Pesticide: **Nanosilver,** EPA-HQ-OPP-2011-0370
Use: Swimming pool algaecide, fabric treatments, materials preservatives.
Why we care: Nanosilver is a priority due to its toxicity to aquatic organisms and the numerous silver 303(d) listings.
Actions taken: BACWA, NACWA, CASQA, the SF Water Board, and Tri-TAC sent EPA a letter response to the Work Plan in 2012.
Status: EPA released the Final Work Plan in October 2018.

Next steps: The EPA does not solicit comments on Final Work Plans. The next opportunity to comment is on the Draft Risk Assessment.
Recommendation: No action is needed at this time but this pesticide will continue to be tracked.

BACWA Comments to EPA	EPA Response	Did EPA incorporate BACWA's comment?
• What quantities of nanomaterials and metallic ions are now being used as antimicrobial agents in commercial products, both those registered and not registered by EPA? • What percentage of metallic nanomaterials will be converted to the ionic form prior to and during the wastewater treatment process? • What fraction of nanomaterials and metallic ions will end up in the treated wastewater and what fraction will end up in the biosolids? • What is the anticipated removal efficiency of nanomaterials in wastewater treatment plants? • What quantities and concentrations of nanomaterials and metallic ions will be released to wastewater treatment plants and the natural environment from the cumulative total of these products being marketed and registered?	The Agency acknowledges receipt of the questions and supporting documents submitted by BACWA and agrees that they may be appropriately addressed through registration review data requirements as part of the risk assessment. EPA requested that all manufacturers of silver-containing pesticides provide nanoparticle content information. Responses were received from many (but apparently not all) manufacturers. The list of products in the current workplan includes all products currently known to contain nanosilver.	**TBD**

• What affect does nanosilver have on biological wastewater treatment processes such as those used in municipal wastewater treatment plants? To what extent could nanosilver reduce treatment effectiveness, increasing releases of other pollutants into surface waters? • If it is shown that nanomaterials partition to biosolids, what impacts will that impart on the beneficial use of biosolids?		
How do nanoparticle characteristics, particularly surface coatings, affect the environmental fate and toxicity of nanoparticles? Recent studies show that both particle size and surface coating affect the environmental fate, toxicity, and bioavailability of nanosilver.	The workplan is designed to obtain additional data and other information in order to conduct risk assessments of potential exposures through registered uses of nanosilver products. (EPA has required a slate of special tests to characterize nanoparticles). The information from these studies, existing information, and other data from the open literature will be used to characterize the aquatic risks, as appropriate. If you are aware of specific studies that the Agency does not currently have, please submit them to the Chemical Review Manager.	**TBD**
Are nanoparticles able to deliver silver ions to new environmental locations, perhaps within organisms that take them up? For example, filter-feeding organisms have been shown to be more sensitive to nanosilver maybe because they are ingesting and accumulating the particles.	The workplan is designed to obtain data and other information, regarding silver nanoparticle/ion transport, and the potential sensitivity of filter-feeding organisms and other aquatic receptors as part of the risk assessment process. It is unclear at this point whether the EPA's data requirements will provide the information necessary to address this question in detail.	**TBD**
What is the potential for nanosilver to accumulate in aquatic and terrestrial food chains? Recent research indicates that gold nanoparticles biomagnify in a terrestrial food chain.	There are presently insufficient data to prepare a more current assessment of these scenarios for each unique active ingredient included in this case. The workplan is designed to obtain data and other information sufficient to make this determination as part of the registration review risk assessment process.	**TBD**

BACWA encouraged EPA to develop a more robust and informative assessment plan for nanosilver that is consistent with other pesticide registration review dockets. BACWA cited the Bifenthrin Registration Review workplan as a strong example of an environmental risk assessment work plan. To illustrate the need for more in-depth risk assessment work planning, BACWA enclosed a side-by-side comparison of the nanosilver registration review environmental work plan document versus the bifenthrin registration review environmental work plan document.	The use of the bifenthrin work plan as an example is not appropriate for nanosilver because there are no previous assessments to rely upon for nanosilver.	**TBD**
While BACWA indicated appreciation of the Antimicrobial Division's recognition in the Environmental Summary that nanosilver in treated fabrics may be discharged to wastewater treatment plants, BACWA requested that EPA evaluate all use patterns for potential environmental exposures. To illustrate how current uses may result in exposures in the aquatic and terrestrial environments, BACWA have enclosed a conceptual model that incorporates uses presented in the Environmental Summary, and a table describing how specific product use patterns can cause environmental exposures. BACWA listed specific use patterns of interest: • Fabric Treatments. EPA states that further environmental fate studies may be required of the registrant if studies show that nanosilver is released from fabric treatments. There is already evidence that fabrics treated with nanosilver release nanosilver as they are washed. EPA also states that nanosilver fabric treatments will not likely impact wastewater treatment operations due to the current low volume of use (Environmental Summary, p. 7). However, once registered, sales of nanosilver-treated clothing may grow without any further regulatory action or evaluation by EPA; therefore, greater volumes of nanosilver may be released to wastewater treatment facilities, posing increasing environmental concentrations. • Swimming Pools. Our concerns related to swimming pool uses are described in the enclosed letter to the EPA13 regarding the registration review for another pesticide used in swimming pools, polyhexamethylenebiguanide (PHMB).	The workplan is designed to obtain data and other information in order to conduct risk assessments of potential aquatic exposures through registered uses of nanosilver products. Data requirements include EPA's standard POTW-related tests and textile leaching and pool product environmental fate studies. The Environmental Summary primarily focused on fabric treatments because at the time it was written, there was only one product registered as nanosilver, which was used for fabric treatments. The Final Work Plan includes more products and more uses (e.g. pool uses) and so has expanded the focus of the data requirements and risk assessments accordingly. During registration review, all uses of all registered nanosilver products will be assessed. However, as with other pesticides, future nanosilver products will continue to be held to these same standards. Thus, if registrants wish to register new uses for their products, for example, the Agency will require data and other information consistent with that described in this final work plan to address the proposed uses.	**TBD**

• Materials Preservatives. EPA needs to account for releases of nanosilver during product use, such as from any frequently cleaned or washed items. • Dental Unit Water Line Cleaner. With regard to nanosilver used in dental unit water line cleaner, we believe EPA should evaluate both direct discharge of water line cleaners to the sanitary sewer as well as via a dental amalgam separator pretreatment unit. In the San Francisco Bay Area, many wastewater facilities require dental offices to use amalgam separators that pretreat wastewater to remove dental amalgam. Given that nanosilver may be more reactive than other forms of silver, it is important to ensure that nanosilver does not adversely impact the proper operation of amalgam separators, such as inadvertently releasing amalgam captured by the separator. • Hard Surface Disinfectant. Whenever any indoor surface is sanitized or disinfected, it is likely that it will eventually be rinsed, washed or wiped down in the near future, likely down an indoor drain that flows to a wastewater treatment facility. We ask EPA to closely all potential exposures from hard surface disinfectants, especially those formulations that are concentrated cleaning products requiring mixing with water, as mixing may result in spills of concentrated product down drains. In addition, leftover portions of cleaners are commonly poured down drains.		
Evaluate Potential Impacts to Wastewater Treatment Facilities: Given that all uses listed in the Summary Document may potentially discharge nanosilver to wastewater treatment plants, BACWA requested that EPA conduct a thorough evaluation of nanosilver's impacts on these facilities. Concerns include protecting water quality, process interference, and the need for a biosolids assessment.	EPA acknowledged that BACWA asked this question but did not directly answer this question. They instead provided this statement: "The Agency acknowledges receipt of the questions and supporting documents submitted by BACWA and agrees that they may be appropriately addressed through registration review data requirements as part of the risk assessment." EPA included its standard POTW-related data requirements, which would support most of the	**TBD**

	requested analyses. It is unclear if or how EPA might tackle biosolids questions.	
Evaluate Risks of Final Products: When reviewing products containing nanoscale pesticides, it is important for EPA to evaluate the environmental risks associated with the final product that is sold to the consumer, including any carrier material. For example, nanoscale pesticides are used in products like treated wood and fabrics that are not ordinarily labeled as pesticides. In some of these products, the nanoscale material is created during the treatment of the material.19 In addition, EPA should also evaluate the impacts of disposal of products treated with nanosilver, particularly products that consumers would not normally consider as hazardous, such as clothing, wipes, toilets, urinals, glassware, etc. California's hazardous waste standard for total silver content is 500 parts per million (ppm).	The planned assessment is intended to evaluate the risks of the specifically manufactured nanosilver particles as they are released from treated articles. Exposures from disposal of treated products is likely less than the maximum estimated exposures from direct use and thus such exposures are assessed as part of the broader assessment.	**TBD**
BACWA requested that EPA require the registrants to develop water, sediment, soil, wastewater, and biosolids methods for nanosilver with appropriate method detection limits and consider drawing from California Department of Pesticide Regulation's specifications for pesticide analysis method development.	Existing analytical instrumentation/techniques are being modified for nanosilver detection in the above sample matrices. (This is required for EPA to accept the various required environmental testing data). Most detection methods require a breakdown of the physical nanoparticle for quantitation. At the same time, not all detection methods are adequate for particle analysis. But, as research advances, as it has greatly in the past few years, more techniques will be either coupled or newly developed for nanosilver. Proposals and test protocols for non-standard test methods should be discussed with the Agency prior to being conducted.	**TBD**
Investigate Cumulative Impacts of Nanosilver Products with Silver Products: Toxicity related to nanosilver could be additive with other forms of silver pesticides, including silver nitrate, silver chloride, and colloidal and ionic silver. While nanosilver is likely to display different fate and effects characteristics than these forms of silver, silver does not degrade in the environment. To better understand whether nanosilver and other forms of silver pesticides could pose a cumulative impact, BACWA urged OPP to employ the Down-The-Drain model to quantify	The Agency concurs with the comment that toxicity related to nanosilver could be additive with other forms of silver pesticides.	**TBD**

potential environmental concentrations of both nanosilver and silver; where there is insufficient data for the Down-The-Drain module, we urge EPA to require this data from the registrant.		