

Case study

# Lessons from Water Safety Plans

for small-scale water supply systems  
as developed  
by schools in Romania



**WECF** | Women in Europe for a Common Future

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Figure1. Map of Romania with the locations of the target villages

## Foreword

The World Health Organisation (WHO) initiated the Water Safety Plans (WSP), which are to be considered as a part of the WHO guideline on drinking water quality. The WSP is a concept for developing a process-orientated observation of the water supply and its goal is to identify and eliminate all the possible risks in the entire water supply system: from the potential risks of water pollution in the catchment area all the way along the line to the consumers. The WSP asks for an identification of risks, which could affect water safety and human health in every stage of the water supply. It is also necessary, however, to identify measures, which minimise and manage the risks. It can be summarised by the following good-house-keeping rules “spot the hazard, assess the risk and make the change”. All possible contamination points and activities which can potentially contaminate the water supply are identified and addressed. The final products of a WSP – maps, posters, reports, safe-water strategy – give the local community information on how to avoid risks of water pollution.

WECF asked the following question in this case study: Can the WSP approach be implemented with the involvement of schools? Can the WSP approach be used in order to mobilise the community for minimizing water related health risks?

In this case study WECF reports about the experiences gained with developing WSPs for small-scale water supply systems by schools in rural areas of Romania.

## Acknowledgements

In particular we would like to thank the children and staff of the schools involved and the local project partners of the target areas for their support, enthusiasm and willingness to participate in this project. They all played a very crucial role in the project activities. And we would like to thank the citizens of the Romanian target villages and the local authorities for their cooperation.

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# 1 | Introduction

In many rural areas of Romania access to water as such is not a major problem. However access to safe water is often a big problem. According the UN statistics, in 2006, 99% of the urban population had access to an improved water source, whereas for the rural population only 76% had access to an improved water source<sup>2</sup>. An improved water source includes any of the following types of drinking water sources: household connections, public stand-pipes, boreholes, protected dug wells, protected springs, and rainwater collection. However, having access to an improved water source does not mean that someone actually has access to safe water<sup>3</sup>.

Romania is a country facing substantial problems in groundwater protection. Poor sanitary conditions and mismanagement of human and agricultural waste cause ground and surface water pollution with nitrates, faecal bacteria and pesticides. 7 million people in rural areas of Romania obtain their drinking-water mostly from wells, mostly private wells, and use conventional pit latrines in their yards, which often smell bad, attract flies and pollute the groundwater<sup>4</sup>. Safe human and animal excreta management is mostly lacking.

Among the citizens and local authorities low awareness exists on the relation of man-made pollution of water sources, water quality and related diseases. In villages with small-scale water supply systems financial mechanisms or structures for water monitoring and water protection measures are often not available.

Romania has adopted the European Union (EU) drinking-water legislation, but this does not cover the private wells in the villages. The EU directive gives countries the possibility to exclude drinking-water systems supplying less than 50 persons or 10 m<sup>3</sup> per day<sup>5</sup>, meaning that drinking-water quality from private wells, the main source of supply in the country, is not controlled and often not protected against contaminants.

The Protocol in Water and Health was ratified by the Romanian Governmental Ordinance no.95 / 29 August 2000 and

approved by Law no. 228/ 30 Nov. 2000 and signed<sup>6</sup>. In the update on progress achieved by the parties in setting targets dates, Romania mentioned in 2009 the main barriers in the process of target-setting among others:

- the inadequate state of the drinking water supplies systems
- the insufficient distribution or the lack of the drinking water supplies systems;
- the inadequate quality of the drinking water
- the small capacity for treatment of water for drinking purpose and inadequate treatment technology for water intended for consumption.
- low managing capacity for sewage systems and waste water treatment plants
- poor financial situation of local water services

According the report, prepared in the framework of the Task Force for the implementation of the Environmental Action Programme for Central and Eastern Europe (EAP Task Force), "the responsibility for drinking water supply, wastewater disposal and treatment belongs in Romania to the local authorities and comprises the management of these duties, whereas water users are obliged to prepare and apply their own plans for prevention and control of accidental pollution that might occur as the result of their activities".

## 1.1. WECF experiences

Since several years Women in Europe for a Common Future, WECF, in cooperation with local partners, has been observing and monitoring water pollution of small-scale water supply systems such as dug wells, in rural areas of Romania. Besides bacteria, WECF identified nitrates as one of the substances that often pollute drinking (ground) water. Nitrate concentrations in drinking water are easily to measure by nitrate quick-tests, far more easily than bacteria, and therefore nitrates can serve as an indicator for man-made (anthropogenic) water pollution. In WECF's experience, proving a severe anthropogenic pollution of drinking water via water tests often does NOT trigger any action by local or regional authorities to start water protection measures.

*7 million people in rural areas of Romania obtain their drinking water mostly from wells (Photo WECF)*



## 2 | Objective - Water Safety Plans, involving schools

WECF and local partners implemented a 2-year project “Safe Sanitation Health and Dignity (SSHD)” in 4 counties (provinces) of Romania, with the financial support of Foundation Ensemble, France, and the Dutch Ministry of Foreign Affairs<sup>8</sup>. One of the aims of the SSHD project was awareness raising on water source protection, safe sanitation, organic waste management, hygiene and health.

To address the above-mentioned problems and aims, WECF created an educational package (WSP toolbox) for schools to develop community based Water Safety Plans (WSP) for local small-scale water supply systems such as dug wells, boreholes and public taps.

The aim of the activities on developing WSP for small-scale water supply systems involving schools was, building local capacity and strengthening and mobilising the community for improved access to safe drinking water.

This case study will formulate the results of the WSPs carried out by 8 Romanian schools to get an insight into the water situation

in rural Romania as perceived by the schools. The case study will give insight into the results of making use of children’s potential and strengths and into which results could best support the local, regional and national planning of policies on water and sanitation for rural areas. The presented results, data and information are based on the reports, provided by the participating schools. Therefore the description of the activities and results of the target schools do not have a similar level and structure.

## 3 | Study area

The selection of the target area was based on that of the ongoing WECF project ‘Safe Water, Sanitation, Health and Dignity.’ The villages were selected based on there being a school with teachers who were interested in participating in the project. The following villages were selected:

### **Giurgiu County:**

one school in the village of *Pietrele* (2300 inhabitants)

### **Ialomita County:**

one school in the village of *Cosereni* (4820 inhabitants)

### **Mehedinti County:**

two schools in the villages of *Garla Mare* (3500 inhabitants) and *Vrata* (1500 inhabitants)

### **Teleorman County:**

five schools in the following villages:

*Cervenia* (3362 inhabitants)

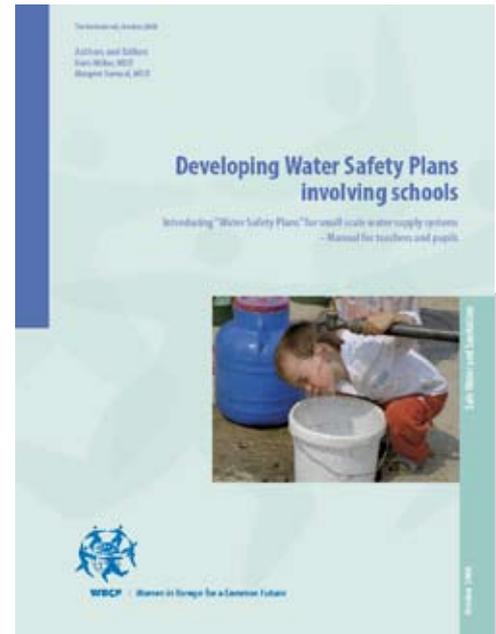
*Tiganesti* (5620 inhabitants)

*Izvoarele* (2900 inhabitants)

*Contesti* (3676 inhabitants) and *Beiu/Storobaneasa* (3735 inhabitants)

None of the target villages is served by a central water supply network or sewerage system. Beside the individual wells the villagers of Cosereni, Tiganesti and Izvoarele use partly public taps. Izvoarele has a pipe which supplies 220 inhabitants.

All the families of the target villages are served with water of the first groundwater layer (aquifer), depending on the geographical conditions varying from 3 to 50 meter depth.



*WSP Manual with background information for teachers*

## 4 | Methodology

The target groups are the people of the rural areas, with focus on schoolchildren. Children will work with the support of their teachers and other stakeholders for safe drinking water, sanitation and health.

### **WSP Manual for teachers**

WECF’s WSP toolkit provides schools and other stakeholders with a WSP manual with background information about the aims of the WSP, about properties of drinking water and sources of pollution and related health risks. The toolkit also includes questionnaires for collecting information from citizens, local health authorities and local authorities responsible for water sources. Further, the toolkit includes sanitary inspection forms on the current state and potential risks of (private) wells. The toolkit also contains materials and instructions for carrying out simple water tests.

## Questionnaires

Three different questionnaires were prepared for the schools: one for citizens, one for the local medical staff and one for the authority responsible for the local water supply. The schools were free to adapt the questions to the local conditions. Together with the pupils, teachers conducted interviews with the local doctors, the authority responsible for water and with 10 local people about their perception of water, about type of water sources, about quality and quantity, water related diseases and about their wishes for the future regarding water issues.

Sanitary inspection forms (checklists)

Based on the sanitary inspection forms published by the World Health Organisation WHO, checklists for the risk assessment of water sources were adapted to the local circumstances of the rural Romanian areas and included in the WSP manual. By field visits and using the checklist, possible contamination points and potentially contaminating activities of water sources could be identified and addressed.

## Water tests

To raise awareness and to gather information about existing drinking water pollution, school staffs were provided with materials and information for carrying out nitrate quick tests and organo-leptic observations (colour, particles). Strips for measuring the acidity (pH) of the water samples were added as well. The nitrate quick test strips with a nitrate measure range of 0-10-50-100-250-500 mg/l are to be considered as a semi quantitative test. Nitrate concentration in water gives an indication of the level of water pollution.

The schools were asked to analyse many local water sources and to carry out a longitudinal (seasonal) nitrate monitoring of five selected drinking water sources spread over the village: one water source with a low nitrate concentration, one with a high nitrate concentration and the other three sources with concentrations between. The purpose of this exercise was to identify fluctuations of the nitrate levels in the water sources. The results could indicate the permeability of the soil or the sensibility of the groundwater for infiltration of pollutants, or indicate the effects of human activities such as fertilizing of fields. The schools were advised to monitor also the weather, in particular the types of precipitation events.

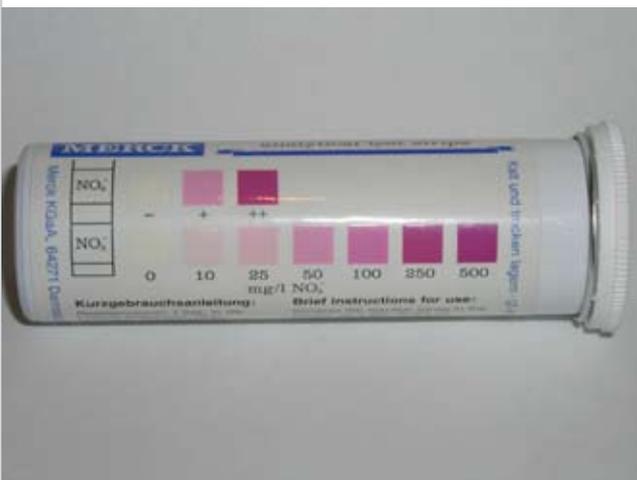
## Training of teachers

Two teachers per participating school and employees of the local NGO were trained by WECF in two half-day sessions on how to develop with the involvement of their pupils a WSP for their local community and about possible additional activities. The training explained how to conduct the water testing and fill in the test result forms. The teachers were asked to form working groups to set out a programme for the WSP activities for one school year (8 months).

## Implementation

In autumn 2008, school staff of 8 Romanian schools developed and started a WSP programme for their pupils. For each participating school a small budget for material or copy costs, or for doing additional laboratory tests e.g. bacteria were made available.

Depending the level, background and skills of the teachers, the available time and the support by local NGO or experts, some schools received additional support e.g. by staff of a local water centre, whilst some schools were left with the programme on their own. Hence also the results of the WSP programme are diverse. For example not all the participating schools managed to conduct interviews or risk assessments of the nitrate-tested wells. The schools carried out the WSP activities from November up to the end of the school year, May or June 2009. Findings and results were presented in an electronic or written report, while not all the involved schools had access to Internet. The local project coordinator collected the results and the best-developed WSP was awarded during the Danube Days, June 2009.



*Nitrate test strips are cheap and water samples are quick to analyse (Photo WECF)*

# 5. Results and experiences

In this case study general data and experiences received from six participating schools will be presented. Two out of the eight participating schools were not able to provide (or only partly) the results in electronic form and were therefore not included in this case study. The experiences and results of four schools will be presented in detail and serve as examples of the range of the variety of activities.

## 5.1. General remarks

The teachers and the pupils of the participating schools were very motivated and enthusiastic about the activities, because the activities were experienced as practical, educative and relevant to the local environment. Many activities could be carried out during the regular curriculum. The weekly time spent on the WSP program was one or two hours, whereas tasks outside of the school such as checking the well was not allowed to be implemented during school hours. The results depended considerable on motivation and available time of the teachers and the pupils. Hence not all the schools checked the state of the wells in their village.

Most schools identified together with the pupils the tasks and activities, which wells should be monitored on seasonal fluctuation of the nitrate concentrations and which wells should be tested only once. The children were asked to take the samples and the water tests were carried out in the classes. Often the teachers felt that it was more appropriate for them to interview the local health and other authorities, whilst pupils interviewed local people. Although it was advised to adapt the questions to the village conditions, only one of the interviewers adapted one questionnaire.

In summary, all the involved schools and stakeholders appreciated the practical activities and the flexibility of the programme. Approximately 500 water samples were tested for nitrate and

other simple tests like pH, observing the turbidity or colour of the samples, were carried out. None of the schools asked for additional water tests.

Some schools invited speakers from health or water authorities and many schools presented the results to the public.

In conclusion, it can be stated that the results of the WSP depend strongly on the background, motivation and availability of the leading teachers, and on the support of the local NGO. Most schools organised contests on clean wells and water, or children wrote poems related to water.

## 5.2. WSP activities and results in the village Pietrele, Giurgiu County

The local WSP coordinator of Pietrele informed us that the village is served by a 30 – 50 meter deep aquifer, covered by a basalt plate and pierced for the water abstraction. Further was mentioned that according to local data, there is a nitrate contamination of the area of Baneasa, where Pietrele is located, due to agricultural activities.

### Water tests

The nitrate monitoring results supported that information. Every 2 weeks water samples were taken from 5 identified wells and tested together with pupils of the school. In two sources the nitrate test showed concentration of 25 mg/l and 3 sources with 50 mg/l without fluctuations indicating a groundwater, which is slowly affected by pollution (fig. 2). No abnormal pH or colour were found and the water was always without particles.

### Citizens' perception and doctor's opinion on drinking water quality

In the village of Pietrele 10 citizens were interviewed about their perception of their local drinking water sources. All the respondents have an individual well; two of them have a pump with

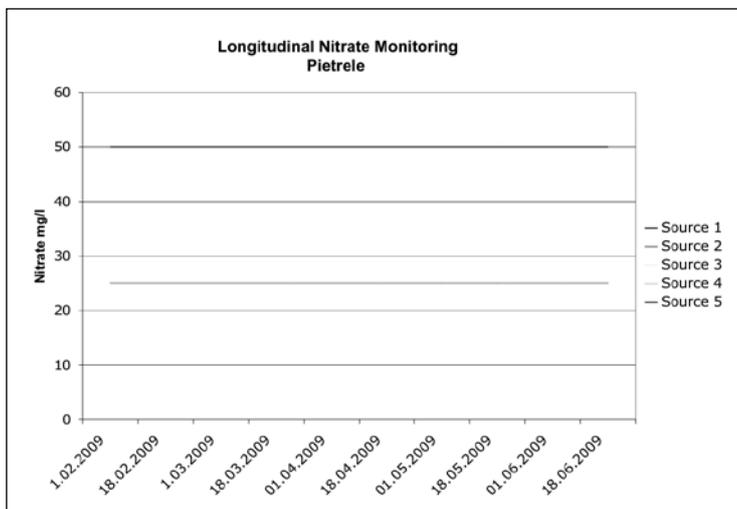


Figure 2. Results of longitudinal nitrate monitoring of 5 drinking water sources in Pietrele, Giurgiu

a pipe to the kitchen and bathroom. All the ten respondents perceived the quality of their water as good and there is always enough water available for their purposes. Hence only one out of the ten respondents buys bottled water. Two of the interviewed persons think they can get ill from the water.

The interviewed local doctors mention that the main problem of the water is its hardness and the contamination with Giardia (see box), and urinary lithiasis (kidney stones) was also mentioned as a water-related disease among the villagers.

### Drinking water use

Surprising was the high daily water need of 100- 800 liters per family. Among the respondents two had no animal husbandry, but both mentioned to use daily 600 liter water. Moreover 6 respondents have during the week a family size of 2 persons, whereas in the weekend 2 or 3 persons join. Most of them collect water twice per day using a pump or hydrofor. Water is stored in barrels and buckets outside in the yard and in the kitchen.

The mayor complained that one of the problems in Pietrele is the drought. The WSP coordinator explained that the garden-owners have to irrigate the fields regularly; otherwise no crops can be harvested.

Recommendations and suggestion of the local WSP coordinator for improving the water quality are:

1. Central water supply system served by a drilled water source
2. Water softening (decarbonisation) of the drinking water
3. Implementation of toilets of the type 'ecosan' (urine diverting dry toilets)
4. Fertilizing the soil with natural fertilizer

### Remarks

The activities and the involvement of this school were not intensive, also due to the fact the school had to act rather isolated and the availability of the local WSP coordinator was low.

At the moment the water quality problems in the village of Giurgiu are not severe. Although the maximal allowed nitrate value of 50 mg/l of the EU directive for drinking water was not exceeded, water protection measures should be applied in the field of agriculture and wastewater management. Taking the depth of the aquifer and the geological conditions in consideration, the identified concentration of 50mg/l indicates anthropogenic pollution, which should be stopped.

### 5.3. WSP activities and results in Cervenia, Teleorman County

The villagers of Cervenia do not have access to central water supply nor public taps. Citizens rely on dug or drilled wells, and on natural captured springs.

The project participating school in Cervenia included in their programme awareness raising on the aim of International Water Day, celebrated on 22 March. Attention was paid to the importance of water for humans, in particular on the relation of water and health and on the role of several elements of water for a healthy life. The local doctor was asked to fill in the questionnaire and stated that in the village the main problem related to drinking water is that drinking water sources are not controlled on quality, and no protection measures are taken, causing diseases like Giardia, Enterocolitis and, Nitrate intoxication.

### Water tests

The pupils and the teachers of the school selected 5 wells for nitrate longitudinal monitoring and identified the following nitrate concentrations:

Nr. 1: Source for the health centre 100 mg/l

Nr. 2: Source for the school 450 mg/l

Nr. 3, 4, and 5 are 3 individual 50, 100 and 450 mg/l

Source nr. 2, 3, and 4 are captured natural water sources.

The depth of the 2 wells and the aquifers was not reported.

The WSP team of Cervenia observed that the water sources (wells) in

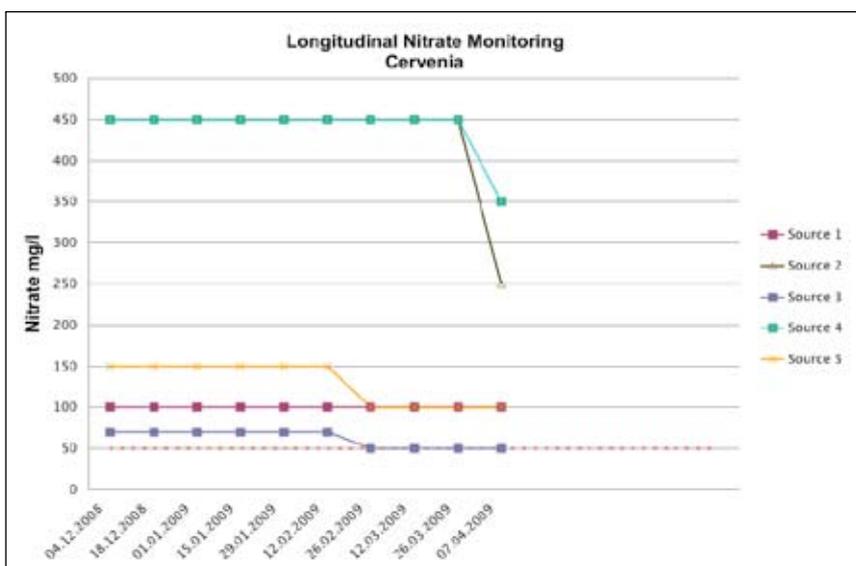


Figure 3. Results of longitudinal nitrate monitoring of 5 drinking water sources in Cervenia, Teleorman

the higher part of the village are less polluted than the water sources down the village and located near by the river Veda (fig 4). The wells nearby the Veda were very contaminated, with a nitrate concentration of 450 mg/l. The school monitored the nitrate concentration of the selected wells only every 4 months.

The WSP team in Cervenia concluded that there are many local sources of water pollution due to wells located near rubbish dumps and animal stables.

Their suggestions for improving water quality and reducing health risks at the household level were that people should be informed more often about what water represents in terms of its human value, water quality analyses should be done more often, and the rules of water protection should be respected.

**Remarks**

The school of Cervenia did not find the time or motivation for interviewing the citizens or to continue the nitrate monitoring after April. However severe problems with local water management and governance, water quality and related health problems were identified.

**5.4. WSP activities and results in Tiganesti, Teleorman County**

After the WSP training the school of the village Tiganesti started very soon with planning their activities and at the end of the project a detailed report was prepared. The villagers of Tiganesti have mostly an individual well in their yard. In addition in the outskirts of the village there is a spring, which is captured and water is accessible for public usage.

**Preparatory works by the school**

In Tiganesti pupils of 8 classes in the age of 11- 15 years old, and four of their teachers were involved in the WSP activities. Two hours per week were spent on the implementation of developing a WSP for their community. With the participation of the pupils it was agreed on which water sources has to be monitored, who has to collect the water samples, who conducted tests, who is doing the interviews, etc. The five monitored water sources were marked on a map of the village (fig. 5).

Source 1:

Drilled individual well, served with water from 4,5 m depth

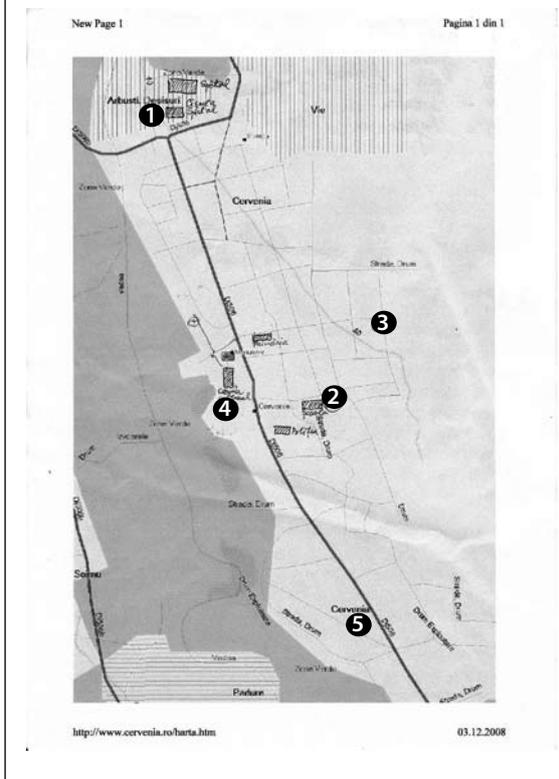
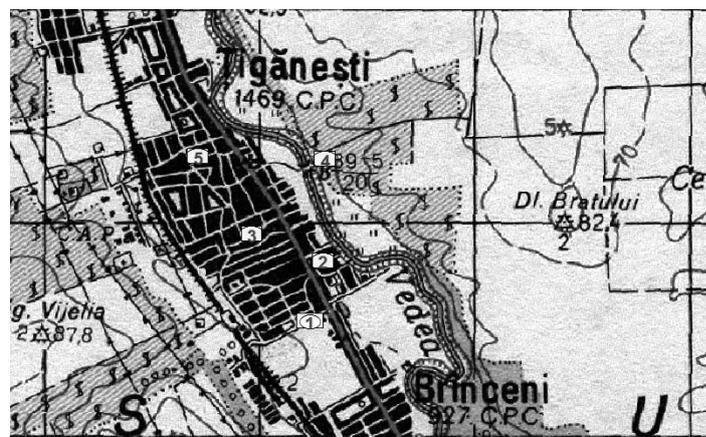
Sources 2, 3 and 5:

Individual dug wells, served with water from 3-5 meter depth

Source 4:

Captured spring, fed with groundwater from 20-30 m depth

*Figure 5. Map of the village Tiganesti with the indication of the location of the Nitrate monitored wells*



*Figure 4. Map of Cervenia: wells in the lower part, nearby the river Veda were very polluted*

A contest was organised, in which the students had to identify their ideas, priorities and actions, which should be taken to improve water safety. The following actions were outlined

- Identifying sources of contamination
- Maintaining hygiene of the wells
- Protection of water supply systems
- Training of local NGOs
- Cooperation with local authorities by completing a partnership
- Obtaining funds
- Management and preservation of water resources

**Monitoring results**

The pupils of the school tested every 2 weeks the 5 selected wells on nitrate, pH and turbidity. In addition the precipitation events and the outside temperature were noted. The pupils found out, that in particular the nitrate concentration in the shallow wells, in the middle of the village, fluctuate tremendously. The two water sources on the border and outskirts of the village did not exceed the EU nitrate limit of 50 mg/l continually unlike the water samples from wells in the middle of the village which did exceed these levels (fig 6). The pupils

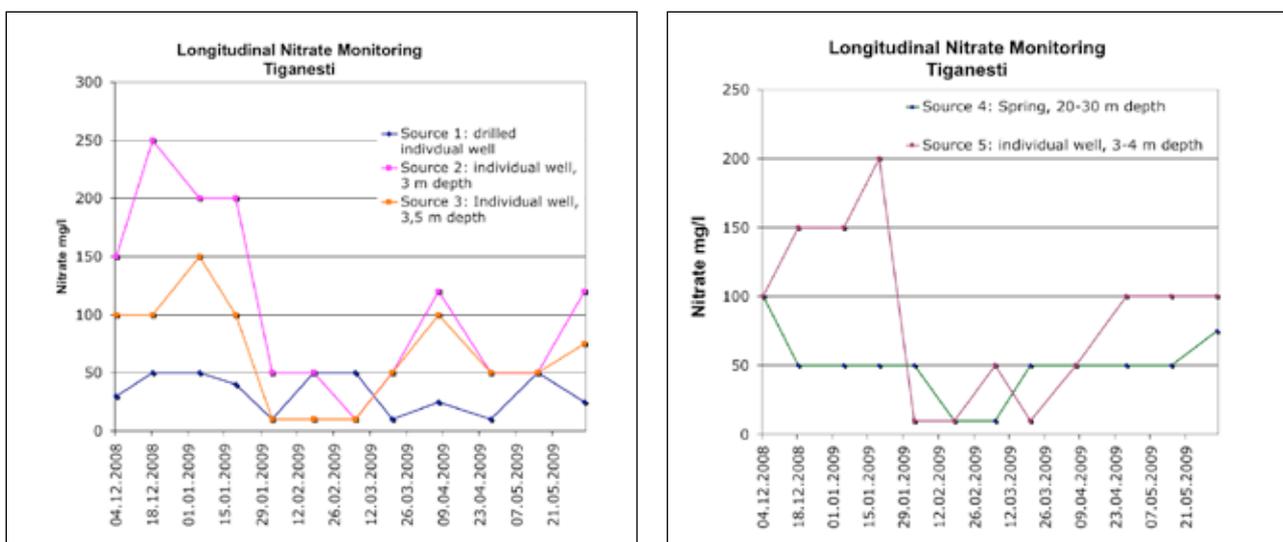


Figure 6. Results of longitudinal nitrate monitoring of 5 drinking water sources in Tigansti, Teleorman

identified a relation between precipitation events, the seasons and the observed fluctuations of the nitrate concentrations. The very high nitrate levels of 150, 200, 250 mg/l found in the month December, decreased during the months of January and February and even reached the maximal allowed nitrate concentration of 50 mg/l or less. However in the month March – April nitrate levels increased again beyond the nitrate limit of the EU water directive.

No particles, no abnormal colour or Ph values were observed.

#### The observations of the WSP-team (pupils and teacher) in Tigansti were:

- After heavy rain fall the nitrate concentration of the well water decreased
- The nitrate concentration decreased dramatically after December

The WSP team suggested the drop of the nitrate concentrations after December were because at Christmas time many pigs are slaughtered and so the number of pigs and manure in the village decreases. In addition the left over fertilizer is washed out during the month November – December and therefore no longer barely contributes much to water pollution in January and February.

Unfortunately the water pollution increased again with the fertilisation of the fields in springtime.

The team observed that household water sources (2, 3 and 5) are located near to animal shelters, also while little space is available in the households little yards.

#### Risk assessment of the monitored water sources

Besides the longitudinal nitrate monitoring of water sources, pupils carried out a sanitary inspection of wells by using the check-lists of the WSP manual. During field visits the pupils

identified the sources of pollution such as the location of the manure heap or pit latrine, or identified the current state of the well. The total to obtain scores of risks for dug wells and boreholes was ten, indicating very high risks for pollution (fig 7). One of the five inspected water sources (source 4, being the captured spring with a maximal found nitrate concentration of 50mg/l) scored two points, what indicated a low risk of pollution. The other four sources scored medium up to high risks, whereas water sources with a score of 3-5 is prone to medium risks for contamination. A score of 8 points meaning a high risk was identified for the well with the highest found nitrate value of 250mg/l (fig 7).

#### Citizens and doctors opinion in Tiganesti

The WSP team of Tiganesti interviewed 10 citizens about their perception of water issues. All the respondents use water from dug wells, but besides the well water half of the respondents use water from the public tap (captured spring) for drinking and cooking purposes. All of them have some animal husbandry and the daily water usage is from 40 up to 100 liter. The distance to reach the water sources is mostly 10 to 20 meter, however one respondent mentioned to go 300 m for fetching water. Most of them go daily 2 to 3 times to one source and to the other source up to 7 times. Four of the 10 interviewed persons think that the water quality of the water sources is not good, the other 6 consider the water of the public tap as good, but of the individual well as not good. All the respondents bought bottled water for drinking.

On the question about the reasons of the bad water quality only one of the respondents mentioned the usage of fertilizers. The other did not know why or were not sure. None of the respondents cover the water reservoirs at home or boil the water before consumption. None of them thinks they will become sick from the water .

The local doctor was aware of the bad quality of the water based on the shallow depth of the wells and mentioned the

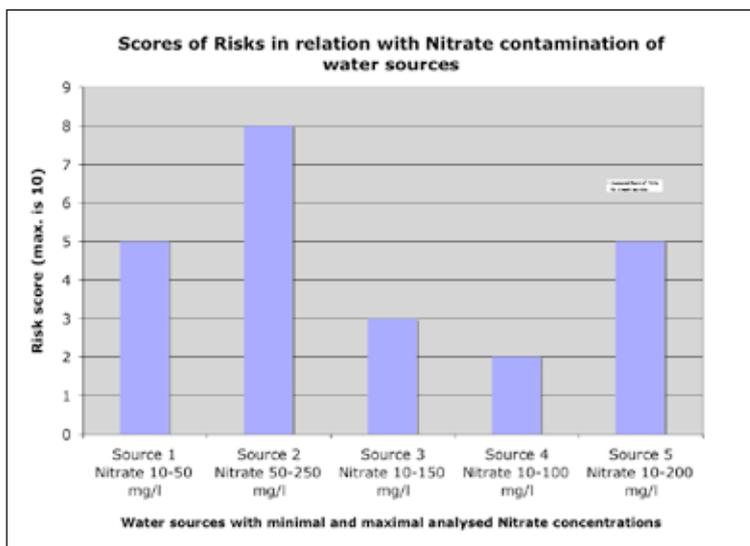


Figure 7. Results of the sanitary inspection of the 5 nitrate-monitored water sources in Tiganesti

#### Scores of Sanitary inspection

Risk score:

9 – 10 = very high risk

6 – 8 = high risk

3 – 5 = medium risk

0 – 2 = low risk

animal droppings and the toilets as the main problems concerning the water in the village. Water analyses are done rarely and only on request. As the main illnesses related to the village drinking water were mentioned microorganism in the flora that grow on the walls of the well shaft causing parasites. Diseases could be for example Giardia, Dysentery, Typhoid, and Hepatitis. In the last 3 years no cases of Blue Baby disease or typhoid were reported. Among the villagers diarrhoea is present, but no severe cases were reported.

#### Experiences and recommendations of the WSP team Tigansti

The WSP team identified the following sources of pollution at local level:

- Latrines, which do not have no septic tanks
- Animals that are raised within the households
- Chemical substances (in particular nitrogen)
- Detergents used and discharged directly into the yard
- Cosmetic products
- Improper storage conditions of fuels
- Randomly throwing out of garbage and household refuse
- Flooding and overflows affecting groundwater
- Dust, which accumulates when wells are not covered

For improving water quality and reducing health risks at household level the WSP team suggested the following measures:

- Realising a safe sanitation system in the shortest time
- Animal farming system in remote places and not inside the village
- Using ecological landfill
- Adequate coverage of the wells
- Collaboration of the citizens with the local authorities
- Constructing a central drinking water supply as soon as possible
- Training citizens for proper hygiene

For improving water quality and reducing health risks at community level the WSP team suggested the following measures:

- Storing water in covered containers
- Periodic analyzes of the water in an institutionalized way
- Establishing ecological landfill
- The development of Local Council decisions to impose compliance rules for the use of drinking water
- Establishment of a local NGOs for better cooperation between local authorities and citizens
- Development of projects to attract European funding to help the improvement of the WSP
- Public participation in future projects
- Conducting voluntary activities to improve environmental quality and drinking water: e.g. waste collection, cleaning wells and channels.
- Implementation of environmental education and bring existing legislation in force.
- Continue to pursue projects at the school level and community such as WSP.
- Stabilisation of the potential of the reserves of underground water by hydro-geological mapping.

#### The Tiganesti school staff suggested for future activities

- A better mobilisation of students and their involvement in many activities
- Extending of analysis to determine water quality more thoroughly

#### Remarks

For developing the WSP the school in Tigansti organised themselves very well, were very motivated and implemented many activities.

The school was chosen from among 8 Romanian schools as the winner of the contest on the best-developed Water Safety Plan.

The results of the water tests and the risk assessment were

presented to the community and served as a basis for further discussion and action. Collaboration with the local administration and environmental institutions was initiated. The water wells in the village are affected by severe water pollution. Even the captured spring served with water from 20-30 meter depth reached already the EU set maximal nitrate value of 50 mg/l. More investigation would be needed for clarifying the extreme fluctuations of the nitrate values in the wells. For example ammonia analyses could indicate if indeed less animal and human excreta entered the groundwater. Or due to heavy rainfall the soil is water-saturated and the ammonia-oxidising rate of ammonia into nitrate is decreased<sup>11</sup>. Decreasing of the nitrate concentration in wells during winter times was observed in nitrate-polluted wells in other Romanian locations<sup>12</sup>. The planning suggested by the WSP team of the school in Tiganesti should be realised as soon as possible.

### 5.5. WSP activities and results in Izvoarele, Teleorman County

Classes 1-8 of the school in the village of Izvoarele participated during the time frame October- June in this WSP project. In the community there are many natural springs, all coming from the surrounding hills. Some of these sources have been captured; public taps arranged in different parts of town are distributing the water. The pupils reported that in the village there are 8 public taps, which are maintained by the community. A quarter of the 220 households are supplied with water from the centralized system.

The remaining households are supplied with water from their own wells, which depth varies between 5m and 32m.

Among the students several working teams were established and tasks and responsibilities such as observing and testing a water source were identified. Experts on water and health were invited to the school and discussions about water related issues were organised. Students found it necessary to awake the consciousness of local people on the importance of quality and

protection of water. Each group of students received materials needed to print posters with the title "Stop water pollution". The posters were displayed on the poster board of the school and of the community. For this activity, students had to search for proverbs, sayings, riddles and quotes on the subject "water" from different sources of information such as books, magazines, Internet or they could create them themselves.

#### Results of the nitrate monitoring

For doing the nitrate, pH and some other simple organoleptic tests like turbidity and colour, the students brought water samples to the classroom every 14 days. The longitudinal nitrate tests of 5 water sources showed that one of the public taps (fig. 9) exceeded the nitrate far beyond the limit of 50 mg/l during the whole period from December to June. The drilled water source, abstracting water from 30m-depth had stable nitrate concentration of 30 mg/l.

Regarding the seasonal fluctuation there is a tendency of decreasing nitrate concentrations after 15 January, stabilising after the end of January (fig. 9).

Besides the 5 water sources for longitudinal monitoring, the pupils analysed 3 times 10 private wells on nitrate pollution and pH; on 29 January, 26 March and 21 May. No or minimal fluctuations of the nitrate concentrations were observed and only 3 of the 10 tested wells did not exceed the EU limit for nitrate in drinking water (fig 10).

The pupils asked the owners of the individual wells about the depth of the water source, which varied between 7 and 29 meter. Three out of the ten wells had a depth of ten meters or less. Surprisingly the water quality of the very shallow wells was not much worse than the deeper wells (fig. 11). However, wells just keeping within the nitrate limit of 50 mg were of more than 20-meter depth (22, 29 m).

#### Results of the sanitary inspection of the water sources

The pupils carried out risk assessments of the 15 nitrate-monitored water sources, using the checklist provided by the WSP-manual. In fig. 12 the nitrate concentrations of the water sources are ranked

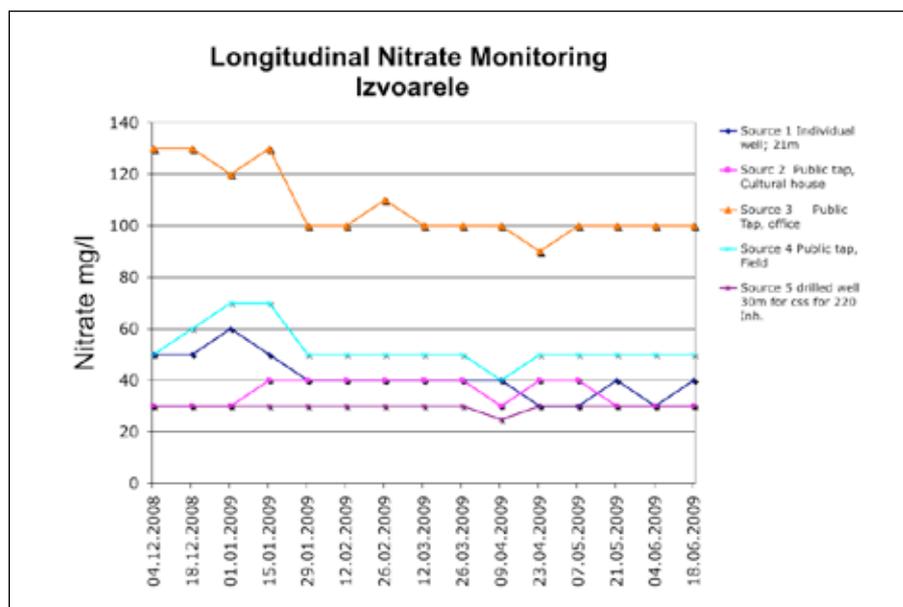


Figure 9. Results of longitudinal nitrate monitoring of 5 drinking water sources in Izvoarele, Teleorman

from the lowest up to the highest concentration with the identified score of risks. The achieved scores showed that the water sources scoring low risks have the tendency to have nitrate concentration of 50 mg/l or less. However also some wells with low risk scores were severely polluted with nitrates. But for all the water sources with medium and high risk scores much too high nitrate concentrations were found.

### Citizens' and doctors opinion in Izvoarele

The pupils interviewed 5 citizens about their perception of the water in Izvoarele. The 5 citizens were using the water sources, which were being monitored for a month by pupils on nitrate contamination and all think the water has a good quality and they men-

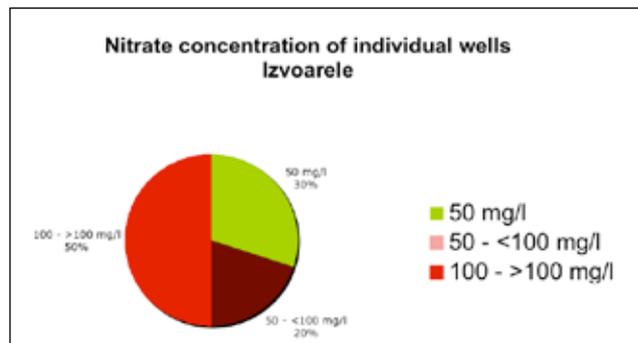
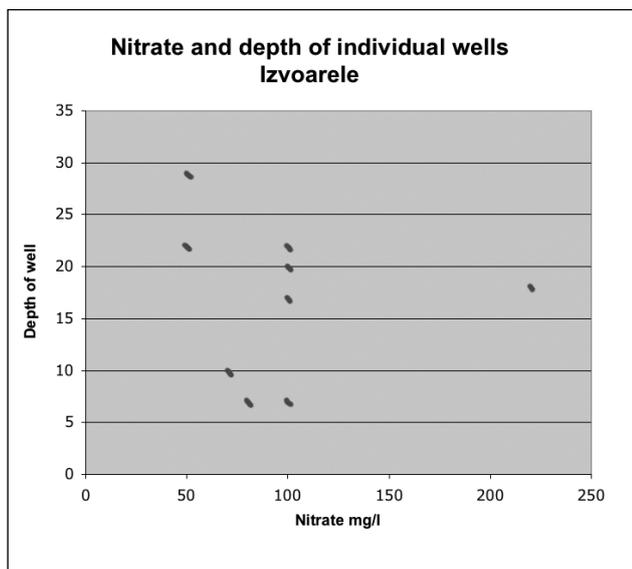


Figure 10. Results nitrate test of 10 individual wells in Izvoarele, Teleorman



| Individual wells | Nitrate mg/l | Depth meter |
|------------------|--------------|-------------|
| 1                | 100          | 22          |
| 2                | 100          | 7           |
| 3                | 100          | 20          |
| 4                | 50           | 22          |
| 5                | 100          | 17          |
| 6                | 220          | 18          |
| 7                | 80           | 7           |
| 8                | 50           | 22          |
| 9                | 70           | 10          |
| 10               | 50           | 29          |

Figure 11. Graphic on the relation between the depth of the well and the nitrate concentration in Izvoarele

tioned there is always enough water available. They estimated daily water use is from 50 up to 120 liter. For fetching the water the respondents said to go 5 up to 100 meter. At minimum they collect water 5 times a day with buckets or bottles for family use and animal husbandry. They would all like to have a central water supply system; in addition one of them would like to have sewerage. Despite the fact that the WSP team identified water pollution in the village of Izvoarele, the local interviewed health authority stated that there are no water related problems or disease

### As sources of pollution the pupils highlighted following issues:

- Animal shelters close to the wells or water catchments for sources
- The wells sources are not covered
- Toilets are without septic tank
- The landfills of the community

| Nitrate mg/l | Score |
|--------------|-------|
| 30           | 0     |
| 30           | 2     |
| 50           | 2     |
| 50           | 2     |
| 50           | 2     |
| 50           | 2     |
| 60           | 4     |
| 70           | 3     |
| 100          | 2     |
| 100          | 3     |
| 100          | 4     |
| 100          | 4     |
| 100          | 5     |
| 130          | 2     |
| 200          | 5     |

Total score of risks of sanitary inspection  
 Risk score:  
 9 – 10 = very high risk  
 6 – 8 = high risk  
 3 – 5 = medium risk  
 0 – 2 = low risk

Figure 12. Overview of nitrate concentration of water sources in Izvoarele and the assessed score of risks

The pupils had discussions with various people of the community. For the improvement of the water quality the following suggestions were made to the citizen:

- Construction of shelters for animals at distances more than 20 m from the water source
- Coverage of wells and concreting the space around the wells
- Toilets should include septic tanks

The pupils stated at community level it would be good if the landfills would be at a larger distance from the water sources and that pesticides and insecticides should be used more carefully.

Besides the local problems the school in Izvoarele organised also lessons and workshops on global water and sanitation problems, on the Millennium Development Goals (MDGs) and the effects of climate change on water resources.

### Remarks

The WSP team of the school of Izvoarele was very active and showed a broad and open view on water related problems. The focus was not only on local conditions, but also on cultural and international water related issues such as MDGs and climate change.

The results showed a rather severe water pollution of the water sources in the village, but also the lack of awareness among the villagers. High nitrates, but also relative low nitrates are found in deep and shallow wells, indicating that the water pollution is going on very locally and which could be decreased by suitable water protection measures.

## 5.6. Results of interviews with the local water responsible authorities of target villages

### Finances and quality control

The WSP team of 6 schools interviewed the bodies responsible for water supply, in most cases the mayor of the village. From the interviews pupils found out that if public taps are available the authorities ask the users to pay 2 RON (approximately 0,5 Euro) per cubic meter water, which can be paid via annual tax by the citizens. The respondents said that the authorities of the communes do not have additional budget and hence there are not enough financial means for operation and maintenance of the system. In one out of the 3 communities with public taps the wells and the water quality was seldom monitored; for the other 2 public taps every 3 month water quality controls were carried out.

For communities relying on public and individual wells there is no budget available for operation and maintenance. The water provided by public wells is for free. However it was mentioned, that once or twice a year the water quality of public wells is controlled.

The water supply responsible persons were asked about the main problems they face. The answers were diverse: in Pietrele drought was mentioned, for two villages it was water quality, in another village the leaking pipes was a problem, and one village representative mentioned the lack of indoors running water as a main problem. Except one, all respondents mentioned plans for improving the water supply exist and partly projects were submitted.

## Poems— pupils Izvoarele

### Water

*But me, the crystalline water  
That flows between the hills  
When the sun appears  
I get very warm  
The trees that are guarding me  
are using me as a mirror  
But they are also making me sad  
and bothering me  
because they evaporate me*

### Clouds

*And we the travelling clouds  
Carried by the wings of wind.  
When we meet cooler air,  
we all condense.  
We shape raindrops*

### Snow

*And me, the bright snow  
When the proud sun appears  
I start melting because of its love  
With the rivers I merge  
And to some parts I go into the earth*

### Ice

*I am the ice, solid ice.  
And when the sun comes  
I am getting warm.  
Then, slowly, I melt,  
And I hurry to the seas and oceans  
And to the earth we return.*

### Accessibility of information and plans

All the interviewed water responsible persons mentioned that the analyses results are accessible to interested and/or authorised persons, and the public. One respondent did not know. However only 3 of the 6 mayors stated they have the results of the water analyses. On the question posed to local medical persons "did you ever receive the results of the water analyses of the water supply/sources on the village?" except one doctor all answered with no. The interviewed medical person of Tiganesti mentioned on that question "I know that it is only done rarely and only on our request".

## 5.7. Results of interviews with the local health authorities of target villages

### Water quality and diseases

The local doctors of 6 villages answered the questionnaire. The question was posed: "What is in your opinion the main problem concerning drinking water in the village and are there water related diseases?"

Two doctors mentioned the pollution via animal droppings, septic tanks, lack of sewerage, the fact that water is not tested or protected.

In three villages served with public taps, the main problem mentioned was patchy partial or lacking a total lack of water supply.

One doctor (Izvoarele) said there are no problems concerning the drinking water.

In Cosereni as a problem the patchy irregular water delivery was mentioned, whereas the quality was considered as good.

Regarding the water quality, the doctors of the four other villages mentioned the high nitrates and water infected with Giardia.

The doctors were asked if during the last 3 years cases of blue baby diseases (Methaemoglobinaemia) or thyroid in their villages occurred. Only in one village one case of blue baby disease was reported. (Blue Baby disease and thyroid is linked to too high nitrate levels in drinking water, see boxes).

Further, a question about the occurrence of tuberculosis and thyroid diseases during the last 3 years was posed. In 2 villages no cases of tuberculosis were reported, in the other four villages 4-5 cases were reported.

Although thyroid diseases are not related to microorganism-infected water, the question about the occurrence of this disease was included in the questionnaire, since there is a relation between increased nitrate concentration in water and thyroid diseases. In 4 villages the local doctors mentioned that several cases of thyroid diseases occurred.

On the question "what is the main illness related to drinking water quality in the village?" the medical staff of the target villages mentioned:

**Cervenia (Te)** Giardia Lambia (parasite infection in gastro-intestinal tract), Enterocolitus (inflammation of colon and small intestine), nitrate intoxication

**Izvoarele (Te)** None

**Tiganesti (Te)** Microorganisms in the flora which grow on the walls of the well shaft, can cause parasite diseases like Giardia, Dysentery, Tricmoniaza, Hepatitis.

**Cosereni (Ia)** None

**Pietrele (Gi)** Urinary lithiasis (stones in urinary tract)

**Garla Mare (Me)** Methaemoglobinaemia

With the exception of one respondent all the interviewed medical staff advise patients to boil the water before consumption. As already mentioned, in only one village (Garla Mare) the doctor received the results of the water analyses from the authorities.

## Giardia Lamblia

Giardiasis is a gastrointestinal illness affecting people and animals of all ages. The symptoms of Giardiasis include diarrhoea, abdominal cramps and wind. It is caused not by a bacteria or virus, but by the protozoan parasite, Giardia lamblia. One of the most common intestinal parasites of man, Giardia lamblia is carried by a number of animal hosts. Giardia organisms form a resistant cyst that is shed by the host in its waste. Infections are acquired by ingesting these cysts in food and water or by personal contact with an infected person. Drinking water is a prime carrier of Giardia cysts for several reasons. Individuals infected with the parasite shed cysts in their waste. Therefore, surface water supplies (like streams, lakes, and ponds) can be contaminated with Giardia cysts through the introduction of sewage or animal wastes. Groundwater supplies are usually protected by the filtering action of the soil which removes the cysts. Humans, dogs, cats, cattle, deer, and other mammals can carry Giardia. Beavers are often found to be the source of contamination because they can become infected and introduce their waste directly into the water near a water supply intake. Once in the water, Giardia cysts can persist for over 60 days. ([http://ohioline.osu.edu/b795/b795\\_5.html](http://ohioline.osu.edu/b795/b795_5.html))

Poor well design and construction, and vulnerable geology such as unconfined aquifers can increase the risk that a system is under the direct influence of surface water [http://www.dep.state.fl.us/water/drinkingwater/gw\\_udi.htm](http://www.dep.state.fl.us/water/drinkingwater/gw_udi.htm).

## Nitrate and Thyroid

Possible relationships between nitrate intake and effects on the thyroid have been studied, as it is known that nitrate competitively inhibits iodine uptake. In addition to effects of nitrate on the thyroid observed in animal studies and in livestock, epidemiological studies revealed indications for an anti-thyroid effect of nitrate in humans. If dietary iodine is available at an adequate range (corresponding to a daily iodine excretion of 150-300 µg/day), the effect of nitrate is weak, with a tendency to zero. The nitrate effect on thyroid function is strong if a nutritional iodine deficiency exists simultaneously<sup>13</sup>.

## Nitrate and Blue Baby Disease (Methaemoglobinaemia)

Nitrates in the drinking water can aggravate “Blue Baby Disease” as they are converted to nitrites in the body. These react then with haemoglobin in the red blood cells to form methaemoglobin, affecting the blood’s ability to carry enough oxygen to the cells of the body. Infants less than three months of age are particularly at risk. The haemoglobin of infants is more susceptible and the condition is made worse by gastrointestinal infection. The intake of tea or other baby food prepared with nitrate-rich water can effect that the baby does not get enough oxygen anymore and gets blue. This disease can be lethal or damage brain or nerves of the baby. Older people may also be at risk because of decreased gastric acid secretion.

## 6 | Conclusion and recommendations

The overall experiences and conclusion was that the approach of developing WSP with the involvement of schools, contributes to awareness raising, capacity building and mobilising of the community.

With the support of the WSP toolkit and the training, all the participating schools of the target villages implemented relevant activities such as identifying local water pollution and causes of the pollution. Many schools and stakeholders expressed the need of improving the water quality, the need of awareness raising and having access to more information on water issues. In order to stop the local water pollution and to improve access of safe water, the WSP teams of the schools formulated many suggestions. The plans, developed by the WSP teams could be a first step for local mobilisation for safer water in the villages.

### 6.1. The main findings of the WSPs developed in the target villages

- Most water sources exceeded the EU nitrate limit of 50 mg/l, locally the nitrate concentration in water exceeded up to 9 times the EU limit
- Even drinking waters in deeper aquifers are endangered by nitrate pollution
- Low awareness exists among the rural citizens on the causes of water pollution

- Water pollution occurs at local level due to unsealed pit latrines, keeping livestock without a safe management of excreta, lack of safe waste disposals and uncovered wells
- The check lists developed for a risk assessment of water wells are a good tool for raising awareness.
- 4 out of the 6 interviewed local doctors mentioned the occurrence of water related diseases in their village
- According to the local authorities for water issues the water quality of public taps is monitored; citizens have access to the results
- In general, citizens and local health authorities consider the drinking water quality of wells as not good, and do not know the results of the water analyses
- The communities do not have a budget for maintenance of public taps- the users of public taps pay approximately 0,40 Euro (2 RON) per cubic meter water, despite it being unsafe
- The available time frame of 7 month (November – June) was too short for implementing local actions, but sufficient to identify needed local actions

### 6.2. The experiences on WSP involving schools showed that the obtained results depend on

- Availability of human resources and time
- Extension of the WSP-training of teachers
- Interest of the teachers
- Flexibility of the curriculum
- Experiences of working with civil society
- Support of local NGOs or experts

### 6.3. The approach to develop WSP involving schools promises to be a good tool for

- Mobilisation of youth and community for taking action at local and regional level
- Capacity building of civil society
- Cooperation of civil society with local authorities
- Raising awareness on water quality and related diseases
- Raising awareness on the lack of public services and finances related to water supply and water quality
- Raising awareness on the need of implementation of water safety strategies

# 7 | Discussion and future perspectives for WSP

In most of the target villages the findings of the WSP-teams showed a severe nitrate contamination of the first aquifer, whose causes are mainly “home-made”. A first step in solving the causes should be awareness raising on all levels, and with public participation and support, followed by concrete water protection measures. Nitrates should also be considered as an indicator for possible contamination by micro-organisms such as Giardia Lamblia and faecal bacteria, originated from animal and/or human excreta. Safe drinking water supply with community involvement should be ensured in rural areas, a section of Romanian society (some 12.000 villages) that was completely neglected until now.

After Romania’s accession to the EU one of the obligations is the compliance with quality parameters for drinking water in 2015. In Romania the water sector is the most demanding environmental sector and the total estimated investment costs for compliance with EU Directives are 19 billions Euro; about 8.6 billions Euro are needed by 2013, of which 4 billions Euros are covered by EU and national co-financing (2009). The long-term objective for rural areas is to reach in 2020 a coverage of 85% of the population having access to water supply<sup>14</sup>.

In general the deeper aquifers are less prone to nitrate pollution than the shallow aquifers, hence for a central water supply deep aquifers are preferred as sources. However, water contaminants do

not know borders and can reach in the long-term deeper aquifers. In addition depending on the hydrological condition water abstraction can cause an increased velocity of infiltration of pollutants from higher layers (suction effect). In order to avoid expensive water treatments for the elimination of nitrates a stringent decreasing of the infiltration of fertilizer, human and animal excreta in the groundwater should have the highest priority.

Without awareness raising, community mobilisation and a better water protection policy the objectives set for the rural areas are probably difficult to reach.

Therefore for many regions the WSP programme could form the bridge between local communities, regional and national authorities and contribute to the realisation of the set targets of the Protocol on Water and Health and set objectives for the rural areas.

For scaling up this WSP programme and for bringing the local findings and experiences up to national level, the issue should become obligatory in the curriculum of the schools.

## For more information:

The WSP manual is available in English, Romanian and Russian: <http://www.wecf.eu/english/publications/2008/wspmanuals-revised.php>

**www.wecf.eu**

## References

1. WHO, 2005, *Water Safety Plans, Managing drinking-water quality from catchment to consumer*. [http://www.who.int/water\\_sanitation\\_health/dwq/wsp0506/en/index.html](http://www.who.int/water_sanitation_health/dwq/wsp0506/en/index.html)
2. [http://unstats.un.org/unsd/environment/envpdf/Country\\_Snapshots\\_Sep%202009/Romania.pdf](http://unstats.un.org/unsd/environment/envpdf/Country_Snapshots_Sep%202009/Romania.pdf)
3. [http://www.oecdobserver.org/news/fullstory.php/aid/1802/Safe\\_water:\\_A\\_quality\\_conundrum.html](http://www.oecdobserver.org/news/fullstory.php/aid/1802/Safe_water:_A_quality_conundrum.html)
4. [http://www.euro.who.int/watsan/Issues/20050802\\_3](http://www.euro.who.int/watsan/Issues/20050802_3)
5. <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31998L0083:EN:NOT>
6. [www.unece.org/env/water/meetings/workshop\\_target.../Romania.doc](http://www.unece.org/env/water/meetings/workshop_target.../Romania.doc)
7. <http://www.oecd.org/dataoecd/53/22/44096445.pdf>
8. <http://www.wecf.de/english/projects/47-romania-safesantation.php>
9. <http://www.wecf.de/english/publications/2008/wspmanuals-revised.ph>
10. [http://www.who.int/water\\_sanitation\\_health/dwq/wsp0506/en/index.html](http://www.who.int/water_sanitation_health/dwq/wsp0506/en/index.html)
11. Parkin, T.B. (1980). *Characterizing the variety of soil denitrification. In Denitrification in Soil and Sediment. Edited by N.P. Revsback and J Sorensen, Plenum Press, New York, 1990*
12. <http://www.wecf.de/english/publications/2004/DrinkingWaterGarlaMare.php>
13. [http://www.who.int/water\\_sanitation\\_health/dwq/2edaddvol2a.pdf](http://www.who.int/water_sanitation_health/dwq/2edaddvol2a.pdf)
14. <http://www.oecd.org/dataoecd/48/21/42754000.pdf>

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