Supplementary Statement S1

Drinking Water Contamination Pathways and Material Risks

Materials used in solar panels, associated electrical equipment, and battery energy storage systems include heavy metals, dielectric fluids, lubricants, and hydraulic fluids, as well as fluorinated and plastic components, some of which are regulated drinking water contaminants. Other substances associated with these systems are not routinely monitored in drinking water, including emerging PFAS compounds from wiring and battery materials, microplastics, plasticizers, flame retardants, rare or technology-critical metals such as selenium, tellurium, indium, and gallium, and battery electrolytes or other organic solvents (1-3).

Assertions that future generations of solar or battery components will eliminate contamination risks do not satisfy the precautionary standards applied to public health and water supply protection under Massachusetts law, which require land-use decisions to be based on the demonstrated performance of materials currently proposed for installation, particularly where contaminants are persistent, mobile, and subject to delayed detection in groundwater systems.

While some manufacturers assert that newer photovoltaic panels are produced without intentionally added PFAS, no federal certification program currently verifies PFAS-free status across photovoltaic modules or associated electrical and balance-of-system components. Fluorinated compounds remain widely used in wire insulation, cable jacketing, sealants, gaskets, fire-retardant materials, and protective coatings required for outdoor electrical infrastructure. As a result, claims of PFAS-free panels do not equate to PFAS-free solar installations when evaluated under public health and water supply protection standards.

Large-scale solar development substantially increases soil disturbance and impervious surface area, increasing stormwater runoff. Stormwater runoff is a documented pathway for the mobilization and transport of metals, PFAS, microplastics, and other persistent organic contaminants from disturbed or developed land into surface waters and underlying aquifers serving public water systems (4-6).

Photovoltaic panels, wiring, transformers, and battery components degrade over time through weathering, corrosion, thermal cycling, and mechanical stress, resulting in gradual chemical release with uncertain long-term fate near public water supplies. Such contamination is often detected only after long groundwater lag times, once a water source has already been impacted (7-8).

Public water supply protection areas are intended for low-risk land uses. Industrial-scale energy infrastructure is incompatible with the precautionary purpose of drinking water source protection. Allowing this development at the proposed site would introduce avoidable, long-term contamination risks and is therefore unacceptable.

Endnotes

1. U.S. Environmental Protection Agency (EPA). Drinking Water Contaminants and Emerging Contaminants. EPA Office of Water, updated 2023-2024.

2. U.S. Geological Survey (USGS). Technology-Critical Elements in the Environment. USGS Fact Sheet, 2019 (current as of 2024).

3. Yandem, G., Grygoyc, K., and Jablonska-Czapla, M. (2025). Impact of photovoltaics on soil and water by metalloids including technology-critical elements: preliminary study. Environmental Geochemistry and Health, 47:389.

4. Zgheib, S., et al. (2023). Urban stormwater as a pathway for persistent, mobile, and toxic substances. Environmental Science Water Research and Technology.

5. Newell, C. J., et al. (2025). Exploration of PFAS mass discharge in stormwater versus other pathways and regulatory considerations. Remediation Journal.

6. U.S. Geological Survey (USGS). PFAS in Surface Water and Groundwater Used for Drinking Water. National Water-Quality Assessment Program, 2022-2024.

7. U.S. Environmental Protection Agency (EPA). Fate and Transport of Contaminants in Groundwater. Technical guidance, updated 2020-2023.

8. Interstate Technology and Regulatory Council (ITRC). (2023). PFAS Technical Guidance.