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Water quality assessment of rural water supplies otherwise and after the flood on the territory of the city of Kraljevo and the municipality of Vrnjachka Banja

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Introduction

Climate variability significantly affects the availability and quality of water resources.

Water quality depends on natural factors and human activity, proper management of water resources, as well as the regulation of the catchment area itself.

There are thousands of rural water supply systems on the entire territory of the Republic of Serbia, according to which there is a le sufficient amount of quality drinking water.

The multidisciplinary of water supply is especially expressed in the examples of rural water supply

Introduction

The present problems in this area, the way of solving them and the possible consequences require that this problem must be approached far more professionally and organized than before.

The paper analyzes the conditions and ways of solving the water supply with quality sanitary-chemically correct drinking water in rural areas of certain municipalities in Serbia.

The segments important for the assessment of the risk of harmful events, which can occur due to torrential floods, were also reviewed and analyzed, and proposals for the introduction of additional measures for flood defense and protection of life, property of citizens and critical communal infrastructure.

Water

Water has a large heat capacity and that various inorganic and organic substances are dissolved in it, is an ideal medium for the development of life. In the water can be found: bacteries, viruses, parasitic organisms.

Water

The causes of infectious diseases such as typhoid fever, paratyphoid fever, bacillary dysentery, cholera, leptospirosis, brucellosis, tularemia, poliomyelitis, hepatitis A and E, but also children's worms, nematodes, histolytic amoeba, etc. can be transmitted through water.

The role of water in the transmission and spread of intestinal and other infectious and parasitic diseases is manifested qualitatively and quantitatively.

In the world and in the Republic of Serbia

Around 200 million people worldwide suffer from waterborne diseases (water-borne diseases) each year, while almost 5 million cases end in death.

In the period from 1900 to 2001 alone, there were 87 epidemics of infectious diseases in Serbia caused by polluted drinking water, with 4,481 infected people

One of the most important tasks of the World Health Organization in the fight against infectious diseases is therefore to provide preconditions for supplying the population with healthy drinking water.

Investigationd and analisys

The paper monitors the physical and chemical parameters of water and the total amount of organo-chlorine insecticides in drinking water samples taken from local reservoirs of 20 villages around the city of Kraljevo, as well as analysis of quantity and quality of available water and population needs, flow and pressure analysis and monitoring water quality with analysis of the situation and guidelines for further work of 5 large waterworks in the villages of Tavnik, Ladjevci, Milochaj and Toplik in the vicinity of the city of Kraljevo. The inhabitants of these villages (about 8000 inhabitants) are supplied with drinking water from reservoirs that are mostly occasionally cleaned and maintained.

Materials and methods

Drinking water samples were prepared according to the procedures given in the "Ordinance on the method of sampling and methods for laboratory analysis of drinking water. O.g. of SFRJ br. 33/87", and investigated with "Standard methods for testing the hygienic correctness of water" or Validated methods of the Institute of Public Health from Kraljevo (VMK).

Physico-chemical and microbiological analysis of drinking water samples was performed.

Results and discussion

The results of the measured physico-chemical parameters and OHI concentrations in drinking water samples taken from local reservoirs of 20 villages in the vicinity of the city of Kraljevo are shown in Tables 1, 2 and 3.

Table 1. Results of examined microbiological and physicochemical parameters in drinking water of rural waterworks.

R.no.	Parameter / unit measures	Metikoshi	Dragosinjci	Ribnica	Kamenica	Zicha	Bogutovac	Drakchici	Vrdila	Rodicevici	Dedevci	MAC
1.	pH value	8.20	7.40	8.20	7.70	8.50	8.10	7.60	7.40	8.40	7.90	6.8-8.5
2.	NTU turbidity	0.59	0.34	0	0.33	0.32	1.567	1.08	1.52	0.36	1.00	5
3.	KMnO4 mg/l	4.42	3.16	3.16	3.16	5.58	12.64	4.74	3.16	3.16	7.90	8.00
4.	Ammonia mg/l	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	1.09	<0.02	<0.02	<0.02	1.00
5.	Nitrates mg/l	1.7	2.0	1.6	12.5	5.1	4.8	0.2	12.5	0.8	4.2	50.0
6.	El.Conduct. µS/cm	390	265	420	460	475	350	560	530	475	420	to 1000
7.	Fe mg/l	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.33	<0.02	<0.02	<0.02	0.300
8.	Mn mg/l	<0.01	<0.01	0.013	<0.01	<0.01	<0.01	0.012	<0.01	<0.01	<0.01	0.05
9.	Sulphates mg/l	7.10	12.38	5.25	41.47	6.94	7.71	3.73	20.74	31.03	20.79	250
10.	Ca mg/l	26.61	43.05	22.30	75.33	15.52	17.84	35.49	86.91	75.34	68.76	200.0
11.	Mg mg/l	26.61	43.05	22.30	75.33	15.52	17.84	35.49	86.91	75.34	68.76	200.0
12.	Microbiol.analysis	Faulty	Correct	Correct	Correct	Faulty	Correct	Correct	Correct	Correct	Faulty	
13.	Water correctness	Faulty	Correct	Faulty	Correct	Faulty	Faulty	Faulty	Correct	Faulty	Faulty	

Results and discussion

Table 2. Results of examined microbiological and physicochemical parameters in drinking water of rural waterworks

R.no.	Parameter / unit measures	Mrsac	Adrani	Sircha	Oplanici	Popovici	Upper Godachica	Lower Godachica	Stubal	Ratina	Vrba	MAC
1.	pH value	6.90	6.90	7.10	7.60	7.40	7.40	7.60	7.70	7.80	7.30	6.8-8.5
2.	NTU turbidity	8.74	0	0	0	0	0	0.63	0	1.15	0	5
3.	KMnO4 mg/l	2.84	3.79	4.74	4.42	2.52	6.32	3.16	4.42	4.74	5.37	8.00
4.	Ammonia mg/l	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	1.00
5.	Nitrates mg/l	4.9	35.9	31.4	0.2	1.3	9.5	1.2	5.2	0.4	43.3	50.0
6.	El.Conduct. µS/cm	505	475	785	670	335	350	420	240	670	615	to 1000
7.	Fe mg/l	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.131	<0.02	0.300
8.	Mn mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.039	<0.01	0.05
9.	Sulphates mg/l	19.87	36.62	63.17	25.60	31.76	35.86	37.73	18.10	7.81	67.75	250
10.	Ca mg/l	44.36	70.98	14.25	51.01	55.45	60.27	78.89	40.89	37.70	44.61	200.0
11.	Mg mg/l	73.94	35.59	75.93	49.78	24.84	22.38	18.18	10.41	114.97	89.91	50.0
12.	Microbiol.analysis	Faulty	Correct	Correct	Correct	Faulty	Correct	Correct	Faulty	Correct	Correct	
13.	Water correctness	Faulty	Correct	Faulty	Correct	Faulty	Correct	Correct	Faulty	Faulty	Faulty	

Results and discussion

Table 3. Results of tested organochlorine insecticides in drinking water, rural waterworks

No.	Villages	OHI (10-2 µgl)							
		α-HCH	Lindane		Hepta-chlorine	Aldrin	Dieldrin	Endrin	DDT	Total
1.	Mrsac	1.81	0.00	0.00	0.73	0.00	0.00	0.00	2.54	
2.	Adrani	0.00	0.25	0.00	0.62	1.02	1.04	0.00	2.93	
3.	Sircha	1.28	0.00	0.00	0.00	0.77	0.92	0.00	2.97	
4.	Oplanici	0.90	1.06	0.00	0.76	0.83	1.51	0.00	5.06	
5.	Popovici	1.28	0.00	0.00	0.00	0.77	0.92	0.00	2.97	
6.	Upper Godachica	1.58	0.00		0.00	1.86	0.96	1.50	0.00	5.90
7.	Lower Godachica	1.41	1.46		0.00	0.78	0.90	0.68	0.00	5.23
8.	Stubal	1.62	0.00	0.75	0.81	1.89	1.52	1.26	7.85	
9.	Ratina	0.00	4.42	0.00	0.00	0.00	1.11	0.00	5.53	
10.	Vrba	0.00	2.15	0.00	1.60	1.33	0.78	0.00	5.86	
11.	Metikoshi	0.00	0.00		0.00	1.12	0.00	1.17	0.00	2.29
12.	Dragosinjci	1.05	0.00		0.00	1.25	1.61	1.23	1.17	6.31
13.	Ribnica	1.51	1.92	0.00	1.01	1.59	0.88	0.00	6.91	
14.	Kamenica	1.68	2.38	0.00	1.35	1.58	1.98	1.53	10.5	
15.	Zicha	0.00	4.56		0.00	0.00	0.00	1.68	0.00	6.24
16.	Bogutovac	1.21	2.58		0.00	1.64	1.22	0.84	0.00	7.49
17.	Drakchici	0.00	2.91		0.00	0.00	0.00	2.84	0.00	5.75
18.	Vrdila	0.00	3.49		0.00	0.00	0.00	2.09	0.00	5.58
19.	Rocevici	1.43	0.00		0.00	0.99	0.00	1.24	0.58	4.24

Results and discussion

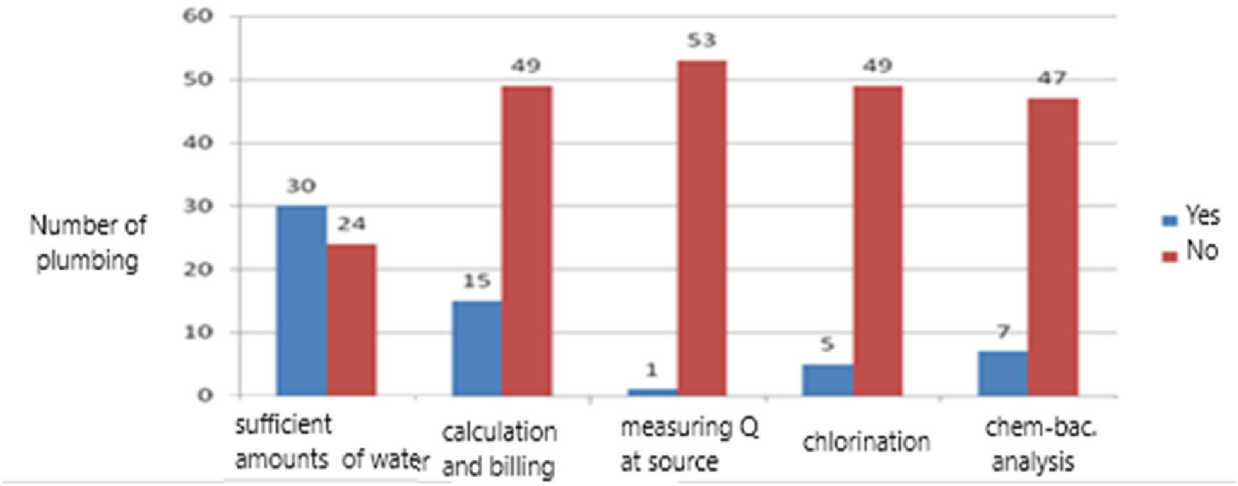

Fig.1. Graphic representation of water supply system maintenance parameters

Conclusion

Based on the analysis of microbiological, physico-chemical parameters and OHI concentrations in the drinking water of rural waterworks in the vicinity of the city of Kraljevo, it can be concluded:

1. that out of the tested 20 drinking waters, 6 (30%) physico-chemical and 8 (40%) are microbiologically defective;

2. the following can be neglected: chemical malfunction of water due to increased value of Mg and increased value for ammonia and Fe which are on the border and microbiological malfunction which can be eliminated by chlorination of water;

3. It remains that out of a total of 20 tested waters in terms of microbiological and physico-chemical correctness, only two drinking waters are defective, one due to increased turbidity (8.74 NTU) and one due to increased consumption of KMnO4;

4. that the concentrations of organochlorine insecticides in all tested rural water supply systems are within the limits of the maximum permitted values standardized by the "Rulebook on the hygienic correctness of drinking water Sl. FRY Gazette No. 42/98 and 44/99 ";

Conclusion

5. springs-catchments are mostly in poor construction, technical and sanitary condition, they are not fenced and locked. Sanitary zones generally do not exist. Water from the catchment to the tank and from the tank to the user is distributed in combination: pressure, pumps and gravity. Cleaning and disinfection of catchments, reservoirs and networks in most villages is done occasionally. Also, there are generally no people in charge of water supply maintenance;

6. The examined localities are characteristic agricultural and fruit rural areas and it is possible to expect changes in the amount of tested compounds in the waters, which imposes the necessity of a periodic year testing.

Conclusion

Conclusion

Based on the assessment of damage to the water supply network and water infrastructure facilities, it's necessary rehabilitation and reconstruction of damaged utility infrastructure caused by inadequate maintenance and previous floods to avoid and reduced real flood hazards.

After reconstruction and construction of water supply network and water infrastructure facilities (drainage buildings, watercourses under rivers, measurement and regulation of reinforced concrete manholes, collection chambers, chlorine houses, connecting pipelines, pipelines, etc.), moderate danger and risk were assessed from floods in the area.

The end