WATER SAFETY PLAN (WSP) IN MĂNĂȘTIUR ROMANIA – PRELIMINARY STEPS

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Background information

- Water Safety Plan Manual – Step by step Risk Management for drinking water suppliers, 2009
- Guidelines for Drinking Water Quality, 4th ed., WHO, 2011
- Water Safety Planning for Small Community Water Supplies Step-by-step risk management guidance for drinking-water supplies in small communities, WHO, 2012
- **Developing a WSSP in a Rural Community Compendium, WECF**, 2014
- Amendments on Annexes II and III of Directive 98/83/EC on the quality of water intended for human consumption – Directive 2015/1787/EC
- Sanitation Safety Planning Manual for Safe Use and Disposal of Wastewater, Grey water and Excreta, WHO, 2016

Background information

- What is a Water Safety Plan (WSP)?

- How to ensure the safe supply of drinking water by:
  - Knowledge and documentation of the entire supply system
  - Identify where and how issues could arise
  - Construction of barriers and management systems to stop problems before they arise - **ANTICIPATION**
  - Ensure that all system components are working properly.

Background information

- WSP Development

	Source	Treatment	Distribution	Tap
Information	type of catchment, the water source	charts, treatment processes, capability, control	diagrams, the flow direction, equipment, storage tanks, the status of valves	type of premises (industrial, residential), distribution network materials
Hazard Identification	sources of pollution, climate	the catchment area, the reagents used in treatment, materials used, the ineffectiveness of treatment, power failures	contamination from outside, flow fluctuations, unauthorized connections, backsiphonage	siphonage, leakage from pipelines, hygiene
Risk Assessment	the likelihood and consequences of pollution	the likelihood of having an ineffective treatment, the consequences of inefficiency	the likelihood of failure, consequences	the likelihood of occurence, consequences
Control Measures	catchment and reservoir management	treatment process, process monitoring, warning systems, automatic shutdown/manual of water supply to the network	operational procedures, approved materials, valve status	regulation of sealing elements (gaskets), treatment to remove the capacity of water to dissolve lead from pipes, education
Monitoring	points of discharge of pollutants, raw water quality	raw water, treatment process, disinfected water supplied to the network (final product)	flow, pressure, residual disinfectant concentration	inspection of premises
Actions in case of MAC exceeding	stopping the takeover of water from source, adjusting the treatment process	stopping the takeover from water source, adjust the treatment process, the treatment plant closing	water discharge, flushing pipes, advising people to boil water	advising consumers

Background information

- Risk Matrix

			Severity/ Impact of Consequence				
			Insignificant	Minor	Moderate	Major	Catastrophic
			1	2	3	4	5
Likelihood	Almost certain	5	5 (L)	10 (M)	15 (H)	20 (VH)	25 (VH)
	Likely	4	4 (L)	8 (M)	12 (H)	16 (VH)	20 (VH)
	Foreseeable	3	3 (L)	6 (M)	9 (M)	12 (H)	15 (H)
	Unlikely	2	2 (L)	4 (L)	6 (M)	8 (M)	10 (M)
	Most unlikely	1	1 (L)	2 (L)	3 (L)	4 (L)	5 (L)

Low 1-5; Medium 6-10; High 12-15; Very High 16-25

Background information

Action to be taken after a risk assessment

Risk classification	Action
Low	Management according to routine procedures, which will be regularly reviewed
Medium	Need to act, plan and preparation
High	Priority actions are needed to reduce immediate danger
Very High	Urgent action is needed to prevent danger (ex. Water supply interruption / warning people to boil water, restrictions in use) and priority actions for immediate reducing of danger

Field study – Mănăștiur

- **Scope**: development of WSP for the centralized drinking water supply in Mănăștiur, Timiș County

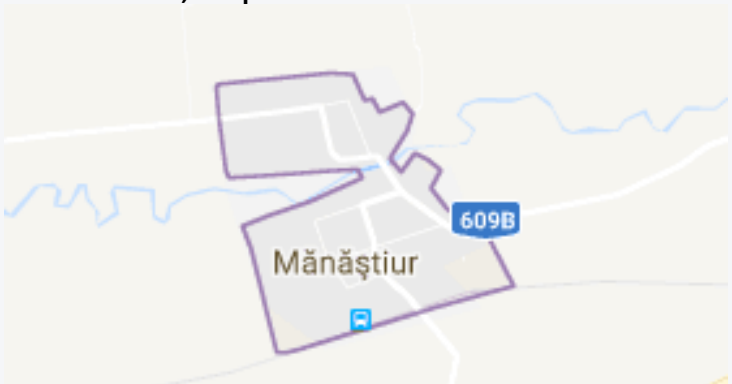
- **Objectives**:
  - Raise awareness about WSP and its significance for a good management of drinking water supply system
  - Establish the WSP team in Mănăștiur
  - Collect the basic information
  - Assembly the information in an incipient WSP
  - Formulate recommendation for completing the information and implementation of WSP

- **Methodology** is based on the existing published documents, and data collected by standardized questionnaires:
  - Field visits
  - Interviews
  - Water sampling and laboratory analysis
  - Data analysis
  - Recommendations for WSP further development and implementation.

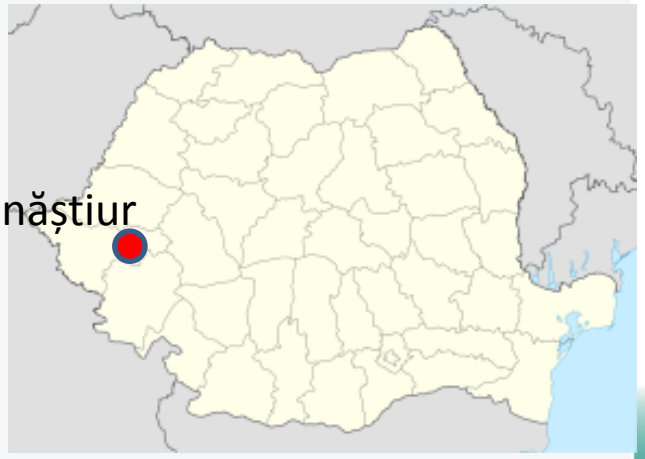
Field study – Mănăștiur

General description

- Located in Lugoj Plain, Lipova Plateau, on the upper Bega River
- Documentary attestation 1427 (*Monostor*)
- Total surface 41,86km^2
- Total Population 1.689 inhabitants (2012); 1.781 inhabitants (2002)
- Households: 629 (2012)
- 4 Villages: Mănăștiur, Pădurani, Remetea Luncă, Topla.



Coordinates: 45º52’45”N, 22º03’19”E



Mănăștiur Village Hall

Field study – Mănăștiur

- **WSP team**

1	Ionel Curuți	mayor
2	Ovidiu Borcescu	water and sewage operator
3	Letiția Popa	professor of chemistry and biology
4	Cristina Popoviciu	local promoter
5	Diana Ionescu	manager SC Bulangerie SRL
6	Corina Ghilezan	healthcare assistent
7	Mihaela Dejica	environmental protection responsible at the village hall

Field study – Mănăștiur

	SOURCE (catchment) - 2007
Information	**Ground water source** – 2 deep boreholes located on Bega riverside: (F1 at 152m depth, located near the treatment station, F2 at 150m depth, and 206m far from F1, at the village limit. Abstraction layers are separated by clay and sandy clay. The boreholes are covered . Water is pumped. It contains Ammonia 2-2,22mg/l . Hydrogeological study to determine the sanitary protection zones 26.07.2012 by Water Basin Administration Banat. There is a 10m sanitary protection area with strict regime, but the fence is broken. Test reports for water characterization since 2005.
Hazard Identification	**Agriculture** – microbiological (cow and sheep farms – manure) and chemical contamination (nitrates, pesticides) **Industry** – chemical and microbiological contamination (factory bakery SC Cornu Boulangerie SRL, wood processing factory SC Pamirco SRL) **Roads** (19km) & **Railways and railway station** - chemical contamination; pesticides **Households** – microbiological contamination (5-10% septic tanks; sewage system with waste water treatment plant that doesn't work) **Recreational areas** - microbiological contamination (arboretum park and station parks)
Risk Assessment	Microbiological contamination: Severity = 4; Likelihood = 5; **Risk score = 20 (VH)** Chemical contamination: Severity = 3; Likelihood = 4; **Risk score = 12 (H)**
Control Measures - Management of catchment area and reservoir	
Monitoring - Points of discharge of pollutants, raw water quality	
Actions in case of MAC exceeding - Stopping the takeover of water from source, adjusting the treatment process	

Field study – Mănăștiur

- Water quality at source – PROED SA laboratory

Sampling point - borehole at 83m, near village hall Sampling date: taken on 11.10.2005, entered the laboratory on 14.10.2005, analyzed on 17.10.2005 **Exceeding of MAC (0,5 mg/l): for ammonia 2mg/l** Observation: • the results were compared with the requirements of STAS 1342/1991 that was abrogated since 2002 • time between sampling and analysis was too long to have accurate results especially for ammonia and COD	Sampling point - borehole at 90m, at school Sampling date: taken on 11.10.2005, entered the laboratory on 14.10.2005, analyzed on 17.10.2005 **Exceeding of MAC (0,5 mg/l): for ammonia 2mg/l** Observation: • the results were compared with the requirements of STAS 1342/1991 that was abrogated since 2002 • time between sampling and analysis was too long to have accurate results especially for ammonia and COD • misinterpretation of the hardness result

Field study – Mănăștiur

Data analysis

- **Water source & catchment area**
  - Ground water source contains ammonia exceeding MAC
  - Boreholes have a fenced sanitary protection zone, but the fence is broken
  - The test reports from hydro-geological study are since 2005, and they are not complete for characterizing the raw water quality; there is no microbiological analysis
  - Estimated microbiological and chemical contamination within the catchment area; there are no test reports either to confirm or infirm the real level of contamination.
  - **Risk score $_{\text{microbiological contamination}}$ = 20 (VH)**
  - **Risk score $_{\text{chemical contamination}}$ = 12 (H)**

Field study – Mănăștiur

- **Recommendations for CONTROL MEASURES**
  - Water source & catchment area: very high and high risk scores require urgent/priority action such as:
    - Management of polluting activities within the catchment area; continuous communication with ANAR and APM
    - Registration of chemicals that are used
    - Control of human activities
    - Control of waste water discharge
    - Regular inspections on catchment area
    - Repair the fence of the sanitary protection zone
    - Monitoring the water quality at the discharge points of industry
    - Monitoring raw water quality more regular and for the parameters of interest (e.g. spring time and autumn)
    - Acquire information to ground the adjustment of the treatment process, especially the disinfection.

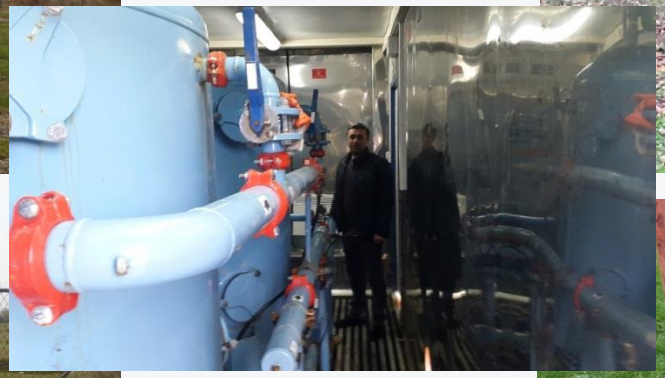
Field study – Mănăștiur

	TREATMENT (Water Work) - 2007
Information	Adduction pipe (HDPE, 473m) from drilling to station; Mono-block treatment plant, flow 3,53 l/s: container with 2 contact tanks with sodium hypochlorite as disinfectant and 3 fast filters with granular active carbon; There is an Operating manual; Maintenance is outsourced to Alex Carm SRL Oradea.
Hazard Identification	Microbiological and chemical contamination (nitrates and pesticides) from the catchment area; Ammonia exceeding the MAC in raw water; Power failure once at 3-4 months for 2-3 minutes. Ammonia ⇒ high consumption of chlorine to form chloramines, and then assure the free residual chlorine for disinfection; Pesticides ⇒ active carbon can reach faster its adsorption capacity; Power failure; Likelihood of having an ineffective treatment, especially for disinfection with the consequences of supplying into network water that is not under control. Water analysis at the exit of WW is not done regularly, not even for free residual Cl_2.
Risk Assessment	Microbiological contamination: Severity = 4; Likelihood = 5; **Risk score = 20 (VH)** Chemical contamination: Severity = 3; Likelihood = 3; **Risk score = 9 (M)**
Control Measures - Check water demand for chlorine and the efficiency of sodium hypochlorite; check if the active carbon is outworn. Daily check (automatic) control of free residual Cl_2 at the exist of WW. Treatment process monitoring, warning systems, automatic shutdown/manual of water supply to the network.	
Monitoring - raw water, treatment process, disinfected water supplied to the network (final product).	
Actions in case of MAC exceeding - stopping the takeover from water source, adjust the treatment process, the treatment plant closing.	

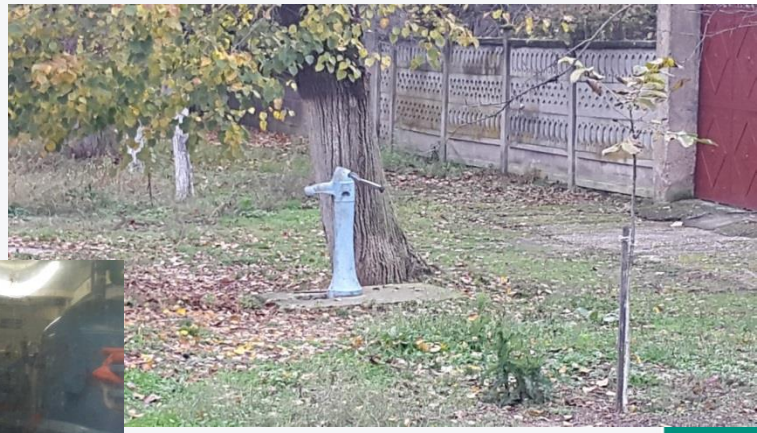
Field study – Mănăștiur

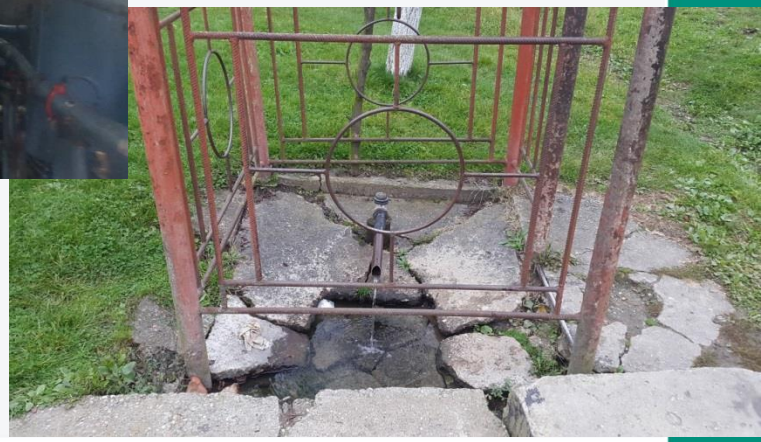
Photo documentation

- Water work



- Street taps





Field study – Mănăștiur

Data analysis

- **Treatment (Water Work)**
  - A.N.R.S.C. license for water service no. 1907/16.03.2012, class 3 (for a number smaller or equal to 50,000 residents), valid until 16.03.2017.
  - Microbiological contamination from catchment area need a careful disinfection; Ammonia exceeding the MAC in raw water, use of sodium hypochlorite and Power failures ⇒ Likelihood of having an ineffective treatment, especially for disinfection with the consequences of supplying into network water that is not under control.
  - Chemical contamination (pesticides) from the catchment area might fasten the reach of adsorption capacity of active carbon.
  - Estimated microbiological and chemical contamination and its removal by treatment is hard to be either confirmed or denied due to the lack of records/test reports about water quality.
  - **Risk score $_{\text{microbiological contamination}}$ = 20 (VH)**
  - **Risk score $_{\text{chemical contamination}}$ = 9 (M)**

Field study – Mănăștiur

- **Recommendations for CONTROL MEASURES**
  - Treatment (Water Work): very high risk score for microbiological contamination requires urgent actions, and medium risk score for chemical contamination requires to act, plan and prepare as follows:
    - Optimization of treatment process and automated control
    - Approval and control of reagents and materials used in the treatment; availability of reserves (including a power generator)
    - Regular monitoring of the quality of raw water and drinking water at the exit of water work, especially for the level of free residual chlorine.

Field study – Mănăștiur

Water and Sewage Association of County SC „APCAN“ SA
Length of drinking water supply network: Mănăştiur = 8,2 km; Remetea Luncă = 5 km; Pădurani = 2 km; between Mănăştiur and Remetea Luncă = 4 km.

	DISTRIBUTION (supply network) - 2007
Information	Stainless steel storage tank for treated water above the ground (200mc), located in the sanitary protection area; water flows by gravity from storage tank into the distribution network; 8226m distribution network of HDPE; 19 street taps; 90% of the households are connected; maintenance is carried out by 2 persons with high school; electricity interruptions (minutes – 5 hours)
Hazard Identification	Water within the supply network is not protected by the residual disinfectant. Plastic pipes are in favor of the biofilm formation, and microbiological growth. Power failures generates interruption in water supply, which can raise a hazard if the pipes of the network are broken (no information about this issue) and the pressure decrease; high water consumption/ day/ person might suggest leaks but also the use of water for irrigation).
Risk Assessment	The description of the situation suggest a risk of microbiological non-compliance (including the exceeding of the oxidability/COD) that is not confirmed by the 2 test reports that were available. The monitoring program approved by public health authority is not followed or the records were not handed to the project team. Microbiological contamination: Severity = 4; Likelihood = ?; **Risk score = ? (?)** Chemical contamination: Severity = 3; Likelihood = ?; **Risk score = 9 (M)** – the same with WW
Control Measures - operational procedures, approved materials, valve status	
Monitoring - flow, pressure, residual disinfectant concentration	
Actions in case of MAC exceeding - water discharge, flushing pipes, advising people to boil water	

Field study – Mănăștiur

- Drinking water monitoring program
  - Approved by DPH Timiș for 2015

Tap	Volume of water produced mc/day	No. of population within the distribution area	Microbiological parameters frequency/year	Chemical parameters frequency/year
Mănăștiur Remetea Lunca	201,79	1614	4 times April, July, September, December	4 times April, July, September, December
Pădurani	19,7	65	2 times April, September	2 times April, September

Water consumption/person/day = 125 – 303 l/person/day

Field study – Mănăștiur

- Water quality – Laboratory of DPH Timiș - 16.09.2015

Sampling point	Microbiological parameters	Chemical parameters
Entry treatment station (source – borehole - raw water)	No exceeding of limit values for Coliform bacteria, E. Coli, Enteroccocus, Colony count at 22ºC and 37ºC	Ammonia 2,5 mg/l (CMA = 0,5 mg/l)
Exit treatment station		No free residual Cl_2
Distribution network		
School in Mănăștiur		No free residual Cl_2 Oxidability 5,135mg O_2/l > MAC=5 mg O_2/l
Street tap 1 in Mănăștiur		-
Street tap 2 in Mănăștiur		-
Street tap 1 in Remetea Lunca		-
Street tap 1 in Pădurani		-

Field study – Mănăștiur

- Water quality – Laboratory of Aquatim - 16.11.2016

Sampling point	Microbiological parameters	Chemical parameters
Artesian fountain Mănăștiur	0 Coliform bacteria 0 E. Coli 0 Enteroccocus/ 100ml	Ammonia 2,56 mg/l > CMA = 0,5 mg/l
Distribution network Mănăștiur		Ammonia <0,5 mg/l (CMA = 0,5 mg/l)
		Free residual Cl_2 was not analyzed

Field study – Mănăștiur

Data analysis

- **Distribution network**
  - There is no free residual chlorine in the water supplied to the consumers, meaning that there is no protection against microbiological growth;
  - Test reports for microbiological quality of water show no exceeding of limit values;
  - The frequency of test regarding water quality is too small, and the parameters that are checked too few to really characterize the final product supplied to the consumers;
  - Although there is no free residual chlorine in the network, the amount of organic matter exceeds the CMA and plastic pipes favors biofilm formation, microbiological parameters show no exceeding;
  - Water consumption based on answers at 18 questionnaires is in range of 6,66 – 50l/person/day (mean value = 18) by comparison with data from the monitoring program showing a range of 125 – 303 l/person, day, suggesting that might exist leaking in the supply network;
  - The electricity interruption may cause pumps failure and decrease of pressure in the network
  - There are no sufficient data to estimate the microbiological risk. The assumption about chemical risk is that it stays as it was at the exit of water work after treatment stage., according to the best scenario, but it can increase (not sufficient information).
  - **Risk score $_{\text{microbiological contamination}}$ = ? (?)**
  - **Risk score $_{\text{chemical contamination}}$ = 9 (M)**

Field study – Mănăștiur

- **Recommendations for CONTROL MEASURES**
  - Distribution Network: risk score for microbiological contamination is unknown, and medium risk score for chemical contamination (best scenario) requires to act, plan and prepare as follows:
    - Providing a partial protection against microbial contamination by providing a residual disinfectant
    - Maintaining a positive pressure in the distribution system
    - Maintenance of the distribution system
    - The introduction of backflow prevention devices
    - Ensure the integrity of storage and distribution systems
    - Adequate procedures for repairs and subsequent disinfection of piping.

Providing a safety barrier against contamination after treatment during the transport of water - Last Chance!

WECF

Field study – Mănăștiur

	TAP (consumers)
Information	Type of premises: factory bakery SC Cornu Boulangerie SRL, wood processing factory SC Pamirco SRL, railway station, 2 schools, 2 kindergarten, 5 sanitary institutions, 2 cultural institutions, 629 households (90% of households are connected to centralized water supply), 1689 persons, Distribution network materials: HDPE, 19,2 km.
Hazard Identification	Not identified, no information about siphonage, leakage from pipelines, hygiene.
Risk Assessment	Not enough information . Microbiological contamination: Severity = 4; Likelihood = ?; **Risk score = ? (?)** Chemical contamination: Severity = 3; Likelihood = ?; **Risk score = 9 (M)** – the same with exit of WW and supply network (best scenario).
Control Measures - regulation of sealing elements (gaskets), education	
Monitoring - inspection of premises	
Actions in case of MAC exceeding - advising consumers	

Field study – Mănăștiur

- **Recommendations for CONTROL MEASURES**
  - Consumers tap: risk score for microbiological contamination is unknown, and medium risk score for chemical contamination (best scenario)requires to act, plan and prepare as follows s:
    - Regulation of sealing elements (gaskets)
    - Education.

✓If appropriate control measures are in place, then the water must be safer.
✓However, if an incident occurs, by investigating the causes, new control measures may be established or the existing ones can be improved.
✓Control measures will be developed and improved based on the assessment of all system's threats.
✓**Control measures should be reviewed to be updated and improved by experts, not by incidents!**

Field study – Mănăștiur

CATCHMENT	TREATMENT	DISTRIBUTION NETWORK	CONSUMER'S TAP
Risk score (m) = **20** (VH) Risk score (c) = **12** (H)	Risk score (m) = **20** (VH) Risk score (c) = **9** (M)	Risk score (m) = **?** (?) Risk score (c) = **9** (M)	Risk score (m) = **?** (?) Risk score (c) = **9** (M)

- **Conclusions**
  - Immediate measures to control the microbiological risk and to control the free residual disinfectant have to be taken
  - Technical assistance on the process of water treatment is recommended , especially by the Regional Operating Company (ROC), e.g. Aquatim
  - Displaying work instructions for operating the treatment plant, and periodic checks
  - Regular training of staff
  - Daily checking of free residual chlorine (with rapid kits, e.g. Merck – Chlorine test, catalog no. 114801, range of concentrations 0,1-2mg/l Cl_2) and adjustment of the disinfectant dose, if necessary
  - Turning wastewater treatment plant
  - Restricting grazing areas so that animals no longer exist in the catchment area
  - Communication and cooperation with all stakeholders in the catchment.