

According to official data, the city of Valjevo had the highest annual reading of particulate matter PM10 in 2019 in Serbia, of 60 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$), compared with the 40 $\mu\text{g}/\text{m}^3$ limit. Valjevo recorded 42 $\mu\text{g}/\text{m}^3$ in PM2.5 air pollution last year, taking the top spot by far as well. The allowed level is 24 $\mu\text{g}/\text{m}^3$.

The findings kept the city's air quality in the worst, third category, where it had been since measurements began in 2012.

The air quality in Valjevo has been in the highest category, designated as "very polluted," ever since measuring began in 2012. According to official data, the city had the highest annual level of suspended particles PM10 and PM2.5 in Serbia last year. There are many sources of pollution, but solutions are neither inaccessible nor unfeasible, according to participants in a recent public discussion event on air pollution. Expanding and greening the district heating system could be a part of the solution. The event was held to draw attention to the fact that residents are very disgruntled over the air pollution they have been suffering for years and over the lack of information on what relevant institutions are doing to address the problem. The online event, attended by citizens, members of the academic community, local activists, and representatives of local institutions, was organized by the Institute of Philosophy and Social Theory and the Belgrade Fund for Political Excellence as a way to support the self-organized Valjevo residents, whose health and existence are affected by the pollution problem.

Institutions failed to warn Valjevo residents of air pollution

Activist group Lokalni odgovor, which means "local response," launched a campaign titled Air Quality Alert at the start of November to improve public notification and raise awareness about the current level of air pollution, but also to encourage activism and the work of institutions, organizations, and the media with regard to their respective roles. The organization is producing weekly air quality reports for Valjevo based on official data from the government's network of measuring stations and is monitoring whether the relevant institutions, those responsible for the citizens' health and safety, are reacting. The report issued on November 23 for the previous week shows the air in Valjevo was "very polluted" for two days and "polluted" for four days, with only one day with the "acceptable" air quality.

PM10 concentration was five times above limit on November 19

The highest concentration of coarse particulate matter PM10 between November 16 and 22 was registered at 6 pm on Thursday, November 19. The value was 243.63 $\mu\text{g}/\text{m}^3$, or five

times above the allowed level. On the same day and at the same time, fine particulate matter PM_{2.5} also reached its highest concentration, of 192,25 µg/m³, which was twice as high as the allowed value.

None of the institutions that were supposed to publish information about such a situation (the Sector for Emergency Situations of the Ministry of Interior of Serbia, the City of Valjevo, the Public Health Institute in Valjevo) informed the public about the daily concentrations of pollutants in the air in Valjevo, and they also failed to warn citizens of the possible health risk and tell them how to protect themselves and mitigate the impact. The media in Valjevo also failed to do so, considering that only three out of 10 local outlets published information on a daily basis about the air quality in the city.

Battle for cleaner air will last for years

At the event, Professor Vladimir Đurđević from the Faculty of Physics of the University of Belgrade said the focus must be on major issues and polluters. On the other hand, it is straightforward and feasible to plant trees on the largest possible area, he said, adding that the existing green locations must be defended and that paving needs to be limited. The battle for cleaner air will last five years or more, according to him. As for immediate measures, Đurđević suggested reducing indoor pollution in schools and kindergartens in Valjevo by using air purifiers. In his words, an increase in the number of foggy days can indicate a rise in pollution as the fog doesn't form so easily without condensation nuclei, which in this case are usually sulfur oxides.

Households are using raw lignite for heating

Dragana Đorđević from the Institute of Chemistry, Technology and Metallurgy in Belgrade warned that coal from the nearby Kolubara complex, widely used for heating, has a much bigger moisture content due to the floods that happened in 2014 and that, according to data from the Vinča Institute of Nuclear Sciences, the share of inorganic matter in raw lignite is as high as 70%. An even more concerning fact is that households burn raw lignite for heating, she said and pointed out that they have no ability to filter the smoke. Đorđević underscored that the public has no access to data on how much Krušik, the biggest factory in Valjevo, is responsible for air pollution. The city should turn to its geothermal energy sources and to biogas, which should be extracted from biomass, she added.

Healthcare expenses are spread across budget items

Professor Aleksandar Jovović from the Faculty of Mechanical Engineering in Belgrade said

that healthcare costs caused by pollution are enormous, for example for treating cancer, but that these expenses are divided into different items in the state budget and therefore not easily visible. At the same time, measures to fight pollution require concrete funds and loans, according to him. The energy efficiency of buildings has an important role in improving air quality, but the renovation rate must be increased so that a minimum of 3% of all structures are refurbished every year, Jovović said. He added the local district heating plant's capacity is greatly underutilized.

Krušik can't afford to replace combustion unit

Marija Petrović Marković from local news website Valjevska posla said several public institutions and enterprises still use fossil fuels instead of connecting to the district heating network. According to the World Health Organization's (WHO) research, Valjevo has a 20% share in the 3,600 premature deaths per year in Serbia's eleven most polluted cities, said Jelena Đuričić from the Institute of Chemistry, Technology and Metallurgy. Milica Spasenić from Krušik's health and safety department said that the company intends to replace the combustion unit and that the project is ready, but that it has no funds for it now. Jovan Grujić from Eko gerila said the environmentalist initiative is demanding from the city to provide incentives for households to switch to heating boilers that use wood pellets.

Heating plant could help slash air pollution in Valjevo

District heating plant Toplana Valjevo has been working on reducing pollution from heat production for several years. Even though the announced investment in a biomass-fueled unit did not materialize, in 2018 the district heating plant started using compressed natural gas as well, managing to significantly lower the share of heating oil in energy production. Preliminary results of a feasibility study on implementing renewable energy sources in the district heating system in Valjevo, which is being conducted by the European Bank for Reconstruction and Development's (EBRD) Renewable District Energy in the Western Balkans Fund, indicate that the district heating plant in Valjevo could significantly contribute to reducing air pollution in the city. The study shows the district heating plant's first step could be to abandon heating oil completely, install a water-to-water heat pump, and start using wastewater from a wastewater treatment facility to produce clean and green energy with zero emissions. In the second step, the savings that would be achieved thanks to the switch to the new technology could enable the launch of a project to improve the energy efficiency of residential buildings connected to the district heating system. The third step would be to connect existing residential buildings to the district heating system, as only

15% of households is connected to the district heating plant, which leaves room for a further expansion of the network.

This project, with a holistic vision, would not only significantly decrease air pollution in the city, infamous for the highest air pollution levels in Serbia, but it would also demonstrate the cost-effectiveness of decarbonizing the district energy system, given that the study has shown that the district heating plant could produce heat with a heat pump at EUR 30 per MWh, including installments to repay the loan needed to invest in such a pump, compared with EUR 50 per MWh when using heating oil and EUR 46 per MWh when using compressed natural gas.

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