Bay Area Clean Water Agencies

Leading the Way to Protect Our Bay

A Joint Powers Public Agency

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March 19, 2009

Nathanael R. Martin
U.S. Environmental Protection Agency (U.S. EPA)
Office of Pesticide Programs (OPP)
Regulatory Public Docket (7502P)
1200 Pennsylvania Ave., NW.
Washington, DC 20460–0001

RE: Petition for Rulemaking Requesting U.S. EPA Regulate Nanoscale Silver Products as Pesticides (Docket Number EPA–HQ–OPP–2008–0650) - Support

Dear Mr. Martin:

The Bay Area Clean Water Agencies (BACWA) agrees with the petitioners that nanosilver products should be regulated as pesticides. Products designed with nanoscale silver use the silver—or ions released from the silver—as a biocide. BACWA's member agencies are very concerned about the water quality impacts from the discharge of silver ions from these products into our municipal wastewater systems. These concerns have been expressed in previous letters to U.S. EPA from our colleagues at Tri-TAC and the National Association of Clean Water Agencies. We respectfully request that U.S. EPA register as pesticides all consumer products that by design contain substances that function as pesticides that can end up in our sewer systems and waterways.

BACWA is a joint public powers authority representing 55 public utilities that collect and treat municipal wastewater. Our membership includes large metropolitan facilities such as East Bay Municipal Utility District, the City and County of San Francisco, Central Contra Costa Sanitary District, East Bay Dischargers Authority, and the City of San Jose. Our members come from the nine counties that surround the San Francisco Bay. Many of our member agencies also manage potable water treatment, distribution systems, and biosolids residual programs.

In November 2008, EPA opened a public review and comment period on a petition for rulemaking to require formal registration of all products containing nanoscale silver under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). We agree with the petitioners—nanosilver products should be regulated as pesticides. There is no technical reason for U.S. EPA to decline to use its FIFRA authorities "to prevent unreasonable adverse effects on the environment" from use of these products. Regulating nanosilver as a pesticide will require specific tests and data that will better inform the U.S. EPA as to whether these products should be on the market.

We appreciated U.S. EPA's decision to regulate silver ion-generating products like the Samsung "Silver Wash" washing machine. This decision recognized our concerns about the potential water quality impacts of residential pesticide uses—and affirmed U.S. EPA's responsibility to regulate releases of biocidal silver into the environment.

Silver is highly toxic to aquatic life at low concentrations, is persistent, and can bioaccumulate in some aquatic organisms, such as clams. Due to concerns about bioaccumulation and the placing of strict silver effluent limits in discharge permits, publicly-owned wastewater treatment works (POTWs) have implemented pollution prevention programs to identify and reduce silver discharges to sanitary sewer systems. These programs have been very successful in reducing POTW influent and effluent silver concentrations. These programs have also reduced silver concentrations in biosolids, ensuring that silver will not limit options for biosolids reuse.

Ordinary use of nanosilver products can result in silver releases to municipal wastewater treatment systems. For example, releases occur when silver-impregnated fabrics are laundered, when silver-containing plastics are washed, and when silver-containing personal care products are washed off. When Benn and Westerhoff (2008) measured silver releases from washing nanosilver-impregnated socks, they found that some products lost silver so quickly most of the nanosilver in these products would be washed into the municipal wastewater system during the products' lifetimes.[1] Widespread use of household products that release silver ions into sanitary sewer systems could increase silver concentrations in POTW influents and effluents, potentially leading to adverse effects on the nation's waterways.

A well-respected San Francisco Bay Area scientist, Dr. Samuel Luoma, recently reviewed the environmental risks from nanosilver products.[2] Dr. Luoma spent most of his career at the U.S. Geological Survey's (USGS's) Menlo Park office, where he oversaw a long-term research study that demonstrated adverse impacts of POTW silver discharges on clams in San Francisco Bay. In the 1980s and 1990s, our member agencies made substantial (multi-million dollar) investments in process improvements and programs to control commercial and industrial silver discharges. Past silver

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[1] Benn, T. M. and P. Westerhoff (2008). "Nanoparticle silver released into water from commercially available sock fabrics." *Environmental Science & Technology* **42**(11): 4133-9.

[2] Luoma, Samuel N. (2008). *Silver Nanotechnologies and the Environment: Old Problems or New Challenges?* Woodrow Wilson International Center for Scholars, Project on Emerging Nanotechnologies. Publication PEN 15. September.

discharges to POTWs came primarily from developing photographs and X-ray films. Our members have controlled these discharges, which are now phasing out as photographers and medical offices transition to digital technologies. Dr. Luoma's USGS research team documented the dramatic recovery of South San Francisco Bay clam populations that occurred as a result of the silver discharge reductions we achieved.[3]

We have enclosed a copy of Dr. Luoma's review, which we request U.S. EPA carefully consider. Highlights of Dr. Luoma's findings include (from the report's Executive Summary):

- "Aside from releasing silver, the toxicity, bioaccumulative potential and persistence of nanosilver materials are just beginning to be known. But enough is known to be certain that risks must be investigated."

- "Nearly one-third of nanosilver products on the market in September 2007 had the potential to disperse silver or silver nanoparticles into the environment."

- "The mass of silver dispersed to the environment from new products could be substantial if use of one product, or a combination of such products, becomes widespread. Traditional photography established a precedent for how a silver-based technology that was used by millions of people could constitute an environmental risk. Release of silver to waste streams when photographs were developed was the primary cause of silver contamination in water bodies receiving wastes from human activities, and of adverse ecological effects where studies were conducted."

- "Risk assessments will require information about mass loadings to the environment. Such information is not currently available. Neither government reporting requirements nor product information is sufficient to construct reliable estimates of mass discharges from these new nanosilver technologies, but the potential exists for releases comparable to or greater than those from consumer usage of traditional photography."

Using available information (which is acknowledged to be limited), Blaser et al. (2008) attempted a rough estimate of the environmental releases that are currently occurring in Europe from selected nanosilver products.[4] Luoma (2008) completed a similar rough

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[3] Hornberger, M. I., S. N. Luoma, et al. (2000). "Linkage of bioaccumulation and biological effects to changes in pollutant loads in South San Francisco Bay." *Environmental Science and Technology*. **34**: 2401–2409; Brown, C. L., F. Parchaso, et al. (2003). "Assessing toxicant effects in a complex estuary: a case study of effects of silver on reproduction in the bivalve, Potamocorbula amurensis, in San Francisco Bay." *International Journal of Human and Ecological Risk Assessment*. **9:** 96–119.

[4] Blaser, S. A., M. Scheringer et al. (2008). "Estimation of cumulative aquatic exposure and risk due to silver: Contribution of nano-functionalized plastics and textiles." *Science of the Total Environment* **390** (2-3): 396-409.

estimate, using the South San Francisco Bay as an example (copies of both papers are enclosed).[5] Both of these estimates employed Blaser et al.'s estimates of the efficiency of silver removal by POTWs (both assumed that 80% of silver-containing wastewaters are treated sufficiently to remove 90% of the silver).[6] On the basis of our POTW management experience, we recommend that U.S. EPA consider the removal efficiency estimate of Blaser et al. as more realistic than the estimate employed by Benn and Westerhoff, who made the unrealistic assumption that 99.8% of silver is removed by wastewater treatment and that all silver-containing wastewaters flow to a wastewater treatment facility.

Wastewater treatment processes at POTWs commonly employ nitrifying bacteria to oxidize ammonium ions to nitrites and nitrates. This "nitrification" is critical to biological nutrient removal. In two related studies, Okkyoung Choi and colleagues found that nanosilver particles less than 5 nanometers in diameter are uniquely toxic to nitrifying bacteria.[7] (Copies of both papers are enclosed). These studies emphasize the importance of careful management of nanosilver products to ensure that discharges do not interfere with POTW treatment processes.

Taken together, this scientific information suggests that if nanosilver product use becomes common, wastewater discharges could reach levels not seen in the last two decades—and could have adverse impacts on our wastewater treatment process as well as on the quality of our effluent and biosolids. POTWs are subject to National Pollutant Discharge Elimination System (NPDES) permits under the Clean Water Act. These permits include toxicity limits and may also include quantitative effluent limitations for silver. Exceeding these limitations has serious consequences, including monetary fines and penalties and the risk of citizen lawsuits. Under California law, our members are liable for daily Mandatory Minimum Penalties should violations of their discharge permits occur.

It is distressing to POTWs to observe the increasing prevalence of household products that use silver nanoparticles and other toxic chemicals for general antimicrobial purposes. POTWs are proud of our history of taking effective actions that reduce discharges of toxic pollutants to the environment. While POTWs have the authority to regulate industrial and commercial sources of silver and other toxic pollutants, we have

[5] Luoma, Samuel N. (2008). *Silver Nanotechnologies and the Environment: Old Problems or New Challenges?* Woodrow Wilson International Center for Scholars, Project on Emerging Nanotechnologies. Publication PEN 15. September.

[6] This estimate recognizes that some silver-containing wastewaters (e.g., swimming pool water) are discharged to storm drains, where the water flows directly to surface waters without any type of treatment.

[7] Choi, O., K. K. Deng, et al. (2008). "The inhibitory effects of silver nanoparticles, silver ions, and silver chloride colloids on microbial growth." *Water Research* **42**: 2066-2074; Choi, O. and Z. Hu (2008). "Size dependent and reactive oxygen species related nanosilver toxicity to nitrifying bacteria." *Environmental Science & Technology* **42**(12): 4583-8.

little or no control over the discharge of pollutants from the thousands of households we serve. Silver is a toxic metal that cannot degrade in the environment and registered for use as a pesticide in numerous products. To allow the unrestricted usage of products that intentionally release silver into the environment would be an irresponsible neglect of the principles of environmental sustainability that should strongly influence such decisions.

In summary, BACWA recommends that U.S. EPA require the registration of all products in which silver nanoparticles function as biocides. We also ask that during the registration process, U.S. EPA obtain data on the quantities of silver ions and nanosilver particles released to the sewer system from ordinary use—including washing—of nanosilver-containing products. These data should be used to impose necessary restrictions to ensure that water quality standards are not exceeded and that discharged nanosilver does not interfere with biological wastewater treatment processes. Since nanosilver products may contain relatively high silver concentrations, measures to ensure proper disposal of treated items at end of life should be considered.[8] We request that U.S. EPA consult with the Food and Drug Administration regarding similar products that may not be regulated by U.S. EPA and consider these products in environmental risk assessments and risk management decisions. Efficacy claims for all products should also be carefully evaluated. In addition, ongoing monitoring and reporting of unit sales and silver releases should be required to determine whether registration should be continued or canceled.

Thank you for your consideration of our comments on the petition for rulemaking requesting that U.S. EPA regulate nanoscale silver products as pesticides. If you have any questions, please contact me at 510 547-1174 or mpla-cleanwater@comcast.net.

Sincerely,

Michele Pla

Michele Pla
Executive Director
Bay Area Clean Water Agencies

Enclosures

1. Luoma, Samuel N. (2008). *Silver Nanotechnologies and the Environment: Old Problems or New Challenges?* Woodrow Wilson International Center for Scholars, Project on Emerging Nanotechnologies. Publication PEN 15. September.

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[8] Product silver concentrations can exceed 1,000 parts per million (ppm) (see Benn and Westerhoff, 2008, enclosed), which is twice California's hazardous waste standard for total silver content (500 ppm, see California Code of Regulations, Title 22, Chapter 11, Article 3).

2. Benn, T. M. and P. Westerhoff (2008). "Nanoparticle silver released into water from commercially available sock fabrics." *Environmental Science & Technology* **42**(11): 4133-9.
3. Blaser, S. A., M. Scheringer, et al. (2008). "Estimation of cumulative aquatic exposure and risk due to silver: Contribution of nano-functionalized plastics and textiles." *Science of the Total Environment* **390** (2-3): 396-409.
4. Choi, O. and Z. Hu (2008). "Size dependent and reactive oxygen species related nanosilver toxicity to nitrifying bacteria." *Environmental Science & Technology* **42**(12): 4583-8.
5. Choi, O., K. K. Deng, et al. (2008). "The inhibitory effects of silver nanoparticles, silver ions, and silver chloride colloids on microbial growth." *Water Research* **42**: 2066-2074.

Note: Enclosures 2 through 5 are copyrighted materials that cannot be posted in the public docket. These have been submitted via email to Nathanael R. Martin. We request that U.S. EPA provide these materials to its staff that are reviewing these comments.

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