

Perez, A.L., C.L. Chen, J.J. Keenan, W.D. Cyrs, B.L. Donovan, and A.K. Madl. An analysis of the proposed benefits and risks of nanotechnology-enabled water treatment. Presented at the Society of Environmental Toxicology and Chemistry (SETAC) North America 31st Annual Meeting; Portland OR. Wednesday November 10th, 2010, Exhibit Hall.

The range of industries employing nanotechnology has expanded rapidly in the past decade. Recent initiatives to secure safe drinking water supplies have incorporated nanotechnology in water treatment processes. Nanotechnologies used in water treatment vary with regard to particle size, shape, and degradability, and are diverse in their chemical composition and the types of contaminants they remove. For example, carbon nanotubes or nanoporous ceramics are incorporated into filters, nanoscale silver are used as an antimicrobial agent, and iron nanoparticles as catalysts are used to detoxify or remove environmental contaminants. Despite the increasing number of applications for nanotechnology in water treatment, the efficacy data are limited. While the focus of nanotechnology in water treatment has been on potential benefits, more research is needed regarding the possible occupational and environmental hazards. For example, the possible introduction of harmful nanoparticles from the treatment technology into drinking water and chemical interactions between nanomaterials and contaminants in water are not well understood. In this analysis, we offer a review of published scientific literature and provide a synthesis of data reflecting the proposed and realized benefits and potential health risks of nanotechnologies in water treatment; over 150 articles were considered. Further, we examine the efficacy of various nanotechnologies currently employed or proposed for use in water treatment. Nanotechnology-based water treatment can be advantageous over conventional water treatment methods due to the selectivity of contaminant removal, cost-effectiveness, reported efficiency, and low maintenance. More studies are needed to estimate the risks associated with the use of nanomaterials in water treatment.