REPUBLIC OF MOLDOVA

APA CANAL CHISINAU

CHISINAU WATER SUPPLY & SEWAGE TREATMENT - FEASIBILITY STUDY



ASSESSMENT OF INDUSTRIAL DISCHARGES - FINAL

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seureca A Subsidiary of VEOLIA ENVIRONNEMENT

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LIST OF ABBREVIATIONS AND ACRONYMS

ACC	Apa Canal Chisinau
MAC	Maximum Allowed Concentrations
WWTP	Wastewater Treatment Plant
TPL	Theoretical Pollution Load

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EXECUTIVE SUMMARY

As for a large number other issues, the way industrial wastewater discharges are currently handled in Chisinau dates back to the 1970s and has not been significantly updated since then. Today, it is obvious that this way of proceeding is not adapted to the existing situation, mainly due to inconsistencies between the true pollution load of the customer and the associated level of requirements and monitoring, and to the inadequacy between MAC values and true pollutant concentrations in industrial wastewater.

Therefore the management scheme for industrial wastewater handling - and all associated procedures - should undergo an in-depth revision in order to take into consideration the significant changes that occurred during the past decades within the industrial sector in and around Chisinau. This revision procedure should involve both governmental bodies (i.e. mainly with regards to legal requirements) and operational entities (i.e. mainly to ensure the practical implementation of the new scheme) so that a sound industrial wastewater management scheme is set up.

The analysis of the figures related to industrial wastewater quantity and quality show the low impact of the industrial wastewater flow rates and pollution loads in the global picture of wastewater collection and treatment at Chisinau. However specific regulations and monitoring procedures should apply to the largest industrial customers in order to encourage water savings and to reduce the environmental impact of industrial activities.

The scattering of industrial sites all around the city and the absence of big industrial polluters makes it unrealistic to plan a future WWTP dedicated to industrial wastewater treatment. On the contrary, it is recommended to keep industrial customers discharging their effluents into the municipal sewerage network while improving the coherence of the contractual terms and the relevance of the monitoring and reporting and pricing procedures.

In conclusion, we consider that the current industrial wastewater management scheme is not well adapted to the situation of industrial customers in Chisinau for the following reasons:

- There is no general database that compiles the data regarding wastewater quantity and quality for every customer.
- Industrial customers must comply with MAC values that are not adapted to their activities and that are not targeted by ACC analyses.
- Contractual terms between ACC and industrial customers are not in accordance with a sound strategy that would encourage industrial customers to reduce their pollution load.
- The existing ACC monitoring plan does not set up a clear classification of the industrial customers that takes into account their respective weight in the total industrial pollution load.

The whole responsibility for measuring and analyzing the wastewater discharges to the sewerage network is on the side of ACC, which requires a lot of work from ACC.

Some specific recommendations are provided to help decision-makers in their task. We appreciate that within the current economic situation, to ask industrialists to incur capital expenditure to modify their wastewater discharges to the sewer is unlikely to be well received. Nevertheless, in places the discharges are not compliant with Moldovan law and as such are illegal. Also, industrialists do have a responsibility to protect the environment and in some instances their discharges could have a serious environmental impact, as well as threatening the ability of ACC to meet its own discharge obligations.. The known inadequacy of the ability of ACC to prevent non-compliant wastewater discharges to its sewer network, might affect its ability to attract international funding for improvements to the wastewater treatment works.

Our recommendations, which are in line with current best international practice are:

- A better categorization of industrial customers in order that ACC may focus its attention on those likely to be the most serious polluters;

- The rationalization of the contracts between ACC and the industrial customers so that there is consistency;
- The improvement of the monitoring plan to focus on the main polluters rather than targeting the whole range of industrial customers;
- The implementation of “self-monitoring” by industrialists and adapted reporting measures to increase awareness among industrial customers and to reduce the workload of ACC, and
- The installation of grease traps at the outlet of each restaurant and food processing plant in order to reduce the grease concentration and to protect the sewerage network.

From our meetings and discussions with the senior managers of ACC and laboratory staff members, we see no requirement for capacity building within ACC for the purpose of monitoring industrial wastewater discharges.

We would wish to thank ACC and it staff for their cooperation and without whose help this report would not have been possible

DETAILED REPORT

1. INTRODUCTION

1.1. TERMS OF REFERENCE

The terms of reference referring to Phase A4 are recalled in the following table. They are addressed by this report.

• Industrial Wastewater - Investigation of quantity and type, extent of pre-treatment, institutional and legal framework (e.g. what kind of arrangements exist between industries and the Municipality/water company concerning discharge and treatment of industrial wastewater); - Assess the existing industrial wastewater treatment facilities, including sludge handling and disposal: type of process, capacity, flow, technological appropriateness, treatment effectiveness, condition, maintenance practices, suitability, bottlenecks and quality of materials and equipment; - Quality standards: Analyze compliance with applicable effluent standards and applicable regulations; - Sustainability: what investigations and investments are recommended to assure the sustainability of the measure in reducing operational costs and/or increasing revenue? - Preparation of the report - Preparation of the maps and drawings	A.4.

1.2. BACKGROUND

The study aims at providing the elements required by the terms of reference of the Feasibility Study as recalled above. This study has been performed by investigating the context of industrial wastewater handling in Chisinau through interviews with key personnel within ACC, a visit to an industrial factory and the desk study of official documents, including a specific analysis of the industrial customer database as provided by ACC.

2. LEGAL FRAMEWORK

2.1. RELEVANT LEGAL DOCUMENTS

A non-exhaustive list of important Moldovan regulations about wastewater management is presented in **Erreur ! Source du renvoi introuvable.**.

Table 1 Main Moldovan regulations relative to wastewater management

(the numbers refer to Figure 1)

Reference	Name	English translation	Comments	
[Discharge temporary conditions]	Conditiile temporare a deversarilor, limitat admisibile in r. Bic pentru statia de epurare biologica mun. Chisinau. Aprobat de Inspectoratul Ecologic de Stat. 11/02/2010	Temporary conditions of discharge into River Bic, Chisinau WWTP	This document defines the Maximum Allowed Concentrations in the outlet of the WWTP and the maximum treated effluent flow rate as approved by the National Inspectorate of Ecology. This document is renewed every 3 years. The current one is valid from 2010 until 2013.	[1]
[Regulation-discharge in natural environment]	Republica Moldova, Guvernul, Hotarire 1141 din 10.10.2008 pentru aprobarea Regulamentului privind condiţiile de evacuare a apelor uzate urbane în receptori naturali	Regulation on the conditions of urban wastewater discharge into the natural environment	This document has been approved by the Government (Decision 1141 dated 10/10/2008) and sets out the conditions for urban wastewater discharge into the natural environment. These conditions are the same as the ones defined in the European Directive 91/271/CEE concerning urban wastewater treatment.	[1]
[Regulation-discharge in sewerage]	Regulament – cadru privind recepţionarea apelor uzate, eliberarea condiţiilor tehnice şi autorizaţiilor de deversare a apelor uzate în sistemul de canalizare al localităţilor	Framework regulation for collecting wastewater, setting out the technical requirements and the permits of discharging wastewater into the municipal sewerage network	One can find in this document the definition of one global set of Maximum Allowed Concentrations (MACs) for industrial customers and one set for domestic customers. It also sets out the removal efficiency of WWTPs for various parameters.	[2]
[Decision 23/05/2002]	“Concentratiile maxim admisibile ale impuritatilor din apele uzate deversate de agentii economici in sistemul de canalizare al municipiului Chisinau”	Decision 2/4 of Chisinau Municipal Council dated May 23rd 2002 on “improving the operation of sewage treatment plants and municipal sewer”	Maximum allowed concentrations of contaminants discharged by the economic agents in the sewerage system are established and approved by the Decision of Chisinau Municipal Council, Decision №.2 / 4 of 23 May 2002 "On improving the operation of sewage treatment plants and municipal sewer”. One of the items of the [Decision 23/05/2002] states that: “Consumers of water that who stores sludge and sewage, with high concentration of pollutants, shall sign with ACC contracts regarding the service provision of sludge and wastewater disposal with high concentration of pollutants, for collecting and discharging them into	[5] & [6]

Reference	Name	English translation	Comments	
			appropriate places. Paragraph 8 of the decision states that: “If the finding of sludge and waste water’ spills, with high concentration of pollutants, with deterioration of sewage networks and disruption of the technological process including treatment plant and installations’ operation, ACC in agreement with the Municipal Ecological Agency will prepare aforementioned acts to compensate for damage caused. Another point also prohibits SA “Autosalubritate” to transport sewage (liquid waste) and transfers this function to ACC.	
[Law 11/1998]		Law № 186 – XIV from 06 November 1998	According to Laws of Republic of Moldova, the Law № 186 – XIV from 06 November 1998, regarding local public administration, Municipal Council approves maximum permitted concentrations for economic agents and are set out in Annexe 1, 2 and 3 (**Erreur ! Source du renvoi introuvable.**).	[5]
[Decision 09/09/1988]			Council of the Ministers of the Socialist Soviet Republic of Moldova. Decision n°282 of 09/09/1988 Related to the differentiated tariffs and economic sanctions in case of breaching of the discharge limits into the municipal sewerage system. (sets the conditions of additional fee in case the CMAs are overrun)	[5]
[Decision 25/03/2008]	Consiliul Municipal Chisinau din 25 Martie 2008 Nr 5/4 Cu privire la aprobarea Regulamentului de organizare şi funcţionare a serviciilor publice de alimentare cu apă şi de canalizare din municipiul Chişinău	Decision of the Chisinau Municipal Council of 03/25/2008 Nr 5/4 Regarding the approval of organization and functioning of the Chisinau public water and wastewater services	The article 4.2. relates to the protection of water and sewerage networks.	[5]

MAC values set out in [Law 11/1998] are reported in **Erreur ! Source du renvoi introuvable.**.

Table 2 Concentration limits of Annex 1 to 3 of [Decision 23/05/2002], “None” means that the concentration shall not exceed the one measured in the drinking water network (background noise).”NS” means not specified.

		Annex 1	Annex 2	Annex 3
		industrial – site specific, customized for each industrial customer	industrial	domestic
pH	-	6.5 – 8.5	6.5 – 8.5	6.5 – 8.5
T	°C	6 – 30 °C	6 – 30 °C	6 – 30 °C
SS	mg/L		130	140
COD	mg/L		300	300
BOD5	mg/L		150	150
NH4	mg/L		8.0	14
TDS	mg/L		600	600
SO4	mg/L		160	160
S	mg/L		1	1
PP	mg/L		1.5	0.1
FOG	mg/L		10	15
Anionic surfactants	mg/L		0.45	0.5
PO4	mg/L		3.7	4.5
Cl	mg/L		100	100
Formaldehyde	mg/L		None	NS
Phenol	mg/L		None	NS
Fe (total)	mg/L		1	1

Cr3+	mg/L		None	NS
Cr6+	mg/L		None	NS
Ni	mg/L		None	NS
Pb	mg/L		None	NS
Other heavy metals (Cd, Hg, Bi, Al, As, Co, Sn, Sr, Be, Se, Mo, F)	mg/L		None	NS

2.2. OVERALL WASTEWATER MANAGEMENT SCHEME

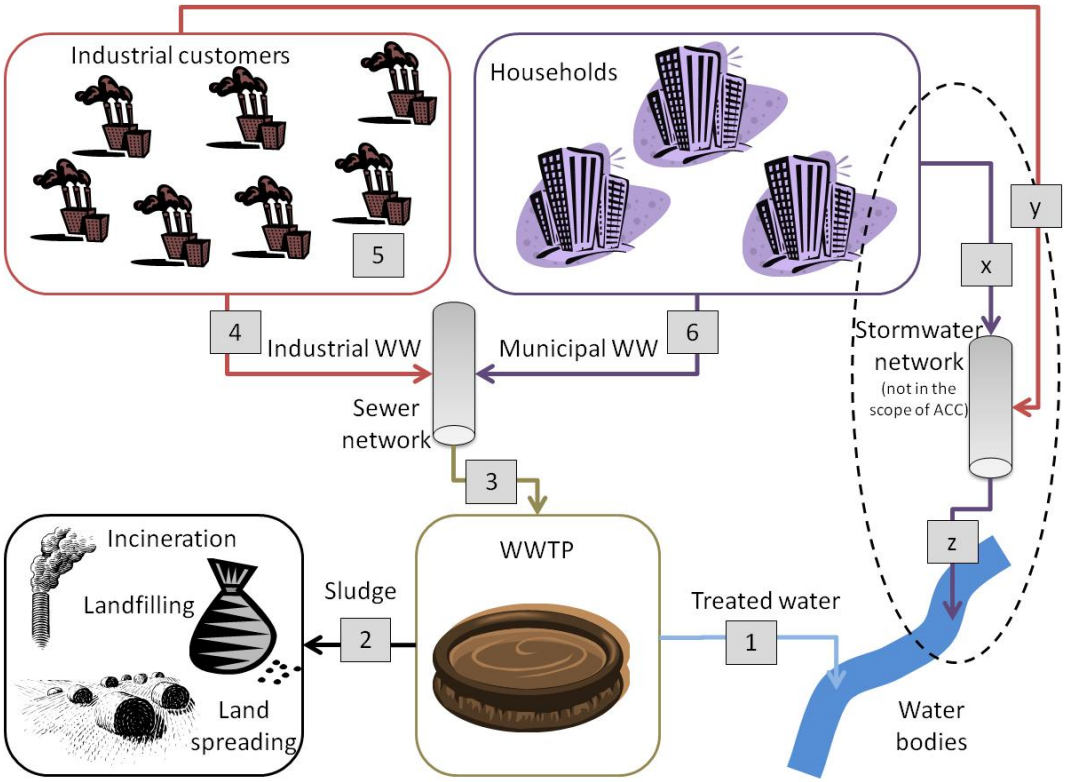

Figure 1 Overall scheme of wastewater management and stakeholders. The numbers refer to paragraphs below.

- Treated wastewater discharge

The constraints over the quantity and the quality of the treated wastewater discharged from Chisinau WWTP into the Bic River as defined by the National Inspectorate of Ecology in [Discharge temporary conditions] are complex and contradictory. For instance a maximum concentration of 30 mg/L of COD is specified in this document whereas it is mentioned that the “de facto” concentration is around 150 mg/L and the maximum concentration is 125 mg/L in the European Directive 91/271/CEE, which should be applied in Moldova following the approbation of [Regulation-discharge in natural environment] by the Moldovan government in 2008. This example shows that the EU Directives have not yet been fully normalised into Moldovan regulations.

- Sludge disposal

No specific regulation exists in Moldova about sludge disposal as far as incineration, land spreading and landfilling are concerned.

- Inlet of WWTP

The maximum pollution load at the inlet of the WWTP (i.e. the maximum load the WWTP is able to handle) is calculated from the MACs in the outlet of the WWTP and the theoretical removal rates at the WWTP as defined in [Regulation- discharge in sewerage].

- Global industrial wastewater discharge into the sewerage network

One global set of MACs for the whole of industrial customers is presented in [Regulation-discharge in sewerage]. These MACs, together with one global industrial wastewater flow rate, define the maximum allowable industrial pollution load.

- Individual agreements between each industrial customer and ACC

Individual contracts can be signed between each industrial customer and ACC in order to set out the conditions of wastewater discharge and the methods to calculate the associated charges.

The [Law 11/1998] and the [Decision 23/05/2002] have defined the MACs values depending on the category of the customer (domestic / Annex 3, standard industrial customer / Annex 2, or specific industrial customer / Annex 1).

The [Decision 09/09/1988] sets the conditions of fines in case the CMAs are exceeded by the industrial customers.

- Domestic wastewater discharge into the sewerage network

The MACs for domestic wastewater discharge into the sewerage network are defined in the [Decision 23/05/2002].

2.3. CONTRACTS WITH ACC

Discharge of industrial effluents into the sewerage network of ACC is ruled by the contract that every industrial customer has signed with ACC.

The [Decision 23/05/2002] allows the establishment of mutual contractual relations between ACC and water users, economic agents, including the subscribers and budgetary institutions, which release wastewater with pollutant concentrations that exceed the established MACs. Control of discharged water shall be performed by ACC laboratory.

There are three main contracts, as presented below.

2.3.1. CONTRACT RELATIVE TO WATER AND SEWERAGE SERVICE

This contract sets out the conditions of drinking and sewerage service provided by ACC to the customer.

This contract is mandatory.

2.3.2. CONTRACT RELATIVE TO THE IMPLEMENTATION OF A PRE-TREATMENT FACILITY

This contract sets out the conditions of the implementation of a pre-treatment facility by the customer in case the concentrations of the untreated effluent exceed the legal requirements.

This contract is optional.

2.3.3. CONTRACT RELATIVE TO THE EFFLUENT TRANSPORTATION

This contract shall be active in case the connection of the customer to the sewerage network is not practically feasible. This contract sets out the conditions of collecting the customer's effluents by ACC.

This contract is optional.

2.4. MAC CALCULATIONS

MAC stands for Maximum Allowed Concentration. Various MAC values have been set up all along the wastewater pathway, from the wastewater source (domestic or industrial customers) throughout the treatment steps and to the final discharge into the environment. This system has been inherited by Moldova from the Soviet era.

MAC values are defined or calculated backward, from the discharge point of the final effluent from the wastewater treatment plant into the environment, following the sequences presented below.

- Definition of the MACs in the WWTP outlet
- Calculation of the MACs in the WWTP inlet by affecting pre-defined removal rates to the WWTP (Cadmissible)
- Definition of the maximum flow rate of the WWTP inlet (Qind + Qdom)
- Definition of the domestic concentrations and wastewater flow rate (Cdom & Qdom)
- Definition of the total industrial flow rate (Qind)
- Calculation of one global set of CMAs for the whole of industrial customers:

$$C_{ind(CMA)} = C_{admissible}\frac{Q_{dom}+Q_{ind}}{Q_{ind}} - C_{dom}\frac{Q_{dom}}{Q_{ind}}$$

- Calculation of individual CMAs for each industrial customer so that

Σ CMAi x Qindi < CMA x Qind

The way of defining/calculating the MACs as presented above raises the following issues:

- Yearly updates of removal rates of the WWTP and of Qind and of Qdom should be done to revise the whole calculation, which is not practically done. Hence the MACs do not generally fit with the current situation.
- The inherent risks of this backward calculation include potential dead-ends, for instance if the removal rates of the WWTP are very low. This difficulty is overcome by the absence of update procedures for removal rates of the WWTP.
- The last calculation step which allocates the total allowed industrial load among all industrial customers is performed by an academic institute. The detailed calculation method for allocating the total load among individual customers is likely to be subject to some form of arbitration, which has not been further investigated. Anyway, individual CMAs have not been updated for a long period and do not fit with the current situation. They were initially determined so that they were achievable by the industrial customers through the operation of on-site pre-treatment facilities. However the latter have been out of use for more than 20 years in almost all industrial sites. This calculation step is also linked to the individual agreements that are signed between ACC and industrial customers (Section 1.1)

2.5. GENERAL COMMENTS ABOUT ENVIRONMENTAL LAWS IN MOLDOVA

In the study entitled “Environmental protection law and policy, law approximation to EU standards in the Republic of Moldova” performed by Breda Howard and Ludmila Gofman, and published in the “Sectoral law approximation guidelines series” (Chisinau, August 2010), one can read the following statements.

"The EU funded Project "Support for the Implementation of Agreements between the Republic of Moldova and the European Union" commenced work in Chisinau in August 2008 and will operate until end–2010. The Project is being implemented by an international Consortium headed by IBF International Consulting. The overall objective of the Project is to assist the Moldovan authorities in implementing the priorities set out in the Partnership & Cooperation Agreement (PCA) of 1998 and the European Neighbourhood Action Plan (ENAP) of 2005."

[…]

"Finally, in a summary of key progress to date in law approximation in the environment sector in Moldova, the clear position emerges that:

- Moldovan environmental legislation lacks a systematic and coherent approach
- Legislation in regard to nature protection, urban wastewater treatment, drinking water quality requirements and GMOs are at best partially compliant with EU standards
- Legislation in regard to good governance (EIA, SEA, access to information, public participation), air quality, water management, groundwater protection, flood management, waste management, industrial permitting and pollution control, chemicals and noise are not compliant with EU standards
- At the same time, the permitting / authorisation regimes and the corresponding enforcement measures fall short of European standards
- The current national legislation reflects to varying degrees the requirements of international environmental treaties
- While efforts to approximate national environmental legislation to EU requirements have obviously increased during the last years, this remains a continuous process.
- With important draft legislation and related secondary legislation advancing at the present time, further progress can be expected in the coming years; although it will take many more years to achieve full approximation in the environmental field."

3. CURRENT PRACTICES

3.1. ON-SITE PRE-TREATMENT FACILITIES

Industrial customers had once implemented pre-treatment facilities to comply with the CMAs that were allocated to them or agreed with ACC and to the terms of the agreement with ACC. However very few of these facilities are still in operation today due to the lack of investment for maintaining their performances and the incapacity of ACC to force the customers to ensure their good operation.

Another limitation to the application of the Moldovan law that requires industrial companies to implement a pre-treatment when required also appears in the fact that a so-called “sanitary protection zone” around every treatment or pre-treatment facility shall be implemented within which no construction should stand. The radius of this zone is 50 m for the underground facilities and 100 m for the open-air facilities, which is a clear obstacle in implementing pre-treatment facilities at industrial sites.

One example of a pre-treatment facility that is still active can be found in the description of the grease separation system implemented by S.A. Carmez (Section 9).

3.2. DISCHARGE TO THE MAIN SEWERAGE NETWORK

There is no identified industrial park in Chisinau. Industrial sites are scattered all around the city. Therefore, industrial wastewater is discharged all along the municipal sewerage network and mixed to the municipal wastewater. However a specific pipe collecting the wastewater from the industries around the WWTP discharges directly into the second mixing chamber or further downstream at the inlet to the sand removal tanks.

The industrial discharges should comply with the conditions set in the Decision of the Chisinau Municipal Council dated March 25th 2008. An extract of this decision is presented in Section 8, which specifically requires the industrial customers not to discharge any dangerous liquids or harmful components that could threaten both the Public Health and the structure and equipment of the sewerage network and of the WWTP.

3.3. MEASURING & BILLING

3.3.1. INDUSTRIAL WASTEWATER FLOW RATES

The estimation of the quantity of wastewater discharged into the main sewerage network by every industrial customer is of prime importance since it is necessary to estimate the pollution load brought by the customer to the sewerage network and to calculate the fraction of the bill dedicated to industrial wastewater discharge and charged by ACC.

This estimation is an issue both for ACC and the industrial customers since only one of them is equipped with a flow meter that records the wastewater flow rate discharged into the sewerage network.

Up to recently the assessment method was the following. Prior to contracting any water and wastewater service to ACC, each industrial customer was requested by ACC to fill in a form with the estimation of its water demand and the description of its industrial process, from which an ACC engineer would calculate the percentage of water (correction factor) that would be discharged into the sewerage network. The resulting flow rate was then taken into account when establishing the bill for wastewater collection and treatment.

However, since a lot of industrial customers do not want to pay for various reasons, ACC has decided in November-December 2010 to

1) ask the industrial customers to install a flow meter on their wastewater outlet pipe.
2) withdraw the correction factor and to charge 100 % of the drinking water as wastewater if they do not install a flow meter.

One single company has installed a flow meter on its wastewater pipe to date: Coca-Cola. The others are reluctant to do it for the following two reasons:

1) They do not have the money to install a flow meter and/or they estimate that the return period is too long and hence have no interest in investing in a flow meter
2) A lot of them are not connected to a rainwater network and rainwater enters the wastewater network; if they install a flow meter, they will also be charged for rainwater.

3.3.2. INDUSTRIAL WASTEWATER QUALITY

The monitoring process of the industrial wastewater discharges depends on the type of contract that has been signed between ACC and each industrial customer, whatever the MACs are for the customer.

Each customer can choose among the two following kinds of contracts, independently from the type of Annexes it belongs to.

3.3.2.1. Contract with stable coefficient

The title of this contract is the following : “Contract privind receptionarea si preepurarea apelor uzate cu concentratii majorate de poluanti” – coefficient stabil

This contract requires ACC to perform three analyses during the first months of operation of the new industrial customer to assess the stability of the wastewater quality. If no significant variations are noticed, ACC agrees to sign this type of contract with the customer.

The customer is then charged for the wastewater discharged in the sewerage network in the following manner:

Price charged by ACC = 1.5 x Normal tariff for wastewater x VAT x Volume of wastewater

In 2011, this price was the following: 1.5 x 10.26 x 1.2 = 18.468 MDL/m3

ACC performs one analysis per year or more if deemed necessary to check the stability of the discharge quality.

In case the analytical results exceed the MACs by a factor higher than 10, then the stable coefficient is not 1.5 any longer but 10. This procedure is seldom applied.

This type of contract was implemented by ACC to allow the customers to pay a bill that would be too high for them in case they choose the contract with variable coefficient presented below.

3.3.2.2. Contract with variable coefficient

The title of this contract is the following: “Contract privind receptionarea si preepurarea apelor uzate cu concentratii majorate de poluanti” - coeficientul de variabila.

In this contract, the correction coefficient is recalculated depending on the analytical results. The frequency of the wastewater analyses is defined in the contract (several times a year). The calculation method of the correction coefficient is detailed in the

document “Calculul coeficentilor la tarif si sumei de plata pentru recpetionare si epurarea apelor uzate de la agentii economici cu concentratii majorate fata de normativele de CMA” which was approved by the technical committee of ACC on 10/07/2002. This calculation method calculates a correction coefficient directly proportional to the ratio between the measured value and the MAC value.

Although the calculation would require the measurement of all parameters on which a MAC applies, ACC generally reduces the number of analyzed parameters to the ones that are of significant relevance for each industrial customer, on a case by case basis. For instance an industrial brewery may have a MAC value about petroleum products, but ACC does not measure petroleum products in the routine monitoring program of this customer because they do not expect to find any petroleum products in its effluent.

This procedure illustrates the lack of coherence between the various agreements and contracts that each industrial customer is required to sign.

3.3.3. GENERAL COMMENTS

Industrial customers must be very cautious when choosing the type of contracts. The contract with stable coefficient appears like a “right to pollute” while being charged 1.5 times the normal tariff; the contract with variable coefficient looks fairer but can reveal to be very expensive when high pollutant concentrations are accidentally - or not - released in the outlet.

Industrial customers are generally not satisfied by these procedures and by the price they have to pay for wastewater collection and treatment. Trials between ACC and industrial customers are common, and ACC seldom wins.

The extra revenue brought by the industrial customers to ACC in addition to the normal tariff amounts to around 1 million EUR per year.

It should be also noticed that the whole control procedure is performed by ACC, including the measuring of drinking water consumption and groundwater extraction and the sampling and analyzing of wastewater samples. ACC does not rely on any data directly provided by the industrial customer.

The regulations and associated list of customers subject to specific MAC as stated in Annex 1 are not regularly updated as they should be, which results in some incoherence. For instance, one can notice from the individual monitoring sheet of ACC that Coca-Cola must comply with specific CMA, whereas the name of Coca-Cola does not appear in the list of the customers registered under the Annex 1.

4. DATA ANALYSIS

4.1. DATA AVAILABILITY

A database does exist, which records the drinking water flow rate consumed by each industrial customer on a monthly basis and the results of the quality measurements performed by ACC on the industrial effluents. These measurements are performed on a regular basis which depends on the contract between ACC and each industrial customer. The number of chemical parameters that are analysed is also depending on the contractual terms. At the most, these parameters include the components presented in

Table 3.

Table 3 List of analyzed components and number and fraction of customers whose wastewater samples have been analyzed for those components in 2009 and 2010.

	2009		2010	
Total number of companies	**529**		**529**	
Flow rate	475	90%	484	91%
Suspended Solids (SS)	321	61%	429	81%
COD	360	68%	424	80%
BOD5	298	56%	359	68%
Chloride	99	19%	58	11%
NH4	214	40%	272	51%
PO4	140	26%	78	15%
Surfactants	313	59%	389	74%
PP (petroleum products)	120	23%	105	20%
Grease	244	46%	323	61%
Fe	79	15%	46	9%
Dry solids	3	1%	11	2%
SO4	24	5%	19	4%
H2S, sulphur	14	3%	12	2%
Formaldehyde	4	1%	3	1%
Aldehyde	0	0%	1	0%
Cr6+	2	0%	2	0%
Cr3+	2	0%	2	0%
Phenol	1	0%	1	0%
Zn	5	1%	2	0%
Cu	3	1%	1	0%
Fluorine	3	1%	2	0%

This database provided the raw data that allowed to assess the quantity and quality of the industrial discharges as a whole, as presented below. The statistical analysis was based on the 2010 figures unless otherwise stated.

4.2. DATA QUALITY

The quality of the data that are recorded in the database is not homogeneous and some information is missing, as illustrated by Figure 2.

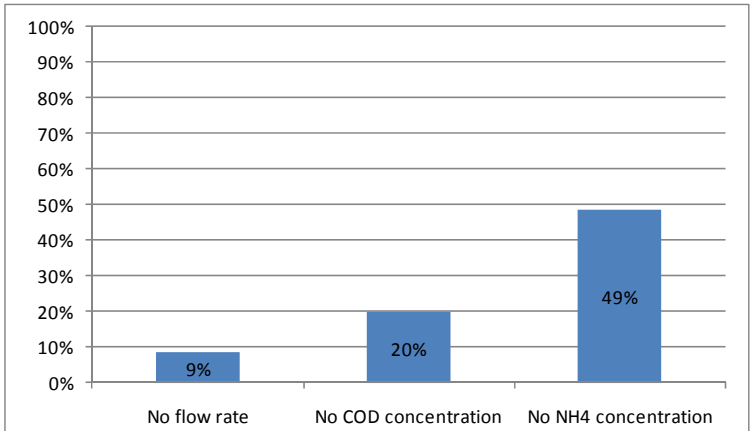

Figure 2 Missing data in the database relative to industrial customers (100% corresponds to the 529 customers registered in the database)

We question how the 9 % of the industrial customers for which the water consumption is unknown can be billed by ACC.

The chemical analyses are performed on spot samples and the frequency of the analyses depends on the contract between ACC and each industrial customer and can be one of the following:

- Once every month
- Once every three month
- Once every six months
- Once every twelve months

Considering the high variations in time of industrial processes, spot samples are far from giving a good picture of the daily average pollution load of industrial discharges, especially if sampling times are known by the industrial customers, which however is not the case in Chisinau.

Therefore the analytical results should not be taken as precise data but rather as a global overview of the situation, the consistency of which can be questioned.

4.3. MAIN FIGURES

The database features 529 companies that are located in the five following districts:

- Botanica
- Buiucani
- Centru
- Ciocana
- Riscani

Some of them have various premises in one or more of these districts.

There is no categorization of the industrial customers with regards to their respective activities and no formal link between their activity and the pollutant concentration limits they are required not to exceed.

4.3.1. LOCATION OF THE INDUSTRIAL CUSTOMERS

The available data allowed to assess the location of industrial customers in Chisinau. The results are presented in Figure 3. Care should be taken when analysing this map since it addresses only the discrete number of industrial customers per zone but does not say anything about the spatial distribution of the industrial wastewater flow rates – or pollution load - into the sewerage network.

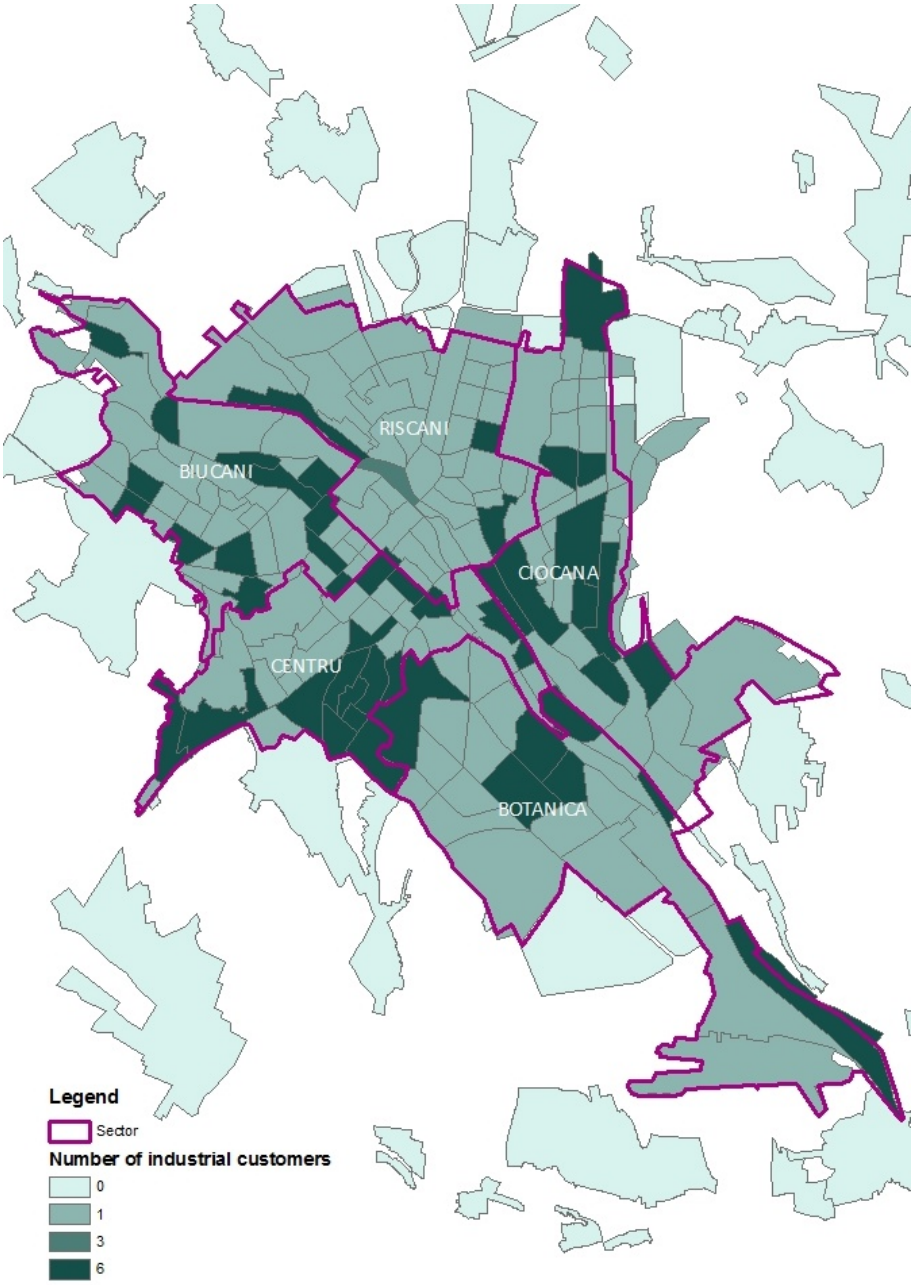

Figure 3 Density of industrial customers per zone in Chisinau

4.3.2. WEIGTH OF INDUSTRIAL DISCHARGES

Erreur ! Source du renvoi introuvable. displays the absolute and relative weight of the industrial wastewater in terms of flow rate, COD load and NH4 load when compared to the global features of the wastewater that was treated at Chisinau WWTP in 2010.

Table 4 Absolute and relative weight of the industrial wastewater in the wastewater treated at Chisinau WWTP in 2010

	Flow rate m3/d	COD load kgCOD/d	NH4 load kgNH4/d
Total	146,898	73,449	5,435
Industrial	9,387	7,955	152
Fraction of industrial	*6%*	*11%*	*3%*

These figures show the low impact of the industrial wastewater flow rates and pollution loads in the global picture of wastewater treatment at Chisinau.

4.3.3. WASTEWATER FLOW RATES

The flow rates of the discharged industrial effluents are estimated by ACC (Section 3.3.1) based on the following elements:

- The drinking water flow rates supplied by ACC through the drinking water network.
- The groundwater abstraction at each industrial site (about 50% of the industrial customers have their own well, which may increase the problems of metering and the estimation errors).
- The industrial process at stake.
- The presence of flow meter installed on the wastewater discharge pipe (only one industrial customer has installed this device to date).

The results of a rough statistical analysis of the available data are presented in Figure 4, Figure 5 and **Erreur ! Source du renvoi introuvable.**. These results are based on the whole database, including the customers for which no flow rate data have been recorded (Figure 2).

It can be highlighted that the 9th decile is approximately 40 m3/d, which means that the water consumption of the top 10% consumers – representing the 52 biggest consumers – is above 40 m3/d. The consumption of these 52 consumers accounts for more than 60% of the total industrial consumption and consequently of the total industrial discharge as per the above-mentioned assumptions.

A more detailed analysis of the database also shows that two customers display a very high water consumption that together accounts for more than 18% of the total industrial water consumption. The two biggest consumers are:

- Bucuria (549 m3/d)
- Efess Vitanta Moldova brewery (1,189 m3/d)

The list of the ten largest industrial customers in terms of wastewater flow rates is presented in Section 6.

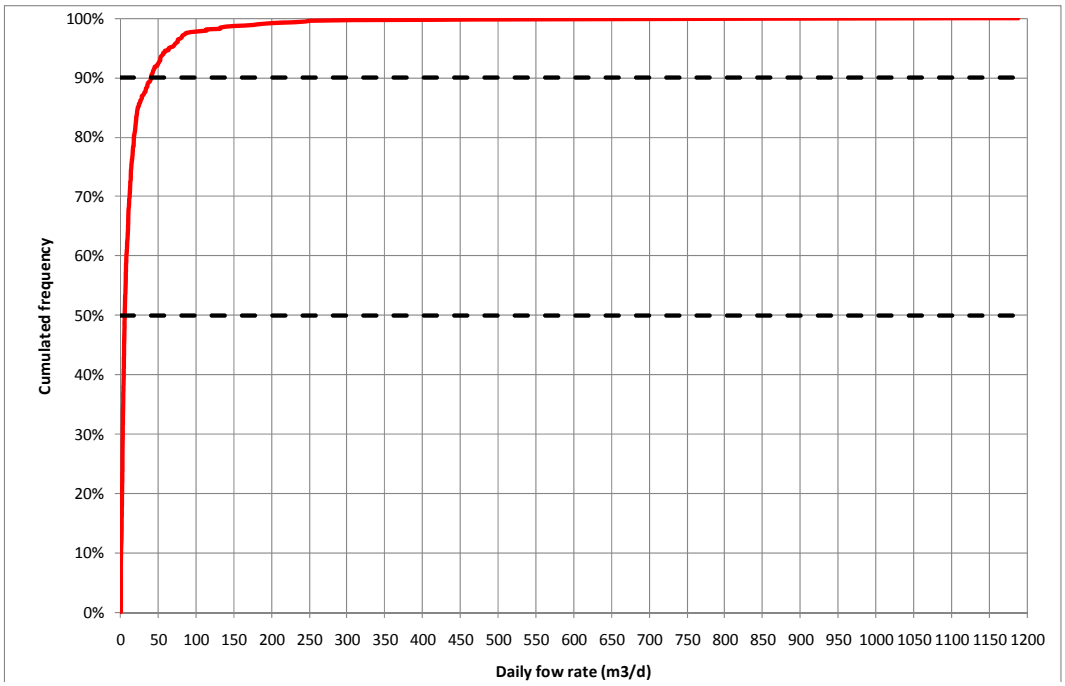

Figure 4 Cumulated frequency of daily flow rates

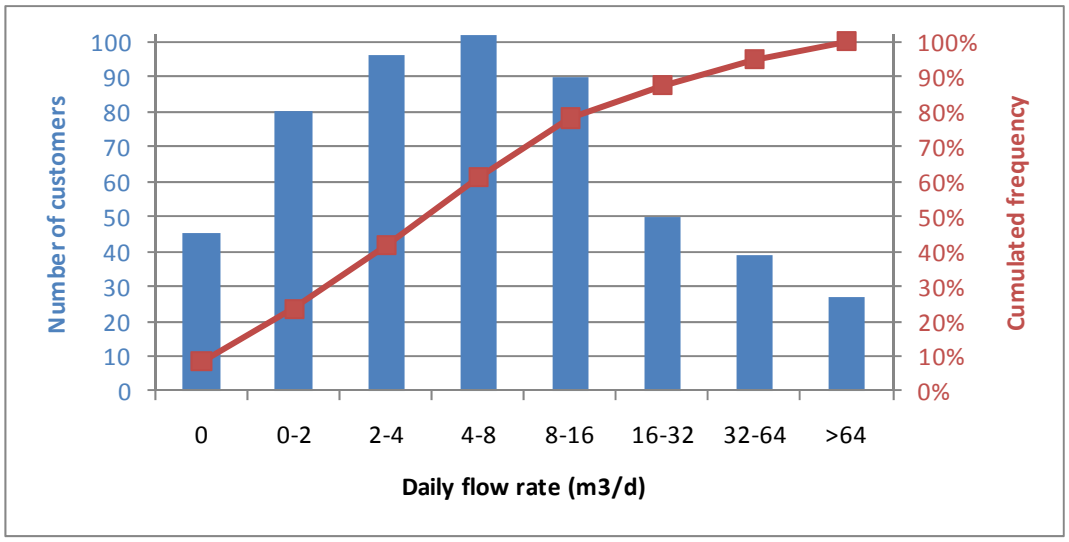

Figure 5 Classes of industrial customers following their daily water flow rate and associated cumulated frequency

Table 5 Analysis of the industrial wastewater flow rates

	Flow rate	
Total	9,387	m3/d
Total number of customers	529	-
Number of customers without data	45	-
50% percentile	5	m3/d
90% percentile	40.3	m3/d
Number of companies above the 90% percentile	52	-
Total of the last 10% percentile	5,847	m3/d
	62%	of the total

4.3.4. COD LOAD

The results of a rough statistical analysis of the available data regarding the COD load of industrial effluents are presented in Figure 6, Figure 7and **Erreur ! Source du renvoi introuvable.**. These results are based on the whole database, including the customers for which no COD load data have been recorded, which corresponds to 20% of the total number of industrial customers (Figure 2).

It can be highlighted that the 9th decile is approximately 30 kgCOD/d, which means that the COD load of the top 10% consumers – representing the 53 biggest polluters in terms of COD load – is above 30 kgCOD/d. The COD load of these 53 consumers accounts for not less than 74% of the total industrial COD pollution load.

A more detailed analysis of the database also shows that the six biggest polluters in terms of COD account together for more than 28% of the total industrial COD load. These companies are:

- I.S. Mecagro ICMEA (285 kgCOD/d)
- S.A. Franzeluta nr.2 (323 kgCOD/d)
- S.A. Efess Vitanta Moldova brewery (384 kgCOD/d)
- S.A. JLC (392 kgCOD/d)
- S.A. Orhei (398 kgCOD/d)
- Franzeluta nr.3 (470 kgCOD/d)

The complete list of the ten largest industrial customers in terms of COD load is presented in Section 6.

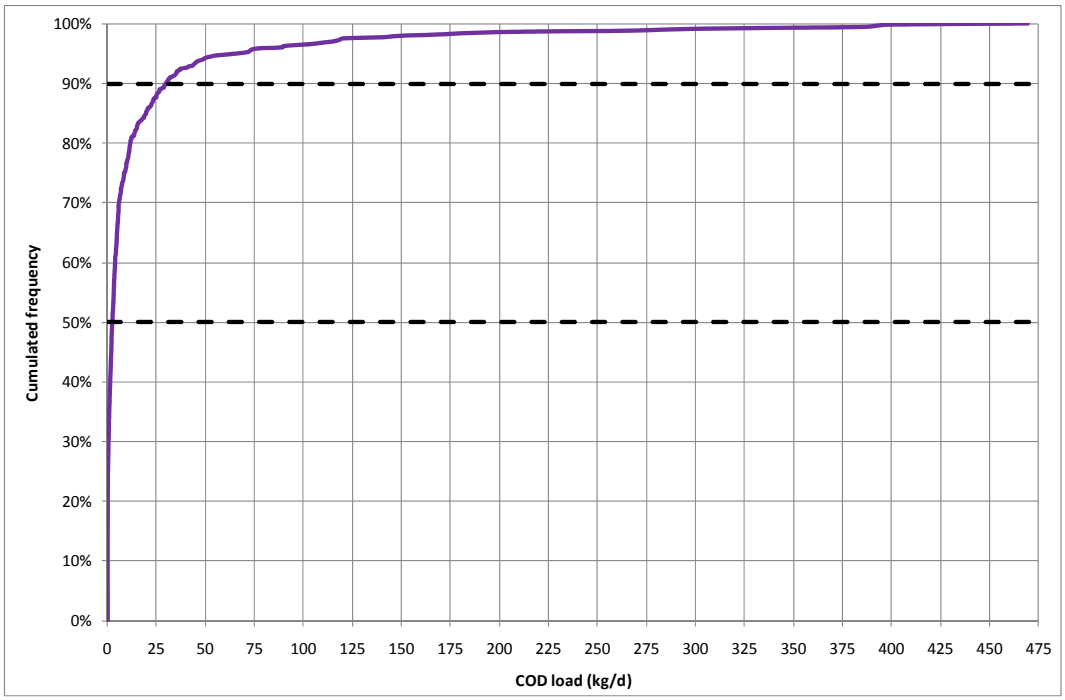

Figure 6 Cumulated frequency of daily COD load

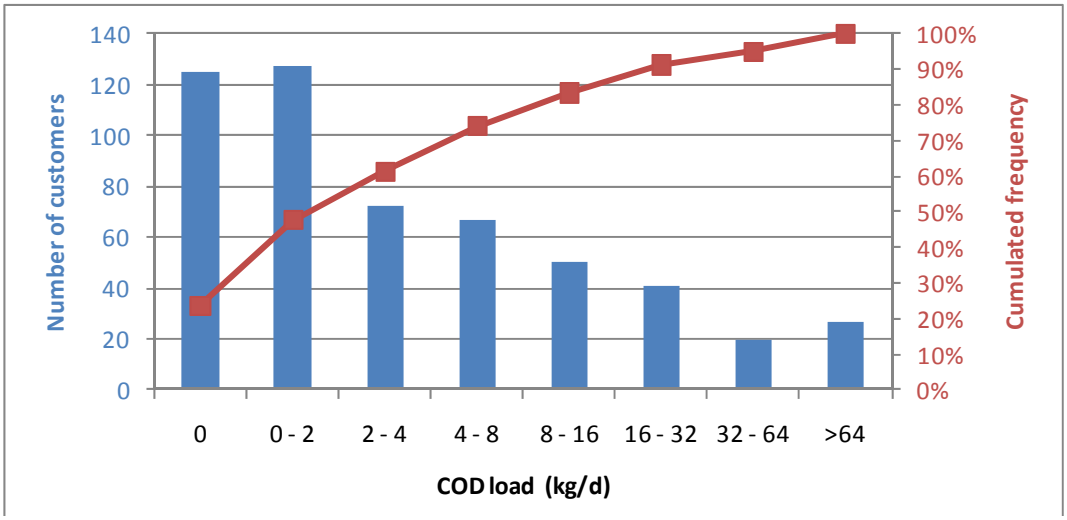

Figure 7 Classes of industrial customers following their COD load and associated cumulated frequency

Table 6 Analysis of the industrial wastewater COD load

	COD load	
Total	7,955	kgCOD/d
Total number of customers	529	-
Number of customers without data	125	-
50% percentile	2.2	kgCOD/d
90% percentile	29.8	kgCOD/d
Number of companies above the 90% percentile	53	-
Total of the last 10% percentile	5,905	kgCOD/d
	74%	of the total

4.3.5. NH4 LOAD

The results of a rough statistical analysis of the available data regarding the NH4 load of industrial effluents are presented in Figure 8, Figure 9 and **Erreur ! Source du renvoi introuvable.**. These results are based on the whole database, including the customers for which no NH4 load data have been recorded, which corresponds to almost 50% of the total number of industrial customers (Figure 2).

It can be highlighted that the 9th decile is around 0.8 kgNH4/d, which means that the NH4 load of the top 10% consumers – representing the 53 biggest polluters in terms of NH4 load – is above 0.8 kgNH4/d. The NH4 load of these 53 consumers accounts for 75% of the total industrial NH4 pollution load.

A more detailed analysis of the database also shows that the six biggest polluters in terms of NH4 account together for more 25% of the total industrial NH4 load. These companies are:

- Directia generala pentru administrarea cladirilor aguvernului RM (4.8 kgNH4/d)
- I.C.S. Metro “Cosh and Carry” S.R.L. (5.04 kgNH4/d)
- I.S. Garile St. Auto (5.17 kgNH4/d)
- S.A. Moldovahidromas (5.48 kgNH4/d)
- S.A. Glass container company (7.45 kgNH4/d)

- S.A. Carmez (9.84 kgNH4/d)

The complete list of the ten largest industrial customers in terms of NH4 load is presented in Section 6.

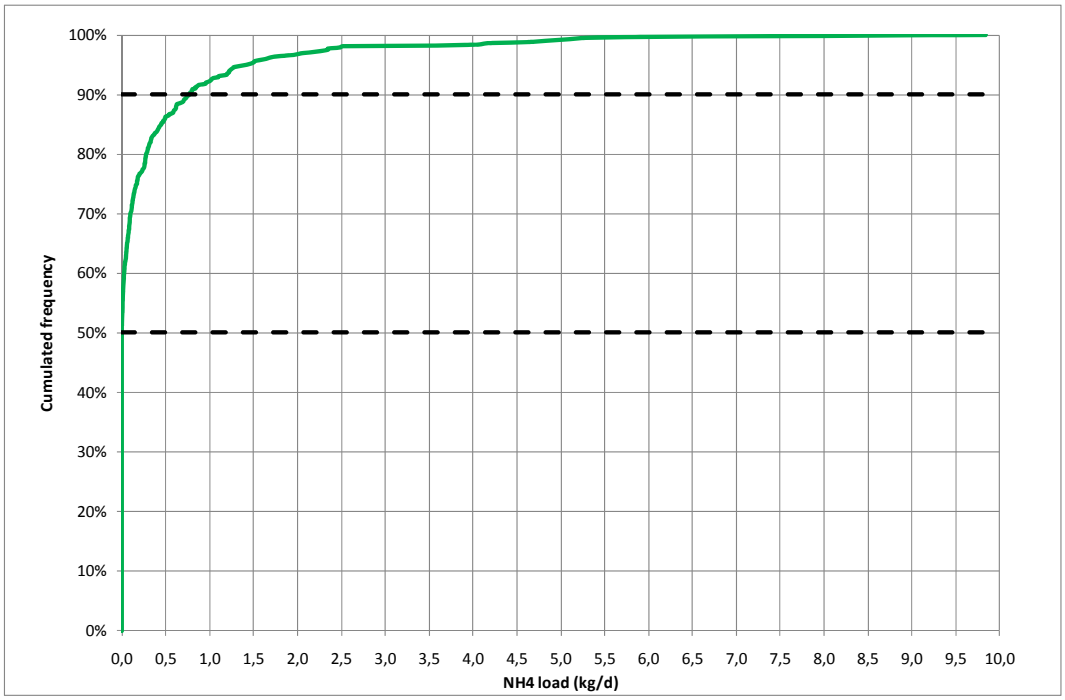

Figure 8 Cumulated frequency of daily NH4 load

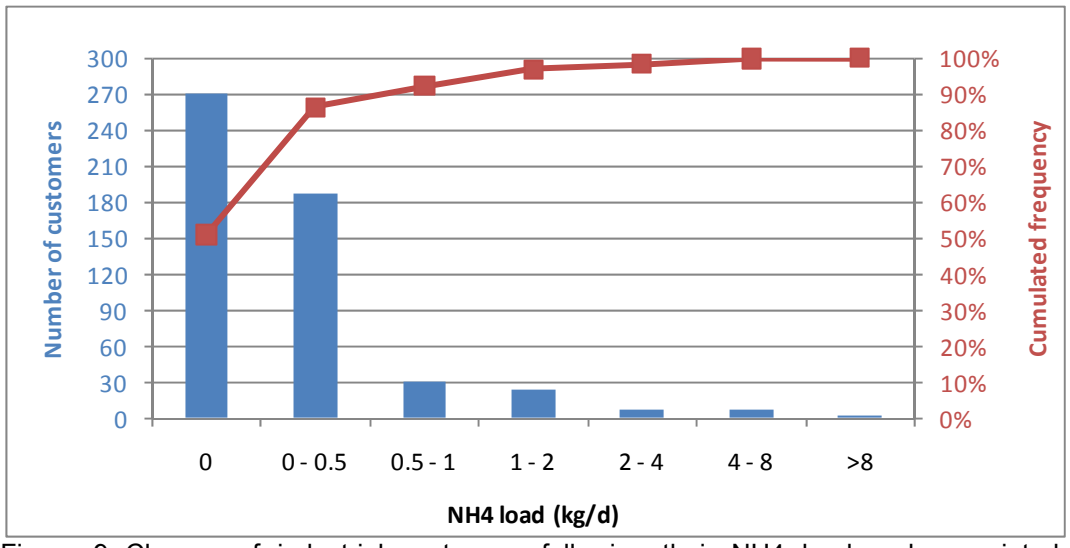

Figure 9 Classes of industrial customers following their NH4 load and associated cumulated frequency

Table 7 Analysis of the industrial wastewater NH4 load

	NH4 load	
Total	152	kgNH4/d
Total number of customers	529	-
Number of customers without data	270	-
50% percentile	*No data*	kgNH4/d
90% percentile	0.77	kgNH4/d
Number of companies above the 90% percentile	53	-
Total of the last 10% percentile	113	kgNH4/d
	75%	of the total

4.4. OTHER ANALYZED POLLUTANTS

Depending on the activity of the industrial customer, ACC has chosen to analyze specific components such as heavy metals, grease or petroleum products (

Table 3). However these analyses are applied to a very limited number of customers (sometimes less than 1 %) although all of them must comply with MAC values associated to these components.

Heavy metals do not appear to play a significant role in the pollution load since the majority of the industrial customers that once may have rejected heavy metals in their wastewater have stopped their activities.

The discharge of grease is reported to cause the main nuisances to the sewerage network. The pollution load of grease is supposed to increase mainly because of the increase number of restaurants in Chisinau, but, considering the low fraction of the pollution load coming from industrial customers compared (**Erreur ! Source du renvoi introuvable.**), the grease concentration is unlikely to threaten the operation of Chisinau WWTP. To be compliant with the MAC values, a few industrial customers had to install grease trap. Our understanding is that the installation of grease traps is not mandatory. We recommend the installation of grease traps at the outlet of each restaurant and food processing plant in order to reduce the grease concentration and to protect the sewerage network.

4.5. MEDICAL AND PHARMACEUTICAL LIQUID WASTES

In the database that has been used to derive all above figures, no hospital or clinic could be found because these customers are part of the institutional customers and therefore do not appear as “economic agents”. However, unlike other institutions such as schools or prisons, hospitals or similar, medical institutions do generate very specific liquid wastes that must be specifically addressed in order to protect the Public Health.

Only five medical and pharmaceutical customers have been identified in the database as presented in **Erreur ! Source du renvoi introuvable.**.

Table 8 Pharmaceutical and medical customers, as registered in the industrial customers database

S.A. "Sanfarm-Prim”	Pharmaceutical warehouse, canteen
S.R.L. "Gambrinus"	Medical Services, canteen
Farmavet S.A.	Veterinarian pharmacy
S.A. "Farmaco"	Pharmaceutical Plant
SRL «Tetis Internaţional şi Co»	Pharmaceutical warehouse

It has been reported that all toxic liquid wastes – including medical and pharmaceutical residues - produced by industries in Chisinau is handled by the Environmental Ministry. No special investigations have been performed to clarify this specific point and to establish the precise definition of “toxic liquid waste” in the sense of the Moldovan regulation. However no dedicated treatment facilities have been identified for such wastes, which may indicate that no special care is taken with regards to the disposal of this type of waste.

Hospitals have been reported to belong to the Annex 2, but ACC does not perform any control over the quality of their wastewater discharge into the municipal sewerage network.

4.6. PRIORITY SUBSTANCES

In addition to the standard parameters that should be monitored on a regular basis (COD, BOD, NH4, TSS, etc.), special attention should be paid in the future to other parameters such as the 33 priority substances as defined in the EU Directive 2008/105/EC (Section 7). These substances mainly include the following categories:

- pesticides (endosulfan, alachlor, diuron, naphthalene, simazine, atrazine)
- polycyclic aromatic hydrocarbon (PAH) and other halogenated organic compounds
- some heavy metals (Ni, Hg, Pb, Cd)

Some of the PAHs are probably already measured as “Petroleum Products” but none of them is specifically targeted by ACC. In the case of Chisinau, the absence of heavy industries (refineries, petrochemical plants, etc.) does not make it necessary to include these analyses in a routine monitoring program for every industrial customers, all the more since these analyses are expensive. However it could be worth setting up a thorough analytical campaign of the quality of the wastewater that enters Chisinau WWTP once a year for instance to get a detailed picture of the wastewater quality, including industrial discharges. This detailed analytical survey could then include these priority substances. If significant concentrations are found, further investigations should be done to trace back the origin of the detected compounds.

4.7. GENERAL COMMENTS ON THE DATA ANALYSIS

The nature of the analyses performed on industrial effluents lack some coherence. For instance, the analyses available in 2010 relative to the effluent of the main contributor to the global industrial wastewater flow rate (i.e. Efess Vitanta Moldova brewery) include only SS and COD, whereas one could reasonably think that the monitoring of at least the BOD and NH4 content of the discharge of the main contributor should have been included.

It is not very clear why some compounds are included in the monitoring plan of one industrial customer and not in the one of others. The revision of the monitoring plan of each industrial customer should allow for the reduction of the number of analyses while focusing on the main polluters. The effluents of the latter should at least be analysed for the main pollution components that include TSS, BOD5, COD and NH4 (or better Total Nitrogen).

5. RECOMMENDATIONS

5.1. GENERAL COMMENTS ABOUT INDUSTRIAL WASTEWATER MANAGEMENT

The current industrial wastewater management scheme is not well adapted to the situation of industrial customers in Chisinau for the following reasons:

- There is no general database that compiles the data regarding wastewater quantity and quality for every customer.
- Industrial customers must comply with MAC values that are not adapted to their activities and that are not targeted by ACC analyses.
- Contractual terms between ACC and industrial customers are not in accordance with a sound strategy that would encourage industrial customers to reduce their pollution load.
- The existing ACC monitoring plan does not set up a clear classification of the industrial customers that takes into account their respective weight in the total industrial pollution load.
- The whole responsibility for measuring and analyzing the wastewater discharges to the sewerage network is on the side of ACC, which requires a lot of work from ACC.

5.2. PROPOSED IMPROVEMENTS MEASURES

5.2.1. CATEGORIZATION

The classification of the industrial customers should allow to simplify and to rationalise the efforts made by ACC in order to monitor the wastewater discharges of all industrial customers. The monitoring program of each customer should be directly dependant on the amount of pollution load discharged into the sewerage network. A minimum monitoring program could be set up for small contributors while a more intensive monitoring program could be implemented for highly polluting industrial sites.

No distinction should be made between private companies and institutional bodies with regards to the implementation of adequate wastewater management scheme. Both kinds of potential polluters should be addressed the same way by ACC with the ultimate goal of reducing the non-domestic pollution load. If a distinction is to be made, it should not be based on the administrative status of the customer but rather on the qualitative features of the wastewater discharged by the customer. Consequently one can reasonably assume that schools are likely to be categorized within the “domestic customers”, whereas hospitals are most likely to be included in the “industrial customers”, thus requiring a tailored monitoring program.

5.2.2. REGULATION – CONTRACTUAL PROCEDURES

The rationalization of the contracts to be signed between ACC and the industrial customers should be written in such a way that they act as incentives for the customers to reduce their pollution load.

These contracts should also target the most cost-efficient way of reducing the nuisances generated by the industrial effluents. For instance, they could encourage the

implementation or revamping of adequate pre-treatment facilities (such as grease traps) with financial mechanisms that ensure their sustainable operation and maintenance.

In addition, and in line with accepted best practice, ACC could think about a procedure of "self-monitoring" that would place the responsibility of measuring and/or sampling and/or analysing the industrial effluents into the hands of the industrial customers themselves (at least in the case of the big polluters), so that ACC would only check the data provided by the customers from time to time by additional measurements. This procedure would significantly reduce the workload of ACC while giving more responsibility to the customers, thus raising their awareness about water savings and pollution reduction (

Table 9).

Table 9 Proposed scheme for a "self-monitoring" program

Analyses performed by	Purpose
The customer	Prove the compliance of the discharge with the terms of the contract (maximum concentration values) Alert in case of accidental pollution Raise awareness and reduce pollution load
ACC	Check the accuracy of the self-monitoring results provided by the customer

It is finally recommended to set-up consulting services - by ACC or another competent institution or company – that could be proposed to industrial customers in order to assist them in reducing their pollution load and increasing the water efficiency of their industrial processes (water recycling options, new pieces of equipment, operational habits, etc.).

5.2.3. MONITORING PLAN

In order to simplify the whole monitoring program and to gain some efficiency in terms of data collection and coherence, it is recommended to improve the monitoring plan to focus on the main polluters rather than targeting the whole range of industrial customers.

An example of monitoring plan is briefly presented in Section 5.3 below.

5.2.4. REPORTING

In case a "self-monitoring" program is implemented, each industrial customer would be required to submit to ACC a data sheet featuring the water and wastewater flow rates (metered and estimated) and the associated quality, following the terms of the contracts (pollutants to be analysed and frequency of the analyses).

Since the billing process takes into account both quality and quantity of the water and wastewater, it is recommended that all information are collected together in such a way that all relevant information relative to one customer can be found on one single report, whether this is done by ACC or directly by the customer.

5.2.5. PRICING

As stated in a reference OECD document (Industrial water pricing in OECD countries, ENV/EPOC/GEEI(98)10/FINAL, Organisation de Coopération et de Développement Economiques OLIS : 30-Apr-1999) various pricing policies for industrial customers are in use in the world with no standard practices. Tariffs for wastewater collection and treatment are now generally set at a level designed to ensure full cost recovery — i.e. to

cover operating expenditure, depreciation, plus a return on capital employed. The main trend consists for the local authorities in charging the industrial customers for the extra cost of treatment that the industrial effluents necessitate at the municipal WWTP, following the "polluter pays" principle. This is generally done in accordance with benchmark values for the cost of treatment expressed in, for instance, €/kgBOD removed or €/m3 treated at the WWTP.

The marginal cost is generally added to a fixed price that accounts for investment costs and for fixed operational costs of the water and wastewater service provider.

In France, for example, the price is made of the following components:

P = Pi + Po

- P: Price for wastewater collection and treatment
- Pi: Price to cover investment costs
- Po: Price to cover operation costs

With Po = Pof + Pov

- Pof: fixed part to cover operation costs of the wastewater service
- Pov: variable part to account for the volume of wastewater generated by the industrial customer

For comparison purpose the cost of wastewater treatment at Chisinau WWTP can be estimated at around 0.68 MDL/m3 of treated wastewater or 2.73 MDL/kgCOD removed. The standard tariff for wastewater collection and treatment applied by ACC towards industrial customers is currently 10.26 MDL/m3 (without tax).

As far as rainwater is concerned, it is recommended to solve the issue that has been raised during this industrial survey – which refers to the fact that not all industrial customers are connected to the rainwater collection network and therefore discharge the rainwater in the municipal sewerage network – by means of one of the following measures:

1) Connect all industrial sites that are deemed relevant (i.e. the ones featuring a significant impervious surface area) to the rainwater collection system. This is the most straightforward option, but it may be too expensive.

2) Introduce an extra fee to be charged to the industrial customers that are not connected to the rainwater collection system; this fee could be a fixed price proportional to the surface covered by the property (or the industrial estate) as a proxy indicator of the related surface drained by rainwater as applied in Germany and Austria.

5.2.6. CONTROL PROCEDURES AND PENALTIES

It appears that ACC has little means to constraint industrial customers to comply to the existing agreements and to pay the calculated charges for wastewater collection and treatment. This is likely due to the economical - and political - context of Moldova, where industrial activities have been plummeting for many years.

Moldovan authorities may then be required to implement adequate subsidies and supporting means in order to secure the financial balance of ACC without compromising any new industrial development in Chisinau.

5.3. EXAMPLE OF PROCEDURE

The following example derives from the French experience and is generally applied throughout the EU The three main steps described below allow to categorize the

industrial customers and to define their respective routine monitoring schedule when needed.

1) Calculation of the theoretical pollution load (TPL) for each customer based on literature data and/or field data for several parameters (TSS, COD, BOD5, etc.)

2) Definition of the pollution thresholds above which industrial customers are required to implement a routine monitoring schedule (third column of Table 10).

Category 1: if at least one TPL exceeds the threshold then the implementation of a routine monitoring schedule is mandatory

Category 2: if all TPL are below the thresholds then the routine monitoring schedule is optional, but minimum monitoring requirements still apply (one analysis per week of significant pollutant).

Table 10 Threshold values for TPL and associated frequency of analysis (example) for industrial customers listed in Category 1

Parameter	Unit	Threshold value	1 per month	1 per week	2 per week	1 per day
TSS	t/y	600	-	<1,000	<3,000	≥3,000
COD	t/y	600	-	<1,000	<3,000	≥3,000
BOD5	t/y	300	<1,000	<2,000	≥2,000	-
TN	t/y	40	<100	<200	≥200	-
TP	t/y	10	<50	<100	≥100	-
Inhibitors	kEquitox/y	10,000	<50,000	<100,000	≥100,000	-
Metox	kg/y	10,000	<50,000	<100,000	≥100,000	-
Halogenated compounds adsorbable on activated carbon	kg/y	2,000	<10,000	<20,000	≥20,000	-
TDS	10^6 . m3 x S/cm/y	0.1	<1	≥1	-	-
Heat discharged	Mth/y	2,000	-	≥2,000	-	-

3) Definition of the monitoring schedule (procedure for sampling - representativeness, analytical method, frequency (columns 4 to 7 in Table 11), etc.). Insertion of some parameters relative to the abstracted water into the monitoring schedule if deemed relevant (in case the supplied water is expected to contain some pollutants). Definition of substitution parameters if relevant.

With such threshold values, none of the industrial customers registered in Chisinau would be required to implement a routine monitoring schedule (Table 11), which shows that the industrial pollution load in Chisinau is rather weak compared with one can find in other industrialized countries.

Table 11 Comparison of threshold values with the TPL of the biggest polluters in Chisinau

Parameter	Unit	Threshold value	Number of customers above threshold	Highest
TSS	t/y	600		
COD	t/y	600	0	Franzeluta: 171 t/y

BOD5	t/y	300		
TN	t/y	40	0	Carmez: 3.6 t/y (NH4 only)
TP	t/y	10		
Inhibitors (Acute toxicity)	kEquitox/y	10,000	Hospital effluents?	
Metox	kg/y	10,000		
AOX (Halogenated compounds adsorbable on activated carbon)	kg/y	2,000		
TDS	10^6 . m3 x S/cm/y	0.1		
Heat discharged	Mth/y	2,000		

6. LIST OF THE LARGEST INDUSTRIAL CUSTOMERS

Table 12 List of the largest industrial customers in 2010 in Chisinau in terms of wastewater flow rates, COD load and NH4 load.

Rank	Name	Activity	Flow rate (m3/d)
1	S.A. "Efess Vitanta Moldova Brevery"8	Beer factory	1189
2	Bucuria	Pastry goods	549
3	Î.S. "Fabrica de sticlă"	Glass Container	256
4	S.A. "Tutun"	Cigarette factory	243
5	S.A. "Glass Container Company"	Glass Container Company	207
6	Direcţia generală pentru administrarea clădirilor a Guvernului RM	Administrative buildings	185
7	S.A. "Carmez"	Sausage factory	171
8	S.A. "Combinatul de articole din carton"	Production of cardboard articles	141
9	S.A. "Franzeluţa nr.3"	Bakery	132
10	S.A."Moldovahidromaş"	Pump factory	131

Rank	Name	Activity	COD load (kg/d)
1	S.A. "Franzeluţa nr.3"	Bakery	470
2	«Orhei» S.A.	Shopping mall	398
3	S.A."JLC"	Milk processing factory	392
4	S.A. "Efess Vitanta Moldova Brevery"8	Beer factory	384
5	S.A. "Franzeluta nr. 2"	Bakery	323
6	Î.S. "Mecagro" I.C.M.E.A.	Production of agricultural machinery	285
7	SRL"Zernoff"	Production of spirits	269
8	«Ungar»S.R.L.	Restaurants, shopping mall	207
9	Bucuria	Pastry goods	184
10	S.A. "Carmez"	Sausage factory	172

Rank	Name	Activity	NH4 load (kg/d)
1	S.A. "Carmez"	Sausage factory	9.8
2	S.A. "Glass Container Company"	Glass Container Company	7.5
3	S.A."Moldovahidromaş"	Pump factory	5.5
4	Î.S. "Gările St. Auto"	Public services , Bus station, restaurant	5.2
5	Î.C.S. Metro "Cosh and Cary" S.R.L.	shopping mall	5.0
6	Direcţia generală pentru administrarea clădirilor a Guvernului RM	Administrative buildings	4.8
7	SC «Gara Nord»	Station	4.6
8	S.A. "MOLDEXPO"	Exhibition center	4.1
9	"Proalfaservice"SRL	Offices	4.1
10	SRL "Trabo Plus"	Pizzeria	3.5

7. PRIORITY SUBSTANCES AND CERTAIN OTHER POLLUTANTS

(According to Annex II of the Directive 2008/105/EC)

Source: http://ec.europa.eu/environment/water/water-framework/priority_substances.htm

7.1. PRIORITY SUBSTANCES

33 substances or group of substances are on the list of priority substances including selected existing chemicals, plant protection products, biocides, metals and other groups like Polyaromatic Hydrocarbons (PAH) that are mainly incineration by-products and Polybrominated Biphenylethers (PBDE) that are used as flame retardants. The complete list is given below.

Number	CAS number (i)	EU number(ii)	Name of priority substance (iii)	Identified as priority hazardous substance
(1)	15972-60-8	240-110-8	Alachlor	
(2)	120-12-7	204-371-1	Anthracene	X
(3)	1912-24-9	217-617-8	Atrazine	
(4)	71-43-2	200-753-7	Benzene	
(5)	NA	NA	Brominated diphenyletheriv	X
	32534-81-9	NA	Pentabromodiphenylether (congener numbers 28, 47, 99, 100, 153 and 154)	
(6)	7440-43-9	231-152-8	Cadmium and its compounds	X
(7)	85535-84-8	287-476-5	Chloroalkanes, C10-13 iv	X
(8)	470-90-6	207-432-0	Chlorfenvinphos	
(9)	2921-88-2	220-864-4	Chlorpyrifos (Chlorpyrifos-ethyl)	
(10)	107-06-2	203-458-1	1,2-Dichloroethane	
(11)	75-09-2	200-838-9	Dichloromethane	
(12)	117-81-7	204-211-0	Di(2-ethylhexyl)phthalate (DEHP)	
(13)	330-54-1	206-354-4	Diuron	
(14)	115-29-7	204-079-4	Endosulfan	X
(15)	206-44-0	205-912-4	Fluoranthenevi	
(16)	118-74-1	204-273-9	Hexachlorobenzene	X
(17)	87-68-3	201-765-5	Hexachlorobutadiene	X
(18)	608-73-1	210-158-9	Hexachlorocyclohexane	X
(19)	34123-59-6	251-835-4	Isoproturon	
(20)	7439-92-1	231-100-4	Lead and its compounds	
(21)	7439-97-6	231-106-7	Mercury and its compounds	X
(22)	91-20-3	202-049-5	Naphthalene	
(23)	7440-02-0	231-111-4	Nickel and its compounds	
(24)	25154-52-3	246-672-0	Nonylphenols	X
	104-40-5	203-199-4	(4-nonylphenol)	X
(25)	1806-26-4	217-302-5	Octylphenols	
	140-66-9	NA	(4-(1,1',3,3'-tetramethylbutyl)-phenol)	
(26)	608-93-5	210-172-5	Pentachlorobenzene	X
(27)	87-86-5	201-778-6	Pentachlorophenol	

(28)	NA	NA	Polyaromatic hydrocarbons	X
	50-32-8	200-028-5	(Benzo(a)pyrene)	X
	205-99-2	205-911-9	(Benzo(b)fluoranthene)	X
	191-24-2	205-883-8	(Benzo(g,h,i)perylene)	X
	207-08-9	205-916-6	(Benzo(k)fluoranthene)	X
	193-39-5	205-893-2	(Indeno(1,2,3-cd)pyrene)	X
(29)	122-34-9	204-535-2	Simazine	
(30)	NA	NA	Tributyltin compounds	X
	36643-28-4	NA	(Tributyltin-cation)	X
(31)	12002-48-1	234-413-4	Trichlorobenzenes	
(32)	67-66-3	200-663-8	Trichloromethane (chloroform)	
(33)	1582-09-8	216-428-8	Trifluralin	

NA	Not Applicable
(i)	CAS: Chemical Abstracts Service.
(ii)	EU number: European Inventory of Existing Commercial Substances (EINECS) or European List of Notified Chemical Substances (ELINCS).
(iii)	Where groups of substances have been selected, typical individual representatives are listed as indicative parameters (in brackets and without number). For these groups of substances, the indicative parameter must be defined through the analytical method.
(iv)	These groups of substances normally include a considerable number of individual compounds. At present, appropriate indicative parameters cannot be given.
(v)	Only Pentabromobiphenylether (CAS number 32534 81 9).
(vi)	Fluoranthene is on the list as an indicator of other, more dangerous polyaromatic hydrocarbons.

7.2. CERTAIN OTHER POLLUTANTS

These eight pollutants, which fall under the scope of Directive 86/280/EEC (Amended by Directive 88/347/EEC and 90/415/EEC) and which are included in List I of the Annex to Directive 76/464/EEC, are not in the priority substances list. Environmental quality standards for these substances are included in the Commission proposal to maintain the regulation of the substances at Community level.

	CAS number	Name of other pollutant
(6a)	56-23-5	Carbon-tetrachloride(1)
(9b)	not applicable	DDT total (1)(2)
	50-29-3	para-para-DDT (1)
(9a)		Cyclodiene pesticides
	309-00-2	Aldrin (1)
	60-57-1	Dieldrin (1)
	72-20-8	Endrin (1)
	465-73-6	Isodrin (1)
(29a)	127-18-4	Tetrachloro-ethylene (1)
(29b)	79-01-6	Trichloro-ethylene (1)

(1) 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

(2) 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).

8. DECISION OF THE CHISINAU MUNICIPAL COUNCIL OF 03/25/2008

Consiliul Municipal Chisinau din 25 Martie 2008 Nr 5/4 Cu privire la aprobarea Regulamentului de organizare şi funcţionare a serviciilor publice de alimentare cu apă şi de canalizare din municipiul Chişinău	The Chisinau Municipal Council on 03/25/2008 Nr 5/4 Regarding the approval of organization and functioning of the Chisinau public water and wastewater services
4.2. Protecţia reţelelor de apă, a apei din reţea şi a reţelelor de canalizare	4.2. Protection of water and sewerage networks
4.2.10. Furnizorul va asigura protecţia calităţii apei în reţelele de apă, prin respectarea timpilor maximi de stagnare a apei în rezervoarele de înmagazinare, şi o va certifica prin buletine de analiză a apei, zilnic, la sursă şi în reţele în secţiunea de măsură (după spălarea acestora) ori de câte ori intervin lucrări de întreţinere sau înlăturare a avariilor.	4.2.10. The supplier shall ensure the protection of water quality in water networks, by observing the maximum stagnation time in reservoirs, and will certify with daily water analysis reports at the source and at the network measurement section (after washing them) or whenever intervene maintenance work or works of removal of damages.
4.2.11. Evacuarea apelor uzate în reţeaua de canalizare este permisă numai dacă prin aceasta: a) nu se degradează construcţiile şi instalaţiile reţelei de canalizare şi ale staţiilor de epurare; b) nu se diminuează capacitatea de transport a canalelor colectoare prin depuneri sau obturări; c) nu se aduce prejudiciu igienei şi sănătăţii publice sau a personalului de exploatare a sistemului de canalizare; d) nu se afectează calitatea apelor uzate din sistemul public de canalizare; e) nu se creează pericol de explozie; f) nu se perturbează procesele de epurare din staţiile de epurare sau nu se diminuează capacitatea acesteia prin depăşirea debitului stabilit, încărcării cu poluanţi a apelor uzate sau prin inhibarea procesului de epurare. În acest sens este interzis consumatorilor să deverseze în reţeaua de canalizare ape uzate care în secţiunea de control conţin: a) materii de suspensie, ale căror cantitate, mărime şi natură constituie un factor activ de erodare a canalelor, provoacă depuneri sau	4.2.11. Wastewater discharge into the sewerage system is permitted only if : a) it does not degrade network construction and installation of sewerage and wastewater treatment plants; b) it does not diminish the carrying capacity of sewers by deposition/scum or filling; c) it does not prejudice public health or hygiene and the health of the staff operating the sewerage system; d) it does not affect the quality of wastewater from public sewers; e) it does not create a danger of explosion; f) it does not disturb the treatment process of the wastewater treatment plant, and does not reduce its capacity by overcoming its established flow, its wastewater pollutant load or by inhibiting the treatment process. In this sense, it is banned to the consumers to discharge into the sewerage system control section wastewater which contains: a) suspended solids, whose quantity, size and nature is an active erosion factor of channels, causing deposits or hamper the normal flow;

stânjenesc curgerea normală; b) substanţe cu agresivitate chimică asupra materialelor din care sunt realizate reţeaua de canalizare, construcţiile şi instalaţiile staţiilor de epurare a apelor uzate; c) substanţe de orice natură, care, plutitoare sau dizolvate, în stare coloidală sau de suspensie, pot stânjeni exploatarea normală a canalelor şi staţiilor de epurare a apelor uzate sau care, împreună cu aerul, pot forma amestecuri explozive; d) substanţe toxice sau nocive care, singure sau în amestec cu apa uzată, pot pune în pericol personalul de exploatare a reţelei de canalizare şi a staţiilor de epurare; e) substanţe cu grad ridicat de periculozitate; f) substanţe care, singure sau în amestec cu apa uzată, pot degaja mirosuri care să contribuie la poluarea mediului înconjurător; g) substanţe colorante, ale căror cantităţi şi natură, în condiţiile diluării realizate în reţeaua de canalizare şi în staţiile de epurare, determină modificarea culorii apei din resursele de apă în care se evacuează apele epurate; h) substanţe inhibitoare ale procesului de epurare a apelor uzate sau de tratare a namolului; i) substanţe organice greu biodegradabile în cantităţi ce pot influenţa negativ procesul de epurare al treptei biologice.	b) chemically aggressive substances on the materials constituting the sewerage network, the civil works and the equipment of wastewater treatment plants; c) substances of any kind, floating or dissolved, or colloidal or in suspension that may impede the normal operation of the channels and of wastewater treatment plants or can form explosive mixtures with air; d) toxic or harmful substances, alone or mixed with sewerage, threatening the operating personnel of the sewerage network and treatment plants; e) highly dangerous substances; f) substances, that alone or mixed with wastewater can release odours that contribute to environmental pollution; g) dyes, whose quantity and nature, according to the dilution carried out in network and at the wastewater treatment plants, causes water discoloration from water resources in which treated water is discharged; h) inhibiting substances of wastewater process or of the sludge treatment; i) organic substances or hard biodegradable substances in quantities that could adversely affect the process of treatment of the biological stage.
4.2.12. Evacuarea în reţeaua de canalizare sau direct în staţiile de epurare a apelor uzate care prin cantitatea, conţinutul, dimensiunea sau combinarea reziduurilor şi substanţelor de orice natură şi în orice stare (solidă, lichidă, gazoasă, în suspensie sau coloidală) degradează construcţiile şi instalaţiile reţelei de transport, ale staţiilor de epurare şi ale echipamentelor asociate, precum şi în cazul în care diminuează capacitatea de transport şi/sau perturbează procesele de epurare din staţiile de epurare, atrage în sarcina consumatorului suportarea costurilor suplimentare pentru refacerea sistemului de canalizare şi epurare afectat, precum şi pentru retehnologizarea proceselor din staţiile	4.2.12. Discharges to the sewerage system or directly into the wastewater treatment plants of the wastewater that by the quantity, content, size or combination of residues and substances of any kind and in any state (solid, liquid, gas, matter or colloidal) degrades the constructions and installations of the transport networks, of the treatment plants and associated equipment, and if the carrying capacity reduces and/or disturbs the treatment processes of wastewater treatment plants, will require the consumer to bear the additional costs for restoring the damaged sewerage and treatment system and for upgrading of wastewater treatment processes at the wastewater treatment plants.

de epurare.	
4.2.13. Amplasarea reţelelor de tranzit pe terenurile unor proprietari se efectuează doar cu acordul scris al acestora. În acordul respectiv se stabilesc condiţiile convenite de părţi, ce vor fi respectate la construcţia, exploatarea şi repararea reţelelor de tranzit.	4.2.13. The location of the pipe networks on the land of owners shall be carried out only with their written consent. In the respective agreement, the parties agree to establish conditions that will be observed in the construction, operation and repair of the pipes.
4.2.14. Construcţia noilor reţele de tranzit prin clădiri şi construcţii este interzisă.	4.2.14. Construction of the new networks in constructed zones is prohibited.
4.2.15. Deţinătorii terenurilor prin care trec reţelele de tranzit existente sunt obligaţi să păstreze integritatea acestora şi să permită executarea lucrărilor de întreţinere, reparaţie şi înlocuire a conductelor, având dreptul la despăgubiri în cazul suportării unui prejudiciu.	4.2.15. The owners of the land through which lay the existing pipe networks are obliged to maintain their integrity and allow the execution of maintenance, repair and replacement of pipes, having the right to compensation in case any damage occurs.

9. AN EXAMPLE: S.A. CARMEZ

9.1. GENERAL INFORMATION

S.A. Carmez is a meat processing company. It used to be the market leader in Moldova but its market share has significantly decreased over the past years due to the emergence of competitive newcomers on this market.

The number of employees has been significantly reduced, from 1,800 at the highest to 500 today, while the factory could be run with only 50 people according to one of the employees.

Figure 10 S.A. Carmez moto and logo.

S.A. Carmez is one of the main industrial polluter in Chisinau. The factory located in str. Muncesti 121 has not been using drinking water supplied by ACC since a few years and is now relying only on groundwater abstraction. The extracted volume of water was 67,194 m3 in 2010 (Table 13), while the concentration of relevant pollution parameters in the wastewater discharged into the sewerage network often exceed legal requirements as can be seen in Table 14.

The information presented below mainly derives from a site visit paid by Seureca to Carmez factory on July 29th 2011.

Denumirea	abonatului		Combinatul de carne S.A. "CARMEZ"
Adresa poştală			Botanica, SosMuncesti, 121,
nr.	terit.		-
Denumirea	teritoriilor		TOTAL
2,004	m^3 Water	Apă potabilă Apă tehnol. Apă p-u încălzire	1,884
	m3 Waste water	Ape uzate sonde	146,207
	Suma calculată	*lei*	*657,161*
2,005	m^3 Water	Apă potabilă Apă tehnol. Apă p-u încălzire	2,015
	m3 Waste water	Ape uzate sonde	135,809
	Suma calculată	*lei*	*614,018*
2,006	m^3 Water	Apă potabilă Apă tehnol. Apă p-u încălzire	1,831
	m3 Waste water	Ape uzate sonde	143,262
	Suma calculată	*lei*	*643,720*
2,007	m^3 Water	Apă potabilă Apă tehnol. Apă p-u încălzire	2,249
	m3 Waste water	Ape uzate sonde	120,613 9,621
	Suma calculată	*lei*	*1,111,111*
2,008	m^3 Water	Apă potabilă Apă tehnol. Apă p-u încălzire	1,090
	m3 Waste water	Ape uzate sonde	1,090 102,106
	Suma calculată	*lei*	*1,129,088*
2,009	m^3 Water	Apă potabilă Apă tehnol. Apă p-u încălzire	1,968
	m3 Waste water	Ape uzate sonde	1,968 59,751
	Suma calculată	*lei*	*717,664*
2,010	m^3 Water	Apă potabilă Apă tehnol. Apă p-u încălzire	1,032
	m3 Waste water	Ape uzate sonde	1,032 67,194

Table 13 Data sheet showing the evolution of the drinking and wastewater flow rates for S.A. Carmez provided by ACC.

Nr. crt.	Nr.abonat, denumirea întrprinderii, adresa	Volum de calcul	Data prelevării probelor	Normele de deversare a apelor uzate în sistemul municipal de canalizare aprobate de Consiliul municipal Chişinău, nr. 2/4 din 23.05.2002 /concentraţiile impurităţilor în apele uzate/ conform rezultatelor cercetărilor efectuate de către Laboratorul ape uzate întreprinderi											
	4-610-33 S.A.	KH		SS	CCO	CBO5	CL	NH4	PO4	Det.	PP	Gr.	Fe	Ru	SO4
	"Carmez" str.		ianuarie+	515	1200	600	350	10	16	0.45	2.5	47	2.4	1100	160
	Munceşti ,	7.2	februarie												
	121	28.8	marie deşeuri												
	contract		15,03,10	17	120							4			
	deşeuri	100	15,03,10	2834	660					0.48	8.3				
	c/f10036000		19,04,10	339	500			11				69			
	02136	100	19,04,10	4598	1200	300				1.90	8.6				
		25.2	aprilie deşeuri												
		32.4	mai dese												
		25.2	iunie deşeuri												
		21.6	iulie deşeuri												
			26,07,10	489	940							114			
		100	26,07,10	1060	500						7.3				
		21.6	luna august												
			24,08,10	347	780	260									
			24,08,10	1254	1550	780				0.30	6.9				
		25.2	20,09,10	236	135					0.10	2.2				
			20,09,10	168	780							42.00			
		28.8	oct deseuri												
			25,10,10	1010	430						3.7				
		6314	25,10,10	270	1550	860	300					58			
		28.8	noiemb deseuri												
			05,11,10	6770	3460	920		36		1.59	4.6				
		6336	05,11,10	234	780	460	970	54	8.9			26.0			
			13,12,10	7750	1780	1000			25	0.20	7.1				
		6546	13,12,10	240	1000	660	330	117				32.0			
34		21.6	decembrie de:												

Table 14 Results of the wastewater analyses performed at the outlet of the S.A. Carmez factory in 2010 (extracted from ACC database). Red values exceed the concentration limits as specified in Annex 1 of Chisinau Municipal Council decision dated 23/05/2002.

9.2. WATER MANAGEMENT

9.2.1. DRINKING WATER

It is pumped from a groundwater well, and is not treated. The water is used for industrial activities (meat processing) and for domestic purposes within the premises of the factory.

The groundwater is stored in a reservoir of 450 m3 (> 24h of the water demand of the factory) before further pumping to the production units (pump capacity: 4 bar, 100 m3/h). A flow meter is installed downstream the reservoir. The maximum hourly water demand is 50-60 m3/h.

The well water is analyzed once per year. The quality is compatible with Moldovan standards except for hardness (2.5 times higher than the limit value).

The water demand has significantly decreased over the past 20 years due to the reduction of the production.

Since 1997, Carmez has been using groundwater and it has completely stopped using the water delivered by ACC for 8 years although the connection is still in working conditions.

9.2.2. WASTEWATER

Only 2 to 3 % of the water is incorporated into the final products (sausages and others). Carmez is charged for 100% of the extracted groundwater by ACC and is not wishing to install a flowmeter at the outlet of its factory (return period for this investment would be more than 20 years).

Each production unit is equipped with a grease trap. All wastewater is then transferred to a large grease trap. Collected grease amounts to 50 t/year and was utilized in the past for soap production within Carmez premises. Today, the collected grease is transferred to Chisinau WWTP by truck. A valorization project supported by a US company aims at utilizing the grease for biogas production, but the project will probably fail due to the lack of appropriate investment on Carmez's side.

9.2.3. RAINWATER

A separate network allows to collect the rainwater. Part of the rainwater is discharged into the general rainwater network while the other part is treated in a dedicated plant before discharge to the Bic River or reuse in the plant as irrigation water (previously also in the production process).

9.3. PICTURES

Groundwater well

Pump downstream the reservoir

Flow meter downstream the pump

Grease trap after each production unit

General grease trap with hydrocyclone in the background for grease dewatering

Grease scraper

Collection pit for all wastewater streams before transfer to the sewerage system (where samples are taken by ACC).

Pipe to the sewerage system downstream the transfer pump.

9.4. DRAWINGS

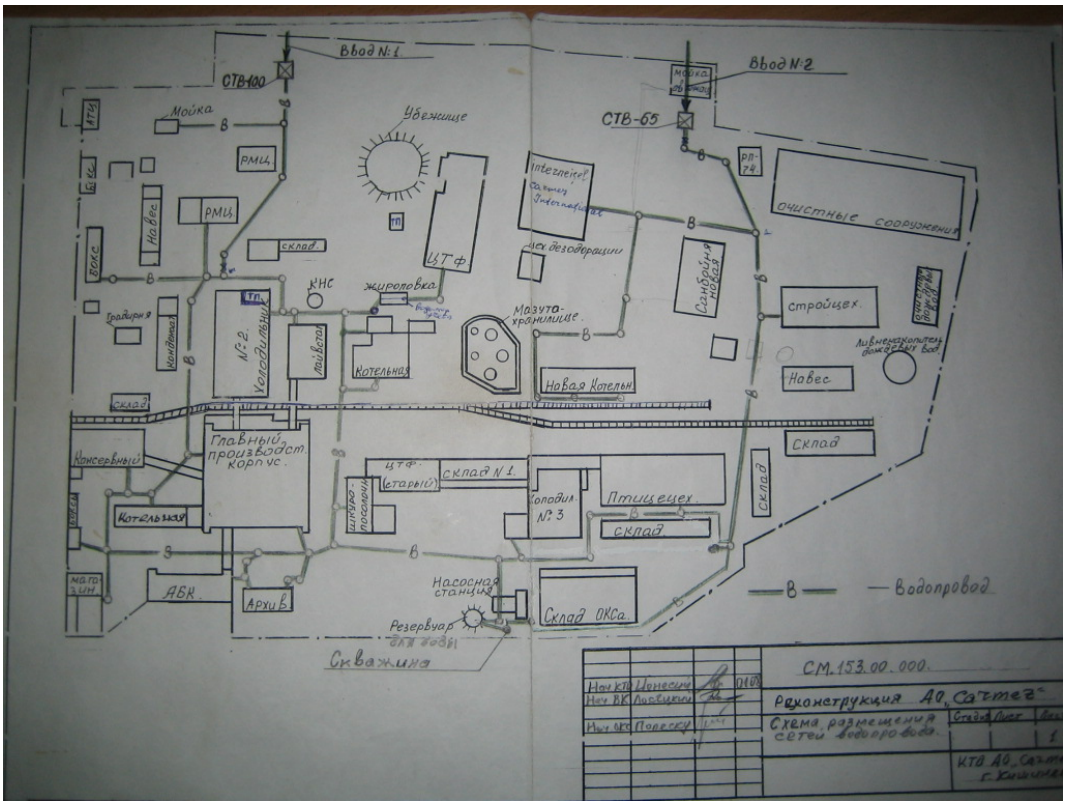

Figure 11 Drinking water network (groundwater well at the bottom, water supply pipes from ACC at the top)

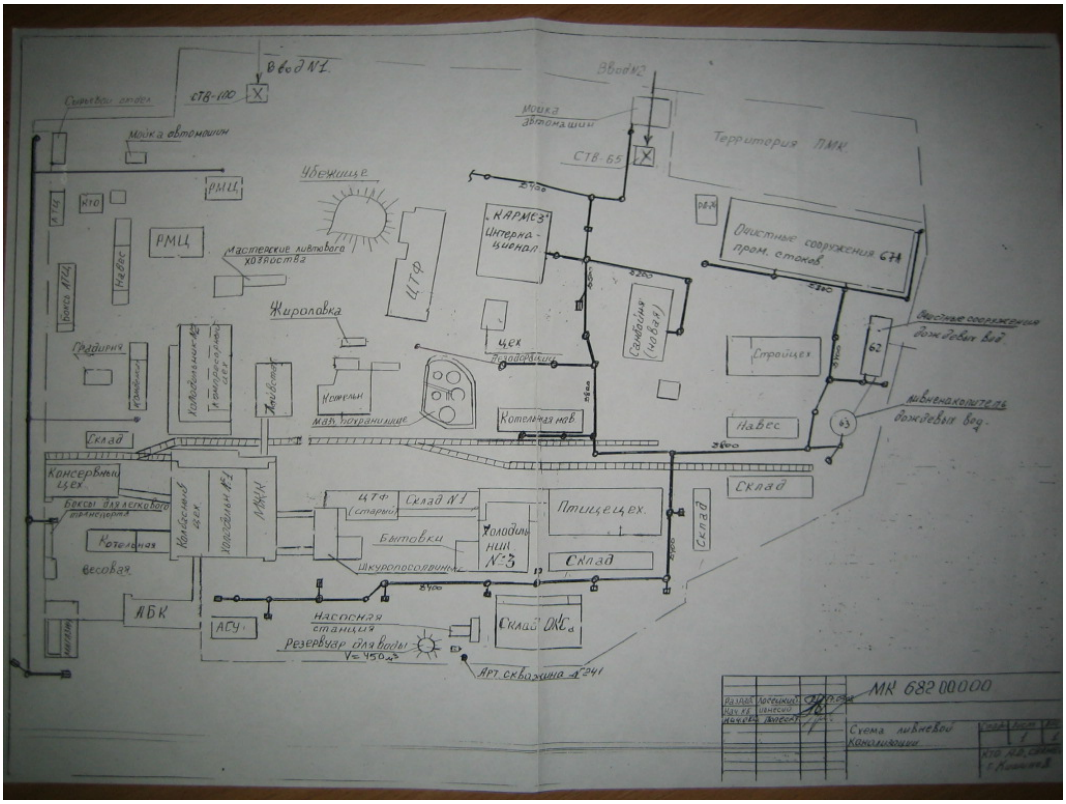

Figure 12 rainwater network (connection to the general stormwater network managed by the Ministry of Transportation on the left, connection to a rainwater treatment facility and discharge to the Bic River on the right)

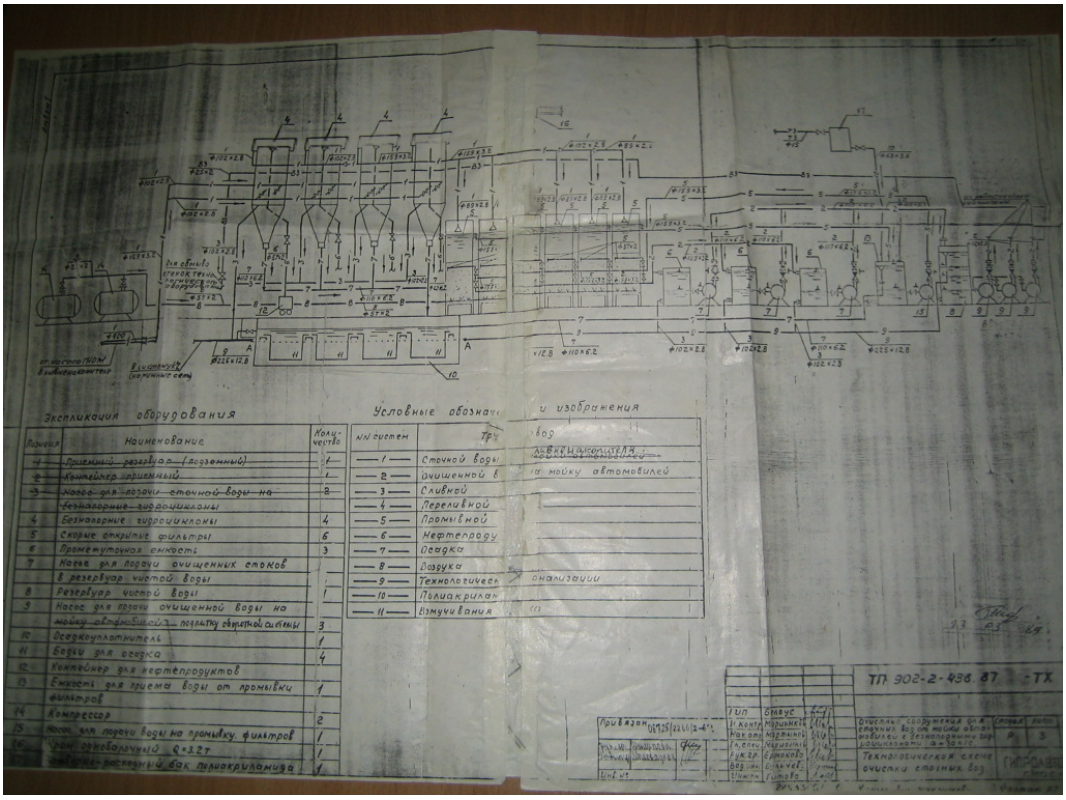

Figure 13 rainwater treatment facility (hydrocyclones and sand filters), built in 1987, still in working conditions.

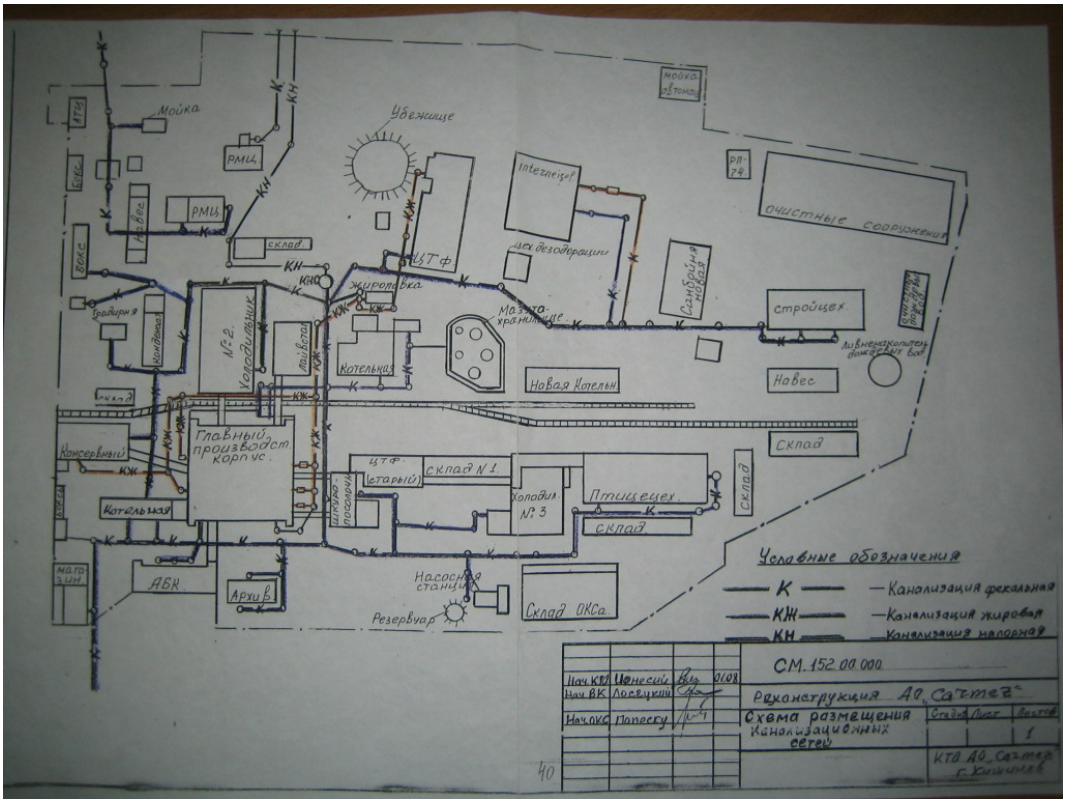

Figure 14 Wastewater network (orange lines)

10. TREATMENT COST AT CHISINAU WWTP

An estimation of the current OPEX of Chisinau WWTP is presented in

Table 15.

Table 15 OPEX estimation of Chisinau WWTP

Energy	18,250,000 kWh/y	1.34 MDL/kWh	24,455,000 MDL/y
Staff	50 people	62,000 MDL/y/person	3,100,000 MDL/y
Chemicals (polymer)	30 t/y	62,650 MDL/t	1,879,500 MDL/y
Sludge disposal (Geotubes)			7,000,000 MDL/y
Maintenance			1,000,000 MDL/y
Total			37,434,500 MDL/y

An estimation of the current treatment cost of wastewater at Chisinau WWTP (including sludge treatment) is presented in

Table 16.

Table 16 Treatment cost at Chisinau WWTP

Total OPEX			37,434,500 MDL/y
Total volume of treated wastewater	150,000 m3/d	54,750,000 m3/y	0.68 MDL/m3
Total COD removed (based on a COD concentration of 500 mg/L in the raw wastewater and 250 mg/L in the outlet)	37,500 kg/d	13,687,500 kg/y	2.73 MDL/kgCODremoved