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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

Docket ID # AMS-NOP-19-0038

Re. CS: Potassium hypochlorite

These comments to the National Organic Standards Board (NOSB) on its Fall 2019 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 the world.

Please deny the petition for potassium hypochlorite for use in organic crop production. It does not meet any of the criteria in the Organic Foods Production Act (OFPA). In addition, we ask that the NOSB not approve more sanitizers or disinfectants until it has performed a comprehensive review that identifies the needs for these materials in organic production.

The petitioner makes comments, repeated by the Crops Subcommittee (CS), that argue against the approval of the material:

- "KOCl is a synthetic, liquid concentrate with virtually identical properties to NaOCl."
- "Potassium Hypochlorite is essentially the same as the existing chlorine chemistries, specifically Sodium hypochlorite (NaOCl)."
- "This product is diverse as it addresses; the needs of the farmer for maintenance of their irrigation equipment, the requirements of FSMA to provides sanitation to pre-harvest irrigation water and the nutritional needs of the plant as potassium is necessary for optimal crop growth and vigor."
- "The material can also incidentally provide a source of potassium for plants."

Since potassium hypochlorite has essentially the same properties as sodium and calcium hypochlorites, which are currently on the National List, there is no need for it. Existing chlorine chemistries cause negative health and environmental effects, so dependence on them should

not be increased. If potassium hypochlorite is a significant source of potassium for plants, it should not be allowed, since it is a synthetic nutrient. The petitioner and the CS both drop mention of calcium hypochlorite when mentioning problems with sodium.

OFPA criteria are addressed in greater detail below.

Potassium hypochlorite poses environmental and health hazards.

The petitioner states, "Potassium Hypochlorite is essentially the same as the existing chlorine chemistries, specifically Sodium hypochlorite (NaOCl)." We address the implications of this statement for the essentiality criterion below. Here we address the environmental and health effects of substances with this chlorine chemistry.

Chlorine chemistry

Chlorine is the second most reactive element (after fluorine) in the halogen series. Halogens bond with hydrogen to form acids, are typically produced from minerals or salts, and are generally toxic. The middle halogens –chlorine, bromine, and iodine—are often used as disinfectants.[1]

Chlorine is a strong oxidizer and hence does not occur naturally in its pure (gaseous) form. Nearly all naturally occurring chlorine occurs as chloride, the ionic form found in salts such as sodium chloride. Gaseous chlorine is formed by running an electric current through salt brine.[2]

The high oxidizing potential of chlorine leads to its use for bleaching, biocides, and as a chemical reagent in manufacturing processes. Because of its reactivity, chlorine and many of its compounds bind with organic matter. In the case of bleaches, the reaction with chlorine destroys chemicals responsible for color. When used as a disinfectant, chlorine reacts with microorganisms and other organic matter. Similarly, the toxicity of chlorine to other organisms comes from its power to oxidize cells.[3]

Organic production should avoid the use of chlorine as much as possible.

Chloride, the ionic form of chlorine, occurs naturally and is necessary for life. Synthetic chlorine compounds may be inert—in which case the chlorine is responsible for a lack of biodegradability—or toxic. Chlorinated organic compounds include pesticides ranging from DDT to 2,4-D, as well as contaminants like dioxins. Chlorine gas was the first poison gas used in warfare. The largest use of chlorine is in the manufacture of polyvinyl chloride (PVC).[4]

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[1] http://www.scienceclarified.com/Ga-He/Halogens.html; http://chemwiki.ucdavis.edu/Inorganic_Chemistry/Descriptive_Chemistry/Elements_Organized_by_Block/2_p-Block_Elements/Group_17%3A_The_Halogens/1Group_17%3A_General_Properties.

[2] The Chemistry of the Halogens. http://chemed.chem.purdue.edu/genchem/topicreview/bp/ch10/group7.php.

[3] http://www.merckvetmanual.com/mvm/pharmacology/antiseptics_and_disinfectants/oxidizing_agents.html.

[4] ATSDR, Toxicological Profile for Chlorine. http://www.atsdr.cdc.gov/toxprofiles/tp172.pdf.

Chlorine gas reacts with water to produce hydrochloric acid (HCl), hypochlorous acid (HOCl), and hypochlorite (OCl^-). When hypochlorous acid reacts with ammonia, it forms chloramines, which are reactive enough to be used as disinfectants, but are more stable than hypochlorous acid and hypochlorite.

Another series of reactions creates chlorine dioxide, an extremely toxic and potentially explosive gas that dissolves in water, rather than reacting with it. Sodium chlorate is produced by electrolysis of hot salt water. Chlorine dioxide is produced by reacting sodium chlorate with a suitable reducing agent in a strongly acidic solution. Sodium chlorite may be produced from the chlorine dioxide solution under alkaline conditions using hydrogen peroxide. Acidifying the sodium chlorite solution produces chlorine dioxide for disinfection.

In addition to the purposeful production of toxic chlorine compounds, the manufacture and use of chlorine compounds results in the unintended production of other toxic chemicals. Disinfection with chlorine, hypochlorite, or chloramines results in the formation of carcinogenic trihalomethanes, haloacetic acids, and other toxic byproducts.[5] Disinfection with chlorine dioxide produces undesirable inorganic byproducts, chlorite and chlorate. Industrial production of chlorine compounds, use of chlorine bleach in paper production, and burning of chlorine compounds releases dioxins and other persistent toxic chemicals into the environment.[6]

The essential difference, then, is between chloride compounds and the toxic products and by-products of the chlorine chemical industry. Almost all of the former are naturally-occurring materials that do not share the characteristics of toxicity and undesired persistence of the latter. The fact that use of chlorine —as opposed to chloride— is so universally associated with the production of persistent toxic chemicals has led some environmental groups to seek a ban on chlorine-based chemicals. We believe that organic production should, for the same reasons, avoid the use of chlorine as much as possible. The allowance of chlorine in the rule reflects the fact that many organic growers —like most of the rest of us— depend on water sources that have been treated with chlorine. We do not believe that organic producers should have to filter chlorine out of the tap water they use for irrigating, cleaning equipment, washing vegetables, or cleaning food-contact surfaces. However, irrigation with chlorinated water may be harmful to crop plants.[7] But they should not be adding more chlorine. Organic production and handling should be, to the extent possible, chlorine-free.[8]

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[5] Alexander G. Schauss, 1996. Chloride – Chlorine, What's the difference? P. 4. http://www.mineralresourcesint.com/docs/research/chlorine-chloride.pdf.

[6] ATSDR, 1998. Toxicological Profile for Chlorinated Dibenzo-p-Dioxins. Pp. 369 ff. http://www.atsdr.cdc.gov/toxprofiles/tp104.pdf.

[7] Lonigro, A., Montemurro, N. and Laera, G., 2017. Effects of residual disinfectant on soil and lettuce crop irrigated with chlorinated water. *Science of the Total Environment*, *584*, pp.595-602.

[8] The Organic Foods Production Act, §6518(m), lists three criteria that directly pertain to chlorine: (1) the potential of such substances for detrimental chemical interactions with other materials used in organic farming systems; (2) the toxicity and mode of action of the substance and of its breakdown products or any contaminants, and their persistence and areas of concentration in the environment; (3) the probability of environmental contamination during manufacture, use, misuse or disposal of such substance.

Potassium hypochlorite poses adverse impacts on human health.

Toxic Release Inventory data includes 5.7 million pounds of chlorine per year released by facilities making and using chlorine.[9] Hypochlorous acid and hypochlorite ions are highly toxic and corrosive, and EPA has placed them in Toxicity Category I (indicating the highest degree of acute toxicity) for oral, dermal, eye, and inhalation effects. When mixed with organic materials (e.g., dirt), hypochlorite produces trihalomethanes (THMs), which are carcinogenic. Hypochlorites are severe respiratory and eye irritants.[10] The CS states, "Bleach is a known asthmagen, and, given the similar chemistries and mechanism of action, KOCL is also likely to cause or exacerbate asthma."

Potassium hypochlorite poses adverse environmental impacts.

Potassium hypochlorite is highly toxic to fish and invertebrates.[11] When mixed with organic materials (e.g., dirt), hypochlorite produces trihalomethanes (THMs), which are carcinogenic, cytotoxic, and genotoxic.[12] It can kill beneficial microorganisms in the soil.[13] Irrigation with chlorinated water may be harmful to crop plants.[14]

Potassium hypochlorite is not essential in organic crop production.

As stated by both the petitioner and the CS, there are two materials—sodium hypochlorite and calcium hypochlorite—already on the National List that can perform the same functions as potassium hypochlorite. While the build-up of sodium in the soil may be a reason to avoid the use of sodium hypochlorite, it is not a reason to avoid calcium hypochlorite. The availability of potassium as a synthetic crop nutrient from this material is not a justification allowed under OFPA. Potassium is a macronutrient that should be supplied by natural sources.

In addition, the 2011 Chlorine TR mentions a number of available alternative practices and materials. These include steam sterilization, UV radiation, combining UV light with oxidants;[15] as well as hydrogen peroxide, ozone, electrolyzed water, alcohols, copper sulfate, peracetic acid.[16]

Potassium hypochlorite is incompatible with organic production.

In the CS review of potassium hypochlorite, the subcommittee responds to the question, "Is the substance used in production, and does it contain an active synthetic ingredient in the following categories: [§ 6517(c)(1)(B)(i)]; copper and sulfur compounds; toxins derived from bacteria; pheromones, soaps, horticultural oils, fish emulsions, treated seed,

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[9] ATSDR Tox Profile for Chlorine, p. 162.
[10] 2011 Chlorine TR lines 395-471.
[11] 2011 Chlorine TR lines 270-271.
[12] 2011 Chlorine TR lines 278-279. Toxnet: Chloroform. https://toxnet.nlm.nih.gov/cgi-bin/sis/search/a?dbs+hsdb:@term+@DOCNO+56.
[13] 2011 Chlorine TR lines 389-390.
[14] Lonigro, A., Montemurro, N. and Laera, G., 2017. Effects of residual disinfectant on soil and lettuce crop irrigated with chlorinated water. *Science of the Total Environment*, *584*, pp.595-602.
[15] TR lines 611-628.
[16] TR lines 535-606.

vitamins and minerals; livestock parasiticides and medicines and production aids including netting, tree wraps and seals, insect traps, sticky barriers, row covers, and equipment cleansers; or (ii) is used in production and contains synthetic inert ingredients that are not classified by the Administrator of the U.S. Environmental Protection Agency as inerts of toxicological concern?" with the simple response, "No." Therefore, the CS has judged that potassium hypochlorite is not eligible for inclusion on the National List.

Conclusion

As shown above, potassium hypochlorite does not meet any of the OFPA criteria for inclusion on the National List. In addition, we ask that the NOSB not recommend any additional sanitizers, disinfectants, or cleansers to the National List until it has performed a comprehensive review that identifies the needs for such materials in organic production.

Thank you for your consideration of these comments.

Sincerely,

Terry Shistar, Ph.D.
Board of Directors