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## ANALYSIS OF SURFACE WATER QUALITY IN THE ARGES RIVER BASIN FOLLOWING ACCIDENTAL AND SYSTEMATIC POLLUTION IN RECENT YEARS

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### **Introduction**

The Argeş-Vedea river basin occupies about 9% of Romania's surface, being formed by 178 watercourses, with a total length of 4579 km. The surface water resources, from the Argeş-Vedea river basin, in an average hydrological year, are 3,600 million m<sup>3</sup>/year, distributed unequally between the Arges River – 1,960 million m<sup>3</sup>/year, Vedea - 363 million m<sup>3</sup>/year, and the rest in other rivers. Surface water represents 68% of total resources. This hydrographic basin has the largest usable resources, of 1672 million m<sup>3</sup>/year. It is favored by the presence of important cities such as Bucharest, Piteşti, Câmpulung and Curtea de Arges, which concentrate large industrial consumers and have large population, but also significant industrial operators such as the Dacia-Pitesti Car Factory, hydropower plants, etc. In this paper, the sources of surface water, rivers and lakes were analyzed. The rivers in natural regime and the courses with modified and artificial riverbeds were treated separately. The 19 lakes were also monitored, of which one natural and the rest hydropower, in 44 measurement sections. An analysis of quality biological and physico-chemical elements was performed to assess the ecological status of surface water. The main sources of accidental and systemic pollution, registered in the last years and their short and medium term consequences, were presented. The areas in which the maximum allowable limits were exceeded were highlighted.

### **Materials and methods**

In the beginning, an analysis of the structure of surface water resources by categories and the points of measurement was presented. For rivers there were 88 measuring points, distributed on the entire hydrologic network, of which 68 on natural rivers, 18 on modified river course, and two on artificial water bodies. An analysis of quality biological and physicochemical elements was performed to assess the ecological status. For natural rivers, biological elements such as phytoplankton, phytobenthos, macro-invertebrate and fish were analyzed. For the general physicochemical elements, water temperature, salinity, pH concentration, amount of dissolved oxygen (CBO<sub>5</sub>, CCO-Cr) and nutrients (N-NH<sub>4</sub>, N-NO<sub>2</sub>, N-NO<sub>3</sub>, N<sub>total</sub>, P-PO<sub>4</sub>, total P) were illustrated. Based on the results obtained, the specific pollutants discharged in high quantities were monitored (Zn, Cu, As, Cr, toluene, acenaphthene, xylene, phenols, detergents, cyanides, PCBs). In many watercourses, concentrations higher than 80% of such substances have been detected with more

than 20% of the EQS- permitted environmental quality standards allowed, limits that must not be exceeded to ensure the protection of human health and the environment. Based on the results obtained, the specific pollutants discharged in significant quantities (Zn, Cu, As, Cr, toluene, acenaphthenes, xylene, phenols, detergents, cyanides, PCBs) were analyzed. Rivers with modified and artificial riverbeds were analyzed separately. For lakes, 19 of them were monitored, of which one natural, Comana Lake and 18 hydropower lakes, a total of 44 monitoring sections, three on the natural lake and the rest on the accumulation lakes. For them also, the ecological status was determined by analyzing the biological elements and the registered physicochemical elements. The ecological potential for the analyzed lakes was classified into three classes, according to the requirements of the Water Framework Directive: maximum ecological potential (MEP), good ecological potential (GEP), moderate-low ecological potential (MoEP).

### ***Results and conclusions***

In 2013, 12 accidental pollutions were registered, most of them contaminations with a mixture of crude oil and salt water, caused by the cracking of the pipes transporting the oil from OMV Petrom and subsequently discharged into the watercourses. The most affected rivers were Valea Seaca, Cobia, Valea Obidita, Sericu, Saru (tributary of Sabar), Cotmeana, Teleorman, and Arges. Another source of accidental pollution was the excessive use of pesticides and chemical fertilizers in the vicinity of the Vedea and Teleorman rivers, beyond the permitted limits, leading to the death of many fish and aquatic animals. Systematic pollution is a consequence of wastewater permanently discharged from localities or industrial operators. Different urban, industrial or other sources were analyzed presenting a global situation of the quantities of pollutants contained in the wastewater.

The analysis of the monitored data proved that the domains with significant contributions in the systematic pollution are the water capture for the food industry, chemical processing in the oil extraction, and irrigations. By analyzing the pollutants discharged between 2014 and 2019 in tons/year, maximum permissible limit of 50 mg NO<sub>3</sub>-/l was greatly exceeded in the Sericu-section confluent with Glavacioc. Another problem was the malfunction of sewage treatment plants. Thus out of the total of 185 analyzed stations, only 36 are functioning correctly. After evaluation on the basis of each biological and chemical element analyzed, a final evaluation was performed. For the quality of the monitored natural rivers, according to the evaluation of the ecological status in the Arges HB, 68% were GEP and 32% MoEP, and in HB Vedea 25% were in the good class and 75% in the bad one. Regarding the evaluation of the chemical state, Arges has 98% GEP and 2% bad, and Vedea has 81.25% GEP and 18.75% bad condition. For the monitored modified river beds, the HB Arges-18.75% has GEP and 81.25% MoEP and Vedea 100% was MoEP. For chemical state Arges was 75% good and 25% bad, and Vedea was 100% good. The natural lake was MoEP. For the accumulation lakes, the ecological status in HB Arges was 46.67%-GEP and 53.33% in MoEP and Vedea 100% MoEP. For the chemical state, Arges was 93.33% good and 6.67% bad, and Vedea was 100% good.