The quality of drinking water in Poland

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Abstract

Introduction. An analysis of the drinking water quality and the degree of access to water supply and sewerage system in Poland was conducted.

Materials and methods. Method of analysis of secondary statistical data was applied, mostly based on data available in the materials of the Central Statistical Office in Warsaw, the Waterworks Polish Chamber of Commerce in Bydgoszcz and the National Water Management in Warsaw.

Result and discussion. 60 % of Poles do not trust to drink water without prior boiling. Water flowing from the taps, although widely available, is judged to be polluted, with too much fluorine or not having the appropriate consumer values (colour, smell and taste). The current water treatment systems can however improve them, although such a treatment, i.e. mainly through chlorination of water, deteriorates its quality in relation to pure natural water. The result is that fewer and fewer Poles drink water directly from the tap. They also less and less use tap water to cook food for which the bottled water is trusted more. Reason for that is that society does not trust the safety of the water supplied by the municipal water companies. The question thus is: Are they right?

Tap water in Poland meets all standards since it is constantly monitored by the water companies and all relevant health services. Tap water supplied through the water supply system can be used without prior boiling. Studies have shown that only the operating parameters of water, such as taste, odour and hardness, are not satisfactory everywhere, different in each city, and sometimes in different districts of cities, often waking thoughts among users about its inappropriateness. The lowered water value can be easily improved at home through the use of filters. In conclusion, due to constant monitoring and investment in upgrading treatment processes, the quality of tap water has improved significantly in the last years.

Conclusion. The results first allow assessing the level of water supply and sewage systems in the country and second drawing conclusions as to the quality of water available to the residents of Poland.

Introduction

On 28 July 2010, the General Assembly of the United Nations (UN) adopted a resolution according to which the right to clean drinking water and sanitation has officially been recognised as a fundamental human right. Access to and quality of drinking water is also one of the Millennium Development Goals, which have been put forward on the basis of the Millennium Declaration accepted by the Member States of the United Nations (189 countries, including Poland) during the so-called Millennium Summit of the United Nations in New York in September 2000.

Equally, a number of business studies conducted by UNDG[1] considered the widespread availability of drinking water as one of the main objectives of development. The justification of such a categorisation was the fact that access to running drinking water is still not granted to approximately 884 million people worldwide, and diseases caused by non-potable water, or as a result of its absence, still make one and a half million children die under five years of age each year. Clean water is understood appropriate for consumption without further treatment and health or human life [1]. However, according to the World Health Organization (WHO) "as much as 80 % of all diseases of modern civilisation have to do with the quality of drinking water" [2].

The global problem of scarcity of water resources proves the demands of the UN to ensure access to clean water to all people on earth justifiable and not only limited to developing countries only. The problem has been present for years also in highly industrialized countries, where the level of pollution in general results in deteriorating water quality in water supply systems. Since all chemical compounds contained in municipal sewage systems and in industrial and agricultural production cycles are excreted into the environment, they inevitably leak into the ground water, surface water and deep water too, thereby reaching drinking water from the tap, from wells or mineral and spring waters.

Materials and methods

The method of analysis of secondary statistical data was applied, mostly based on data available in the materials of the Central Statistical Office in Warsaw, the Waterworks Polish Chamber of Commerce in Bydgoszcz and the National Water Management in Warsaw.

Results and discussion

Statistical dimension of water and sewage system in Poland. According to the Yearbook of the Central Statistical Office (GUS), "Environmental Protection in 2011 and 2012" and "Statistical Yearbook of the Republic of Polish 2012", the systems of collective water supply - water systems - served in 2011 about 87.6% of the population of the country, including 95,4% of the urban and 75.7% of the rural population. In contrast, the collective sewage systems - sewer systems - were used by 63.5% of the population, respectively 86.7% of the urban population and 27.8% of the rural population [3]. Changes in water supply and sewage in urban and rural areas in the period 2000-2011 are presented in Table 1.

[1] UNDG – United Nations Development Group.

Table 1

General characteristics of water supply and sewage in Poland in the years 2000-2011

Category		Year			
		2000	**2005**	**2010**	**2011**
Total population of the country	**thousands**	**38 254**	**38 157**	**38 529**	**38 538**
Total number of cities	-	880	887	903	908
Urban population	**thousands**	**23 670**	**23 424**	**23 416**	**23 385**
Cities/towns with waterworks	-	877	886	901	906
Length of active distribution waterworks nets in cities	klm	50 067	54 872	61 003	62 009
Number of cities operating waterworks' nets	-	845	881	873	901
Urban population using the services of water supply systems provided by public water supply	thousands	21 889	22 219	22 171	22 303
	%	**91,7**	**94,9**	**95,3**	**95,4**
Urban population using sewege services provided by public sewer systems / sewage treatment plants*	thousands	19 828	19 908/ 20 234	20 156/ 20 614	20 279/ 20 670
	%	**83,0**	**84,5**	**86,1/88,6**	**86,7/88,4**
Length of active waterworks in cities	klm	34 948	43 310	51 493	54 194
Rural population	thousands	**14 584**	**14 733**	**15 113**	**15 152**
Rural population using waterwork services provided by public water supply	thousands	8 870	10 755	11 368	11 472
	%	**60**	**73**	**75,2**	**75,7**
Length of active distribution waterworks nets in village	klm	161 831	190 729	211 885	216 291
Rural population using sewage services provided by public sewer systems collecting system, i.e. sewage networks / sewage treatment plants	thousands	-	2 799/ 3 006	3 749/ 4 307	4 207/ 4 631
	%	**11,5/10,8**	**19,0/ 20,4**	**24,8/ 28,8**	**27,7/ 30,6**
Length of active waterworks	thousands	16 162	36 820	55 566	63 551

Source: RP GUS Statistical Annual, Warsaw, 2000, 2005, 2012.

*Number of people using the sewer network / number of people using the wastewater treatment plant.

When analysing the above table, one can see that in the cities sewer systems development can keep pace with the development of systems of public water supply, however as to the rural areas, one can observe large differences in this respect. That might be partly explained with the fact that there is a considerable dispersion of rural housing. 15.1 millions inhabitants do live in more than 40 thousand villages, which due to technical and economic aspects demands for individual solutions to wastewater collection and treatment necessary to ensure adequate protection of the environment [4]. However, this does not change the fact that the sewage systems in rural areas served only 27.8% of the rural population. That also makes additional problems because environmental pressure exerted by households that are not connected to the sewage systems produces a significant portion of wastewater discharged directly into the environment, which deteriorates the environment and hence on the quality of water resources.

Legal regulations concerning the quality of drinking water supplied by water companies. Water companies operating in Poland are required to comply with standards adapted to the European Union (EU) regulations [5]. What concerns a broader water management, the most important piece of legislation in the EU is the Water Framework Directive (WFD) No 2000/60 EC.

The basic premise of the directive is the protection of water against pollution at its source: in accordance with its demands formulated in 2015, the EU is to achieve a "good water status". One of the priorities of the WFD is the elimination of the so-called "priority substances", i.e. the environmentally most dangerous chemical substances produced by industry and agriculture. In particular, such substances as DDT, PCB, PCT, aldrins, dieldrins, isodrins and HCH were to be completely eliminated [6].

The WFD regulation also changed the water cleanliness evaluation system and the economic water utility functioning in Poland since 1970 and replaced them with the assessment of the general ecological status. According to the Decree of the Minister of Environment from 11 February 2004 on the classification in presenting the status of surface and ground water, concerning the method of monitoring and interpreting the results and the presentation of the status of these waters, the rating of the waters can range from class I to class V [7]. Only water classified as belonging to the class V is not suitable for human consumption. Water quality belonging to the categories I to IV can be delivered to the population after treatment and appropriate processing in the required water quality. The Decree of the Minister of Environment from 27 November 2002 concerning the requirements as to be met by surface and ground water used for public consumption distinguishes three categories of quality of water intended for human consumption: I, II, III - classified according to the degree of treatment [8].

As a result of adaptation of the Polish legislation to the requirements of the directive concerning control of water quality, a "Water Law" [9], an Environment Protection Law [10] as well as law on collective water supply and sewage collection have been passed [11].

When it comes to the same sanitary standards for water, the most important piece of legislation is the directive of the EU Parliament and the EU Council on the quality of water intended for human consumption specifying the standards on the chemical, physical and biological properties needed to be met by water supplies [12].

Water intended for consumption must not, even potentially, constitute a danger to human health. The directive defines both the parameters of acceptable concentration of harmful substances for the human body (substances and toxic, mutagenic, carcinogenic compounds) and such parameters as colour, turbidity, total number of bacteria, total organic carbon, taste and smell. Although they do not have a direct impact on health of consumers, their task is still to determine the effectiveness and quality of the water treatment process. Standards concerning a number of indicators in force under the directive are more restrictive than those recommended by the WHO [13].

Surveillance of the water quality intended for human consumption is controlled in Poland by the State Sanitary Inspection (SSI) [14]. The systematic control of water is carried by the county health inspector. The quality of water intended for human consumption must comply with the requirements set out in the Regulation of the Minister of Health of 29.03.2007 on the quality of water as issued at the 20th April 2010 [15].This regulation intends to implement the EU directive (OJ EU L 1998).

Subject to a special rigor is raw surface water (before treatment), which is regulated by the decree issued by the Minister of the Environment in 27th Nov 2002 regarding the requirements to be met by surface water used for public supply and human consumption [16].

Standards governing the admissible concentrations of selected compounds in drinking water.

Very dangerous to human health is a situation when the standards for microbiological purity of water are exceeded. Microbiologically contaminated water resulting primarily from human and animal waste may contain pathogenic bacteria, viruses, protozoan as well as helminths (intestinal parasite) causing gastrointestinal disease and other infectious diseases. In accordance with the current regulation of the Minister of Health of 20 04.2010r, the water must therefore be completely free of impurities such as *Escherichia coli* and *Enterococcusfaecalis* [17]. The regulation also specifies the admissible concentrations of chemicals with a significant and direct relevance to the health safety of consumers. One important group among them are nitrates, of which already traces can be found in most waterworks in the country. They are substances produced by natural processes related to agriculture, which penetrate into the deeper layers of soil and from there into the water. They are particularly and directly dangerous for infants and young children. They may also indirectly threaten the health of adults. They are also conducive for nitrosamines, which in turn have been proved to promote mutagenic and carcinogenic processes when exposed to them.

Another group of substances dispersed in waterworks throughout the country are fluorides. They are commonly used in phosphate fertilizers for agricultural purpose in Poland [18]. In addition to these frequently occurring compounds, the list of harmful substances includes *inter alia* elements such as quicksilver (mercury), nickel, lead, selenium, boron, and other organic and inorganic compounds. Among them, special attention should be paid to the chlorine and all its derivatives. In contrast to other substances listed in the regulation, chlorine is not considered as pollution that enters water in an undesirable way. On the contrary, it is intentionally added to water through the water treatment plants in order to minimise the bacteriological risk.

The water taken from the surface water passes through multiple purification steps, the last of which is its disinfection. There are many methods for water disinfection. The basic distinction consists between the physical and chemical methods. Physical methods include UV radiation, ultrasound and disinfection using thermal techniques. Such methods are relatively new and very expensive and, above all, are not as effective and sustainable as chlorination with regard to preventing the formation and growth of bacterial communities. Therefore, the application of chemical methods, which is mainly based on the use of chlorine or chlorine dioxide, or ozone and potassium permanganate, is still much more popular around the world.

Disinfection of drinking water is one of the most important factors that contributed to the prolongation of human life because it virtually eliminated cholera epidemic, typhoid fever, etc [19]. At the same time, however, chlorine in large doses is not conducive to human health and its related compounds, which are formed by reaction of chlorine in water with other substances, are also toxic. Particularly dangerous are the trihalomethanes (THMs). According to the WHO, the risk of death due to cancer caused by THM is as low as 1/100-1/1000 compared to the risk of death due to bacteria in not germ-free water [20].

Research is currently conducted on the effects of chlorine in diseases such as atherosclerosis, heart attacks, bowel and bladder cancer or gradual loss of memory [21]. These studies are, however, very difficult because chlorine disinfection is so widespread in highly developed societies that it is virtually impossible to find people that have not been exposed to its impact for a long time. Finally, it should be mentioned that chlorine's most serious shortcoming is its effect on water flavour in Poland as well as its high

concentration, both having a decisive influence on the negative opinion of Poles about water supply [22].

The aroma of chlorine is so strong that even water containing 10% of chlorine as compared to the standard is widely considered as distasteful. However, the sole criterion for regulating the issue of taste and odour of water in the decree is whether they are "acceptable to the consumer".

Changes in the quality of waterworks in the opinion of the controlling institutions. Information on the assessment of waterworks and sanitary wells and on the quality of water delivered from these devices are prepared in accordance with the Regulation of the Minister of Health of 29 March 2007 on the quality of water intended for human consumption [23]. The data have been developed on the basis of the results conducted in the field and followed laboratory tests carried out by the sanitary and epidemiological stations. Control of the water supply was performed on the specific points in the waterworks systems, as agreed between the relevant county sanitary and epidemiological station and the manager of the waterworks. Waterworks were grouped according to their capacity. On the basis of physical, chemical and bacteriological tests, two categories of devices are named; one providing good water, i.e. corresponding with the sanitary requirements and, second, supplying bad water not doing so. The second group has not been discovered in the study.

In 2011, the control of the water quality intended for human consumption was conducted by the State Sanitary Inspectorate in respect of a total of 8 831 of 8 965 water supply facilities registered on the 31st December 2011, i.e. 98.5 %. Table 2 illustrates the detailed data.

Table 2

The quality of water supplied to the population for consumption in 2011

Category	Device				Population supplied with water correspondiong with sanitary requirements in % of the population using facilities
		Controlled devices			
Waterworks with performance of m^3/day	As evidenced at 31.12.2011	Total	Delivering water in total in %		
			Corresponding with Sanitary requirements	Not corresponding with Sanitary requirements	
Below 100	4 176	4 101	90,7	9,3	92,4
100 – 1000	4 112	4 063	93,7	6,3	93,1
1000 – 10000	613	603	93,5	6,5	95,2
10000 - 100000	60	60	95,0	5,0	97,0
above 100000	4	4	100,0	0	100,0

Source: Self-compilation based upon RP GUS Statistical Annual, Warsaw 2012, pp. 103.

Waterworks devices on which tests were conducted were divided into groups according to their performance in water operation in m3 per day. First group of such devices was one with capacities below 100m3 per day. In 2011, there were 4176 such devices in the evidence, of which 4101 were tested, i.e. 98.2%. 90.7% of water from these

devices met the necessary sanitary requirements, which corresponded with 92,4% of the population using the water from these devices.

Another group are the devices of which the daily performance ranges from 100 to 1000m3 per day. In 2011, there were 4112 such devices, of which 4063 has been controlled. As to this group, about 93.7% of the devices met the satisfactory sanitary requirements, which in this case meant 93.1% of the population using these devices to get water.

Another threshold in the daily performance of water supplies, which was determined by the GUS, is 10000m3, which means that it includes devices with capacities from 1,000 to 10,000 m3 per day. In 31st December 2011, 613 such devices were evidenced in Poland, of which 603 were tested as to the quality of water in terms of sanitation. This group of water devices showed a lower performance by 0.2 percentage points compared to the previous group. This means that 93.5% of water tested on these devices met the sanitary requirements. This result corresponds with 95.2% of the population using and being provided with water meeting the standard water quality intended for human consumption (Journal of Law of Poland, No 61, pos. 4170).

Another type of water supply devices, on which water quality testing was performed were devices operating daily with from 10,000 to 100,000 m3 of water. There were 60 such devices in 2011 in Poland and on each of them water quality was tested and monitored. These devices are characterized by the fact that about 95% of water quality testing conducted on them indicated no breaches on water quality as required by the Polish law, which met the requirements up to 97% as to the delivery of water to the population.

The last group of water supply devices are the largest in its capacity, i.e. with capacity going beyond 100,000 m3 a day. There were only 4 of such type of water equipment in Poland and all of them were tested as to water quality. The results of these studies showed the best performance in terms of the water quality as in each case the tested water met sanitary requirements. The percentage of population supplied with water meeting sanitary requirements, i.e. water quality meeting 100% of the requirements in using the largest facilities, was the highest among all groups amounting to 100 %.

Equally “Brita”, the company manufacturing water filters (for, among others, removing chlorine) conducted in 2010 an independent study of water quality in 10 selected Polish cities. The water was analyzed by the Institute of Chemistry of the University of Warsaw. Brita decided to participate in the program because of the public opinion polls showing that 60% of Poles do not trust the tap water quality. The results confirmed the study of Chief Sanitary Inspector (GIS) that water is safe and meets all standards. However, as it comes to the usability of water, especially its smell and taste, it often leaves much to be desired. According to Brita, the bad taste of water is linked to the low hardness of water, where chlorine is perceptible.

In the ranking of the surveyed cities concerning the best taste of water was in Zakopane, Lodz and Gdansk, followed by Warsaw, Bialystok, Lublin, Poznan and Wroclaw. The worst taste water had Katowice and Krakow. Similarly, in the assessment of water odour Zakopane and Gdansk were best, while the most repulsive smell of water had Lublin, Wroclaw and Katowice. Brita tests also confirmed that the vast majority of urban concentrations of harmful substances in water were visibly below the limit. [24] The test conducted by Brita examined the indicator parameters and microbiological purity, the content of organic compounds as well as the concentrations of metals and inorganic compounds.

The results of laboratory tests of all water samples delivered from different cities confirmed that the water from the water supply meets all standards and is safe for human

consumption. All tested samples of tap water were characterised by a high bacteriological, physico-chemical and chemical purity.

Conclusions

There is a lot of concern about drinking tap water among Poles. However, as research shows, these concerns are unjustified. Tap water in Poland meets all standards since it is constantly monitored by the water companies and all relevant health services. Tap water supplied through the water supply system can be used without prior boiling. Studies have shown that only the operating parameters of water, such as taste, odour and hardness, are not satisfactory everywhere, different in each city, and sometimes in different districts of cities, often waking thoughts among users about its inappropriateness. The lowered water value can be easily improved at home through the use of filters. In conclusion, due to constant monitoring and investment in upgrading treatment processes, the quality of tap water has improved significantly in the last years.

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