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# Assessment of chemical contamination of condensed water from Atmospheric Water Harvesting

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As access to drinking water is a major public health issue worldwide, many technologies have emerged for water harvesting from alternative sources. Among these, active atmospheric water harvesting technologies, known as atmospheric water generators (AWGs), are attracting growing interest as a decentralised water production system. However, the water quality they produce is known to be influenced by the ambient air pollution, but scientific data on air-to-water transfer is limited, stressing the need for assessment tools to support monitoring and management strategies. This difficulty is exacerbated by the complexity of atmospheric chemistry and the large number of compounds present in the air, which far exceeds the number of compounds regulated in drinking water. To address this challenge, we present the first systematic methodology for risk assessment of air-to-AWG water transfer and apply it to the Greater Paris area. First a bibliographic inventory of the compounds found in the air in the region of interest and of their maximum reported concentration was created. For each compound, empirical (when available) or theoretical air-to-water transfer models were applied to determine the upper concentration expected in AWG water. The risk level of each compound was determined based on the ratio between this concentration and experimental or extrapolated guideline values for ingestion toxicity. In the Greater Paris area, while as many as 193 air pollutants were inventoried with quantified ground-level atmospheric concentrations over the last 15 years, only about half of them presented a risk of being present in AWG water above the set thresholds. Of these, around 20 - a much more manageable number of species to monitor - may reach concentration levels two orders of magnitude or more above the threshold values and may require priority consideration. These include ammonium, Polycyclic Aromatic Hydrocarbons -PAHs- (e.g., phenanthrene), pesticides (e.g., prosulfocarb), organic acids (e.g., acetate), phenols (e.g., benzenediol), and aldehydes (e.g., acrolein). The presence of some of these species linked to vehicle emissions was studied experimentally in the water of an AWG exposed to varying levels of diesel emissions through integrated water and air quality monitoring, both *in-situ* and in Sense-City climatic chamber (https://sense-city.ifsttar.fr/). A large number of species were discovered for the first time in AWG water, notably numerous PAHs and acrylamide, while several were observed to exceed EU regulatory thresholds (pH, ammonium, nitrite, Cu, Al, Mn, Pb, Ni, benzo(a)pyrene, benzene and acrylamide), some of them for the first time (Cu, acrylamide). The composition of raw AWG water was found to be directly correlated with exhaust levels through NOx and TVOC concentrations

with turbidity, total organic content, nitrite, BTEX, several metals and most PAHs. Acrylamide concentration also featured correlation with the exhaust pollution, a surprising, as of yet unreported, finding in air or water that thus needs to be extensively confirmed. Overall, the study confirms the strong influence of air pollution on AWG water but its viability despite extreme pollution conditions.