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Ms. Michelle Arsenault
National Organic Standards Board
USDA-AMS-NOP
1400 Independence Ave. SW
Room 2648-S, Mail Stop 0268
Washington, DC 20250-0268

Re. CS: fixed coppers and copper sulfate

These comments to the National Organic Standards Board (NOSB) on its Spring 2015 agenda are submitted on behalf of Beyond Pesticides. Founded in 1981 as a national, grassroots, membership organization that represents community-based organizations and a range of people seeking to bridge the interests of consumers, farmers and farmworkers, Beyond Pesticides advances improved protections from pesticides and alternative pest management strategies that reduce or eliminate a reliance on pesticides. Our membership and network span the 50 states and groups around the world.

Current listings:

§205.601(i) As plant disease control.
(2) Coppers, fixed—copper hydroxide, copper oxide, copper oxychloride, includes products exempted from EPA tolerance, *Provided,* That, copper-based materials must be used in a manner that minimizes accumulation in the soil and shall not be used as herbicides.

§205.601(i) As plant disease control.
(3) Copper sulfate—Substance must be used in a manner that minimizes accumulation of copper in the soil.

Beyond Pesticides does not propose the delisting of coppers. These comments point out the need for careful review of specific use patterns, which requires information about how these products are actually used by organic growers.

Copper is viewed as an essential tool in organic agriculture by many who practice organic farming. Although there are many documented environmental and health impacts of copper products, the environmental impacts vary not only with use, but with soil type. There are many soils that are low in copper, and an increase that results from the pesticidal use of copper may be beneficial in those cases. However, compatibility with sustainable agriculture is a criterion for organic materials review, and European vineyards attest to the impacts of copper after 100 years of application.[1] Critics of organic production point to the allowed use of copper products as "proof" that organic methods are no less hazardous than nonorganic, chemical-intensive methods.[2]

Fungicides are among the most hazardous of all pesticides in terms of human toxicity. Many are carcinogenic. Copper-based fungicides are less hazardous than most, and organic farmers challenged by diseases often consider them essential. However, organic farmers who do rely on copper materials do so without a specific listing of the allowed uses, as is required by OFPA.[3] The NOSB is limited in its ability to evaluate the health and environmental impacts of copper, with its range of use patterns, or its essentiality, given specific needs and alternative practices or materials. Without a firm foundation for NOSB decisions, the National Organic Program (NOP) cannot ensure that uses of copper (i) meet the standards of OFPA in protecting the health of workers, consumers, and the ecosystem, and (ii) are based on data or information that supports claims of essentiality.

Copper products are toxic and persistent.

Copper compounds are toxic, and this particularly poses risks to workers. Toxicity is described in the 2001 TAP lines 144-191,

> Acute toxicity: The oral LD50 of copper is 472 mg/kg in rats. Copper sulfate is caustic and acute toxicity is largely due to this property. The lowest dose of copper sulfate that has been toxic when ingested by humans is 11 mg/kg. Ingestion of copper sulfate is often not toxic because vomiting is automatically triggered by its irritating effect on the gastrointestinal tract. Symptoms are severe, however, if copper sulfate is retained in the stomach, as in the unconscious victim. … Copper sulfate can be corrosive to the skin and eyes. It is readily absorbed through the skin and can produce a burning pain, as well as the other symptoms of poisoning resulting from ingestion. Examination of copper sulfate-poisoned animals showed signs of acute toxicity in the spleen, liver, and kidneys. Injury may also occur to the brain, liver, kidneys, and gastrointestinal tract in response

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[1] 2011 Copper Sulfate and Other Copper Products Technical Review, lines 535-537. "Vineyard soils in Europe, which have seen intensive use of copper sulfate containing Bordeaux mixtures for 100 years, have concentrations ranging from 100-1,500 mg/kg in soil (Besnard et al., 2001)."

[2] See, for example: Christie Wilcox, 2011. Mythbusting 101: Organic Farming > Conventional Agriculture. http://blogs.scientificamerican.com/science-sushi/2011/07/18/mythbusting-101-organic-farming-conventional-agriculture/.
Steve Savage. An Unlikely Pair: "Heavy Metal" and "Organic Produce" http://redgreenandblue.org/2010/09/27/an-unlikely-pair-heavy-metal-and-organic-produce/.
David Derbyshire, 2008. "Thousands of tons of organic food produced using toxic chemicals," http://www.dailymail.co.uk/news/article-505427/Thousands-tons-organic-food-produced-using-toxic-chemicals.html
Rob Johnston, 2008. "The great organic myths: Why organic foods are an indulgence the world can't afford" http://www.independent.co.uk/environment/green-living/the-great-organic-myths-why-organic-foods-are-an-indulgence-the-world-cant-afford-818585.html.
Fox News, 2008. "Organic Food Offers Little More Than Peace of Mind, Critics Say," http://www.foxnews.com/story/2008/10/04/organic-food-offers-little-more-than-peace-mind-critics-sa-346245969/
In its publication "Criticisms and Frequent Misconceptions about Organic Agriculture: The Counter-Arguments," IFOAM (International Federation of Organic Agriculture Movements), includes "Misconception Number 7: Organic farming uses pesticides that damage the environment: natural pesticides are more dangerous than conventional pesticides because they are less efficient and therefore require the application of huge quantities. This is also true for fungicide (e.g., organic grape producers contaminate the soils with large quantities of copper because they are not allowed to use modern fungicides). In addition, some organic pesticides are as poisonous as synthetic ones (e.g., nicotine and pyrethrum)." http://infohub.ifoam.org/sites/default/files/page/files/misconceptions_compiled.pdf.

[3] OFPA §6517(b) The list established under subsection (a) of this section shall contain an itemization, by specific use or application, of each synthetic substance permitted under subsection (c)(1) of this section or each natural substance prohibited under subsection (c)(2) of this section.

to overexposure to this material. Some of the signs of poisoning that occurred after 1-12 g of copper sulfate was swallowed include: a metallic taste in the mouth, burning pain in the chest and abdomen, intense nausea, repeated vomiting, diarrhea, headache, sweating, shock, and discontinued urination leading to yellowing of the skin. Injury to the brain, liver, kidneys, stomach, and intestinal linings may also occur in copper sulfate poisoning. It is readily absorbed through the skin and will give the above symptoms. Contact with skin causes burns and also acts as a sensitizer. Later exposure can cause allergic reactions (Kamrin 1997; Extoxnet).

Chronic toxicity: Vineyard sprayers experienced liver disease after 3 to 15 years of exposure to copper sulfate solution in Bordeaux mixture. Long-term effects are more likely in individuals with Wilson's disease, a condition that causes excessive absorption and storage of copper. Chronic exposure to low levels of copper can lead to anemia. The growth of rats was retarded when given dietary doses of 25 mg/kg/day of copper sulfate. Dietary doses of 200 mg/kg/day caused starvation and death. Sheep given oral doses of 20 mg/kg/day showed blood cell and kidney damage. They also showed an absence of appetite, anemia, and degenerative changes.

Reproductive effects: Copper sulfate has been shown to cause reproductive effects in test animals. Reproduction and fertility was affected in pregnant rats given this material on day 3 of pregnancy.

Teratogenic effects: There is very limited evidence about the teratogenic effects of copper sulfate; unlikely to be teratogenic in humans at expected exposure levels.

Mutagenic effects: Copper sulfate may cause mutagenic effects at high doses. At 400 and 1000 ppm, copper sulfate caused mutations in two types of microorganisms. Such effects are not expected in humans under normal conditions.

Considered an experimental equivocal tumorigenic agent (NTP, 2001). It has systemic and gastrointestinal effects in humans. HIGH via intraperitoneal route. MODERATE via oral and inhalation routes.

Carcinogenic effects: Copper sulfate at 10 mg/kg/day caused endocrine tumors in chickens given the material parenterally, that is, outside of the gastrointestinal tract through an intravenous or intramuscular injection. However, the relevance of these results to mammals, including humans, is not known (Extoxnet 1996).

Organ toxicity: Long-term animal studies indicate that the testes and endocrine glands have been affected.

Fate in humans and animals: Absorption of copper sulfate into the blood occurs primarily under the acidic conditions of the stomach. The mucous membrane lining of the intestines acts as a barrier to absorption of ingested copper. After ingestion, more than 99% of copper is excreted in the feces. However, residual copper is an essential trace element that is strongly bioaccumulated. It is stored primarily in the liver, brain, heart, kidney, and muscles.

Persistence is described in the 2001 TAP lines 210-220,

> Environmental Fate: Breakdown in soil and groundwater: Since copper is an element it will persist indefinitely. Copper is bound, or adsorbed, to organic materials, and to clay and mineral surfaces. The degree of adsorption to soils depends on the acidity or alkalinity of the soil. Because copper sulfate is highly water soluble, it is considered one of the more mobile metals in soils. However, because of its binding capacity, its leaching potential is low in all but sandy soils. When applied with irrigation water, copper sulfate does not accumulate in the surrounding soils. Some (60%) is deposited in the sediments at the bottom of the irrigation ditch, where it becomes adsorbed to clay, mineral, and organic particles. Copper compounds also settle out of solution. (Kamrin, 1997)
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> Breakdown in water: As an element, copper can persist indefinitely. However, it will bind to water particulates and sediment (Extoxnet, 1996).

The 2011 TR lines 512-537 says,

> Copper is a metal that has a potential to build up and decrease the productivity, filtering capacity, and buffering capacity of soil (Andreu and Gimeno-Garcia, 1999). This may be more of a concern in fragile ecosystems such as marsh or wetlands than rice crops. When metals such as copper are applied to the soil they may: (a) remain in soil solution and run off in drainage water, (b) be taken up by plants, or (c) be retained by soil in soluble or insoluble forms. In a system that is seasonally wet and dry, there is continuous change in the availability of metals due to cycles of aerobic and anaerobic conditions affecting the soil redox potential. This may make such soils more vulnerable to enhanced solubility and toxicity of metals (Andreu and Gimeno-Garcia, 1999). Of the metals, copper is relatively more mobile (extractable) than cadmium, lead, zinc, nickel, or cobalt, but even so is retained in the soil for very long time periods. In a study that sampled the same site over a five-year period in a rice growing region of Spain, it was found that copper does, however, gradually decrease over time, unlike cadmium that has shown a tendency to increase (Andreu and Gimeno-Garcia, 1999). Copper is found in the upper levels of the soil profile, and decreases with depth.
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> Factors Affecting Copper in Soil
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> Copper in a specific location greatly depends on the bedrock composition, weathering extent, and agricultural operations (crop rotation, fertilizer application, pesticide application, irrigation, crop harvest, etc). Copper levels in soils studied in Italy were found to be closely correlated to agricultural use (Facchinelli et al., 2000). An application of 10 lb A-1 of copper sulfate pentahydrate, which is 25% copper as the active ingredient, would add 2.5 lb A-1 of copper (Besnard et al., 2001; Gimeno-Garcia et al., 1996). Grape producers may apply 3-10 application per year of Bordeaux mix. Vineyard soils in Europe, which have seen intensive use of copper sulfate containing Bordeaux mixtures for 100 years, have concentrations ranging from 100-1,500 mg/kg in soil (Besnard et al., 2001).

Copper products create environmental hazards in both use and manufacture.

The 2001 TAP lines 238-240 says,

> Copper mining and refining cause pollution through runoff from spoils and emissions associated from acid rain. Production of copper sulfate recycles water used in the crystallization vats and wastewater is limited to some sludge form the softening process plus boiler blowdown (Sittig, 1980).

Reviewer #1 in the 2001 TAP lines 376-379 said, "From 1987 to 1993, about 450 million pounds of copper were released to the environment in the U.S., mainly through copper smelting operations. About 1.5 million pounds were released into water from various industrial operations (EPA, 2001). So it looks like the probability of environmental contamination from copper mining and smelting is high."

And at lines 222-230 the 2001 TAP says,

> One of the limiting factors in the use of copper compounds is their serious potential for phytotoxicity. Copper sulfate can kill plants by disrupting photosynthesis. Blue-green algae in some copper sulfate treated Minnesota lakes became increasingly resistant to the algacide after 26 years of use (Extoxnet, Kamrin, 1997). Copper is more available for plant uptake from soil when soil is acidic. Toxic plant levels could be reached at soil levels of 25-140 ppm in acidic mineral soils. It is less available in soils rich in organic matter. Levels in soil with high organic matter could reach 1000 ppm before phytotoxicity would occur (Erich 1994). In Europe, general cropland has 5- 30 mg/kg soil, and vineyards in Europe 100 to 1500 mg Cu/kg soil (Besnard 1). Each addition of 10 lbs/acre of copper sulfate could increase the concentration in the top 2 inches of soil by 6 mg/kg or 6 ppm.

The 2011 TR lines 606-612 says,

> The event of fish kills in New York was reported by Preddice (2009) in the New York State Department of Environmental Conservation. The event occurred in the Hoosic River of Rensselaer County, New York, in 2001. Over one million of fish were killed by acidic copper sulfate solution. Details were not given in the report. According to a local newspaper, about 2,000 gallons of acidic copper sulfate, used to electroplate circuit boards, was accidentally spilled from a storage building at the Oak-Mitsui plant into the Hoosic River before 3:30 am, June 28, 2001. A seven-mile stretch of the river was contaminated. Most of the aquatic life, including brown and rainbow trout, was killed (Albany Times Union, 2001).

And lines 620-621, "A 23-page review on the effect of copper on freshwater food chains and salmon was given by Woody (2007)."[4]

In 2011, the NOSB recommendation emphasized the requirement to minimize soil accumulation, coming close to requiring frequent testing, "Good management practices require close monitoring to ensure that there is no accumulation in the soil."

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[4] Woody CA. 2007. Copper – Effects on freshwater food chains and salmon: A review. Fisheries Research and Consulting. http://www.fish4thefuture.com/pdfs/Woody_Copper_Effects_to_Fish%20-%20FINAL2007.pdf

Copper products are hazardous to humans, particularly workers.
As documented by the quotations from the TAP and TR above, copper causes a wide range of toxicological effects. The 2001 TAP line 243 says, "Direct hazards to applicators are the major concern." In 2011, the NOSB demonstrated concern over worker protection by including language in the narrative portion of the recommendation:

> The Committee will work with the National Organic Program to advance guidance that ensures that organic operations are strictly meeting, and to the extent possible, exceeding the standards established by the product label in meeting principles of sustainability and a sustainable work environment for all those who work in organic production.

This never happened. Since the NOP has not taken action to advance such guidance and has taken action to limit NOSB workplans to the consideration of petitions for and reviews of National List materials, we ask that the NOSB recommend the inclusion of language protecting workers in the listings for copper products. According to EPA, "The WPS (Worker Protection Standard) requires that owners and employers on agricultural establishments provide protections to workers and handlers from potential pesticide exposure, train them about pesticide safety, and provide mitigations in case exposures may occur." Since copper products may be the most hazardous materials for workers used in organic production, this is an appropriate place to stress the importance of appropriate Personal Protective Equipment and compliance with EPA's Worker Protection Standard. We suggest this worker protection annotation, "Steps to meet worker protection standards must be documented in the Organic System Plan."

Copper products cannot be properly evaluated without enumerating their uses.
OFPA §6517(b) says, "The list established under subsection (a) of this section shall contain an itemization, by specific use or application, of each synthetic substance permitted under subsection (c)(1) of this section or each natural substance prohibited under subsection (c)(2) of this section." Copper products provide a perfect example of why OFPA requires this itemized list. It is not so much that any one use fails OFPA criteria, but that the sum of all uses may. In order to be able to ensure that the use of copper materials in organic production is limited to that which is necessary and does not harm humans or the environment –and to reassure the public of those facts—the NOSB must solicit input on uses of copper products in organic production and annotate the listings.

Conclusion
The NOSB must not let another sunset review of copper materials slip by without taking steps to comply with §6517(b). It must start by requesting a technical review to enumerate and evaluate needs for copper materials in organic production. Since past actions by the NOSB have not been effective in initiating NOP action, we ask the board to attach an expiration date to the listings for fixed coppers and copper sulfate. The NOP's sunset policy does not allow such a change to be made as part of the sunset process. Therefore, the NOSB must make this and later changes through a two-stage process of removing the listing and creating a new listing. The USDA Office of General Counsel has previously ruled that a petition is not necessary for this

process. In fact, the first National List did not arise based on petitions.[5] The NOSB and those reliant on copper should note that the process we are recommending is just that –a process. It is critical for organic integrity and public trust in organic production methods to follow the law, past Board reviews and requests for action and follow-through, and create a full public record that ensures the public that all materials are subject to full and thorough review. This is what distinguishes organic from chemical-intensive practices.

Thank you for your consideration of these comments.

Sincerely,

Terry Shistar, Ph.D.
Board of Directors

[5] The November 2009 NOSB recommendation on chlorhexidine said, "In terms of the board recommending a substance to be added to the national list without a petition, (An OGC person sees) nothing in the OFPA or NOP regulations that would prohibit such action. (Another OGC person) agrees as well, and indicated that he believes the original NL was created by the board without any petitions. In either event, it would seem like the board's primary function is to make recommendations concerning the NL (to add, remove, renew, etc.) and that petitions are just one mechanism through which the board can make such recommendations."
http://www.ams.usda.gov/AMSv1.0/getfile?dDocName=STELPRDC5081492&acct=nosb