The Hygienic-Sanitary Conditions of Providing Drinking Water in the Rural Space

Augusta Sîrbu
University of Medecine and Pharmacy "Iuliu Haţeganu", Cluj-Napoca, Romania

Introduction

Rural areas represent an association of variable physical spaces, population, and specific habitats with different levels of evolution with basics purposes.

Comparing rural areas with the city the main characteristics of rural areas are:

- Low density of population and different background.
- Domination of natural lands for agriculture.
- An expressive communion of the population with the natural elements.
- A lower level of industrialization, information, and health in the population.
- An specific rhythm of work dependant of the biological processes in agriculture activities, so a differentiation of seasons in the efforts for work.

Statistics shows that in 1985 in Romania 50 % was rural population and 3 years later in 1989 the rural population was just 45 %; now the rural population increased to 47,8 %. Romanian has 13 098 villages grouped in 2 687 communes, every village has app. 700 inhabitants. From the total of villages, 565 are with less than 500 inhabitants.

Providing villages the potable water is one of the main sanitary issues. In present the general attitude is to provide the potable water from central installations, the only ones who can guarantee conditions for potable water.

The problem remains an open issue in most collectivities from the rural areas because providing water is from a local system.

The system is formed from many individuals systems and the water is transported individual from the source to the beneficiary. The disadvantages of the local system for providing water are:

- Not always in the necessary quantities of water for all the needs;
- Water can't be treated;
- A poor control of water qualities because of many installations;

Providing water in local areas can be from:

- Subterraneous water: is about the water used from fountains. This runs between the rocks or is cumulated in the permeable soil. This water is formed because precipitation permeates the soil. The subterraneous water can be captives or freatic.
- Surface water: is from precipitation. The chemical composition depends on the soil, season and on the composition of the others water that come across. Surface water is used as it is or is treated through home systems.
- Meteoric water: is the water used when there are no natural sources or when those are at far distances. Water is impure from the moment of condensation around nucleus of dust, fog and after the pollution continues because of the unclean surfaces.

Sanitary Issues About Individual Instalations for Providing Water: The Fountain

In the rural areas the fountain is a traditional way of providing water. Fountains are local installations for providing water that can be individuals or publics for one or more than one families. A fountain is formed from a vertical hole to the water and a system for bringing the water to the surface. The fountains can be classified after the way of piercing the soil in drilled and digger fountains.

Drilled fountains are used when the water layer is too deep or in some geological conditions of the land. Those can be:

- Norton tubular fountain: built by introducing in soil a sharp metallic tube punched on the bottom section. The water can be pull out by pumping. Those fountains are simples, easy to arrange and the water layer is protected. Can be used only when the water layer is at 6-7 m deep in a sand soil or a gravel soil and if there are no sources of pollution near. During winter the water can froze in the tubes and because of the stagnation can receive a metallic taste.
- Deep drilled fountains: are used when the water can be fund at 25-100 m deep. Water can be pull out by centrifugal mechanical pumps. Because of the deepening sometimes water is with a lot of minerals in.
- Drilled artesian fountain: results from drilling the stratum of water.
- Drilled fountain with pail: the body of the fountain is a cement tube out of soil 120 cm tall and covered by a lid. Water is pulled out by using a pail with a chain acted From the by a pulley and a crank. The pail enters the hole and at the end has a lid that is raised by the water pressure and is closed because of his weight.

  From the hygienic point of view drilled fountains have the following advantages:
  - the metallically walls hinder water pollution;
  - the sanitary conditions are good because the water is pulled out by pumps that close the top of the fountain;
  - the water layer can be hundreds meters deep

The Dig Fountain

The fountain with elevating buckets / on a flexible belt that runs around two rolls sprocket are metallic steady cups. The cup water filled rise up and pulls out the content in a draining pipe. The system is expensive.

The fountain with pump is a well digger with concrete walls and a ghizd of 20-30 cm covered with concrete surface. The pulling pump is on the surface or on a side. A tube with draught and a tap for draining pull out the water. The fountain with pump is hygienic and well protected only when airtight between the pump and the concrete surface is perfect. If water stays longer in the tube it can froze.

The fountain with pail- is on variable types.

The fountain with sweep pulls out water by a system of levers. The disadvantages are: can't be covered, the pail can touch the ground, if the pail is not centered can hit the walls and can be spoiled.

The pulley fountain- the pail with a chain runs on a pulley. Maneuvering it is not hygienic.

The wheel fountain- the pail with a chain runs on a large wood roll acted by a wheel.

The auto-evacuation fountain- is a covered fountain in which the filled pail that reaches the top of the fountain hangs on a rod and overthrows the water in a lateral pipe.

Hygienico-Sanitary Conditions for the Fountains

Keeping the right conditions is the base of sanitary control of providing water in the rural areas.

Position depends on two criteria: functional and of security. The fountain can be built at a convenient distances to the house and at least 30 m far from the pollution sources for the soil or for the water layer (toilets, coops, pigsties, garbage). The fountain should be positioned on the high point of the yard for the precipitation to drain in different directions and not on the well. The proper soil is a wholesome one with a good filtration of meteoric water. It is not recommended the fountain to be built on flood land or near the roads.

The water source – is better to choose a deep-water layer with constant debit and composition. The superficial layers depend on the atmospherically conditions (air temperature, precipitation) and can be easy polluted. So is recommended that the protection stratum of soil at least 4 m.

Elements of Building the Fountain

The walls to hidden infiltration from sides to interior. Have to be built from resistant and waterproof materials: concrete, bricks or stones. The concrete tubes can be joined with cement. The end of the tube has to be punched for the water to come in the fountain.

The ghizd is tall from the soil 70-100 cm. Should be built from waterproof materials and the joint with the fountain's walls has to be airtight 60 cm deep in the soil. The purpose of this is to prevent accidents (the fall of persons or animals) and to protect water against infiltration from up.

The covert of the fountain prevent meteorically waters, different strange things, and powders to fall in the fountain.

Functional Issues

The pulling out water from the fountains should be made by a system with no pollution. Every fountain must have his own pail fixed at the pulling out system. It is not allowed to use a pail from house, the pail manipulation with dirty hands, touch of the ground, feeding the animals with the fountain's pail. Watering the animals should be from a special pipe with water from a pool positioned outside of the sanitary area of the fountain with special pails for this. For security the pails should have metal crosses at the top.

THE PROTECTION OF THE WATER QUALITIES FROM FOUNTAINS can be realized only when arranged two protection areas around the fountain.

The little sanitary protection area is of 3 m in slope from the fountain to the outskirts made on concrete or pavement.

The large sanitary protection area continues from the first area to 30 m around the fountain. This area presents restrictions so it has to be perfectly clean with no source of pollution. The 30-m area can be less if the well is deep and larger if the soil hasn't efficient filtration proprieties. To project, built and arrange the individuals or publics fountains must be according to special local conditions and according the generals principles presented previous (Monitorul Oficial al Romaniei, Partea I, nr. 140, Bucureşti, 23 iunie 1997, nr. 536).

The fountain's water must respect the national qualitative standard according to low and to assure the minimum daily qualitative for the consumers.

The Restoring and the Draining of the Fountains

The levels of disinfecting are:

- **Restoring of the fountain** has as purpose the correction of building problems of the walls, ghizd, lid, roof and of the pulling out system.
- **Draining** has as purpose:

- the elimination of pollution sources from the sanitary area;
- the disinfecting is made with slaked lime;
- draining the stagnation water around fountain;
- laying sand and grave on the drained land

- **Identification of the pollution sources and neutralisation them**:
  - surface pollution – because of building troubles, deterioration, unclean maneuvers in using the pail or accidents;
  - pollution due to the infiltration on communication in underground (trickling from a wrong positioned toilet or build in garbage hole or animal offal. The infiltration can be evidenced by *the communication tests*-for it is necessary to prepare a mixture from 100 g fluorescein, 100 g concentrate NH **3** and 1000 ml. Water. The mixture and few pails of water are spilled in the pollution source. It is important to have in view the tests of water about the green color of fluorescein and the ammoniac smell. The tests follow the schedule: on the first day from hour to hour; on the second day from 3 to 3 hours; on the third day from 6 to 6 and if necessary on the following days from 12 to 12.
- **Interpretation.** If the green color and the ammoniac smell appear in the fountain soon after the spilling, the communication between the fountain and the pollution source is more directly and intensive. Than is necessary to neutralize the pollution source identified in this way.

The Fountain Desinfectation

Is necessary when a contamination occurred and there is a danger for the consumers. For it to be efficient is necessary first to remove the source of pollution and after it to disinfect the fountain. The following steps must be previous to the fountain disaffection.

To establish the water volume from the fountain:

- if the fountain is a cylindrical one, the water volume is calculate according to : $V=\Pi R^2H$, where $\Pi=3,14$, R=radius of the well , H=the high of water column- can be measured with Pettenkofer tool;
- if the fountain is a rectangle one, the water volume is calculate according to: $V=L\times l\times H$, where L and l are the sides of the fountain;
- draining the fountain means:
  - pull out all the water from the fountain;
  - the walls and the bottom must be cleaned. Before this act is necessary to check if the air inside the fountain is good for breathing using a candle; if it is put out needs mechanical ventilation;
  - then a person enters the fountain and cleans it putting in a pail the substances from inside.

After all this can be disinfected the fountain (water must be as clean as possible substances in suspension consumes a lot of oxygen).

When the hygienic-sanitary conditions of the fountain are according to the hygienic standard and when water is clean the draining is not necessary.

The fountain *disinfecting* can be made by:

- Chlorine substances: lime chlorine, chlorine, and hipoclorit de sodium. Those action through the active chlorine so for a good disinfecting must previous be established the active chlorine content. The chlorine substances well kept (in airtight bottles, in dry, cool, dark and well aired places must have 20 % active chlorine) ,
- lime chlorine: is 64 % oxy-chlorine of Ca, 20 % hydroxide of Ca, water, Na, Fe, Al, Si oxide. Normally is 25 % active chlorine. It is a white powder, with a specific smell, with a bactericide action, with a large spectrum, virulicide, sporocide;
- cloramine is 25 %-35 %. It is a white powder crystalline with a chlorine smell, stable, can be quick dissolved in water. Delivering chlorine is slow but durable;

- ipocloritum de sodium is a good disinfectant but a very unsteady one.

Establishing the necessary qualities of chlorine for disinfecting:

- must be established the water volume from the fountain: V (m^3 water);
- must be established the active chlorine from the substance: 20 %, 25 %;
- must be calculate the residual free chlorine concentration

The quality of chlorine substances varies according the active chlorine quality that can be used depending the pollution level of the fountain.

For obtaining the desirable quality of residual free chlorine is recommended to used a 10 times more quality of chloric substance, so 2 g substance (m^3×10=20 g/ m^3 water)

So for to have residual free chlorine of 0,5 mg/l water is necessary 20 g chlorine substances with 20 % active chlorine for each m^3 water from the fountain. The qualities of chlorine substance must be multiplied with the water volume from the fountain, than this is dissolved in water and results a mixture of 1-5 % that can be pour out in the fountain.

Substances without chlorine: actions through the oxygen that is set free in the moment of effervescence:

- quick lime (CaO)- 6 kg bolls of lime is poured out in the fountain for 1 m^3 water. They stay 24 hours in contact with water and after is the evacuation process until the water is clear;
- slaked lime (Ca (OH**)2**): 10 kg lime are slaked in 40 l water and the mixture is poured out in the fountain. They stay in contact with water 24-48 hours and after are the evacuation process until the water is clear;
- permanganate of potassium (KMnO**4**): can be used alone or in combinations. When is used alone is necessary a mixture of 10 l with a 1% concentration for 1 m^3 water. In combination in 10 l water is put 5 g KMnO**4** and 50 g Al**2**(SO**4**)**3.** This mixture is for 1 m^3 water is poured out in the fountain for 36-48 hours and after the water is evacuated until it stays clean.

For establishing the level of drinking water is necessary the control for the efficiency of the disinfecting that are bacteriological tests of water. The tests must be after few days till the disinfecting.

The Fountain File

Every fountain has to have a file about:

- dates about the geographical position end the owners names;
- characteristics of the fountain (position, building, age);
- issues about protection of the water qualities;
- conclusions about hygienic-sanitary situations;
- issues about maintenance of the fountain(draining, disinfecting);
- the laboratory tests;
- conclusions about the water qualities

The Hygienic-Sanitary Control of the Fountains

The hygienic-sanitary control of the fountains can be preventive or permanent hygienic-sanitary control:

a. The preventive sanitary control: develops in project stage, previous than the building of the fountain. It follows the issues about to respect all the hygienic-sanitary conditions according the lows.
b. The permanent sanitary control is about:
   - the evidence of the fountains;
   - the technique-sanitary control;

- laboratory control.

The tests from the fountains deserving schools, hospitals, institutions are twice a year and the tests from public fountains are annuals. When are epidemiological situations tests will be from all the fountains involved in.

It is important that tests are correctly applied and well transported to laboratory because the exactly and verity of the results depends of that in this case of bacteriologic and physic-chemically tests.

Another way of providing drinking water for rural areas are the **WELLS** – the best sources of the water but it can't be used in that stage, the water must be first collected.

Sanitary Conditions for the Wells

Collecting water is the main operation in sanitary protecting of the well. A collection system means a special room for collection with waterproof walls in which enters the well and from which the water in directed to the surfaces. Water can enter the collection room with some drains help. The drains have also the purpose of filtrate the water. From the collection room water is evacuated through pipes to exterior. The well draining must be perfectly clear and if pollution occurred the maneuvers are similar to those in the fountains case.

The well disinfecting substances are similar to those used in the case of the fountains. In some particular cases must be applied disinfecting methods specific for wells. Those are:

- Boiling the water is commonly known as the main method and the most efficient against bacteria and viruses. Water has to boil at least 30 minutes. Water loses most of gases and minerals so it gets a vapid, unpleasant, taste; so for consumption has to be cooled.
- Distillation is a sure method in removing from water. The microorganisms. Water loses all the minerals and it gets a vapid, unpleasant taste.
- Filtration with bacteriological filters (Seitz, Chamberland, Berkefeld, etc) presents good effects only on bacteria, not on viruses because those can enter the filtrating membranes. The bacteriological filters must me renewed and are not able to filtrate large quantities of water; so it is not an economical method.

Water Contamination in the Fountain

Water can be polluted and contaminated through infiltration in the water source of human and animal dejects and also of some unhealthy results of human activities. In fountain substances from garbage and toilets that are unhygienic built can infect water so the water layer can be polluted. Water can be polluted also by draining of unclean water from surface for example water resulted from cleaning the clothes near the fountain, toilets positioned near the fountain or on a higher earth. Another way of pollution is using an unclean pail in the fountain.

General Issues of Catching Diseases Transmition Through Water

The viability of microorganisms in water is varied and depends on chemical composition and temperature of the water, the presence of oxygen and effect of light as well as the characteristics of flora and fauna.

Due to many researches regarding viability of microorganism it is known that different species of pathogen bacteria and viruses can survive in groundwater and surface water from few days to some months.

From microbiological point of view potable water means the absence of pathogen germs and the decrease of saprophyte germs to limits accepted by standards.

The Hygienic-Sanitary Conditions of Providing Drinking Water in the Rural Space

Sources of potable water can be polluted direct, indirect or from wastewater. In the case of fecal pollution the water is contaminated with a diversity of intestinal pathogen microorganisms – bacteria, viruses and parasites.

The microorganisms, presented usually in the environment and considered inoffensive, can affect under special circumstances the health of human beings. They are called pathogen-conditioned germs and generally affect people with affected immune mechanisms: old people, children, patients with chronic diseases, burn or treated with immunosuppressive medicines.

For pathogen microorganisms the minimal doze required for provoking an infection are varied, depending on characteristics of microorganisms as well as on different individual factors of the person: Age, nutritional status, hygiene conditions and health in the moment of exposure.

Due to many microbial diseases transmitted through water, it is very important to identify in the water the microorganisms, whose origin is dejects of human beings or warm blood animals.

The water transmitted diseased are provoked by bacteria, viruses and parasites.

Bacterial diseases -using water can be a way of transmitting catching diseases with different ethnologies. In the population those can be:

- Epidemically form: epidemiological situation in which a disease appears in a specific area affecting a large population in a short time.
- Endemically form: a situation in which the catching agent is permanent in an area, and the cases of diseases are constant and limited to a low number of individuals.
- Sporadically forms: isolated cases of diseases, rare situations in the pathology of catching diseases through water, because a water source has a specific using at the population level and the contamination of the source is a risk to all the population.

The most frequent catching diseases provoked by bacteria water transitioned are: *CHOLERA, TIFOIDE FEVER, BACTERIAL DISENTERIA, LEPTOSPIROSE, TUBERCULOSE, BRUCELOSE, TULAREMIA, etc*

Viral diseases – Improvement of the viruses tests for the water and the entrance in the laboratory practice confirmed that water is a way of transmitting viral diseases. The most common of those are: *POLIOMIELITE, VIRAL HEPATITE A, THE ADENOVIRAL CONJUNCTIVITE, THE VIRAL GASTROENTERITE, etc .*

Parasite diseases – water has an important role in transmitting parasites, with two aspects: water represents the medium in which the parasites develops or the water represents effectively the way of transmitting the parasite to the healthy person. The parasites diseases who can be transmitted by water are: *ENTAMOEBA HISTOLITYCA, GIARDIA spp, BALANTIDIUM COLI, ASCARIS, TRICHURIS, ENTEROBIUS, HIMENOLEPIS, etc.*

Water is a direct factor in transmitting catching diseases in case of contamination the sources and systems of providing water and an indirect factor in the case of insufficient water for consumers. The insufficient quantities of water determined a faulty personal hygiene, an insufficient hygiene in the houses and an unsuitable hygiene for the habitat areas.

References

Ardelean, I. (1962), *General and Communal Hygiene*, Medical Publisher, Bucharest.

Ilea, Th. (1964), *Public Health in Rural Space*, Medical Publisher, Bucharest.

Ionuț, C., Laza, V., Rusu, I., Ionuț, V., Popa, M. (1998), *Practical Application in Health Enviranment,* Universitarian Medical Publisher " Iuliu Hațiegan", Cluj-Napoca.

Matei, I., Mihăileanu M. (1985), *The Romanian Village - studies*, Academy Publisher R. S. Romania.

Mănescu S., Cucu M., Diaconescu M. L. (1978), *Sanitary Chemistry for Environment ,* Medical Publisher, Bucharest.

Mănescu S., Tănăsescu Gh., Dumitrache, S., Cucu M. (1991), *Hygiene,* Medical Publisher, Bucharest.

Pop Gr., Benedec J. (1996), *Small Villages from Romania*, Studia UBB Publisher, Geography 3, Cluj-Napoca.
Popa, M., (2001), *Concepts and Trends about Pollution in the Environment,* Quo Vadis Publisher, Cluj-Napoca.
Straus, H. (1975), *Hygiene,* Educational Publisher, Bucharest.
Surd, V., (2002), *An Introduction to Rural Space Geography* , PUC publisher, Cluj-Napoca.