

## PM Two point Five levels from missile and drone attacks on Kyiv

Data collected between June One and Thirty, Two Thousand Twenty Five

During the Russian missile and drone attacks of June Two Thousand Twenty Five

sensors recorded sharp spikes in PM Two point Five concentrations, offering quantitative evidence of pollution directly associated with military activity. The prevailing winds were shown to play a decisive role in the spatial development of fire-related smoke plumes.

Although the configuration of air defense systems is likely relevant, available data are insufficient to assess its influence. Short-term episodes up to Eight to Nine Hours were found to elevate daily average PM Two point Five concentrations beyond WHO guideline values. In this context, citizen-led monitoring not only advances scientific understanding of conflict-related air pollution but may also serve as supplementary evidence in assessments of potential environmental impacts and their broader public health implications. Kyiv, the capital of Ukraine, was frequently struck in June Two Thousand Twenty Five resulting in destruction of residential and industrial infrastructure, as well as fires, leading to acute increases in ambient concentrations of fine particulate matter PM Two point Five. Observational data were collected between One and Thirty June Two Thousand Twenty Five using a distributed network of low-cost air quality monitoring stations aggregated by the Save Eco Bot platform. The optical particle counters, based on light scattering technology, enable real-time monitoring of airborne particulate fractions of PM Two point Five along with meteorological parameters and gas pollutants. The study period included two significant attacks on June Ten and Seventeen, during which the temporal and spatial dynamics of PM Two point Five concentrations were analyzed in comparison to baseline levels observed under non-attack conditions. Raw concentrations of PM Two point Five up to Two Hundred Forty One Micrograms per Cubic Meter were observed in the epicenters of air-strike-induced fires, while smog plumes covered half of the city area. Elevated PM Two point Five concentrations were recorded during and for several hours following the attacks and corresponding air raid alerts. The findings show days of PM Two point Five exceedances above the World Health Organization (WHO) daily threshold of Fifteen Micrograms per Cubic Meter. These results underscore the acute environmental and public health hazards posed by military assaults on urban centers. Furthermore, this research highlights the role of citizen-driven environmental monitoring as a valuable tool for both scientific documentation and potential evidentiary support in assessing the environmental impacts of warfare. The recent Russian-Ukrainian war is a significant factor in air deterioration, as recognized both from satellite-based remote sensing and on-ground measurements in the short run. Notably, tropospheric nitrogen dioxide  $\text{NO}_2$  levels over major Ukrainian cities, including Kyiv, declined by Fifteen to Sixty Percent in early Two Thousand Twenty Two compared to prior years. This reduction is attributed to the sharp contraction in transportation, industrial activity, and energy production caused by the war. PM Two point Five levels also initially decreased by approximately Thirty Eight Percent nationally and Thirty One Percent in Kyiv before later rising due to war-related fires and explosions. A general improvement in air quality in the near-frontline Ukrainian cities has been recognized from decreases in PM magnetic susceptibility and metal concentrations, attributable to the broader impacts of the ongoing war. A sharp decline in PM magnetic susceptibility was caused by the destruction of industrial facilities in Kharkiv and a significant reduction in traffic intensity due to a Five-fold depopulation in Kherson. Contrasting with the general decline in anthropogenic emissions, localized spikes in pollutants were recorded during intense military operations. Early in the conflict, PM Two point Five concentrations in Kyiv surged to Twenty Seven point Eight times the WHO-recommended Twenty Four Hour guideline levels due to widespread bombing and resulting structural fires. Frontline regions also experienced heightened levels of  $\text{CO}$ ,  $\text{O}_3$ ,  $\text{SO}_2$ , and  $\text{NO}_2$ , driven by artillery, explosions, and burning infrastructure. For instance, PM Two point Five peaked at Twenty Four point Two Micrograms per Cubic Meter, while  $\text{NO}_2$  reached One Hundred

Thirty Nine point Seven micromoles per meter squared, both significantly exceeding recommended health thresholds. Although long-range trends show short-term reductions in emissions from paused industrial activity, new sources, such as fires and explosive-related releases of toxic substances, pose severe localized threats to air quality and human health.

The short-term improvements in baseline air pollutants reflect disrupted socioeconomic functions rather than genuine environmental recovery. Meanwhile, toxic exposure events exacerbate risks for the population in Kyiv and may have long-term health implications. A research paper sought to monitor and assess variations in PM Two point Five concentrations in Kyiv Ukraine during and after the episodes of intense combined drone and missile attacks in June Two Thousand Twenty Five, using low-cost particulate matter sensors. Russian forces have been carrying out between two and five such assaults per month on the capital, yet little is known about the spatial and temporal distribution of air quality impacts across the urban environment. This study attempted to address this gap. In Conclusion, PM Two point Five has proven to be a robust indicator of air quality, capturing long-term tendencies and short-term episodes that are not adequately reflected by gaseous pollutants. The deployment of low-cost air quality sensors by citizen scientists in Kyiv provides an effective means of documenting the environmental consequences of armed conflict. Despite incomplete datasets, the existing PM monitoring network enables the mapping of individual pollution episodes, estimation of affected areas, and modeling of the impacts of mass bombardments and subsequent fires. During the Russian missile and drone attacks of June Two Thousand Twenty Five, the sensors recorded sharp spikes in PM Two point Five concentrations, offering quantitative evidence of pollution directly associated with military activity. The prevailing winds were shown to play a decisive role in the spatial development of fire-related smoke plumes. Although the configuration of air defense systems is likely relevant, available data are insufficient to assess its influence. Short-term episodes, up to Eight to Nine Hours were found to elevate daily average PM Two point Five concentrations beyond World Health Organization WHO guideline values. In this context, citizen-led monitoring not only advances scientific understanding of conflict-related air pollution but may also serve as supplementary evidence of potential environmental impacts and their broader public health implications. How is this study of PM Two point Five levels from missile and drone attacks on Kyiv Ukraine by Russia in June Two Thousand Twenty Five relevant to Residents Against Wood Smoke Emission Particulates? Like the resident owned PM Two point Five sensors Employed by the residents of Kyiv the resident owned PurpleAir PM Two point Five sensors can detect What is undetected by official PM Two point Five sensors even if these official PM Two point Five sensors Exist. Official government owned PM Two point Five sensors which are used alongside PurpleAir sensors On United States Environmental Protection Agency maps of Smoke and Fire which generate data Available for download by the general public are few and far between. The U S government PM Two point Five monitors are usually deployed far from Residential areas where indoor residential wood burning which creates air pollution that enters the yards and infiltrates the homes of near neighbors sickening the near neighbors or shortening the lives of near neighbors. Therefore PurpleAir PM Two point Five monitors Bought by the near neighbors are the only air pollution monitors located hyper locally enough to collect Air pollution data that could theoretically be used as evidence of preventable air pollution and the only air pollution monitors able to provide data that could be used to shut down air polluting wood burning residential appliances such as wood burning stoves or fireplaces one wood burning stove at a time if necessary. In the same way, the resident owned PM Two point Five monitors hyper located in Kyiv Ukraine provided evidence of harm to human health and the environment from missile and drone activity last June. It probably seems self-evident to most people that a plume of smoke arising during war and a plume of smoke arising from unnecessary residential wood burning are both air polluting, but to bring A lawsuit or enforce an air pollution regulation what is obvious to the layman must sometimes be proven again and again before laws are passed to stop indoor residential wood burning. This study not only proves that the level of PM Two point Five goes up during modern warfare, but that the level of air

pollution is such that it affects the climate health of the entire planet eventually as well as immediately negatively at a great enough level to affect human health and mortality from air pollution alone.