



# Chromium Content in Drinking Water in the Pleven Region, Bulgaria – Sources and Health Control



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## INTRODUCTION

Water supply organizations in Bulgaria face several serious challenges in providing quality drinking water. The main problems include outdated infrastructure with high water losses, pollution of natural water sources by agricultural fertilizers, pesticides and untreated wastewater, as well as migration of harmful chemical elements from the soil to groundwater.

These pollutants, including heavy metals and toxic chemicals, can cause health problems, such as endemic diseases and even cancer. Water in some regions contains multiple pollutants that could mutually reinforce their harmful effects.

Particular attention is paid to chromium in Northern Bulgaria, where its content in groundwater is of natural geological origin. Depending on its form (Cr<sup>6+</sup> and Cr<sup>3+</sup>), it can be both a toxic carcinogen and a vital trace element.

Strict monitoring and modernization of the water infrastructure, as well as the implementation of effective purification technologies, are necessary to protect water resources and public health.

## METHODS AND MATERIALS

The aim of the study is to conduct a health assessment of water sources used for drinking and domestic water supply in the Pleven region based on chromium levels, and to propose mechanisms for reducing its concentration to acceptable values in order to ensure standard drinking water for the population.

To achieve the goal of the study, we used the following methods and materials:

A retrospective study was conducted on chromium levels in drinking water in the Pleven region for the period 2010–2017, based on data from the Regional Health Inspectorate – Pleven and the Danube River Basin Directorate. Groundwater bodies used for water supply were analyzed and visualized using Geographic Information Systems (GIS) to better represent their locations and associated risks. A review of modern technologies for chromium removal from drinking water was carried out, aiming to reduce its levels to acceptable limits in accordance with national and European water quality standards.

## RESULTS

The Pleven region, located in the Danube Plain and comprising 123 settlements in 11 municipalities, relies mainly on groundwater and four rivers for its drinking water. The geological features shape five main types of groundwater bodies used for supply. During the study period, 1,242 water samples were tested for chromium by the Regional Health Inspectorate – Pleven. Of these, 25.9% exceeded the 50 µg/L limit, and only 20.1% were below detectable levels. In 12 settlements, average chromium levels consistently surpassed legal limits, while 6 other settlements showed elevated levels during certain periods, highlighting an ongoing water quality issue.

## DISCUSSION

During a study in the Pleven region, high levels of chromium and nitrates were detected in some areas. Chromium appears in two forms—trivalent (Cr<sup>3+</sup>), which is essential, and hexavalent (Cr<sup>6+</sup>), which is toxic and carcinogenic. Standards only regulate total chromium without distinguishing between the two types, and testing reflects this. The chromium contamination, mainly from natural sources in the soil and rocks, enters the human body primarily through drinking water. Standard purification methods are ineffective against chromium, and while advanced treatment technologies exist, they are not yet used in Bulgaria. The study highlights the need for better monitoring and the implementation of effective water treatment solutions to protect public health.

## CONCLUSIONS

The analysis of drinking water supply and chromium content in the Pleven region shows that the infrastructure provides water even to the smallest settlements. Despite regular monitoring, some settlements exhibit chromium levels above the limits, as well as combined contamination with nitrates. Regulatory requirements for chromium are insufficient, as they do not differentiate between trivalent and hexavalent chromium, which complicates control and data interpretation. There are also technical issues in comparing results due to differing measurement units. It is recommended that for contaminated water sources, solutions such as finding new sources, mixing waters, or using treatment technologies should be applied, with emphasis on treatment since the chromium source is natural. A combined approach to remove both chromium and nitrates is especially important.

The conclusion is that water supply organizations should focus on implementing specialized purification methods rather than searching for new water sources.

Table 1 Settlements in Pleven region showing excessive chromium values for the period 2010-2017

No	Settlement	Municipality	N (samples)	Average Cr concentration [µg/L]	Min	Max
1	Slavovitsa	Dolna Mitropoliya	36	124.00	104.05	138.82
2	Bozhuritsa	Dolna Mitropoliya	42	102.00	24.01	129.72
3	Dolni Viti	Gulyantsi	24	96.58	52.57	128.20
4	Tatari	Belene	36	82.22	48.58	109.29
5	Brest	Gulyantsi	28	65.70	54.92	77.30
6	Dabovan	Gulyantsi	10	61.83	35.88	97.98
7	Museliievo	Nikopol	40	60.10	19.32	70.09
8	Petokladenzi	Belene	25	57.33	44.16	83.80
9	Cherkovitsa	Nikopol	12	51.10	36.70	60.72
10	Gigen	Gulyantsi	24	50.55	29.08	64.72
11	Evlogievo	Nikopol	8	50.44	33.94	58.51
12	Asenov	Nikopol	23	50.43	37.18	74.23
13	Zagrajden	Gulyantsi	9	48.87	8.00	71.49
14	Novachene	Nikopol	65	48.80	4.00	93.29
15	Debovo	Nikopol	22	46.46	27.60	7424.00
16	Stezherovo	Levski	29	43.77	9.11	75.52
17	Bozhurluk	Levski	25	41.75	21.80	56.86
18	Lenkovo	Gulyantsi	24	36.24	18.90	73.97

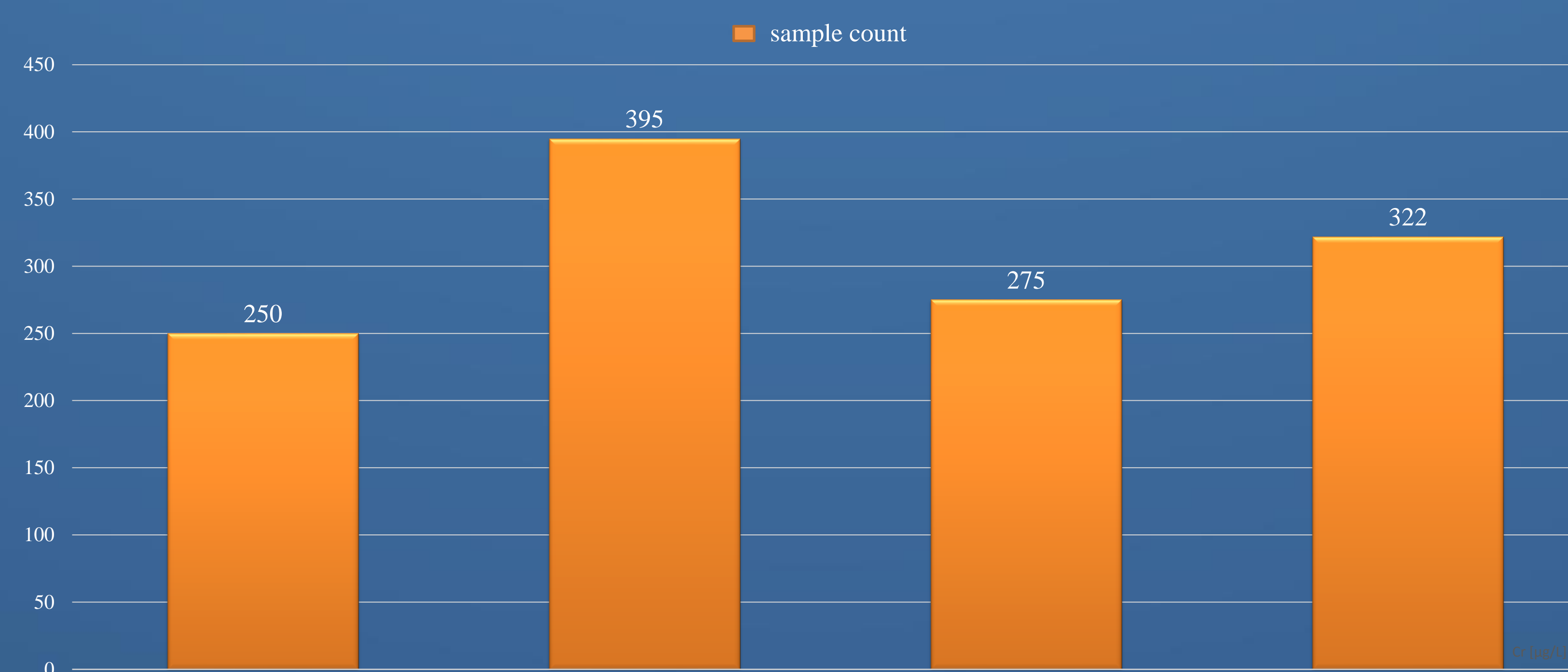


Figure 5 - Distribution of samples according to chromium content

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