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Potable water quality in the Karachunyvskyi reservoir

Abstract: Practical experience of research, carried out in the SE ‘Dnipropetrovsk Medical Academy Ministry of Public Health of Ukraine’ covered results of ecological methods usage in the branch of preventive medicine. On the basis of Kryvyi Rig powerful iron mining enterprises (Ukraine) complex experimental research covered long-term foundation secondary landscapes on the dumps surface after mining exploitation process carried out. The poorer quality soils are dangerous for environment, surface- and groundwater and human health. Under the influence of dumps quality of water taken from Karachunyvskyi reservoir dropped wildly. Well water in the settlements, which are situated near the dumps, is forbidden for drinking purposes. Our data characterise priority in the sphere of potable water supply and main problem of water supply and potable water quality, actual for many regions of Ukraine, including Kryvorozskyi district — major rural part of Dnipropetrovskyi region, which population received potable water with deviations on some indicators from hygienic standards.

Keywords: chemical composition of water, over normal value, mineral components of water, potable water, centralizes, decentralizes sources.

Background and Study Propose. Since 1971, the CDC, EPA, and Council of State and Territorial Epidemiologists (CSTE) have maintained the collaborative national Waterborne Disease and Outbreak Surveillance System (WBDOSS) to docu-

ment waterborne disease outbreaks (WBDOs) reported by local, state, and territorial health departments. WBDOs were recently reclassified to better characterize water system deficiencies and risk factors; data were analyzed for trends in outbreak occurrence, etiologies, and deficiencies during 1971 to 2006 [1]. A total of 833 WBDOs, 577,991 cases of illness, and 106 deaths were reported during 1971 to 2006 [2]. Trends of public health significance include a decrease in the number of reported outbreaks over time and in the annual proportion of outbreaks reported in public water systems, an increase in the annual proportion of outbreaks reported in individual water systems and in the proportion of outbreaks associated with premise plumbing deficiencies in public water systems, no change in the annual proportion of outbreaks associated with distribution system deficiencies or the use of untreated and improperly treated groundwater in public water systems, and the increasing importance of Legionella since its inclusion in WBDOSS in 2001 [3]. The proportion of outbreaks (28) associated with groundwater sources increased 87% from the previous reporting period (15 outbreaks), and these outbreaks were primarily associated (60.7%) with consumption of untreated groundwater [4]. Recreational water outbreaks involving gastroenteritis doubled (36 outbreaks) from the number of outbreaks reported in the previous reporting period (18 outbreaks). These outbreaks were most frequently associated with *Cryptosporidium parvum* (68.2%) in treated water venues (e. g., swimming pools or interactive fountains) and by *Escherichia coli* O157: H7 (21.4%) in freshwater venues. The increase in the number of outbreaks probably reflects improved surveillance and reporting at the local and state level as well as a true increase in the number of WBDOs [5].

Mineral composition of potable water influenced to the taste and caused non-infectious diseases among population. In the conditions of Ukraine investigations in the field of potable water had become an actual hygienic problem [6]. One can consider that total mineralization of potable water and its influence on the human body studied sufficiently [7]. Daily using of potable water with dry residue more than 1000 mg/dm³, accompanied by increasing such diseases as stones in the kidneys and urolic system diseases, illnesses of blood circulation system, hypertensive illness, ischemic illness of heart, cardiomyopathy, hypertension, etc [8]. Water with high level of mineralization can cause diarrhea disorders among persons, who had changed their place of residence [9]. It's connected with magnesium sulphate, which irritated mucous membrane of the intestines, increasing their motility [10].

Aim is study samples of mineral and chemical composition of potable water, which was taken from Karachunyvskyi reservoir, main source of centralized water supply system at the industrial city Krivoy Rog.

Material and Methods. Quality of potable water from Karachunyvskyi reservoir was studied by 14 indicators for the period 2008–2012 years (n=102).

Database of chemical substances potable water from Karachunyvskiy reservoir included average daily concentrations of the following compounds: total hardness, dry residue, chlorides, sulfates, calcium, magnesium, sodium, potassium, nitrogen ammonia, nitrite, nitrates, iron, manganese, copper, fluorine. There were counted such statistic indicators: average values and their errors ($M \pm m$), median (Me), (25–75)% confidence interval (CI). Results of laboratory researches presented in units of multiplicity excess of SSRN 2.2.4–171–10. [11]

Results and Discussion. Tendency to decrease total hardness from (10.83 ± 0.13) until (9.09 ± 0.23) mol/m^3 had been revealed during 2008–2012 years. Excess of hygienic rates had been established in (1.55–1.29) times, according to the level of this indicator ($7.0 \text{ mol}/\text{m}^3$).

Tendency to decrease was registered by dry residue. Average annual level was in the measure from (1344.92 ± 23.32) to (1081.17 ± 27.15) mg/dm^3 . It was determined that dry residue exceeded hygienic standard (up to $1000 \text{ mg}/\text{dm}^3$) during 2008–2012 years in 1.34–1.08 times. The highest value of dry residue was observed in 2009, being in the measure (1373.25 ± 11.22) mg/dm^3 , exceeding standard value in 1.37 times. At the same time (25–75)% confidence interval (CI) of this salt component ranged from (1348.5 to 1415) mg/dm^3 .

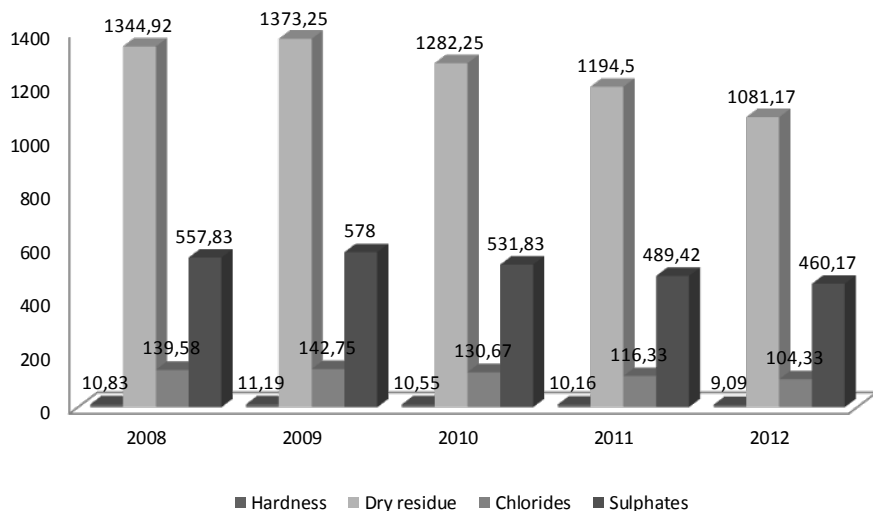


Fig. 1. Values of salt components in the potable water samples, which were taken from Karachunyvskiy reservoir during 2008–2012 years.

By an average value of chloride samples in the potable water, taken from Karachunyvskiy reservoir till 2008–2012 years, were not registered excess more than normal content ($< 250 \text{ mg}/\text{dm}^3$), according to SSRN 2.2.4–171–10. Content of

chloride in the potable water annually decreased and ranged from (139.58 ± 2.49) to (104.33 ± 1.80) mg/dm³.

Salt composition of potable water was characterized by over normal contents of sulphates: in 2.23 times (2008); in 2.31 times (2009); in 2.13 times (2010); in 1.96 times (2011); in 1.84 times (2012). The highest content of this salt was recorded in 2009 and amounted (578.00 ± 5.09) mg/dm³. Value of (25–75)% CI sulphates was $(560–589)$ mg/dm³ (Fig.1).

Calcium in the potable water is not standardized, its average amount varied from (91.17 ± 0.97) till (82.25 ± 3.51) mg/dm³, the highest meaning was (95.50 ± 0.92) mg/dm³ in 2009 year. Such chemical substances as copper and fluoride in the potable water from reservoir decreased until 2008–2012 years: Cu was in the measures (0.0056 ± 0.001) — (0.0031 ± 0.0006) mg/dm³; F (0.313 ± 0.021) — (0.266 ± 0.164) mg/dm³. Magnesium in the potable water from reservoir during 2008–2012 years characterized by the tendency to decrease from (76.57 ± 1.19) to (58.85 ± 2.64) mg/dm³. Sodium — potassium, which was regulated at the level (<200 mg/dm³), excess maximum admissible concentration (MAC) Na⁺-K⁺: (1.18 MAC) in 2008, an average value (236.58 ± 4.83) mg/dm³; (1.18 MAC) in 2009, an average value (236.42 ± 4.70) mg/dm³; (1.11 MAC) in 2010, content Na⁺-K⁺ ions (222.17 ± 13.12) mg/dm³. Until period of observation water in the Karachunyvskyi reservoir never excess MAC by an average content of iron. Instead in 2010, where was registered excess concentration of this chemical substance (1.71 MAC).

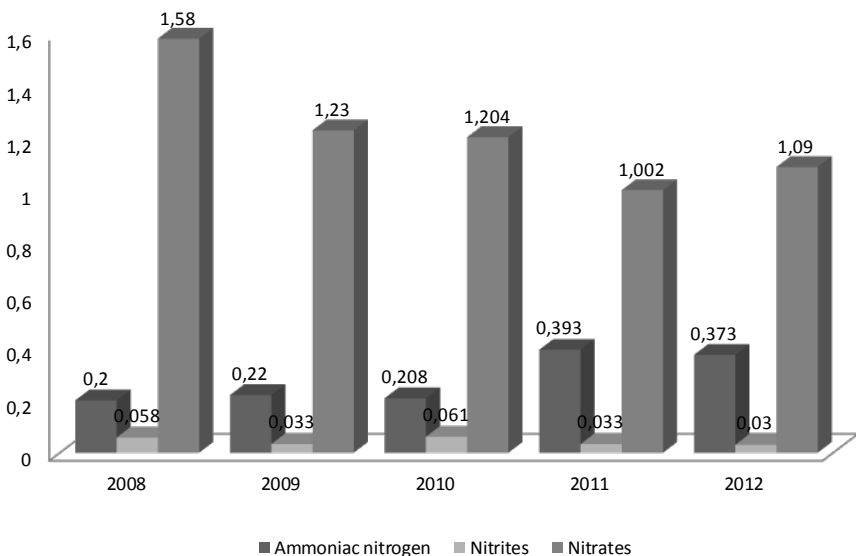


Fig. 2. Values of ammoniac nitrogen, nitrites, nitrates in the potable water samples, which were taken from Karachunyvskyi reservoir during 2008–2012 years.

In the potable water samples, taken from reservoir negative growth trend, characterized for ammoniac nitrogen, against increase an average concentration of nitrates during 2008–2012 years, caused infringement at the process of natural self-purification and sequence process of nitrification organic compounds (Fig.2).

Average concentration of iron in 2010 was (0.342 ± 0.003) mg/dm³, (25–75)% CI fluctuated in the measure $(0.02–0.045)$ mg/dm³, due to the presence of iron on the environmental objects, including water sources such industrial city as Krivoy Rog. Content of manganese exceeded average value: in 2008 (1.42 MAC), in 2009 (1,3 MAC), in 2010 (1,54 MAC), probably due to the high background content of this element on the environmental objects, and discharge highly mineralized waters from mining enterprises.

Conclusions. The results of scientific research clearly show that:

1. Potable water, using for centralized water supply at an industrial city of the Dnipropetrovsk region, mismatches SSRN 2.2.4–171–10. It's connected with natural conditions of their forming and with an anthropogenic pollution water sources. During 2008–2012 years was established over normal concentrations such salt components in the potable water of Karachunyvskiy reservoir: general hardness (1.55–1.29 MAC); dry residue (1.34–1.08 MAC); chlorides (1.39–1.04 MAC); sulphates (2.23–1.84 MAC); ions Na⁺-K⁺ (1.18–1.11 MAC); Fe (1.71 MAC); Mn (1.42–1.54 MAC).

2. Low efficiency outdated water treatment technologies, having been used in the Karachunyvskiy reservoir, poor sanitary condition water distribution network contribute to secondary contamination of the potable water, which complicates problem of access high-quality water, according to the requirements SSRN 2.2.4–171–10. Outdated treatment technology were not perform adequate barrier function to many contaminants reservoir, which corresponds to the 3rd class (moderate quality) sources of water supply and waterworks designed for efficient purification 1 class of potable water (best quality).

3. Alternative way to improve water supply among the population of industrial city with high-quality potable water is water supply by the using well-room complexes, points of spill additionally cleaned potable water and packaged potable water.

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The comparison assessment of effectiveness of low-dose aspirin in women with gestational endotheliopathy for prevention of preeclampsia depending on beginning of treatment

Abstract: We are estimated the effect of low-dose aspirin (75 mg/day) depending on beginning (gestational age 11–14 vs. 16–20 weeks) in women with gestational endotheliopathy, on the incidence of preeclampsia and other perinatal complications. Our investigation showed statistically significant effect of low-dose aspirin initiated in 11–14 weeks in preventing the incidence of preeclampsia and IUGR in women with gestational endotheliopathy.

Keywords: gestational endotheliopathy, low-dose aspirin, preeclampsia, IUGR.

Preeclampsia (PE), which affects about 2–8% of pregnancies, is a multisystem complication that occurs after 20 weeks of pregnancy [6]. PE is estimated to affect 8370000 women worldwide every year and is a major cause of maternal, fetal and neonatal morbidity and mortality. Early-onset preeclampsia means that the delivery of the baby is needed before 34 weeks of pregnancy because the disorder is having an adverse effect on the mother's or the baby's condition. Although less common than the late form of the disorder, early-onset preeclampsia contributes most to the mortality and morbidity statistics. There is evolving evidence that both the degree of impaired placentation and the incidence of adverse fetal and maternal short- and long-term consequences of preeclampsia are inversely related to the gestational age at onset of the disease [2].

Early in normal placental development, extravillous cytotrophoblasts of fetal origin invade the uterine spiral arteries of the decidua and myometrium. These invasive cytotrophoblasts replace the endothelial layer of the maternal spiral arteries, transforming them from small, high-resistance vessels to high-caliber capacitance vessels capable of providing adequate placental perfusion to sustain the growing fetus. In preeclampsia, this transformation is incomplete. Cytotrophoblast invasion of the spiral arteries is limited to the superficial decidua, and the myometrial segments remain narrow. Fisher et al. showed that in normal placental development the cytotrophoblasts assume an endothelial phenotype in a process called pseudovasculogenesis, or vascular mimicry, by down-regulating the expression of adhesion molecules characteristic of their epithelial cell origin and adopting an endothelial cell surface adhesion phenotype. The underlying cause of preeclampsia is thought to be abnormal placenta-