi and Soroca) and the various tributaries flowing into the Dniester River. On the other hand, water quality will change due to processes like self-purification. The situation downstream is more straightforward, but still the Dniester River is leaving Moldova and entering Ukraine via two branches; the Dniester branch near Palanca and the Turunchuk branch near Nezarvertaylovka / Troytskoye.

At the following locations, samples are taken by both Moldovan and Ukrainian organisations at a relatively close distance:

- Upstream border:
    - Naslavcha (Moldova: CPM, SHS; Ukraine: SCWM)
    - Otaci / Mohyliv-Podil's'kyi (Moldova: CPM, SHS; Ukraine: EI, SCWM, SES, SHS)
    - Grushka / Velika Kosnitsa (Moldova: HC; Ukraine: EI)
- Downstream border
    - Dniester branch: Palanca (Moldova: CPM/NSPCPM; Ukraine: EI)
    - Turunchuk branch: Nezarvertaylovka / Troytskoye (Moldova: HC; Ukraine: EI, SCWM, SES)

Naslavcha is the first Moldovan town after the Dniester River enters the Moldovan territory. Considering that the distance to Mohyliv-Podil's'kyi is only 17 kilometres, one could argue the need for deploying two locations in the framework of transboundary boundary monitoring; one of them will suffice. With six organisations, the section Otaci / Mohyliv-Podil's'kyi is the most densely sampled; at this cross-section SHS Chernivtsi furthermore conducts hydrological measurements. Implying that Otaci / Mohyliv-Podil's'kyi would be an appropriate (joint) transboundary monitoring location for the entry of the Dniester River into Moldova.

The sampling activities near the exit of the Dniester River from Ukraine to Moldova at Grushka / Velika Kosnitsa are limited to the Environmental Inspectorate in Vinnitsa and the Hydrometeorological Centre in Tiraspol. SHS Chisinau takes its samples more upstream near Soroca. Contrary to the entry of the Dniester to Moldova, there is basically not yet an existing location that could be regarded as appropriate for joint transboundary monitoring.

Downstream near the exits of the Dniester River from Moldova to Ukraine, the picture is a bit scattered. Near Palanca, only two organisations take samples on a routine basis[13]. At Nezarvertaylovka / Troytskoye, most Ukrainian organisations are represented, but only the Hydrometeorological Centre in Tiraspol[14].

4.3 Sampling frequencies

As already mentioned in section 4.1, rivers are dynamic systems with the water quality and discharge varying over time. The sampling frequency is relevant in order to capture such dynamics. Figure 9, Figure 10, and Figure 11 show examples of parameters that vary seasonally.

Figure 9 Monthly dissolved oxygen concentrations in the Dniester River at Belyaevka (лаб 1), years 2001 - 2005 [mg O_2/l]

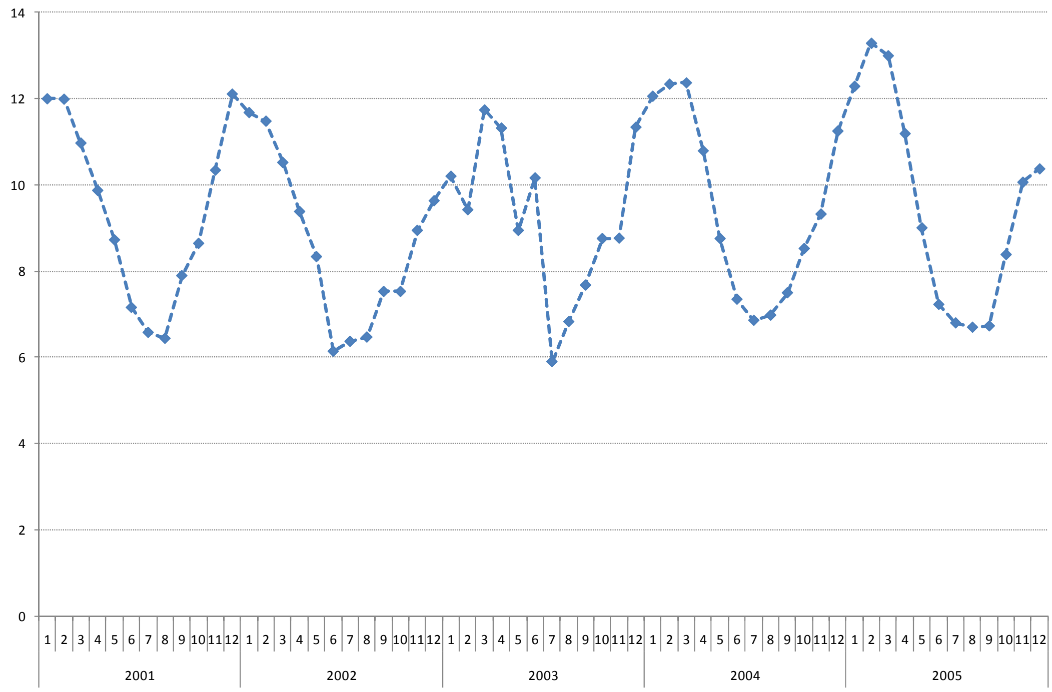


Figure 10 Monthly BOD_5 concentrations at Belyaevka (лаб 4), years 2001-2005 [mg/l]

[13] Furthermore joint samples are taken in the neutral zone between Palanca and Mayaki, following the Regulations of the Ukrainian-Moldovan co-operation on water and environmental monitoring and control of water quality (sections 2.3.2 and 2.3.3).

[14] SHS also used to take samples at Nezarvertaylovka, but due to the territorial conflict no longer has access to the Transdniestrian region.

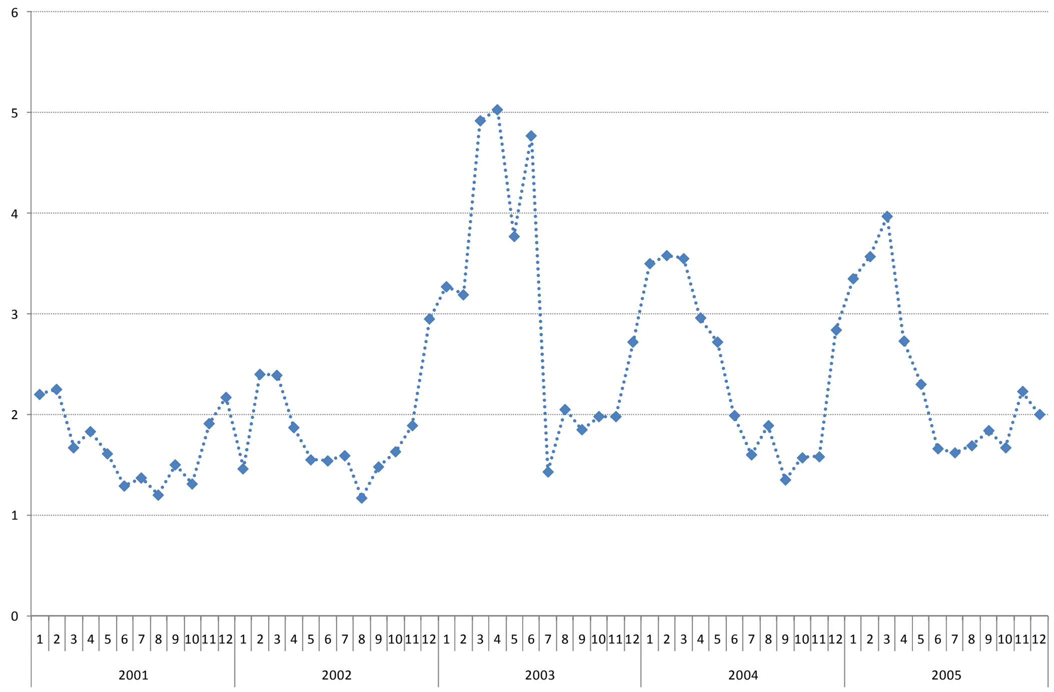
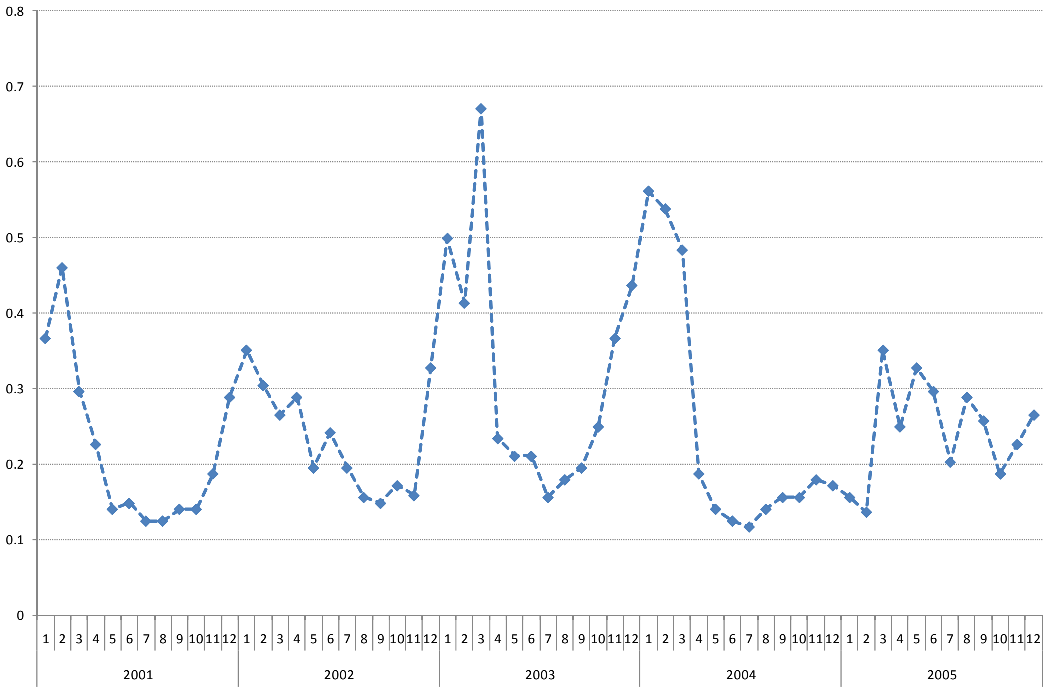


Figure 11 Monthly NH_4 concentrations at Belyaevka (лаб 4), years 2001-2005 [mg N/l]



The effect of the sampling frequency is illustrated in Figure 12, containing the results of the organisation that routinely takes four samples per year (once per quarter); the seasonal variations of Figure 9 can hardly be recognised.

Figure 12 Quarterly dissolved oxygen concentrations in the Dniester River at Belyaevka (лаб 4), years 2001 - 2005 [mg O_2/l]

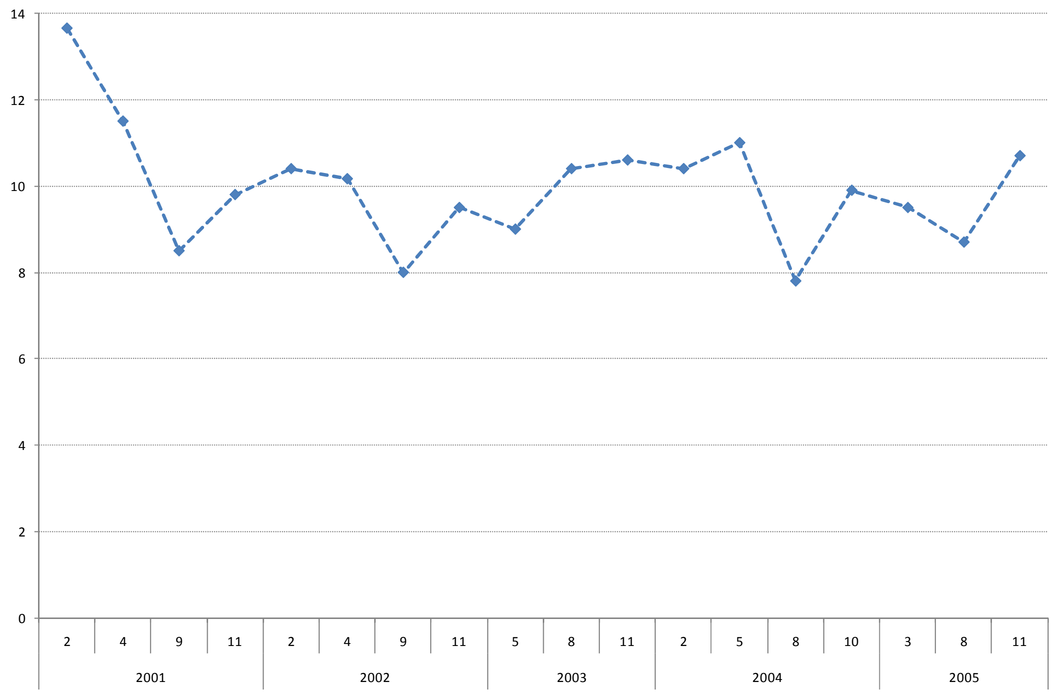


Figure 12 shows yet another complication with a regime of quarterly sampling. When for whatever reason one of the samples is not taken, as was the case in the years 2003 and 2005, very few data remain.

From the above examples, one can infer that different (assessment) results can be expected among organisations, depending on the sampling frequency. The most common sampling frequencies in the transboundary sections of the Dniester River range from 4 to 12 per year (Table 2 and Table 5). Some organisations take the hydrological cycle (e.g. floods and low-water periods) into account in their sampling scheme.

4.4 Laboratory analysis

An in-depth assessment of the laboratories was not the subject of this study. However, with information collected during the interviews and using experiences in other projects, an indication of the laboratory capacities can be provided.

4.4.1 Routine monitoring of physico-chemical parameters

Annex 2 contains an overview of the sets of physico-chemical parameters that are included in the routine monitoring programmes of the various organisations[15]. This list should be considered as a maximum list; not all parameters are necessarily analysed at all locations and/or samples.

In total, 100 parameters are listed in the table of Annex 2. The total number of parameters per organisation range between 14 (EI Odessa) to 62 (NSPCPM Chisinau). The monitoring programmes of the health organisations comprise the largest number of parameters. This is partially due to the analyses

[15] Although the CHE Tiraspol has no monitoring locations in the transboundary sections, it has been included in the overview because of the participation in the joint sampling exercises. The CPM rayon laboratories in Otaci, Soroca and Ştefan-Vodă are not included in the overviews. Their capacity for analysis is less than those of the NSPCPM in Chisinau. Furthermore, SHS Chernivtsi also sends samples to the central laboratory in Kyiv for analysis on pesticides.

for microbiology, helminths and viruses, which are of specific interest when dealing with human health aspects.

Table 10 Total number of routine monitoring parameters

	Ukraine						Moldova				Ukraine		
	DPBA	EI	EI	SES	SES	SHS	CHE	NSPCPM	HC	SHS	EI	SCWM	SES
		Cher	Vinn	Cher	Vinn	Cher	Tira	Chas	Tira	Chas	Odes	Odes	Odes
total	**36**	**29**	**33**	**56**	**56**	**38**	**56**	**62**	**19**	**36**	**14**	**18**	**69**

Table 11 lists the 'top four' parameters. Twenty-four parameters are analysed by ten or more laboratories; just eight parameters are analysed by all laboratories. Those twenty-four parameters are the more traditional ones. Pesticides, for example, are analysed by few organisations.

Table 11 'Top four' sets of most frequently analysed parameters

Parameter		№ of labs	Parameter		№ of labs
Ammonium	NH_4	all	calcium	*Ca*	11
biological oxygen demand (5 days)	BOD_5	all	detergents		11
Chloride	*Cl*	all	dissolved oxygen	O_2	11
Magnesium	*Mg*	all	dry residue		11
Nitrate	NO_3	all	potassium	*K*	11
Nitrite	NO_2	all	colour		10
pH	*pH*	all	nickel	*Ni*	10
Sulphates	SO_4	all	odour		10
Copper	*Cu*	12	sodium	*Na*	10
Hardness		12	transparency		10
Iron	*Fe*	12	zinc	*Zn*	10
oil products		12			
suspended solids		12			

4.4.2 General laboratory analysis capacity

The parameters listed in Annex 2 do not represent the full analytical capacity of the various organisations. For example, the laboratory of SHS in Chisinau meanwhile possesses gas chromatographs with mass spectrometry (GC/MS) and a liquid chromatograph (LC), allowing for the analysis of a wide range of organic micropollutants (including pesticides); also recently equipment for the analysis of mercury has been received. Enhanced capacity for analysis of organic pollutants, other than those listed in Annex 1, also is available in the laboratories of NSPCPM Chisinau and SES Odessa.

Intermezzo: examples of specific equipment needs mentioned during the interviews

The EI and SES in Chernivtsi prepared lists with equipment for upgrading their laboratory capacity. In the case of EI, this concerns: a "KFK-3" (ammonia, nitrite, nitrate and phosphates), "Fluorat" (oil products, phenols, detergents, formaldehyde and some metals); conductivity, pH and oxygen meters for field measurements. The list of SES comprised: "Fluorat-02" (oil products, phenols, detergents, formaldehyde, COD, turbidity, aluminium, copper, zinc, iron, nitrite, fluorides, cyanides), "Kapel" (cations, anions, organic acids, synthetic substances, preservatives, antioxidants), "Expert-001" "Analytic-expert" (cations, anions), "Mikran" (automatic analyser for oil products).

The fact that other laboratories did not specify certain equipment does not imply that there are no needs, on the contrary.

During both the interview with SHS in Chernivtsi and the HCBSSA in Odessa it was mentioned that the current equipment used for hydrological measurements stems from the Soviet era and is becoming old and outdated.

Having noticed this, substantial differences exist between the various laboratories. Overall, the largest capacity is available in the laboratories in Chisinau. The analytical capacity of the SES Odessa is most likely larger than that available in Chernivtsi and Vinnitsa. In Tiraspol, the laboratory deployed by the HC has a rather basic capacity, whereas the lab of the CHE is capable of analysing a wider array of parameters. The laboratory used by the DPBA analyses more routine parameters than the lab of the SCWM in the Odessa oblast. The lab of the EI in Odessa analyses a smaller amount of parameters than the EIs in Chernivtsi and Vinnitsa.

4.4.3 Detection limits

The detection limit (lowest concentration of reliable analysis of parameters) is significant especially for the analysis of micropollutants (heavy metals and organic micropollutants, including pesticides).

For example, the detection limits for the analysis of copper in Moldova are respectively: 0.002 mg/l (SHS), 0.01 mg/l (HC) and 0.02 mg/l (NSPCPM). The former Soviet MACs for copper are: 0.001 mg/l for fishery[16] and 1.0 mg/l for sanitary/hygienic purposes (e.g. drinking water abstraction). Implying that none of the three laboratories would be able to measure copper concentrations at levels that would be required for comparison with the fishery MAC.

During the interviews, a list with the results of the monitoring the Dniester River at six locations in the year 2008 was provided by one of the organisations. For cadmium, out of twenty-four analysed samples, twenty-two times a concentration of 0.001 mg/l was reported and two times 0 mg/l. Such results imply a detection limit for the analysis of cadmium of 0.001 mg/l. A detection limit of 0.001 mg/l is not adequate for determining environmentally relevant cadmium concentrations in fresh surface water. For example, the environmental quality standard for cadmium now applying in the European Union is (depending on the water hardness) between 0.00008 – 0.00025 mg/l (refer to section 5.3 for further details).

[16] on top of the natural background concentration

Relatively high detection limits for some heavy metals can be expected in several other laboratories as well.

4.4.4 Monitoring of viruses

The health organisations in Moldova and Odessa are concerned about possible contamination with viruses, notably in relation to the abstraction of the Dniester River for the preparation of drinking water. Antigens (indicator organisms) of various pathogenic viruses (hepatitis A virus, rotavirus, rheovirus, and adenovirus) were regularly recorded in the Dniester water samples in the period of 1996-2002. The presence of viruses in the water supplied may have been the major cause of enteric disease outbreak in 2000 [OSCE/UNECE, 2005]. During one of the interviews it was mentioned that the current methods for analysis of viruses are not considered to be adequate. Only groups of viruses can be identified, with coliphages furthermore being used as an indirect indicator. Old methods are used and it can take 10 – 20 days before results are obtained. These and other issues are addressed under the Dniester-III component “Improvement of water quality control through capacity-building and networking of sanitary services in the transboundary Lower Dniester River area”.

Monitoring and analysis of waterborne viruses entail a complex issue that goes beyond the reach of this study; some considerations are elaborated in the textbox below. Generally, it will be recommended to conduct a more detailed and targeted study for better positioning the justifications and strategies with respect to monitoring and analysis of waterborne viruses in the Dniester River.

Intermezzo: Some considerations in relation to routine Dniester River (transboundary) monitoring of waterborne viruses

Laboratory analysis of waterborne viruses is definitely a limiting factor. Modern techniques are quite demanding in terms of methods and skills of the analytical staff, requiring specialist facilities; analyses still can be time-consuming. There are, however, more considerations that could be taken into account when dealing with monitoring of waterborne viruses in the Dniester River.

The source of human pathogenic viruses in water is faeces from infected individuals independent of their disease status [Roda Husman et. al., 2005]. The numbers of viruses are reduced with common wastewater treatment techniques, but ozonization of the effluent would be needed for proper removal. Water purification -including disinfection (usually chlorine or ozone) in combination physico-chemical treatment, coagulation/sedimentation and filtration- will result in a reduction of viruses during the preparation of drinking water from surface water.

At low concentrations, viruses may still be infectious and pathogenic. The low virus concentrations present in water are relevant for public health and at the same time difficult to assess [Roda Husman et. al., 2005].

It is important to bear in mind that pollution with viruses is basically only relevant in relation with bathing and with the abstraction of drinking water from the Dniester River.

There is no general consensus about pollution with waterborne viruses. Sometimes it is argued that the population of human pathogenic viruses will reduce rapidly within the river system. Furthermore, some state that virus numbers are not considered especially significant in the treatment of drinking waters. A water source that meets the other - notably: microbiological - criteria for a drinking water source, with or without extensive physico-chemical treatment, is likely to be acceptable in terms of viruses. Possibly with bathing higher risks might be involved. However, as mentioned above, such opinions are not generally shared and agreed.

While early detection prevails, it remains difficult to imagine an (cost-)effective strategy for monitoring waterborne viruses in the Dniester River, also because the analysis is demanding and time-consuming. It is obvious that a quarterly sampling frequency will not suffice; also monthly sampling may not be adequate, because of the accidental character of outbreaks that are associated with waterborne viruses.

A specific study concerning monitoring of viruses is conducted under the Dniester-III project; results are expected to become available by the end of the year 2010.

4.5 Hydrology

The network of hydrological stations has been described in the sections 3.1.2 and 3.2.2. A common feature of the hydrological measurements in the transboundary sections is that only water levels are measured; there are no (continuous) discharge measurements. Due to financial constraints, the Hydromets are not able to keep the Q_h relations at the various cross-sections up-to-date.

Hydrological measurements of the Lower Dniester River in Ukraine are not very well developed. Until recently, there was only a hydrological post at Mayaki, primarily used by the university for educational purposes. The location Mayaki is not considered optimal, since there can be interference (on the water level) from the Black Sea, via the Dnistrovsky Lyman. The Hydrometeorological Centre for the Black Sea and the Sea of Azov (HCBSSA) has submitted proposals to Kyiv for rehabilitation and extension of the hydrological measurements in the Lower Dniester River. Meanwhile, after the 2008 flooding the Odessa Oblast Board on Water Management of the SCWM decided to establish three hydrological posts, with the one at Palanca already being installed; the posts at Troytskoye and Mayaki are pending.

Contrary to the water quality monitoring, there is no overlap in terms of locations and organisationsAt the upper border this concerns Mohyliv-Podil's'kyi (SHS Chernivtsi), Soroca (SHS Chisinau) and Grushka (HC Tiraspol). At the downstream border there used to be only Moldovan hydrological posts at Olaneshti (SHS Chisinau) and Nezarvertaylovka (HC Tiraspol); meanwhile the Ukrainian hydrological post of the SCWM at Palanca has been established. Moldova and Ukraine deploy hydrological posts at different locations. According to the interviewees, this hardly creates problems, since the Hydromets generally have a good tradition in exchanging their hydrological data (see also section 4.9.2). One set of hydrological data is not directly accessible by the Hydromet in Moldova, namely about the actual water releases from the Dnistrovsky Reservoir. However, latter information is not collected by SHS Chernivtsi, but by the operators of the reservoir.

4.6 Regulations on joint monitoring

4.6.1 Interview findings

The two regulations on joint monitoring have been introduced in section 2.3. Interviewees generally were positive about these regulations and notably about the ensuing joint sampling campaigns. Frequently, statements were made in terms of:

- Being able to meet and discuss with colleagues and to observe/share sampling practises.

- Now having a certain basis for trusting the monitoring results data of the other organisations, notably the ones abroad.

Concerning the Regulation *of the Ukrainian-Moldovan cooperation on water and environmental monitoring and control of water quality*, some interviewees suggested increasing the joint sampling from quarterly to monthly. However, also some comments were raised, like:

- There are insufficient explicit criteria for the selection of the (joint) sampling sites and parameters (the latter most likely could be reduced).
- There is no agreed template for preparing the annual reports; the contents of the current country reports are partially different.
- The heads of the Monitoring Working groups are supposed to meet quarterly in either Chisinau or Odessa, but no financial resources are made available for such travels. As a result, the heads of the Working Group delegations meet irregularly.

The Regulation *on cooperation on sanitary-epidemiological control of water quality in the transboundary Moldovan-Ukrainian section of the Dniester River basin and the transboundary rivers of the Black Sea basin* is still a draft, but expected to be finalised and agreed in the first half of the year 2010. With respect to this regulation, among others the following was mentioned:

- For example, SES Chernivtsi is not yet able to analyse some of the parameters included in the agreed list, like chromium (3+ and 6+), arsenic, bicarbonates, and cyanides.
- The project “Action Programme to Improve Transboundary Cooperation and Sustainable Management of the Dniester River Basin (Dniester – III)” for the time being covers the costs of two of the envisaged three annuals joint sampling campaigns.
- There are no arrangements yet for annual meetings to discuss and evaluate the results.

4.6.2 General assessment

Improved international working relationships and enhanced confidence building are important assets of both regulations. What still seems to be lacking are agreed mechanisms to build upon the findings, notably from the joint sampling exercises. Differences in results should trigger questions like “what causes the differences” and “which interventions are needed for solving these causes”. The issue as such is anticipated in Article 2 of both regulations “*In the event that discrepancies in test results exceed the permissible instrument and technique tolerances, alternative measurements shall be taken jointly in laboratories of the Parties as proposed by the experts.*” The latter might be a topic for an expert discussion during an annual meeting, organised to discuss and evaluate the findings of the joint sampling.

Furthermore, it should be emphasised that the joint sampling exercises cannot be considered as an alternative for an (international) proficiency and interlaboratory testing scheme. The joint sampling will show to which extent there is an agreement between the results of the various laboratories. However, even when laboratories produce comparable results, this does not necessarily imply that the results are correct; theoretically, all laboratories still could be wrong! Section 5.2 will elaborate on the issue of proficiency testing.

It is also important to notice that both regulations use different water quality indicators for evaluation of the results. The Regulation *on cooperation on sanitary-epidemiological control of water quality in the* *transboundary Moldovan-Ukrainian section of the Dniester River basin and the transboundary rivers of the Black Sea basin* contains a set of maximum allowable concentrations for 58 parameters, largely based on the former Soviet MACs for sanitary/hygienic purposes. The Regulation *of the Ukrainian-Moldovan cooperation on water and environmental monitoring and control of water quality* comprises a system with five classes, with defined concentrations for each class for in total 18 parameters.

Table 12 contains examples of both sets of surface water quality standards. First, it can be noticed that the class V and the MAC values are not always similar; threshold values are the same only for dissolved oxygen, total hardness and oil products. In some cases the sanitary MAC values are smaller than the class V limits (total iron, manganese, ammonium, COD, BOD_5, caesium); in the other cases the sanitary MACs are higher. The differences for copper and BOD_5 are striking examples for such cases.

Table 12 Comparison of surface water quality standards in both regulations

Parameter	Unit	Regulation of the Ukrainian-Moldovan cooperation Class limits					Regulation on cooperation on sanitary-epidemiological control
		I	II	III	IV	V	MAC
pH	-	6.9-7.5	6.7-8.1	6.3-8.5	5.9-8.7	>8.7	6.5 – 8.5
Dissolved oxygen	mg O_2/l	>8.0	7.1-8.0	5.1-7.0	4.0-5.0	<4	4
Mineralization	mg/l	<500	501-1000	1001-1500	1501-2000	>2000	1000
Total hardness	mg-eqv/l	2.0-5.0	1.5-7.0	1.5-8.0	1.0 10.0	>10.0	10
Total iron	mg/l	<0.05	0.05-0.1	0.1-1.0	0.5-1.0-2.5	>2.5	0.3
Manganese	mg/l	<0.010	0.01-0.05	0.05-0.5	0.5-1.25	>1.25	0.1
Ammonium	mg N/l	<0.10	0.10-0.30	0.31-1.00	1.01-2.5	>2.5	2
Nitrite	mg N/l	<0.002	0.002-0.010	0.011-0.050	0.051-0.100	>0.100	1
Nitrate	mg N/l	<0.20	0.20-0.50	0.51-1.00	1.01-2.5	>2.5	10.2
Orthophosphate	mg P/l	<0.015	0.015-0.03	0.031-0.200	0.201-0.3	>0.3	-
COD	mg O_2/l	<9	9-25	26-40	41-60	>60	15
BOD5	mg O_2/l	<1.0	1.0-2.1	2.2-7.0	7.1-12	>12	2
Copper	µg/l	<1	1-2	3-25	26-50	>50	1000
Oil products	µg/l	<10	10-50	51-200	201-300	>300	300
Detergents	µg/l	0	<10-20	21-100	101-250	>250	500
^{137} Caesium	Bq/L	<1	1-10	10.1-27	27.1-54	>54	8

Depending on which system of quality indicators is used, substantially different conclusions might be drawn about the water quality of the Dniester River. For example: a copper concentration of 0.075 mg/l would be quite satisfactorily when applying the sanitary MAC, whereas it would indicate a critical situation by exceeding the threshold value of Class V. Vice versa, a BOD_5 concentration of 2.1 mg/l would not be acceptable when compared to the sanitary MAC, while reflecting proper conditions by corresponding with the Class II limit. These are good examples for how assessments of monitoring data by different organisations may lead to substantially different conclusions.

Finally, it is interesting to notice that the EI Chernivtsi already since several years is engaged in joint sampling exercises with a Romanian laboratory.

4.7 Automated stations

The need for automated stations was regularly raised during the interviews, both for water quality and hydrological measurements[17]. It is beyond the scope of the underlying study to make a more thorough evaluation of the pros and cons of automated monitoring stations, but some words can be said.

For hydrological level and discharge measurements, such automated stations are rather straightforward in terms of parameters. Solutions with continuous discharge measurements though can be expensive; it should be investigated whether such investments are justified for the Dniester River.

In the case of water quality, the situation is more complicated. On-line monitoring of water quality parameters like temperature, dissolved oxygen, pH and conductivity is relatively easily. Meanwhile, technologies exist for (semi-)continuous measurement of parameters like nutrients, oil products heavy metals and organic micropollutants like pesticides. However, such options go with certain costs and demand more sophisticated infrastructure, installation as well as operational requirements. Another important issue is whether the detection limits of on-line sensors are sufficiently low to allow for (environmentally) significant readings.

4.8 Accidents and emergency warning

The discussion about automated monitoring stations is partially linked to accidents and emergency warning. In the past decades, there have been – luckily, infrequent – cases of spills of pollutants in the upstream as well as in the middle/downstream sections of the Dniester River. On-line monitoring of water quality definitely can support registering such accidental spills, although it will be difficult to develop a system that can record a wide range of relevant parameters. In this context, on-line biomonitoring (e.g. Daphnia, fish, mussels) actually can be a useful tool too.

However, accidents and emergency warning systems are not just a matter of on-line monitoring systems, but also require non-technical solutions in terms of information exchange protocols and the willingness/commitments to exchange data and information.

The 2008 flooding has been a good test case. Generally, the international exchange of information was assessed to have been satisfactorily, but this specific case showed that sometimes frequent, up-to-date (like hourly) information was not always available. This for example applied to Moldova with respect to the Dnistrovsky Reservoir and in the lower part of Ukraine concerning the Dubasari Reservoir. Hence, in this respect there is definitely room for improvement left.

In a number of interviews the needs for a mobile laboratory and express analysis of water quality parameters in the field were mentioned, notably in relation to emergencies and accidental spills, where the time required for regular laboratory analysis often cannot be afforded.

[17] In 2009, a joint Moldovan-Romanian-Ukrainian project proposal has been submitted to the EU Cross border Cooperation programme for establishing three automated monitoring stations along the Prut River and four along the Dniester River.

4.9 Information exchange

4.9.1 National

MOLDOVA

In Moldova, there is neither exchange nor centralised storage and processing of the surface water monitoring data collected by the Ministry of Environment (SHS) and the Ministry of Health (NSPCPM), although an organisation like Apele Moldova (in late 2009 partially integrated into the Ministry of Environment) has easy access to the data collected by SHS. Hydrological data and information are exchanged between the Hydromets in Chisinau and Tiraspol. There is no exchange of water quality data between the Hydromets, noticing that the HC started water quality measurements only in 2010. No data are exchanged or shared between the CPM and NSPCPM. except for the joint sampling exercises.

UKRAINE

In Ukraine, environmental monitoring data of the various organisations (EI, SCWM, SES, and SHS) flowing from the respective networks to the organisations' headquarters are also collected centrally per oblast by the recently established Monitoring Centres of the Environmental Departments. This information gathered per oblast is sent to the Information-Analytic Centre of the Ministry of the Environment in Kyiv (iac-menr.rgdata.com.ua). The data are further forwarded to the Ukrainian Scientific Research Institute of Ecological Problems under the Ministry in Kharkiv, who issues monthly bulletins that are partially based on the monitoring data. In the case of the Dniester River (as apparently also for some other basins), the Dniester-Prut Basin Administration also receives data from various monitoring networks in the basin.

Despite this centralised collection and storage of data, the main organisations appear to be using only their own monitoring data for their actual work.

4.9.2 International

The various 'Hydromets' mutually exchange their hydrological data across the border. Overall, this was assessed as satisfactorily by the interviewees, but with some comments. The HC in Tiraspol has no direct link with the authorities in the upper Ukrainian part of the basin and mainly depends on receiving data via SHS in Chisinau. During the 2008 flooding SHS Chisinau would have preferred receiving more frequent (in terms of hours) data for the upstream reaches, including the Dnistrovsky Reservoir, whereas HCBSSA in Odessa did the same concerning the Dubasari Reservoir.

There are no mechanisms for exchanging the overall Dniester Monitoring water quality data between both countries. Information is exchanged via the annual reports published under the Regulation *of the Ukrainian-Moldovan cooperation on water and environmental monitoring and control of water quality*. A copy of a Moldovan report for the year 2007 was received during the interviews. Besides the narrative sections, the report contains tables with the corresponding Class of each parameter (compare also Table 12) per location; the raw monitoring data are included as tables in the annex of the report.

The results of the joint sampling exercises are shared. In the case of the joint sampling under the Regulation *of the Ukrainian-Moldovan cooperation on water and environmental monitoring and control of water quality*, the results of the previous joint sampling are exchanged on paper during the actual joint sampling exercise.

Arrangements concerning the reporting and dissemination of the results of the joint sampling are not yet fully in place and operational under the (draft) Regulation *on cooperation on sanitary-epidemiological control of water quality in the transboundary Moldovan-Ukrainian section of the Dniester River basin and the transboundary rivers of the Black Sea basin*. The organisations are to send their results to "Eco-Tiras" in Chisinau, where the data are aggregated and to be forwarded to the OSCE office in Kiev. Dissemination of these results in the reverse direction to the participating organisations has yet to take shape.

4.10 Public access to data and information

Non-governmental organisations in both countries mentioned that is it not possible, either at least very difficult and time-consuming, to get access to the (raw) monitoring data produced by the various organisations.

4.11 Financial constraints

Basically all organisations meet financial problems for fulfilling their monitoring obligations. The financial constraints affects the organisations are various levels, like modernising the equipment, purchasing consumables and the actual analysis of samples. Sometimes financial resources are too scarce even to buy gasoline for travelling to the sampling sites!

5 Discussion

The discussion in this section is centred on a number key topics, which addressing the various issues raised in the previous chapters.

5.1 Involvement of multiple organisations

All together, quite a number of organisations and laboratories are involved in monitoring of the Dniester River in the transboundary sections. As already mentioned in section4.2, at Mohyliv-Podil's'kyi samples are taken by all four Ukrainian state organisations and on the opposite bank in Otaci by SHS and CPM/NSPCPM.

To a certain extent, this situation is understandable. All three Ukrainian ministries plus the SCWM, as well as both Moldovan ministries implement monitoring programmes, the general principles of which have been agreed at state levels. Furthermore, organisations have different tasks, responsibilities, and interests with respect to the Dniester River; for example, the primary interest of the health organisations is a river water quality that safeguards human health in relation to drinking water abstraction, bathing and irrigation.

The different tasks roles and responsibilities of the various organisations, however, do not automatically explain the added value of national organisations taking samples at similar locations that are analysed for largely the same physico-chemical parameters. At least two drawbacks can be highlighted.

- Firstly, from a financial point of view this does not appear to be an optimal use of state budgets.
- Secondly, and more significantly, there is the risk that the organisations may come to different conclusions about water quality problems associated with the same part of the river. The examples in the sections 4.1.2 and 4.1.3 indicate that this indeed can be the case[18]. Such differences can be explained by a combination of factors (section 4.1). Nevertheless, none of the organisations questions the validity of their own monitoring data and generally does not take monitoring results of other organisations into account in their assessments.

The ramifications of this situation become more obvious once the water quality assessments will be used for the identification of problems to be solved by certain programmes of measures. Extending on section 4.1.2, one for example could:

- Either conclude that there is no exceedance of the fishery MACs for NH_4 and BOD_5 when using the monitoring of лаб 1 or лаб 2, hence no need for reduction of pollution with NH_4 and BOD_5;
- Alternatively, conclude, based on the monitoring data of лаб 3 that because of exceedance of the fishery MACs for NH_4 and BOD_5 measures will have to be taken to reduce the pollution with both parameters[19].

It is obvious that this is not a satisfactory basis for taking decisions in which tens of millions of Euros in investments can become involved.

[18] This assumption can be easily further tested for Mohyliv-Podil's'kyi and Otaci by examining a set of three to five years of monitoring data collected by the various Moldovan and Ukrainian organisations.
[19] The former Soviet fishery MAC for BOD of 3 mg/l is actually defined for BOD_{full} (BOD_{20}).

From both a methodological and a financial point of view it prevails to limit the number of organisations involved in sampling and analysis. Take for example Mohyliv-Podil's'kyi, with respectively EI, SCWM SES, and SHS taking water samples that are analysed for largely the same parameters (compare also Annex 2). It will be more efficient and avoid bias between datasets if only one organisation would take care of sampling and analysis, disseminating the results among the other organisations. This situation will become more significant when anticipating an enhancement of laboratory capacity for the analysis of WFD Priority substances (refer to section 5.3 further below).

The above not necessarily means that only one laboratory should be involved. For example, the analysis of bacteria, parasites and viruses is quite specific and best hosted by the health organisations. Still, the health organisations could receive data about the physico-chemical water quality from another organisation.

5.2 Laboratory quality management

Notwithstanding the argumentation in section 5.1 above, the involvement of various laboratories, partially analysing the same parameters, is nearly inevitable in monitoring of the transboundary sections of the Dniester River. This is definitely the case for Ukraine; it would not be very practical to aim at centralising sampling and analysis for the Dniester River of both the Vinnitsa and Odessa oblasts into one laboratory. The question of involvement of various laboratories partially can be tackled by thorough quality management and proficiency testing.

All laboratories are accredited according to national standards, with several laboratories (also) having ISO 17025 accreditation. However, this accreditation as such does not warrant the validity of the results of monitoring. It are the ensuing quality management procedures that will make the difference. For example, a quality system in conformance with ISO 17025. means that laboratories should:

- use methodologies that are modern and approximate to EN ISO standards[20];
- should have validated those methods in their own laboratories before producing data;
- when carrying out day-to-day analysis maintain control (Shewhart) charts and act on the information obtained to improve the quality of their work;
- comparing their data frequently with other laboratories in interlaboratory comparisons (proficiency testing) and acting on the information obtained to improve the quality of their work.

[20] EN standards are developed under the auspices of the CEN (European Committee for Standardization); ISO standards under the International Standards Organisation.

Intermezzo: EN/ISO for other monitoring components

The above is not limited to laboratory analysis. There are, for example, also EN ISO standards for sampling:

- EN 25667 1:1993 Water quality – Sampling - Part 1: Guidance on the design of sampling programmes (ISO 5667-1:1980)
- EN 25667-2:1993 Water quality – Sampling – Part 2: Guidance on sampling techniques (ISO 5667-2:1991)
- EN ISO 5667 3:1995 Water quality – Sampling guidance on the preservation and handling of samples (ISO 5667-3:1994)

There are even ISO Guidelines for developing proficiency testing schemes:

- ISO Guide 43-1:1997 Proficiency testing by interlaboratory comparisons -- Part 1: Development and operation of proficiency testing schemes
- ISO Guide 43-2:1997 Proficiency testing by interlaboratory comparisons -- Part 2: Selection and use of proficiency testing schemes by laboratory accreditation bodies

The underlying study did not zoom into the quality management systems of the various laboratories. Nevertheless, it can be stated that there are:

- no proficiency testing schemes in the countries in which laboratories of the different organisations participate;
- no fully fledged proficiency testing schemes in laboratories of both countries take part.

In robust proficiency tests, laboratories receive specially prepared test samples with known concentrations of pollutants (that is to say: known by the provider of the test samples). This is the major difference with the present joint sampling exercises along the Dniester River. The laboratories in principle use one and the same river water sample for analysis and therewith can compare the results among each other. However, when the results of all laboratories are in agreement this does not automatically means that these results are 'right', since the actual concentration of the river water sample is not known. This is where the test samples come in, since now the results can be compared to a known concentration.

Finally, is important to notice that laboratories are not necessarily expected to use the same -brand of-equipment (although this always helps). The combination analytical techniques and –methods is more decisive.

5.3 Outlook: the Water Framework Directive

The issue of laboratory capacity becomes more significant when taking into account plausible developments for both countries. Moldova and Ukraine aim at a close co-operation with the European Union (EU). This also involves a certain level of harmonisation (up to convergence or approximation) with EU approaches. The latter also becomes necessary, since both countries are situated in transboundary river basins extending to the EU (Danube, Prut, Tisza and Western-Bug).

Currently, the EU Directive 2000/60/EC *establishing a framework for the Community action in the field of water policy* (in short, the Water Framework Directive, WFD) is the most decisive piece of legislation for river basin management in the EU, with significant implications for the monitoring and assessment of rivers.

The overall objective of the WFD is “good status” of all waters (surface water and groundwater) by the year 2015. Annex 3 contains a brief primer on the concept of “good status”; here it suffices to mention that it requires monitoring of:

- physico-chemical quality elements, including Priority substances;
- hydrobiological quality elements (benthic invertebrate fauna, aquatic flora including phytoplankton, fish);
- hydromorphological quality elements;

Bacteriological parameters and other micro-organisms are not included in the ‘good status’ concept of the WFD. This does not imply that these parameters are not relevant. However, they are mainly significant for two specific uses of surface water: drinking water abstraction and bathing/recreation. In the EU, the WFD is not the only Directive dealing with surface waters. For example, the Directive 2006/7/EC *concerning the management of bathing water quality and repealing Directive 76/160/EEC* contains specific provisions for the quality of bathing waters in the EU.

Notably the explicit inclusion of hydrobiological and hydromorphological quality elements is a novelty, also for most EU Member States. The routine monitoring by SHS Chisinau already includes hydrobiological quality elements, albeit not yet covering all WFD hydrobiological quality elements and not yet fully complying with the recommended sampling and assessment methods. In Ukraine, only SHS has included some hydrobiological quality elements in the routine monitoring programmes. Hydromorphological quality elements like water levels and discharges are already included in the monitoring programmes, but other ones (like river continuity, river depth and width variation, structure and substrate of the river bed, structure of the riparian zone) are yet to be introduced.

It is good to notice that the concept of “good status” and the related monitoring is not to be considered a ‘political issue’. The explicit inclusion of monitoring and assessment of aquatic species is the most straightforward way to obtain information about the functioning of aquatic ecosystems. It is virtually impossible to assess or predict the conditions of aquatic ecosystem solely based on physico-chemical parameters. Also the explicit inclusion of hydromorphological parameters makes sense; aquatic communities are not only affected by physico-chemical stress.

The concept of good status comprises both “good ecological status” and “good chemical status”, as explained in Annex 3. The ecological status is mainly to be assessed via monitoring of hydrobiological quality elements and basic physico-chemical parameters.

The assessment of the chemical status implies monitoring of a specific group of pollutants, the so-called Priority substances and certain other pollutants, listed in Annex 4 with their environmental quality standards. When comparing the list of pollutants in Annex 4 with Annex 2, it can be noticed that relatively few of the Priority substances and certain other pollutants are included in the current routine monitoring programmes for the Dniester River. The EQSs in Annex 4 furthermore indicate what is expected in terms of analytical performance. As already mentioned in section 4.4.3, for example a detection limit for cadmium of 0.001 mg/l (1 µg/l) is too high for comparison with EU's EQS for cadmium.

Establishing laboratory capacity that allows for analysing pollutants like the Priority substances and certain other pollutants requires investments in analytical equipment of an order of magnitude of hundreds of thousands Euros. The analyses themselves are also quite costly and require well trained and experienced staff. Most of the analytical equipment performs most optimally when used more or less continuously (contrary to using it only for several days per month). Extending on the discussion of the sections 5.1 and 5.2, such an outlook emphasises the need for rationalization of using and sharing laboratory capacity. Regarding Ukraine, for example the establishment of a Central Regional Laboratory in the Lower Dniester (Odessa) and on in the Upper Dniester (Lviv and/or Chernivtsi) would be a promising option to be further investigated.

Intermezzo: "Technical assistance for the Lower Dnister River Basin Management Planning"

The EU Tacis project "Technical assistance for the Lower Dnister River Basin Management Planning" was implemented during the period 2006-07. The project's area was limited to the Ukrainian part of the Lower Dniester, although the project managed to involve Moldovan experts in various activities. The project outputs contain useful examples that could be extended to the rest of the Dniester River Basin, among others:

- The design of a surface water monitoring programme for the Lower Dniester including physico-chemical, hydrobiological and hydromorphological parameters, in line with the monitoring requirements under the WFD.
- A draft River Basin Management plan for the Lower Dniester.
- A GIS based database/information system.

Furthermore, the project conducted several interlaboratory exercises, including joint sampling and participation in AQUACHECK proficiency tests.

5.4 Transboundary monitoring locations

"Is monitoring in a transboundary section always a transboundary monitoring?" This may seem to be a trivial question, but relevant to be addressed in the framework of the underlying study. Take, for example, the justification of some of the sampling sites of the CPM/NSPCPM:

- Naslavcha: perimeter II-III of the protection zone of the drinking water abstraction at Soroca (quarterly sampling frequency).
- Otaci: influence of the municipal wastewater discharge of Otaci (quarterly sampling upstream and 500m downstream of the discharge point).
- Palanca: water quality of the Dniester when exiting Moldovan territory (quarterly sampling).

From the three locations above, only the monitoring at Palanca is explicitly earmarked as transboundary. Then again, there does not seem be a big difference with the monitoring at Naslavcha, where also four samples per year are taken. If the data collected at Palanca are used to assess the water quality of the Dniester River leaving Moldovan territory, then why not (also) use the data collected at Naslavcha for assessing the water quality of the Dniester River entering Moldovan territory. It is obvious that the data collected 500m downstream of the wastewater discharge at Otaci in principle cannot be used for an assessment of the overall water quality of the Dniester River at that cross-section.

SHS Chisinau takes samples at both Naslavcha (monthly) and Otaci (quarterly). The distance between Naslavcha and Mohyliv-Podil's'kyi is about 17 km; there are no significant pollution sources or inflowing tributaries along this stretch. Therefore, basically monitoring at one of the two locations would suffice for assessing the water quality of the Dniester River entering Moldovan territory. Because of the bridge between Otaci and Mohyliv-Podil's'kyi, the latter location is better from the point of view of representative sampling.

The distance between Otaci / Mohyliv-Podil's'kyi and the border where the Dniester leaves Ukrainian territory is about 200 km. Because of this distance, and because of wastewater discharges and inflowing tributaries along this stretch, the water quality assessed at Otaci / Mohyliv-Podil's'kyi, most likely is not representative of the border 200 km downstream. However, compared to Otaci / Mohyliv-Podil's'kyi, the monitoring activities near the latter border are rather modest, especially regarding the involvement of the number of Ukrainian organisations.

Several questions can be raised with regard to the monitoring near the downstream border, where the Dniester River returns in Ukrainian territory. For example: until recently, Olaneshti was the downstream monitoring location of SHS Chisinau along the Dniester branch. The distance to the actual border at Palanca is about 45 km. Would it be necessary to move the monitoring location from Olaneshti to Palanca (or even add Palanca to the sampling sites)? Of course, Palanca would be more evident a transboundary location. Then again: SHS also has a hydrological post at Olaneshti and meanwhile many years of monitoring data collected at this location. How important is it to have information for the Dniester River exactly at the border?

5.5 Information needs

Underlying the above discussion is basically the following key question: what are the information needs related to the transboundary sections of the Dniester River? From the information needs, the monitoring locations can be selected and the monitoring programmes defined, including the selection of parameters and sampling frequency. The importance of selecting an adequate sampling frequency has been illustrated in section 4.3. Quarterly sampling in many cases will not suffice to give a representative picture of the water quality throughout the year. For transboundary monitoring locations, at least monthly sampling should be considered, possibly in addition fine-tuned with the hydrological regime. In case trend detection (evolution of quality or quantity over the years) and/or calculation of pollution loads are envisaged, even monthly sampling may turn out to be insufficient.

Currently, there seem to be no very explicit information needs for the transboundary monitoring, other than generally wanting to know the conditions of the Dniester River entering/leaving the national territory. This situation may well change in the years to come, when both countries start preparing river basin management plans (RBMP), including programmes of measures. Examples of *joint* information needs could include:

- Identification of critical pollutants, to be addressed by the programmes of measures.
- Establishment of base-line conditions, to be used
  - to set (joint) targets for the quality and/or quality of the Dniester River at the transboundary sections;

- as reference for the development of Dniester River water quality and/or quantity in the ensuing years.
- Determination of pollution loads, requiring a combination of water quality and discharge data.
- Accident and emergency warning.

The national flows of monitoring data and information are rather different in both countries. A centralised collection of monitoring data as in Ukraine does not yet exist in Moldova, whereas in Moldova this would involve SHS and NSPCPM; the conflict about the country's Transnistrian Region further complicates the picture.

Exchange of information between both countries shows a bit mixed picture. Exchange of hydrological data and information is generally organised quite well. On the other hand, exchange of water quality monitoring data and -information is mainly substantiated via the annual reports published under the Regulation *of the Ukrainian-Moldovan cooperation on water and environmental monitoring and control of water quality*. Since 2009, this is extended with exchanging the results of the joint sampling exercises, including the ones organised under the (draft) Regulation *on cooperation on sanitary-epidemiological control of water quality in the transboundary Moldovan-Ukrainian section of the Dniester River basin and the transboundary rivers of the Black Sea basin*.

5.6 Concluding remarks

While there is definitely room for improvement, it should be acknowledged that both countries have established rather well developed monitoring programmes in the transboundary sections of the Dniester River. In addition, already reasonable levels of co-operation and joint activities between the countries exist. Unfortunately, the territorial conflict in Moldova introduced specific complications. Hopefully, at least as far as monitoring of the Dniester River is concerned, this situation can meanwhile be partially solved via co-operation agreements between the organisations themselves or through enhanced international attention and support to such cooperation.

Intermezzo: Ten basic rules for a successful monitoring and assessment programme

The UNECE Guidelines on Monitoring and Assessment of Transboundary Rivers mention ten basic rules for a successful monitoring and assessment programme [UNECE, 2000, chapter 5]

1. The information needs must be defined first and the programme adapted to them, and not vice versa (as was often the case with multi-purpose monitoring in the past). Adequate financial support must then be obtained.
2. The type and nature of the water body must be fully understood (most frequently through preliminary surveys), particularly the spatial and temporal variability within the whole water body.
3. The appropriate media (water, particulate matter, biota) must be chosen.
4. The parameters, type of samples, sampling frequency and station location must be chosen carefully with respect to the information needs.
5. The field equipment and laboratory facilities must be selected in relation to the information needs and not vice versa.
6. A complete and operational data treatment scheme must be established.
7. The monitoring of the quality of the aquatic environment must be coupled with the appropriate hydrological monitoring.
8. The quality of data must be regularly checked through internal and external control.
9. The data should be given to decision makers not merely as a list of parameters and their

values, but interpreted and assessed by experts with relevant recommendations for management action.

10. The programme must be evaluated periodically, especially if the general situation or any particular influence on the environment is changed, either naturally or by measures taken in the catchment area.

The current financial and economical situation in Moldova and Ukraine is not very favourable for further expanding the (transboundary) monitoring programmes. Actually, many organisations face financial problems for carrying out the routine monitoring programmes as defined and ordained at a state level. This applies not only to the Dniester Basin, but basically to the countries as a whole. By sharing resources, at least part of the financial pressure could be alleviated. Obtaining more consistent and uniform sets of monitoring data should be considered as more than just an additional bonus. Nevertheless, it is obvious that sufficient budgets should be allocated for the monitoring programmes, not only for the implementation of routine tasks, but also for upgrading and enhancing the monitoring capacities, including the purchase of new equipment, consumables, salaries of staff, etc.

6 Conclusions and recommendations

6.1 Water quality

6.1.1 Organisational setup

At several locations in/near the transboundary sections of the Dniester River, water samples are taken by several national state organisations that for a substantial amount are analysed for the similar physico-chemical parameters. At least two disadvantages can be noticed for this setup:

- it does not appear to be an efficient use of (state) budgets;
- there is a serious risk for organisations obtaining different water quality data, resulting in different assessments and thus perceived water quality problems to be addressed by the water management.

It is recommended to:

- Investigate the benefits as well as complications for organisations to combine and share monitoring resources (sampling and/or analysis), including the financial ramifications.
- Substantiate the potential risk of biased information by assessing and evaluating sets of three to five years of recent monitoring data, collected by the various organisations. For the upstream border, the routine monitoring data collected at Naslavcha, Otaci / Mohyliv-Podil's'kyi, Soroca and Velika Kosnitsawould be optimal; for the downstream border, the monitoring data collected at Troytskoye, Palanca, Belyaevka (Ukraine) and Olaneshti. Furthermore, the data collected by the joint sampling exercises should be included in the assessment and evaluation.

6.1.2 Network design

It is not yet obvious which locations actually serve as transboundary monitoring locations. At the entry of the Dniester River into Moldovan territory, two monitoring locations are candidates: Naslavcha and Otaci / Mohyliv-Podil's'kyi. The latter location has two advantages: hydrological measurements are conducted by the SHS Chernivtsi and the bridge allows for more representative sampling. The situation at the exit will have to further investigated, notably in Ukraine where currently sampling is limited to Velika Kosnitsa by the Environmental Inspectorate of Vinnitsa, with only four samples per year. Also assigning the transboundary locations in the Lower Dniester border area will require further attention. The Turunchuk branch being situated in the Transnistrian Region of the Republic of Moldova complicates affairs.

Generally, it is important to notice that a location not necessarily has to be situated exactly at the border. For example: Otaci / Mohyliv-Podil's'kyi is situated 17 kilometres from the entry of the Dniester River; no significant changes can be expected along this stretch. Similar considerations most likely apply to Olaneshti / Palanca. Palanca is situated at the border, but then again SHS Chisinau has established a hydrological post and already conducts routine water quality monitoring for many years at Olaneshti.

It is recommended that the competent Moldovan and Ukrainian authorities will jointly discuss and decide upon the transboundary monitoring locations of the Dniester River.

6.1.3 Sampling frequencies

Examples show that quarterly sampling is not sufficient for tracking seasonal variations; furthermore, very few data remain in case one or two samples for whatever reason cannot be realised.

It is recommended to aim at (at least) monthly sampling at the transboundary monitoring locations. The sampling regime may further be fine-tuned for the hydrological regime.

6.1.4 Express analyses

Expresses analyses allow for relatively quick and simple, albeit not always very accurate, measurements in the field. This kind of measurement may come useful for example in the case of accidental spills.

It is recommended that the competent authorities, interested in express analysis, define into more detail to scope of application of express analysis and furthermore investigate the options for express analyses, including the costs.

6.1.5 Joint sampling exercises

The joint sampling exercises are a useful and well appreciated activity that definitely should be continued in the coming years. They strengthen the working relationships and add to confidence building. The results of the joint sampling also can become a proper source of inspiration, motivation and justification for elaborating fully-fledged quality management and proficiency testing schemes.

The participating organisations are recommended to organise dedicated annual meetings to discuss the results of the joint sampling and to agree on activities to be pursued by the laboratories when apparent differences in results are obtained. Evaluation of the success of these activities then can be discussed during the next annual meeting. Financial resources should be allocated for enabling these meetings.

Concerning the Regulation *of the Ukrainian-Moldovan cooperation on water and environmental monitoring and control of water quality*, some interviewees suggested increasing the joint sampling from quarterly to monthly. Furthermore, some other comments were raised, like:

- There are insufficient explicit criteria for the selection of the (joint) sampling sites and parameters (the latter most likely could be reduced).
- There is no agreed template for preparing the annual reports; the contents of the current country reports are partially different.

The heads of the Monitoring Working groups are supposed to meet quarterly in either Chisinau or Odessa, but no financial resources are made available for such travels. As a result, the heads of the Working Group delegations meet irregularly.

It is recommended to discuss and accordingly adapt the Concerning the Regulation *of the Ukrainian-Moldovan cooperation on water and environmental monitoring and control of water quality* in the light of the above remarks.

6.1.6 Quality management

The results of the joint sampling by the health organisations in December 2009 and February showed that in many cases laboratories reported concentrations differing 50% or more. Such results underpin the importance of proficiency testing. This is a key issue, especially since so many laboratories are involved in sampling and analysis of the transboundary sections of the Dniester River. Proficiency testing is relevant between laboratories deployed within the main state monitoring organisations, between the laboratories of the different national organisations, as well as between the laboratories in both countries.

It is recommended that both countries will continue developing plans and strategies for establishing proficiency testing schemes, both at regional, national as well as international levels.

6.1.7 Monitoring of waterborne viruses

It is recommended to conduct a further study dealing with the issue of monitoring and analysis of waterborne viruses in the Dniester River. Components of such a study could entail, among others:

- To inventorise the views and rationales of the competent health organisations in Moldova and Ukraine (CHE, NSPCPM, and SESs) concerning monitoring and analysis of waterborne viruses in the Dniester River, including their expectations in terms of establishment and operation of analytical facilities
- To solicit the opinion from a professional virology sampling institution in the EU.
- To make a synthesis from the above in terms of recommendations for further strengthening in the framework of transboundary sampling and cooperation of the health organisations.

6.2 Hydrology

6.2.1 Discharge measurements

Currently, the hydrological measurements in the transboundary sections of the Dniester River comprise water level measurements only. Due to lack of financial and human resources, the Hyromet organisations are not able to establish and/or update the Q_h curves that allow calculating discharges from water levels. This situation is unsatisfactorily; reliable discharge data are of crucial importance for quantitative management of the Dniester River, including flood forecasting and flood control.

It is recommended to:

- Allocate resources in order for the Hydromets to establish and/or update the Q_h curves at the transboundary locations.
- Investigate the options, advantages/disadvantages and financial ramifications of establishing automated discharge measurements.

6.2.2 Network design

In the upstream border area, there are three locations with hydrological posts: Mohyliv-Podil’s’kyi (SHS Chernivtsi), Soroca (SHS Chisinau) and Grushka (HC Tiraspol). These posts will suffice for the hydrological transboundary monitoring, presuming that the Hydromets will fully share and exchange their data.
The post at Mohyliv-Podil’s’kyi could be used as the transboundary location for the Dniester River after entering the Moldovan territory. The distance between Soroca and Grushka is only forty kilometres; basically one of both posts would suffice as the transboundary location for the Dniester River existing Ukrainian territory. However, the yet unresolved territorial conflict about the Transnistrian Region hampers this option.

The situation in the downstream border area is more complicated. The Dniester River enters Ukraine via two branches, the Dniester branch and the Turunchuk branch (with the latter being fully situated in the Transnistrian Region). SHS Chisinau deploys a hydrological post along the Dniester branch at Olaneshti, about 45 km from the actual border near Palanca. HC Tiraspol maintains a hydrological post along the Turunchuk branch at Nezarvertaylovka, situated near the actual border. There are no mirroring hydrological posts in Ukraine. Water levels are measured at Mayaki, after the confluence of the Dniester and Turunchuk branches; these measurements are not considered to be adequate, also because the post is not maintained by HCBSSA. Meanwhile, the Odessa Regional Water Management Department of SCWM started establishing hydrological posts at Palanca (already operational), Troytskoye and Mayaki (expected to become operational in 2010 or 2011); initially, water levels will be measured at these posts.

It is recommended that the Moldovan and Ukrainian Hydromet organisations, complemented by the Odessa Regional Water Management Department of SCWM, will discuss and decide upon the optimal design for hydrological measurements in the transboundary area of the Lower Dniester, taking full sharing and exchange of data into account.

6.2.3 Hydromorphological quality elements

Following the principles EU Water Framework Directive, one may have to anticipate incorporation of hydromorphological quality elements in the future transboundary monitoring programmes. This comprises quantity and dynamics of water flow, connection to ground water bodies, river continuity, river depth and width variation, structure and substrate of the river bed, and structure of the riparian zone.

It is recommended for the competent authorities to prepare a strategy and an implementation plan for the introduction of the Hydromorphological quality elements in the transboundary monitoring. While developing the strategies at the national levels, compatibility between both countries should be aimed at. An international Working Group could be established for these purposes.

6.3 Monitoring following principles of the EU Water Framework Directive

Gradual introduction of monitoring and assessment methods in line with the EU Water Framework Directive is a reasonable expectation for both Moldova and Ukraine, including the monitoring in the transboundary sections of the Dniester River.

It is recommended for both countries to develop a strategy for how to extend the capacity for monitoring and assessment of:

- physico-chemical quality elements, including Priority substances;
- hydrobiological quality elements (benthic invertebrate fauna, aquatic flora including phytoplankton, fish);
- hydromorphological quality elements.

The strategy should address both technical and financial, as well as organisation aspects, and furthermore the possible ramifications for the transboundary monitoring programmes. It is important, especially for the transboundary sections, to harmonise this process between both countries.

6.4 Equipment

A systematic inventory of monitoring equipment has not been part of this assigned. However, in various interviews needs for modernising and enhancing the equipment has been expressed. This applies to both hydrological measurements as well as water quality measurements, including laboratory analysis.

It is recommended to conduct a systematic inventory among the various monitoring organisations of the currently available equipment and the needs for new equipment. Such an inventory will also be useful in connection with the orientation on the organisational setup (section 6.1.1).

6.5 Financing

Basically all organisations meet financial problems in carrying out the routine monitoring programmes that have been agreed at a state level, let alone that there is room for upgrading and extension of the monitoring capacities (staff, training in new techniques, purchase of equipment, et cetera).

Monitoring will be the only way for water managers and decision makers to know the conditions of surface waters and groundwater they have to govern and how to act accordingly via investments in programmes of measures. Hence, it is crucial that sufficient funds are allocated for the organisations to enable them to carry out their required monitoring tasks and allow improving and enhancing the monitoring programmes.

6.6 Data exchange

Central collection of the raw monitoring data from the various organisations involved in monitoring is rather well developed in Ukraine. In Moldova, monitoring data are not yet collected and stored centrally. The conflict about the Transnistrian Region furthermore hampers exchange and sharing of data between the Hydromets and the health organisations.

Exchange of monitoring data between both countries can be improved. Currently, the annual reports, produced under the Regulation of the Ukrainian-Moldovan cooperation on water and environmental monitoring and control of water quality, are the major vehicles for exchanging information and data. Furthermore, the joint sampling exercises lead to exchange of data.

It is recommended to further pursue the options for exchange and sharing of monitoring data, at a national as well as an international level. Here, the Dniester III information component could contribute.

6.7 Information needs

In order to be able to design adequate transboundary monitoring programmes, the competent water management and water use organisations should explicitly define what kind of information they expect to be generated. Such information needs should include the joint interests of both countries. After having identified and agreed the information needs, the monitoring organisations can draft the monitoring programmes accordingly (locations, parameters, sampling frequencies, etc.).

It is recommended that the competent authorities explicitly define the information expected to be generated by the transboundary monitoring programmes. Preferably, these information needs are discussed and agreed at a bilateral level.

Ultimately, the information needs are to be subsumed and expressed in a river basin management plan (RBMP) for the Dniester River as a whole. The RBMP will be needed in order to design tailor-made monitoring programmes, not only for the border sections, but for the whole basin in both Moldova and Ukraine. Hence, also from the point of view of designing monitoring programmes, the preparation of a joint RBMP for the Dniester River has a high priority.

6.8 The Transnistrian Region

The conflict about the Transnistrian Region of the Republic of Moldova had several ramifications for the transboundary monitoring as well. The Chisinau-based organisations no longer have access to the Dniester River in the Transnistrian Region without having received clearance; also exchange of data and information is limited. This situation definitely hampers the transboundary monitoring in the Lower Dniester area.

A political solution would be required also to resolve these problems, but cannot be expected on short/medium term. Nevertheless, it will be useful to investigate whether there are alternative options for establishing mechanisms for co-operation between the competent monitoring organisations in Chisinau and Tiraspol.

6.9 External support (ENVSEC / Dniester III / international donors)

The monitoring organisations meet serious constraints in financial and human resources, as already mentioned in section 6.5. In order to be able to implement the various recommendations mentioned above, external support will be indispensable. This support can vary from facilitating international meetings, tough adoption and outsourcing of activities, to support in investments in new equipment. Tentatively, support could be outlined as following.

- Facilitation of international meetings (organisation and costs for participation):
    - Selection the transboundary monitoring locations.
    - Define the specific information needs in relation to the transboundary monitoring programmes.
    - Strategies for establishing international (bilateral) proficiency testing schemes.
    - Annual evaluation of the results of the joint sampling exercises.
- Adoption and outsourcing:
    - Assessment and evaluation of three to five years of water quality monitoring data collected at: Naslavcha, Otaci / Mohyliv-Podil’s’kyi, Soroca and Velika Kosnitsa (upstream border); Olaneshti, Palanca, Troytskoye and Belyaevka (downstream border).
    - Inventory of the current capacity and needs for improvement of laboratories involved in sampling and analysis of the Dniester River, including equipment, methods of analysis and quality management, extended to the river as a whole.
    - Inventory of the current capacity and needs for improvement of the Hydromets concerning hydrological monitoring of the Dniester River.
    - Organisation of proficiency testing schemes, at national and bilateral levels
    - Improvement of co-operation between the monitoring organisations in Chisinau and Tiraspol.
    - Exchange and sharing of monitoring data, at national and bilateral levels.
    - Study on the rationale, needs and options for transboundary monitoring and analysis of waterborne viruses.
    - Preparation of a River Basin Management Plan for the whole Dniester River.
- Support in investments
    - Several of the above activities will result in concrete lists with needs for investments in equipment, training, et cetera. Most likely, these investments may be fully covered by the organisations themselves.

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The full text of the Convention on The Protection and Use of Transboundary Watercourses and International Lakes can be downloaded from http://www.unece.org/env/water/pdf/waterconr.pdf (Russian Version) or http://www.unece.org/env/water/pdf/watercon.pdf (English version)

Annex 1 Results of the joint sampling December 2009 and February 2010

The table below contains the results of the joint sampling by the health laboratories. In the sampling at Voloskovo and Techinovca two laboratories participated, at Palanca three laboratories.

In case (one of) the paired results deviated more than 50%, the cells are marked with a grey background. This criterion is rather arbitrary and merely applied for facilitating an assessment of the table.

		Voloskovo 08/02/2010		**Ţechinovca 08/12/2009**		**Palanca 02/02/2010**		
Quality indicator	**Unit**							
1. Physical properties								
1.1. Transparency	Cm	30	-	35	-	>30	-	12
1.2. Temperature	^{o}C	7	-	-	-	4	-	4
1.3. Odor	unit	0	1	-	1	-	1	1
1.4. Color	degree	0	50.4	-	32.6	16.31	**38.5**	11.7
1.5. pH	-	8	8	8	8.38	8.22	8.2	8.48
1.6. Surface floating matter	-	absent	-	-	-	absent	-	absent
1.7. Turbidity	mg/L	0.077	1.2	0.23	0.29	0.45	2	0.52
2. Dissolved oxygen indicators								
2.1. Dissolved oxygen	mg O/L	10.72	10.8	8.5	11.4	11.23	10.6	**17.2**
2.2. Chemical oxygen demand	mg O/L	-	12	-	8	10	14	10.8
2.3. Biochemical oxygen demand 5	mg O/L	2.35	1.8	0.56	1.2	1.9	1.9	1.9
3. Mineralization indicators								
3.1. Suspended substances	mg/L	0.03	-	-	-	7.6		38.25
3.2. Dry residues	mg/L	160	-	328	-	387.8		439
3.3. Total hardness	mg-eqv/L	4.5	4.7	5	4.8	5.2	5.2	5
3.4. Total mineralization	mg/L	160	424	-	438	347.5	501	455.01
3.5 Chlorides	mg/L	32.3	28.5	60	26.5	33.41	34	34.7
3.6. Sulphates	mg/L	8.23	61.5	22.74	74.5	83.78	95	71.7
3.7. Calcium	mg/L	-	-	66.13	-	69.64	-	68.1
3.8. Magnesium	mg/L	44.6	-	20.67	-	20.98	-	19.5
3.9. Natrium	mg/L	-	-	-	-	22.3	-	-
3.10. Potassium	mg/L	-	-	-	-	6	-	-
3.11. Hydrocarbonates	mg/L	-	-	-	-	-	-	231.8
3.12. Bicarbonates	mg/L	-	-	-	-	222.72	-	-
4. Biogenic substances								
4.1. Ammonia (nitrogen content)	mg/L	0.046	0.24	0.077	0.22	-	0.54	-
4.2. Nitrites	mg/L	0.008	0.03	0.023	0.03	0.004	0.04	-
4.3. Nitrates	mg/L	1.18	5.7	4.9	5.7	3.37	6.8	-
5. Specific indicators								
5.1. Total iron	mg/L	0.195	<0.03	<0.05	**0.31**	**0.09**	<0.03	0.02
5.2. Manganese	mg/L	0.017	0.01	<0.009	0.01	0.0159	0.01	0.01
5.3. Nickel	mg/L	0.008	<0.02	<0.005	<0.02	0.0062	<0.02	0.02
5.4. Copper	mg/L	0.019	<0.02	0.001	<0.02	0.007	<0.02	0.007
5.5. Synthetic surfactants	mg/L	0	<0.1	0.116	<0.01		<0.1	0.1

		Voloskovo 08/02/2010		Ţechinovca 08/12/2009		Palanca 02/02/2010		
5.6. Petroleum products	mg/L	0	<0.1	<0.3	-	<0.01	<0.1	**0.1**
5.7. Lead	mg/L	0.003	0.02	<0.001	0.02	0.0028	**0.02**	0.005
5.8. Total chromium	mg/L	0.010	0.01		<0.01	0.0037	**0.01**	0.005
5.9. Trivalent chromium	mg/L	0.010	-	-	-	-	-	-
5.10. Hexavalent chromium	mg/L	-	-	-	-	-	-	-
5.11. Zinc	mg/L	0.064	0.01	<0.005	0.01	0.007	<0.01	**0.05**
5.12. Cyanides	mg/L	-	-	-	-	<0.01	-	-
5.13. Phenols	mg/L	0	<0.001	<0.001	<0.001	<0.001	<0.001	
5.14. Arsenic	mg/L	-	-	<0.01	-	<0.01	-	-
5.15. Chloroform	mg/L	0	-	-	-	<0.001	-	-
6. Radioactivity								
6.1. Total alfa	Bq/L	-	-	-	-	-	-	-
6.2. Total beta	Bq/L	-	-	-	-	-	-	0.11
6.3. Caesium-137	Bq/L	0.1	-	-	-	-	-	0.1
6.4. Strontium-90	Bq/L	0.9	-	-	-	-	-	0.03
7. Pesticides								
7.1. DDT	mg/L	<0.005	<0.0001		<0.0002		<0.0001	absent
7.2. Hexachlorocyclohexane (HCH)	mg/L	<0.005	<0.0001		<0.0001		<0.0001	0.0001
7.3. Dieldrin	mg/L	<0.005	<0.0001		<0.0001		<0.0001	absent
7.4. Simazine	mg/L	-	-	-	-	-	-	absent
7.5. Atrazine	mg/L	-	<0.001	-	<0.001	-	<0.001	absent
8. Helminths								
8.1. Eggs	№/L	absent	-	-	-	-	-	-
8.2. Trematodes	№/L	absent	-	-	-	-	-	absent
8.3. Cestodes	№/L	absent	-	-	-	-	-	absent
9. Microbiology								
9.1. Thermotolerant coli-form bacteria	CFU	absent	-	-	-	-	-	60 CFU/ 100 ml
9.2. Total coli-form bacteria	CFU	50	-	-	-	-	-	620 CFU/ 100 ml
9.3. Coliphages	PFU	absent	100	-	100	-	**1300**	50 PFU/ 100 ml
9.4. Pathogenic flora	CFU	absent	-	-	-	-	-	absent
10. Virology								
10.1. Enteroviruses	PFU	absent	-	-	-	-	-	-
10.2. Rotaviruses	PFU	absent	-	-	-	-	-	-

Annex 2 Overview of routine monitoring physico-chemical parameters

Abbreviations

CHE	Centre of Hygiene and Epidemiology
CPM	Centre of Preventive Medicine
DPBA	Dniester-Prut Basin Administration
EI	Environmental Inspectorate
HC	Hydrometeorological Centre
NSPCPM	National Scientific Practical Centre of Preventive Medicine
SCWM	State Committee on Water Management
SES	Sanitary-epidemiological Service
SHS	State Hydrometeorological Service

Cher	Chernivtsi
Chis	Chisinau
Tira	Tiraspol
Vinn	Vinnitsa

Note:
the CPM rayon laboratories in Otaci, Soroca and Ştefan – Vodă are not included in the overviews

			UKRAINE						MOLDOVA				UKRAINE			
Group	**parameter**		**DPBA**	**EI Cher**	**EI Vinn**	**SES Cher**	**SES Vinn**	**SHS Cher**	**CHE Tira**	**NSPCPM Chis**	**HC Tira**	**SHS Chis**	**EI Odes**	**SCWM Odes**	**SES Odes**	***№ of labs***
General parameters	colour		√	√	√	√	√	√	√	√		√			√	*10*
	odour		√	√	√	√	√	√	√	√		√			√	*10*
	pH	pH	√	√	√	√	√	√	√	√	√	√	√	√	√	*13*
	suspended solids		√	√	√	√	√		√	√	√	√	√	√	√	*12*
	temperature water	T	√	√		√		√	√	√		√			√	*8*
	transparency		√	√	√	√	√	√	√	√		√			√	*10*
	turbidity					√			√	√					√	*4*
Oxygen regime	biological oxygen demand (20 days)	BOD20	√			√									√	*3*
	biological oxygen demand (5 days)	BOD5	√	√	√	√	√	√	√	√	√	√	√	√	√	*13*
	chemical oxygen demand	COD	√	√	√				√	√		√		√	√	*8*
	dissolved oxgen	O2	√	√		√	√	√	√	√		√	√	√	√	*11*
	dissolved oxgen, saturation		√					√				√				*3*
	oxydation		√		√	√	√								√	*5*
Major ions	alkalinity			√	√	√	√				√		√		√	*7*
	bicarbonate	HCO3	√		√		√	√	√	√		√		√	√	*9*
	calcium	Ca	√	√	√		√	√	√	√	√		√	√	√	*11*
	chloride	Cl	√	√	√	√	√	√	√	√	√	√	√	√	√	*13*

			UKRAINE						MOLDOVA				UKRAINE			
Group	**parameter**		**DPBA**	**EI Cher**	**EI Vinn**	**SES Cher**	**SES Vinn**	**SHS Cher**	**CHE Tira**	**NSPCPM Chis**	**HC Tira**	**SHS Chis**	**EI Odes**	**SCWM Odes**	**SES Odes**	***№ of labs***
	conductivity							√				√				*2*
	dry residue		√	√	√	√	√	√	√	√	√		√		√	*11*
	hardness		√	√	√	√	√	√	√	√	√	√	√		√	*12*
	magnesium	Mg	√	√	√	√	√	√	√	√	√	√	√	√	√	*13*
	mineralization					√	√	√		√		√		√		*6*
	potassium	K	√	√	√	√	√	√	√	√		√		√	√	*11*
	sodium	Na	√	√	√		√	√	√	√		√		√	√	*10*
	sulphates	SO4	√	√	√	√	√	√	√	√	√	√	√	√	√	*13*
	total dissolved solids								√							*1*
Nutrients	ammonium	NH4	√	√	√	√	√	√	√	√	√	√	√	√	√	*13*
	nitrate	NO3	√	√	√	√	√	√	√	√	√	√	√	√	√	*13*
	nitrite	NO2	√	√	√	√	√	√	√	√	√	√	√	√	√	*13*
	orthophosphates	PO4	√	√	√		√	√			√	√	√			*8*
	total nitrogen		√					√				√				*3*
	total phosphorous											√				*1*
Metals	aluminium	Al	√		√										√	*3*
	arsenic	As					√		√	√					√	*4*
	cadmium	Cd	√		√	√	√		√	√		√			√	*8*
	chromium	Cr	√	√	√	√	√			√					√	*7*
	chromium 3+	Cr 3+							√	√					√	*3*
	chromium 6+	Cr 6+						√	√	√	√				√	*5*
	cobalt	Co	√		√		√								√	*4*
	copper	Cu	√	√	√	√	√	√	√	√	√	√		√	√	*12*
	iron (total)	Fe		√	√	√	√	√	√	√	√	√	√	√	√	*12*
	lead	Pb	√	√	√	√	√		√	√		√			√	*9*
	manganese	Mn	√	√	√	√	√	√	√	√					√	*9*
	mercury	Hg													√	*1*
	molybdenum	Mo													√	*1*
	nickel	Ni	√	√	√	√	√		√	√	√	√			√	*10*
	zinc	Zn	√	√	√	√	√	√	√	√		√			√	*10*
Various	carbon dioxide	CO2						√								*1*

			UKRAINE						MOLDOVA				UKRAINE			
Group	**parameter**		**DPBA**	**EI Cher**	**EI Vinn**	**SES Cher**	**SES Vinn**	**SHS Cher**	**CHE Tira**	**NSPCPM Chis**	**HC Tira**	**SHS Chis**	**EI Odes**	**SCWM Odes**	**SES Odes**	***№ of labs***
	cyanides	Cn							√	√					√	*3*
	detergents			√	√	√	√	√	√	√	√	√		√	√	*11*
	floating matter								√	√						*2*
	fluor(-ide)	F			√	√	√			√					√	*5*
	free gases					√									√	*2*
	oil products		√	√	√	√	√	√	√	√	√	√		√	√	*12*
	phenols					√			√	√	√	√			√	*6*
	polyphosphates														√	*1*
	redox potential							√								*1*
	silica														√	*1*
Pesticides	As, Cu, F, Hg absorbing capacity					√										*1*
	atrazin								√	√						*2*
	carbamate					√									√	*2*
	DDD					√	√			√		√			√	*5*
	DDE							√				√				*2*
	DDT							√	√	√						*3*
	dieldrin					√	√		√	√					√	*5*
	endrin								√	√						*2*
	hexachlorcyclohexane	HCH				√	√			√					√	*4*
	hexachlorobenzene	HCB						√								*1*
	organochlorinated pesticides					√	√					√			√	*4*
	organoposhopours pesticides					√									√	*2*
	pesticides														√	*1*
	pyrethroid insecticides					√	√								√	*3*
	simazin						√		√	√						*3*
	trifluarin							√								*1*
	hexachlorcyclohexane-alpha	α-HCH						√				√				*2*
	hexachlorcyclohexane-beta	β-HCH						√								*1*
	hexachlorcyclohexane-gamma	γ-HCH					√	√	√							*3*
	nitrocompounds					√										*1*
	Сидрин *						√									*1*

			UKRAINE						MOLDOVA				UKRAINE			
			DPBA	EI	EI	SES	SES	SHS	CHE	NSPCPM	HC	SHS	EI	SCWM	SES	*№ of*
Group	**parameter**			**Cher**	**Vinn**	**Cher**	**Vinn**	**Cher**	**Tira**	**Chis**	**Tira**	**Chis**	**Odes**	**Odes**	**Odes**	***labs***
	Сипкриазин *						√									*1*
Organic micropollutants	Chloroform					√			√	√					√	*4*
	Cresol														√	*1*
	Formaldehyde														√	*1*
Radioactivity	Cesium 137	Ce	√			√	√		√	√						*5*
	Strontium 90	Sr	√			√	√		√	√						*5*
	Total alpha					√	√		√	√						*4*
	Total beta					√	√		√	√						*4*
Microbiology	Coliphages					√	√		√	√					√	*5*
	E-coli									√					√	*2*
	Enterococci									√						*1*
	Intestinal disease causing organisms						√								√	*2*
	Lactose-positive bacteria (index)					√	√			√					√	*4*
	Pathogenic flora					√	√		√	√					√	*5*
	Saprophytes at 22C					√										*1*
	Thermotolerant coliform bacteria						√		√	√					√	*4*
	Total coliform bacteria						√		√	√						*3*
Helminths	Cestodes					√			√	√					√	*4*
	Eggs (various worms)					√	√		√	√					√	*5*
	Trematodes					√			√	√					√	*4*
Viruses	Enteroviruses					√	√		√	√					√	*5*
	Rotaviruses					√	√		√	√					√	*5*
Hydrobiology	Phytoplankton							√**				√***				*2*
	Zooplankton							√**				√***				*2*
	Macrozoobenthos											√				*1*
	Macrophytes											√				*1*
	phytobenthos/periphyton											√				*1*
Grand total			**36**	**29**	**33**	**56**	**56**	**40**	**56**	**62**	**21**	**41**	**16**	**21**	**70**	

* no English equivalent could be found

** species composition, quantity, biomass, Pantle-Buck saprobity index, Shannon index

*** species composition, quantity, biomass, Pantle-Buck saprobity index

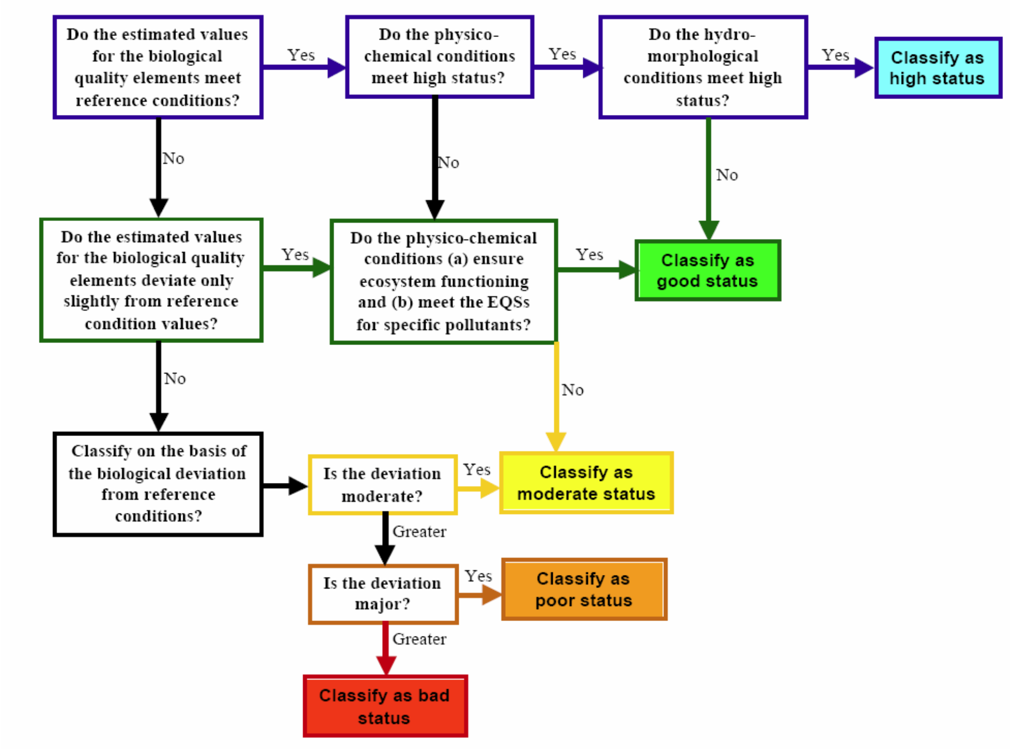
Annex 3 Primer on 'good status' under the Water Framework Directive

The Directive 2000/60/EC *on establishing a framework for Community action in the field of water policy*, better known as Water Framework Directive, introduces new approaches towards water management. The WFD has far-reaching consequences at institutional as well as technical levels.

The overall objective of the WFD is "good status" of all waters[1] (surface water and groundwater) by the year 2015. For water bodies which are (expected to be) of less than good status, plans of measures have to be prepared and implemented in order to improve the status to become at least "good". Whether or not the water bodies are of "good status" has to be determined through monitoring and assessment.

One of specific features of the WFD is its integrated approach. This also applies to the assessment of the status of surface waters. The figure below contains a flowchart for the assessment of the status of a water body, at the same time introducing several typical WFD features.

Figure 1 Indication of Relative Roles of Biological, Hydro-morphological and Physico-chemical Quality Elements in the Ecological Status Classification



[1] "good ecological potential" for 'heavily modified and artificial water bodies'

As illustrated in Figure 1, the WFD assessment of the status of surface water bodies comprises biological, physico-chemical, and hydromorphological quality elements, elaborated into detail in Table 1.

Table 1 Quality Elements for Assessment of Ecological Status in Rivers and Lakes

RIVERS	LAKES
Biological elements	
• Composition, abundance of aquatic flora • Composition, abundance of benthic invertebrate fauna • Composition, abundance and age structure of fish fauna	• Composition, abundance of aquatic flora • Composition, abundance of benthic invertebrate fauna • Composition, abundance and age structure of fish fauna • Composition, abundance and biomass of phytoplankton
Hydro-morphological elements supporting the biological elements	
• Quantity and dynamics of water flow • Connection to ground water bodies • River continuity • River depth and width variation • Structure and substrate of the river bed • Structure of the riparian zone	• Residence time • Connection to the groundwater body • Lake depth variation • Structure and substrate of the lake bed • Structure of the lake shore
Chemical and physico-chemical elements supporting the biological elements	
• Thermal conditions • Oxygenation conditions • Salinity • Acidification status • Nutrient conditions • Specific pollutants o pollution by Priority Substances discharged into the water body (*). o pollution by other substances discharged in significant quantities into the water body.	• Transparency • Thermal conditions • Oxygenation conditions • Salinity • Acidification status • Nutrient conditions • Specific pollutants o pollution by priority substances discharged into the water body (*). o pollution by other substances in significant quantities into the water body.

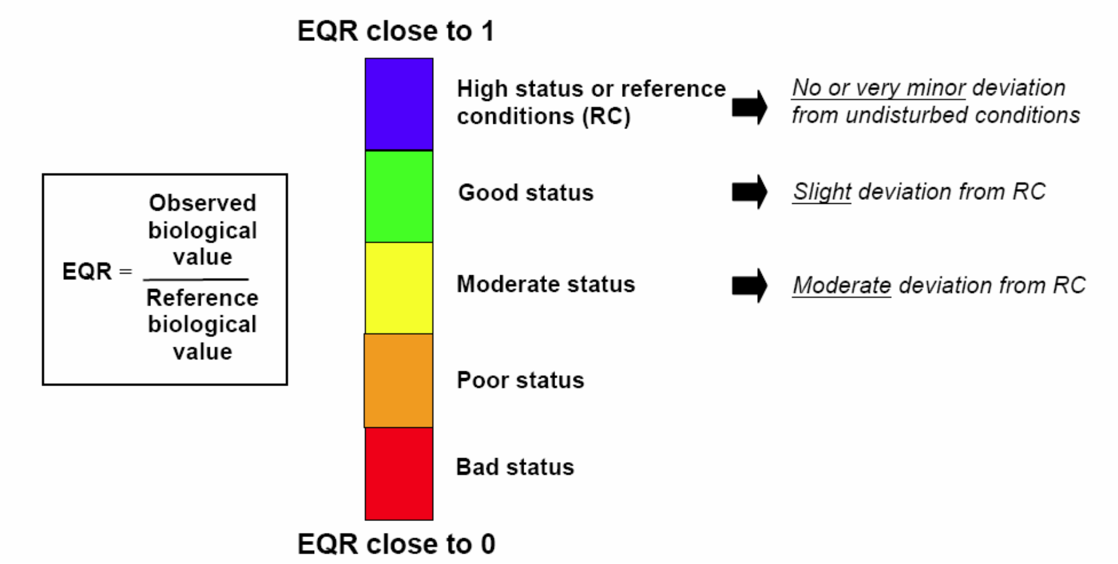
(*) Priority substances meanwhile became part of the chemical status; see further below.

The establishment of “good status” actually comprises two assessments: the *ecological status* and the *chemical status*.

The *ecological status* comprises both biological quality elements and physico-chemical elements indicated as general conditions (thermal conditions, oxygenation conditions, salinity, acidification status, and nutrient conditions) as well as ‘other substances’.

Member States are expected to establish so-called Ecological Quality Ratios (EQR) for the biological quality elements. The basic WFD principles for classification of ecological status based on Ecological Quality Ratios are shown in Figure 2. It is considered as one of the most complicated monitoring and assessment features introduced by the WFD.

Figure 2 Basic Principles for Classification of Ecological Status Based on Ecological Quality Ratios [in: EC, 2003]



For the assessment of the *chemical status*, it suffices to assess whether or not water bodies are of "good chemical status". The WFD has selected a group of 'Priority Substances and certain other pollutants'. These substances must be progressively reduced or, in the case of priority *hazardous* substances, phased out. Many substances that were included in the EU Dangerous Substances Directive 76/464/EC have become Priority Substances.

The EU has provided Environmental Quality Standards (EQS) for the Priority Substances and certain other pollutants for assessment whether or not water bodies are of "good chemical status" [2]. An overview of these substances and EQSs is included in Annex 3 of this report.

For other specific synthetic and non-synthetic pollutants, WFD Annex V. 1.2.6 prescribes the "Procedure for the setting of chemical quality standards by Member States", implying thorough eco-toxicological research, either adoption of recognised SWQS.

[2] Directive 2008/105/EC on environmental quality standards in the field of water policy, amending and subsequently repealing Council Directives 82/176/EEC, 83/513/EEC, 84/156/EEC, 84/491/EEC, 86/280/EEC and amending Directive 2000/60/EC of the European Parliament and of the Council

Annex 4 Environmental quality standards for Priority Substances and certain other pollutants included in the Directive 2008/105/EC

DIRECTIVE 2008/105/EC on environmental quality standards in the field of water policy, amending and subsequently repealing Council Directives 82/176/EEC, 83/513/EEC, 84/156/EEC, 84/491/EEC, 86/280/EEC and amending Directive 2000/60/EC of the European Parliament and of the Council

Annex I: Environmental quality standards for priority substances and certain other pollutants

PART A: ENVIRONMENTAL QUALITY STANDARDS (EQS)

AA: annual average;
MAC: maximum allowable concentration.
Unit: [µg/l]

(1)	(2)	(2)	(4)	(5)	(6)	(7)
No	Name of substance	CAS number[(1)]	AA-EQS[(2)] Inland surface waters[(3)]	AA-EQS[(2)] Other surface waters	MAC-EQS[(4)] Inland surface waters	MAC-EQS[(4)] Other surface waters
(1)	Alachlor	15972-60-8	0.3	0.3	0.7	0.7
(2)	Anthracene	120-12-7	0.1	0.1	0.4	0.4
(3)	Atrazine	1912-24-9	0.6	0.6	2.0	2.0
(4)	Benzene	71-43-2	10	8	50	50
(5)	Pentabromodiphenylether[(5)]	32534-81-9	0.0005	0.0002	*not applicable*	*not applicable*
(6)	Cadmium and its compounds (*depending on water hardness classes*)[(6)]	7440-43-9	≤0.08 (Class 1) 0.08 (Class 2) 0.09 (Class 3) 0.15 (Class 4) 0.25 (Class 5)	0.2	≤0.45 (Class 1) 0.45 (Class 2) 0.6 (Class 3) 0.9 (Class 4) 1.5 (Class 5)	≤0.45 (Class 1) 0.45 (Class 2) 0.6 (Class 3) 0.9 (Class 4) 1.5 (Class 5)
(6a)	Carbon-tetrachloride[(7)]	56-23-5	12	12	*not applicable*	*not applicable*
(7)	C10-13-chloroalkanes	85535-84-8	0.4	0.4	1.4	1.4
(8)	Chlorfenvinphos	470-90-6	0.1	0.1	0.3	0.3
(9)	Chlorpyrifos (Chlorpyrifos-ethyl)	2921-88-2	0.03	0.03	0.1	0.1
(9a)	Cyclodiene pesticides: Aldrin[(7)] Dieldrin[(7)] Endrin[(7)] Isodrin[(7)]	 309-00-2 60-57-1 72-20-8 465-73-6	Σ = 0.01	Σ = 0.005	*not applicable*	*not applicable*
(9b)	DDT total [(7)] [(8)]	*not applicable*	0.025	0.025	*not applicable*	*not applicable*
	para-para-DDT[(7)]	50-29-3				
(10)	1,2-Dichloroethane	107-06-2	10	10	*not applicable*	*not applicable*
(11)	Dichloromethane	75-09-2	20	20	*not applicable*	*not applicable*
(12)	Di(2-ethylhexyl)phthalate (DEHP)	117-81-7	1.3	1.3	*not applicable*	*not applicable*
(13)	Diuron	330-54-1	0.2	0.2	1.8	1.8
(14)	Endosulfan	115-29-7	0.005	0.0005	0.01	0.004
(15)	Fluoranthene	206-44-0	0.1	0.1	1	1

(1)	(2)	(2)	(4)	(5)	(6)	(7)
No	Name of substance	CAS number[1]	AA-EQS[2] Inland surface waters[3]	AA-EQS[2] Other surface waters	MAC-EQS[4] Inland surface waters	MAC-EQS[4] Other surface waters
(16)	Hexachloro-benzene	118-74-1	0.01 [9]	0.01 [9]	0.05	0.05
(17)	Hexachloro-butadiene	87-68-3	0.1 [9]	0.1 [9]	0.6	0.6
(18)	Hexachloroc-yclohexane	608-73-1	0.02	0.002	0.04	0.02
(19)	Isoproturon	34123-59-6	0.3	0.3	1.0	1.0
(20)	Lead and its compounds	7439-92-1	7.2	7.2	*not applicable*	*not applicable*
(21)	Mercury and its compounds	7439-97-6	0.05 [9]	0.05 [9]	0.07	0.07
(22)	Naphthalene	91-20-3	2.4	1.2	*not applicable*	*not applicable*
(23)	Nickel and its compounds	7440-02-0	20	20	*not applicable*	*not applicable*
(24)	Nonylphenol (4-Nonylphenol)	25154-52-3	0.3	0.3	2.0	2.0
(25)	Octylphenol((4-(1,1′,3,3′-tetramethylbutyl)-phenol))	1806-26-4	0.1	0.01	*not applicable*	*not applicable*
(26)	Pentachloro-benzene	608-93-5	0.007	0.0007	*not applicable*	*not applicable*
(27)	Pentachloro-phenol	87-86-5	0.4	0.4	1	1
(28)	Polyaromatic hydrocarbons (PAH) [10]	*not applicable*	*not applicable*	*not applicable*	*not applicable*	*not applicable*
	Benzo(a)pyrene	50-32-8	0.05	0.05	0.1	0.1
	Benzo(b)fluor-anthene	205-99-2	∑= 0.03	∑= 0.03	*not applicable*	*not applicable*
	Benzo(g,h,i)-perylene	191-24-2				
	Benzo(k)fluor-anthene	207-08-9	∑= 0.002	∑= 0.002	*not applicable*	*not applicable*
	Indeno(1,2,3-cd)-pyrene	193-39-5				
(29)	Simazine	122-34-9	1	1	4	4
(29a)	Tetrachloro-ethylene [7]	127-18-4	10	10	*not applicable*	*not applicable*
(29b)	Trichloro-ethylene [7]	79-01-6	10	10	*not applicable*	*not applicable*
(30)	Tributyltin compounds (Tributhyltin-cation)	688-73-3	0.0002	0.0002	0,0015	0,0015
(31)	Trichloro-benzenes	12002-48-1	0.4	0.4	*not applicable*	*not applicable*
(32)	Trichloro-methane	67-66-3	2.5	2.5	*not applicable*	*not applicable*
(33)	Trifluralin	1582-09-8	0.03	0.03	*not applicable*	*not applicable*

[1] CAS: Chemical Abstracts Service.
[2] This parameter is the EQS expressed as an annual average value (AA-EQS). Unless otherwise specified, it applies to the total concentration of all isomers.
[3] Inland surface waters encompass rivers and lakes and related artificial or heavily modified water bodies.
[4] This parameter is the EQS expressed as a maximum allowable concentration (MAC-EQS). Where the MAC-EQS are marked as 'not applicable', the AA-EQS values are considered protective against short-term pollution peaks in continuous discharges since they are significantly lower than the values derived on the basis of acute toxicity.
[5] For the group of priority substances covered by brominated diphenylethers (No 5) listed in Decision No 2455/2001/EC, an EQS is established only for congener numbers 28, 47, 99, 100, 153 and 154.
[6] For cadmium and its compounds (No 6) the EQS values vary depending on the hardness of the water as specified in five class categories (Class 1: < 40 mg CaCO3/l, Class 2: 40 to < 50 mg CaCO3/l, Class 3: 50 to < 100 mg CaCO3/l, Class 4: 100 to < 200 mg CaCO3/l and Class 5: ≥ 200 mg CaCO3/l).
[7] This substance is not a priority substance but one of the other pollutants for which the EQS are identical to those laid down in the legislation that applied prior to 13 January 2009.
[8] DDT total comprises the sum of the isomers 1,1,1-trichloro-2,2 bis (p-chlorophenyl) ethane (CAS number 50-29-3; EU number 200-024-3); 1,1,1-trichloro-2 (o-chlorophenyl)-2-(p-chlorophenyl) ethane (CAS number 789-02-6; EU number 212-332-5); 1,1-dichloro-2,2 bis (p-chlorophenyl) ethylene (CAS number 72-55-9; EU number 200-784-6); and 1,1-dichloro-2,2 bis (p-chlorophenyl) ethane (CAS number 72-54-8; EU number 200-783-0).

(9) If Member States do not apply EQS for biota they shall introduce stricter EQS for water in order to achieve the same level of protection as the EQS for biota set out in Article 3(2) of this Directive. They shall notify the Commission and other Member States, through the Committee referred to in Article 21 of Directive 2000/60/EC, of the reasons and basis for using this approach, the alternative EQS for water established, including the data and the methodology by which the alternative EQS were derived, and the categories of surface water to which they would apply.
(10) For the group of priority substances of polyaromatic hydrocarbons (PAH) (No 28), each individual EQS is applicable, i.e. the EQS for Benzo(a)pyrene, the EQS for the sum of Benzo(b)fluoranthene and Benzo(k)fluoranthene and the EQS for the sum of Benzo(g,h,i)perylene and Indeno(1,2,3-cd)pyrene must be met.

PART B: APPLICATION OF THE EQS SET OUT IN PART A

1. Columns 4 and 5 of the table: For any given surface water body, applying the AA-EQS means that, for each representative monitoring point within the water body, the arithmetic mean of the concentrations measured at different times during the year does not exceed the standard.

The calculation of the arithmetic mean, the analytical method used and, where there is no appropriate analytical method meeting the minimum performance criteria, the method of applying an EQS must be in accordance with implementing acts adopting technical specifications for chemical monitoring and quality of analytical results, in accordance with Directive 2000/60/EC.

2. Columns 6 and 7 of the table: For any given surface water body, applying the MAC-EQS means that the measured concentration at any representative monitoring point within the water body does not exceed the standard. However, in accordance with section 1.3.4 of Annex V to Directive 2000/60/EC, Member States may introduce statistical methods, such as a percentile calculation, to ensure an acceptable level of confidence and precision for determining compliance with the MAC-EQS. If they do so, such statistical methods shall comply with detailed rules laid down in accordance with the regulatory procedure referred to in Article 9(2) of this Directive.

3. With the exception of cadmium, lead, mercury and nickel (hereinafter ‘metals’) the EQS set up in this Annex are expressed as total concentrations in the whole water sample. In the case of metals the EQS refers to the dissolved concentration, i.e. the dissolved phase of a water sample obtained by filtration through a 0,45 µm filter or any equivalent pre-treatment.

Member States may, when assessing the monitoring results against the EQS, take into account:
(a) natural background concentrations for metals and their compounds, if they prevent compliance with the EQS value; and
(b) hardness, pH or other water quality parameters that affect the bioavailability of metals.

Annex 5 List with interviewees

MOLDOVA	
Chisinau	
National Scientific and Practical Center of Preventive Medicine	Mr. Dumitru Siretsyanu
State Hydrometeorological Service	Mr. Gavril Gilka Mrs. Ludmila Serenco Mrs. Svetlana Stirbu
'Apele Moldovei' (meanwhile MENR), Dniester Basin Department	Mr. Dumitri Proca
Ministry of Ecology and Natural Resources	Mr. Lazor Chirica Mrs. Maria Nagornii
Eco-TIRAS	Mr. Ilya Trombitsky
Akvaprojekt	Mr. Ruslan Melian
OSCE, Chisinau	Mr. Kenneth Pickles
UNDP, Chisinau	Mr. Victor Munteanu
Tiraspol	
Hydrometeorological Centre	Mr. Vitaliy Basok
Transnistrian Authority for Natural Resources and Ecological Control	Mr. Oleg Kalyakin Mr. Aleksandr Kozelskiy
Eco-Spectrum	Mr. Ivan Ignatiev

UKRAINE	
Kyiv	
State Committee on Water Management of Ukraine	Mrs. Olga Lysyuk
Ministry of Protection of Natural Environment of Ukraine	Mr. Gregory Petruk Mrs. Larysa Yurchak Mr. Volodimir Olshevski Mrs. Irina Goncharova Mr. Iurii Kashpirenko Mrs. Lesya Nikalaeva
Ukrainian Research Hydrometeorological Institute	Mr. Iurii Nabyvanets Mr. Vladimir Osadchiy
Ukrainian Scientific Research Institute of Ecological Problems (Kharkiv)	Mr. Oleksander Vasenko
Odessa	
Odessa Regional Water Management Department	Mrs. Lilya Michenko
State Department for Environment Protection	Mrs. Alla Tachanskaya Mrs. Anna Boreyko
State Ecological Inspectorate	Mrs. Marina Mityukova
Odessa Region Sanitary-Epidemiological Service	Mrs. Alla Kildysheva Mrs. Elena Shvaleva
Hydrometeorological Centre of Black and Azov Sea	Mr. Victor Sytov Mr. Igor Neverovskiy

	Mr. Alexei Dudinov
Odessa National I.I. Mechnikov University	Mr. Vladimir Medinets
Mama 86	Mrs. Svetlana Slesarenok
Chernivtsi	
Dniester-Prut Basin Management Board	Mr. Ivan Losik Mr. Olexander Toniyevich Mr. Olexander Yusko
Oblast sanitary-epidemiological service	Mrs. Nadeshda Vorbeva Mrs. Natalya Klimchuk
Ukrainian Hydrometeorological Service	Mrs. Tatyana Negadaylova Mrs. Ludmila Rybak
Regional Environmental Inspectorate	Mr. Yuri Makeev Mrs. Inna Slivka Mrs. Tatyana Kartavina

Annex 6 Mission itinerary

15 February 2010	Travel Amsterdam – Chisinau
16, 17 February 2010	Interviews Chisinau
18 February 2010	Interviews Tiraspol Travel Chisinau – Tiraspol – Odessa
19, 22, 23 February 2010	Interviews Odessa Travel Odessa – Kyiv
24 February 2010	Travel Kyiv – Chernivtsi
25, 26 February 2010	Interviews Chernivtsi
27 February 2010	Travel Chernivtsi – Kyiv
1, 2 3, March 2010	Interviews Kyiv Travel Kyiv – Amsterdam