Formal Recommendation
From: The National Organic Standards Board (NOSB)
To: The National Organic Program (NOP)

Date: November 27, 2022

Subject: 2024 Sunset Reviews - Crops

NOSB Chair: Nate Powell-Palm

The NOSB hereby recommends to the NOP the following:

Rulemaking Action: X

The NOSB recommends the following sunset substances be renewed:

§205.601 Sunsets: Synthetic substances allowed for use in organic crop production:

- Herbicides, soap-based
- Biodegradable biobased mulch film
- Boric acid
- Sticky traps/barriers
- Elemental sulfur
- Coppers, fixed
- Copper sulfate
- Polyoxin D zinc salt
- Humic acids
- Micronutrients:
    - Soluble boron products
    - Sulfates, carbonates, oxides, or silicates of zinc, copper, iron, manganese, molybdenum, selenium, and cobalt
- Vitamins C E
- Squid byproducts

§205.602 Sunsets: Nonsynthetic substances prohibited for use in organic crop production:

- Lead salts
- Tobacco dust (nicotine sulfate)

NOSB Vote: See below for votes and rationale supporting each recommendation

Herbicides, soap-based

Reference: §205.601(b) As herbicides, weed barriers, as applicable.
(1) Herbicides, soap-based—for use in farmstead maintenance (roadways, ditches, right of ways, building perimeters) and ornamental crops.
Technical Report: 1996 TAP; 2015 TR
Petition: N/A
Past NOSB Actions: Actions: 1996 recommendation; 11/2005 sunset recommendation; 10/2010 sunset recommendation; 10/2015 sunset recommendation; 11/2017 sunset recommendation.
Recent Regulatory Background: Sunset renewal notice effective 3/15/2017 (82 FR 14420). Sunset renewal notice effective 10/30/2019 (84 FR 53577)
Sunset date: 10/30/2024

Subcommittee Review

Use
As herbicides, soap-based herbicides are used as weed barriers, for use in farmstead maintenance (roadways, ditches, right of ways, building perimeters) and ornamental crops as a last resort.

Manufacture
Soap-based herbicides are potassium salts of fatty acids and are produced through saponification, where aqueous potassium hydroxide is added to fatty acids commonly found in animal fats and plant oils. Ammonium salts of fatty acids, such as ammonium nonanoate, are produced through room temperature reaction of aqueous ammonia or ammonium hydroxide with fatty acids.

International Acceptance
Canadian General Standards Board Permitted Substances List
The Canadian Organic Production Systems Permitted Substances List provides several use patterns for soaps in organic crop and livestock production, as well as organic processing

European Economic Community (EEC) Council Regulation, EC No. 834/2007 and 889/2008
European organic regulations allow the use of soap salts in crop and livestock production as insecticides and disinfecting agents but are not mentioned for use as herbicides.

CODEX Alimentarius Commission, Guidelines for the Production, Processing, Labelling and Marketing of Organically Produced Foods (CXG 32-1999)
The use of soaps in organic productions is an allowed synthetic substance for plant pest and disease control but no mention of specific use as an herbicide.

International Federation of Organic Agriculture Movements (IFOAM) Norms
A number of uses of soaps are listed for organic crop production and disinfection but no mention of specific use as an herbicide.

Japan Agricultural Standard (JAS) for Organic Production
Soaps can be used for control of pests in organic crop production. No mention of specific use as an herbicide.

Environmental Issues
Potassium and sodium salts of fatty acids decompose rapidly and do not persist in the environment. They need to be sprayed directly on the target plant and thus, environmental contamination is not expected. Studies have not shown any negative interactions with other chemicals used for organic farming.

Discussion
In 2017, the NOSB received several comments in favor of keeping soap-based herbicides on the National List. Comments indicated that although soap-based herbicides are sometimes only marginally effective, they are a safe alternative, and some farmers rely on them for weed control on farmsteads, roadways, and other places they are approved for use. In the Spring 2020 NOSB meeting again there were no comments in favor of removing soap-based herbicides. The subcommittee discussed soap-based herbicides and considers them to be benign to the environment and human health.

Questions to our Stakeholders
None

NOSB Review
The majority of the public comments were in favor of relisting soap-based herbicides because they can be useful in some situations are relatively benign in the environment.

Justification for Vote
The NOSB finds herbicides, soap-based compliant with the Organic Foods Production Act (OFPA) and/or 7 CFR 205.600(b) and is not proposing removal.

NOSB Vote
Motion to remove herbicides, soap-based from the National List
Motion by: Rick Greenwood
Seconded by: Jerry D'Amore
Yes: 1 No: 14 Abstain: 0 Recuse: 0 Absent: 0

Motion failed

Biodegradable biobased mulch film

Reference: §205.601(b) As herbicides, weed barriers, as applicable. (2) Mulches.
(iii) Biodegradable biobased mulch film as defined in §205.2. Must be produced without organisms or feedstock derived from excluded methods.
Technical Report: 2012 TR; 2015 Report; NOP Policy Memorandum 15-1; 2016 Supplemental TR.
Petition: 2012.
Past NOSB Actions: Actions: 10/2012 recommendation; 11/2017 sunset recommendation; 2021 annotation change
Recent Regulatory Background: Sunset renewal notice effective 3/15/2017 (82 FR 14420). Sunset renewal notice effective 10/30/2019 (84 FR 53577)
Sunset date: 10/30/2024

Subcommittee Review

Use
Biodegradable biobased mulch film (BBMF) is used to suppress weeds, conserve water, and facilitate production of row crops. Some commenters have noted that having a degradable plastic mulch is likely to be more environmentally friendly than using landfills for the non-degradable plastic mulches. The requirement for 100% biobased feedstocks to manufacture the film is articulated in the preamble of the final rule that added BBMF to the National List. Past commenters have acknowledged that there are currently very few options (other than difficult to use paper mulch) for 100% BBMF but have generally felt this listing should remain

despite the fact that no 100% BBMF is available (see below). At the Fall 2021 NOSB meeting, the Board voted to allow 80% BBMF.

As noted in numerous public comments on past documents relating to BBMF, the current listing allowing the use of these films is impractical. No biobased films meet the 100% annotation and are unlikely to meet this criterion in the near future. There is also broad consensus among the Board and stakeholders that the use of allowed polyethylene mulch has serious negative environmental impacts. After input from stakeholders on the practicality and environmental impacts from biodegradable mulch, the Board passed a proposal modifying the annotation for BBMF. While there are no currently available products that meet the modified criteria, commenters noted that it is possible that materials meeting the proposed annotation could be available in the near future. The use of BBMF that meets this proposed annotation would alleviate the environmental impact of disposal of non-recyclable polyethylene mulch. The proposed language, "When greater than 80% biodegradable biobased mulch films become commercially available, producers are required to use them, given that they are of the appropriate quality, quantity, and form", also reflects the Board's intent to ensure that farmers must use BBMF with biobased content greater than 80% when these materials become commercially available.

The timing of this sunset review predates the rulemaking process to implement the annotation allowing 80% BBMF. at §205.601(b) As herbicides, weed barriers, as applicable. (2) Mulches. (iii) Biodegradable biobased mulch film as defined in §205.2. Must be produced without organisms or feedstock derived from excluded methods until the annotations is implemented.

Manufacture
BBMF is a synthetic plastic material manufactured from polymers using plant-based carbon sources.

International Acceptance
Canadian General Standards Board Permitted Substances List
Plastic mulches: non-biodegradable and semi-biodegradable materials shall not be incorporated into the soil or left in the field to decompose. Use of polyvinyl chloride as plastic mulch or row cover is prohibited. Biodegradable mulches: 100% of biodegradable mulch films shall be derived from bio-based sources. Biodegradable polymers and Carbon Black from GE or petroleum sources are not permitted.

European Economic Community (EEC) Council Regulation, EC No. 834/2007 and 889/2008
Mulches are not specifically addressed in EEC. Under plant protection it states that all plant production techniques used shall prevent or minimize any contribution to the contamination of the environment.

CODEX Alimentarius Commission, Guidelines for the Production, Processing, Labelling and Marketing of Organically Produced Foods (CXG 32-1999)
No reference in CODEX on biodegradable mulch.

International Federation of Organic Agriculture Movements (IFOAM) Norms
Under section 4.5.1, mulches are permitted as a pest management practice under and 4.5.2 references appendix 3 as an approved list including "mulch" as a barrier. 4.6.3 states "for synthetic structure coverings, mulches, fleeces, insect netting and silage wrapping, only products based on polyethylene and polypropylene, or other polycarbonates are permitted. These shall be removed from the soil after use and shall not be burned on the farmland."

Japan Agricultural Standard (JAS) for Organic Production

Mulches are permitted for the control of noxious animals and plants in fields or cultivation sites. Mulches derived from used papers (those without chemically synthesized materials added in production) or plastic mulches (those intended to be removed after use). There is no listing of biodegradable mulches.

Environmental Issues

Concerns about BBMF have been discussed extensively in prior documents, including discussion documents, reports, and proposals for an annotation change. Concerns have been raised about incomplete degradation and migration of partially decomposed particles into the environment.

Discussion

There have been numerous public comments requesting the NOSB work with the NOP to allow a BBMF that contains unique polymers. Some noted that having a degradable plastic mulch is likely more environmentally friendly than disposing of non-degradable mulches in landfills. Previous commenters also acknowledged that there currently are no alternatives (other than difficult-to-use paper mulch) to 100% BBMF but felt the listing should remain despite the fact that 100% BBMF is not available. As noted above, at the Fall 2021 NOSB meeting, the Board voted on a recommendation to allow 80% BBMF. Subsequently, in 2022, during Subcommittee review for the sunset, there was hesitation by both the NOSB and stakeholders for relisting biodegradable mulch. Ongoing discussions include the degradation of BBMF and its unknown effects on soil health, comparisons of biodegradable mulches and bags, stickers, and other “biodegradable” products; estimates of polyethylene (PE) mulch residue; and concerns about phthalate residues.

Questions to our Stakeholders

1. At the Spring 2022 meeting the Crops Subcommittee asked about availability of 100% biodegradable biobased mulches. Commenters did not present any new information. Has there been any new development since then?
2. Mulches are critical to many organic farming operations; are those operations eager for biodegradable options?
3. How much residue is typically remaining after attempting to remove the standard polyethylene (PE) mulch?
4. If any producer has experience with trials of biodegradable mulches, please share.

NOSB Review

Plastic mulches have been identified as a critical material category for many organic producers. The quest for an appropriate alternative has proven difficult, and stakeholders and NOSB members have conflicting opinions. The Subcommittee would like further information on the decomposition products of BBMF, including micro-plastics, and whether they are harmful to soil microorganisms. There is not a BBMF product on the market and the proposition of delisting now, waiting for a developed product and filing a petition was discussed. After other thorough discussions, the board voted narrowly to relist BBMF to the national list.

Justification for Vote

The Subcommittee vote was mixed. Four members voted to remove BBMF from the National List, two voted to not remove it, and one member abstained. While the substance's manufacture, use, and disposal may have minimal impact on the environment and are done in a manner compatible with organic handling, under OFPA SEC. 2109. [7 U.S.C. 6508] Prohibited crop production practices and materials; (c) CROP MANAGEMENT - For a farm to be certified under this title, producers on farms shall not- (2), “use plastic mulches unless such mulches are removed at the end of each growing or harvest season.” Complete removal of these materials has proven to be challenging and has organic producers searching for alternatives.

NOSB Vote
Motion to remove biodegradable biobased mulch film (BBMF) from the National List
Motion by: Logan Petrey
Seconded by: Rick Greenwood
Yes: 9 No: 6 Abstain: 0 Recuse: 0 Absent: 0

Motion failed

Boric acid

Reference: §205.601(e) As insecticides (including acaricides or mite control).
(3) Boric acid - structural pest control, no direct contact with organic food or crops.
Technical Report: 1995 TAP.
Petition: N/A
Past NOSB Actions: 04/1995 minutes and vote; 11/2005 sunset recommendation; 10/2010 sunset recommendation; 10/2015 sunset recommendation; 11/2017 sunset recommendation.
Recent Regulatory Background: Sunset renewal notice effective 3/15/2017 (82 FR 14420). Sunset renewal notice effective 10/30/2019 (84 FR 53577)
Sunset date: 10/30/2024

Subcommittee Review

Use
As an insecticide, boric acid is odorless. It attacks insect nervous and metabolic systems. It can also dehydrate insects and be abrasive to insect exoskeletons. It has been used as an insecticide since 1948 and is common in household insecticides.
As a structural pest control tool, it is used as a bait which insects ingest and return to their colonies. As a result, it can eliminate entire pest colonies.
Boric acid is often used in packing sheds and other facilities. Many times, it is used as a powder introduced into cracks and crevices, and is essential for controlling ants and roaches.
It has a number of industrial and medical uses and is often used as an amendment in boron-deficient soils.

Manufacture
Boric acid is a white powder that is soluble in boiling water. It is a mined substance, occurring naturally in areas of high volcanic activity, and its primary source is the Mojave Desert of Nevada and California. It also occurs in plants, is prevalent in most fruits, and appears in rocks and soil.

Boric acid produced through the manufacturing process includes a broad range of formulations in concentrations from 1-100% in liquids (solutions, emulsifiable concentrates), granules, wettable powders, dusts, pellets, tablets, and baits.

International Acceptance
Canadian General Standards Board Permitted Substances List
The Canadian Organic Production Systems Permitted Substances List includes boric acid for structural pest control.

European Economic Community (EEC) Council Regulation, EC No. 834/2007 and 889/2008
European organic regulations do not reference boric acid.

[CODEX Alimentarius Commission, Guidelines for the Production, Processing, Labelling and Marketing of Organically Produced Foods (CXG 32-1999)]
CODEX regulations do not reference boric acid.

[International Federation of Organic Agriculture Movements (IFOAM) Norms]
IFOAM regulations do not reference boric acid.

[Japan Agricultural Standard (JAS) for Organic Production]
JAS regulations allow boric acid for pest control for plants.

Environmental Issues
Boric acid is generally regarded as safe (GRAS) and of low toxicity, although it can be an eye, skin, and respiratory and nasal irritant. Ingestion by humans or pets can cause gastrointestinal distress. Long-term exposure can affect the kidneys, although it is not generally considered to be carcinogenic. There is no evidence it can be an endocrine disruptor or can create reproductive toxicity in humans (although birds may experience some reduced growth rates after ingestion). Several species of fish have been tested for impacts from boric acid, and the World Health Organization determined very low sensitivity to the material in those species. It has low toxicity to bees.

Boric acid is mined from the environment in deserts where sensitive habitats and species may exist. Boric acid is released into the environment due its wide range of applications, including borate salt laundry products, power generation, chemical manufacturing, copper smelters, rockets, mining operations, and the manufacture of glass, fiberglass, porcelain enamel, ceramic glazes, metal alloys and fire retardants.

Discussion
Boric acid, derived from the mineral borax/borate salts, is a weak acid that has long been considered a "least-toxic" pesticide because it is non-volatile when placed in bait or gel formulations and therefore eliminates risk of direct exposure. It is essentially hydrated boron.

At the Fall 2015 NOSB meeting, the Crops Subcommittee proposed to remove boric acid from §205.601(e) on the basis of not fully meeting all sub-components of OFPA criteria, particularly criteria of Impacts on Humans and the Environment, Essentiality, and Compatibility & Consistency. The motion to remove failed after receiving 1 "Yes" and 13 "No" votes. While boric acid does not fully meet the OFPA criteria of Impacts on Humans and the Environment, Essentiality, and Compatibility & Consistency, the alternatives often have equally challenging issues.

In 2017 and 2022, there was no new information provided from the stakeholder community through public comment. There was also no support for removing boric acid from the National List. Neither the Subcommittee nor the full Board recommended its removal from the National List.

The Crops Subcommittee discussed the use of this material and noted it is both common and useful for structural pest control applications.

Questions to our Stakeholders
None

NOSB Review
There were over 15 written public comments about boric acid during the Fall 2022 meeting cycle. While the majority of comment supported keeping this substance on the National List due to widespread use and absence of relevant alternatives in organic production, one non-profit commenter opposed relisting and two other commenters requested annotation consideration to limit the scope of its use to a gel-based formulation.

Justification for Vote
The NOSB finds boric acid compliant with the Organic Foods Production Act (OFPA) and/or 7 CFR 205.600(b) and is not proposing removal.

NOSB Vote
Motion to remove boric acid from the National List
Motion by: Wood Turner
Seconded by: Jerry D'Amore
Yes: 0 No: 15 Abstain: 0 Recuse: 0 Absent: 0

Sticky traps/barriers

Reference: §205.601(e) As insecticides (including acaricides or mite control).
(9) Sticky traps/barriers.
Technical Report: 1995 TAP.
Petition: N/A
Past NOSB Actions: 10/1995 minutes and vote; 11/2005 sunset recommendation; 10/2010 sunset recommendation; 10/2015 sunset recommendation; 11/2017 sunset recommendation.
Recent Regulatory Background: Sunset renewal notice effective 3/15/2017 (82 FR 14420). Sunset renewal notice effective 10/30/2019 (84 FR 53577)
Sunset date: 10/30/2024

Subcommittee Review

Use
Sticky traps/barriers are used for pest control and monitoring. They are also used with traps as a production aid.

Manufacture
This listing covers a wide range of traps and coatings made with a number of different materials, including coated paper, coated plastic, and brushed on sticky chemicals applied directly to plants. Some sticky traps are made with petroleum wax or linear hydrocarbons.

International Acceptance
None noticed

Environmental Issues
Sticky traps are used in limited quantities in confined areas such as traps or tree trunks, and have limited mobility, making it unlikely to have environmental impacts. Also, sticky traps do not come into contact with food.

Discussion
There was broad support for relisting sticky traps/barriers from farmers, certifiers, and trade organizations during the last sunset review for these materials. Based on the previous Subcommittee review and public comments from the Spring 2022 NOSB meeting, the NOSB found sticky traps/barriers compliant with OFPA criteria, and do not recommend removal from the National List.

Questions to our Stakeholders
None

NOSB Review

Virtually 100% of the public comments were in favor of relisting sticky traps/barriers. Comments stated that they are useful in monitoring insect levels and can provide information on when to apply defensive measures.

Justification for Vote
The NOSB finds sticky traps/barriers compliant with the Organic Foods Production Act (OFPA) and/or 7 CFR 205.600(b) and is not proposing removal.

NOSB Vote
Motion to remove sticky traps/barriers from the National List
Motion by: Rick Greenwood
Seconded by: Amy Bruch
Yes: 0 No: 15 Abstain: 0 Recuse: 0 Absent: 0

Motion failed

Elemental sulfur

Reference: §205.601(h) As slug or snail bait.
(2) Elemental sulfur.
Technical Report: 1995 TAP; 2018 TR.
Petition: 2017.
Past NOSB Actions: 04/2018 recommendation.
Recent Regulatory Background: Added to National List on 11/22/2019 (84 FR 56673).
Sunset Date: 11/22/2024

Subcommittee Review

Use
When used to manage slugs and snails, sulfur is formulated with attractants plus other inert ingredients and extruded into pellets. These are broadcast or hand-applied near crops needing protection from these target pests. For this purpose, a 1% sulfur formulation is used at a labeled rate of up to 44 lbs. per acre, with an actual elemental sulfur application rate of up to 0.44 lbs. per acre. This application rate is much lower than labeled rates for sulfur when it is used as a fungicide in formulations of 80% or 90% elemental sulfur.

Manufacture
Elemental sulfur can come either from a natural mined source, or may be produced as a by-product from natural gas or petroleum operations and refinery processes. The latter appears to be the source of most elemental sulfur currently being used. Because the sulfur is chemically extracted from fossil-fuel feedstock, it is considered synthetic.

International Acceptance
Canadian General Standards Board Permitted Substances List
The Canadian General Standards Board (CGSB) includes elemental sulfur from either mined and reclaimed sources as permitted substances for organic production systems (CAN/CGSB-32.311-2015) for use as a soil amendment and as a foliar application. The CGSB also permits the use of sulfur for the control of external

parasites and sulfur smoke bombs in conjunction with other methods used for rodent control when a pest control program is temporarily overwhelmed.

European Economic Community (EEC) Council Regulation, EC No. 834/2007 and 889/2008
The European Economic Community (EEC) Council Regulation (EEC No 2092/91) and carried over by Article 16(3)(c) of Regulation No 834/2007, permits the use of sulfur as a fungicide, acaricide, and repellent in organic food production.

CODEX Alimentarius Commission, Guidelines for the Production, Processing, Labelling and Marketing of Organically Produced Foods (CXG 32-1999)
The Codex Alimentarius Commission's "Guidelines for the Production, Processing, Labelling, and Marketing of Organically Produced Foods" (GL 32-1999) lists elemental sulfur as an allowed substance for pest and disease control.

International Federation of Organic Agriculture Movements (IFOAM) Norms
The International Federation of Organic Agriculture Movements (IFOAM) lists sulfur as an approved substance for pest and disease control, for use as fertilizer/soil conditioner, and for use as a crop protectant and growth regulator.
Japan Agricultural Standard (JAS) for Organic Production
The Japan Agricultural Standard (JAS) for Organic Production (Notification No. 1605 of 2005) permits the use of sulfur as a fertilizer or soil improvement substance, and as a substance for plant pest and disease control.

Environmental Issues
When used as a fungicide with several applications per season, sulfur can lower soil pH over time, and have negative effects on beneficial mite populations. However, application rates used for slug and snail management are much lower and would not be expected to have those effects.

Discussion
Sulfur for use as a slug or snail bait was added to the National List at §205.601(h) in 2019. This is its first sunset review. It was petitioned for use in 2017 with studies showing that a sulfur slug bait product was slightly more effective than other products approved for the same use in organic production.

Other synthetic products commonly used by organic farmers to kill slugs contain the active ingredient, ferric phosphate. It is invariably combined with a synergist, the chelator EDTA, which is an inert ingredient on the defunct EPA List 4. The EDTA + ferric phosphate combination has been implicated in harm to earthworms in soil and also pet dogs due to enhanced iron toxicity. In 2012, these products were petitioned for removal from the National List at § 205.601(h) for this reason, but the NOSB motion to remove failed. At that time, the NOSB Recommendation indicated that there were no commercial alternatives to ferric phosphate. In 2018, the listing for ferric phosphate was renewed on the National List.

In light of questions about the toxicity of ferric phosphate and the availability of relatively new sulfur alternatives, organic farmers may consider the sulfur products to be desirable. The label of one sulfur-based slug bait product states that it can be used around pets and wildlife when used as directed. The label shows 1% sulfur and 99% inert ingredients, which include iron. It is not known whether this product also contains EDTA. At labeled rates, sulfur used to target slugs and snails is thought to have little or no negative environmental impacts, even if applied multiple times per season. However, other components of a sulfur product's formulation are unknown and may have negative environmental effects.

Written and oral comments in 2022 included 5 in favor of relisting, 1 opposed, and 1 calling for further review. The point was made that farmers have little experience with sulfur for this specific use because it is relatively new.   Also, some commenters noted that the goal of reducing tillage may lead to an increase of damaging slug populations. Questions about inert ingredients in product formulations, which can be 99% of total ingredients, highlight the need for more work on these products.

NOSB Review
Of the Fall 2022 meeting comments, 5 were in favor of continued listing, 1 was opposed, and 2 felt that more information was needed. One specifically called for a resolution to the inerts issues. Commenters noted the relatively low environmental profile of sulfur for this use, and its potential as a less toxic formulation than current slug control products.

Justification for Vote
The NOSB finds elemental sulfur compliant with the Organic Foods Production Act (OFPA) and/or 7 CFR 205.600(b) and is not proposing removal.

NOSB Vote:
Motion to remove elemental sulfur from the National List
Motion by: Brian Caldwell
Seconded by: Jerry D'Amore
Yes: 0 No: 15 Abstain: 0 Recuse: 0 Absent: 0

Motion failed

Coppers, fixed

Reference: §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.

Technical Report: 1995 TAP; 2011 TR.
Petition: N/A
Past NOSB Actions: 10/1995 minutes and vote; 11/2005 sunset recommendation; 4/2011 sunset recommendation; 10/2015 sunset recommendation; 11/2017 sunset recommendation.
Recent Regulatory Background: Sunset renewal notice effective 3/15/2017 (82 FR 14420). Sunset renewal notice effective 10/30/2019 (84 FR 53577)
Sunset date: 10/30/2024

Subcommittee Review

Use
Fixed coppers was reviewed and approved for continued use during the October 2015 NOSB meeting. Coppers were considered to be an important tool for organic producers as part of a comprehensive approach to disease management in many crops. For example, copper products became an integrated part of fire blight control in pome fruits after antibiotics were removed from the National List. While some copper minerals and compounds occur in nature, products for agriculture are made from by-products of processing copper ores and are considered synthetic. Copper is on the list of exemptions for synthetic materials in OFPA at § 6517(c)(1)(B)(i). Copper sulfate is also undergoing sunset review, and the Crops Subcommittee has submitted a separate review.

Manufacture
Fixed coppers, such as copper hydroxide, are formed by treating copper sulfate with another compound (in this case sodium hydroxide). In another example, copper carbonate is formed by treating copper sulfate with sodium carbonate.

International Acceptance

Canadian General Standards Board Permitted Substances List

- Permitted for use as a wood preservative, fungicide on fruit and vegetables or for disease control.
- Shall be used with caution to prevent excessive copper accumulation in the soil. Copper buildup in soil may prohibit future use.
- Visible residue of copper products on harvested crops is prohibited.

European Economic Community (EEC) Council Regulation, EC No. 834/2007 and 889/2008

- The EEC states that, "it is appropriate to restrict the use of plant protection products containing copper compounds to a maximum application rate of 28 kg/ha of copper over a period of 7 years (i.e., on average 4 kg/ha/year) in order to minimize the potential accumulation in soil and the exposure for not target organisms, while considering agro-climatic conditions occurring periodically in Member States leading to an increase of the fungal pressure. When authorizing products Member States should pay attention to certain issues and strive for the minimization of application rates."

CODEX Alimentarius Commission, Guidelines for the Production, Processing, Labelling and Marketing of Organically Produced Foods (CXG 32-1999)
- Copper in the form of copper hydroxide, copper oxychloride, (tribasic) copper sulfate, cuprous oxide, Bordeaux mixture and Burgundy mixture are listed in Annex 2 (Permitted substances for the production of organic foods), Table 2 (Substances for plant pest and disease control) of ―Guidelines for the production, processing, labeling, and marketing of organically produced foods‖ (CODEX-GL 32, 1999).

International Federation of Organic Agriculture Movements (IFOAM) Norms
Copper is only mentioned as a soil amendment and trace soil nutrient under IFOAM.

Japan Agricultural Standard (JAS) for Organic Production

- While the document refers to 'copper powder" repeatedly, only copper sulfate is specifically mentioned. Copper sulfate is only permitted in organic agriculture as a fungicidal spray

Environmental issues
Run-off from treated fields can contain high levels of copper. Copper is readily dissolved and suspended in the water and is lethal to fish and other aquatic organisms at fairly low concentrations. In the soil, it tends to concentrate heavily in the topsoil and leads to copper resistant fungal strains over time, as well as altering the soil microbiota and killing soil-dwelling animals such as earthworms. Copper toxicity in the soil can reduce the growth and nutrient value of crop plants, as well as damage the integrity of root systems (Van Assche and Clijsters, 1990). Because copper accumulates in the soil over time and eventually results in poor plant outcomes, its use as a sustainable practice must be questioned.

Discussion

Copper products are difficult substances to evaluate, as there appears to be broad consensus throughout the US, EU, and Canada that they are hazardous to both human health and the environment. Despite this, they have repeatedly had their use period extended in all three jurisdictions. There doesn't yet appear to be a viable organic alternative for copper in certain applications, including in the lucrative organic wine industry. Banning the use of coppers entirely could eliminate organic wine production, as there are no other widely available and effective tools for controlling downy mildew. While there is not yet a broadly accepted alternative to copper compounds for controlling downy mildew, research has pointed to plant extracts from yucca and salvia, as well as another fungus , *Trichoderma harzianum*, as a possible means of biological control (Dagostin et al., 2011). However, some organic vineyards have also withdrawn from the organic label in order to allow for use of copper alternatives in their vineyards, citing toxic copper build-up in the soil. One way to mitigate this issue would be to implement regular soil testing in organic vineyards and mandate soil remediation once a toxic threshold is approached.

One method to remove toxic copper levels from the soil of vineyards uses plants and bacteria to pull the heavy metal from the soil (Mackie et al, 2012). Phytoremediation with mustard (*Brassica juncea*) can help remove toxic copper levels from the soil (Ariyakanon and Winaipanich, 2006). There appears to be varying tolerance of crops to copper levels in the soil, suggesting that copper-tolerant crops could be rotated into place after a period of copper intensive cropping. While this would clearly not work for long-lived perennial crops like grapes, annual crops such as potatoes and melons might benefit from this type of crop rotation.

2017 NOSB Review

Fixed coppers and copper sulfate used for plant disease control (§205.601(i)(2) and §205.601(i)(3), respectively) were reviewed in 2015 ahead of the 2017 sunset date. There was strong public support for relisting of copper materials. Although there was some discussion regarding the annotation, the final public comment was that the current annotation is adequate. Given the extensive use and documented need for copper sprays, the NOSB found coppers, fixed, compliant with OFPA criteria, and voted unanimously to not remove coppers from the list.

2022 NOSB Review

Overview: Distinguishing between fixed coppers and copper sulfate seems redundant as they are used in a similar manner and are reviewed in the same technical reports (TRs). In the scientific literature, they are grouped as CBACs (copper-based antimicrobial compounds). Copper sulfate contains more "free" copper ions vs. "fixed" and is therefore often combined with lime to bind the copper ions. The free copper ions contribute to its solubility in water and its higher uptake by plants.

Main Considerations in 2022 Review

- Copper compounds readily dissolve in water and are highly toxic to many aquatic organisms. They disperse quickly in water.
- Copper compounds bind to soil and tend to accumulate significantly in clay soils and increasingly with increasing soil pH. Soils with pH over 6.5 are particularly susceptible to metal toxicity from repeated application.
- Copper compounds can damage the plants they are applied to, as well as impact the appearance and taste of the crop.
- Widespread use of copper compounds has led to the evolution of copper-resistant disease varietals
- There is a well-studied link between dysfunctional copper metabolism and Alzheimer's disease. Recent research finds a link between the epidemic of Alzheimer's disease and the agricultural use of copper for disease management in plants.

- Foliar spray of copper mixtures has long been recognized to impact lung and liver function in agricultural workers

In December 2021, the Crops Subcommittee discussed the need for an updated TR. Not only have ten years passed since the previous report was written, but there are new concerns regarding human and environmental health.

The Subcommittee requested that the new TR highlight five areas that should be expanded and updated with the latest research: human health concerns, soil health and microbiota, application rates and accumulation in the soil, copper in the aquatic environment, and alternatives to copper-based products. We also asked that the future TR use consistent units of measurement when discussing rates of application and copper concentrations.

In July 2022, just prior to the deadline to submit proposals for the Fall meeting, the Crops Subcommittee received a draft copy of the copper TR, which it found comprehensive, thorough, and sufficient. The 2022 TR contained updated and expanded information regarding continued and expanded environmental and human health concerns, and the Crops Subcommittee will continue to review the TR and public comment. Although the Subcommittee found the TR sufficient, it did submit additional clarifying questions for the authors of the TR, and expects those answers some time prior to the Fall NOSB meeting.

Questions to our Stakeholders

1. Are there organic alternatives available to copper products that are more suitable for use in disease control?
2. Are there viable practices that can be used *in situ* to offset the toxic build-up of copper in the soil and water?

NOSB Review

The NOSB acknowledges that copper can be harmful to both human health and the environment when used improperly, and also acknowledges that copper is essential to control plant disease in organic farming. The Crops Subcommittee received a technical report in mid-July, and found it sufficient, but it was not available in time for the stakeholder comment period. The TR will be available during the next sunset period.

Based on the Subcommittee review and public comment, the NOSB finds these materials compliant with OFPA criteria, and does not recommend removal from the National List.

Justification for Vote

The NOSB finds coppers, fixed compliant with the Organic Foods Production Act (OFPA) and/or 7 CFR 205.600(b) and is not proposing removal.

NOSB Vote

Motion to remove coppers, fixed from the National List
Motion by: Jerry D'Amore
Seconded by: Brian Caldwell
Yes: 2 No: 13 Abstain: 0 Recuse: 0 Absent: 0

References

1. Ariyakanon N, Winaipanich B (2006). Phytoremediation of copper contaminated soil by *Brassica juncea* (L.) Czern and *Bidens alba* (L.) DC. var. *radiate*. J Sci Res Chula Univ 31(1):49–56

2. Dagostin S, Schärer H, Pertot I, Tamm, L (2011). Are there alternatives to copper for controlling grapevine downy mildew in organic viticulture? Crop Protection. 30(7):776-788.
3. Mackie KA, Müller T, Kandeler E (2012). Remediation of copper in vineyards—a mini review. Environmental Pollution 167:16–26.
4. Van Assche F, Clijsters H (1990). Effects of metals on enzyme activity in plants. Plant Cell Environ. 13:195-206.

Copper sulfate (i)(3)

Reference: §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.
Technical Report: 1995 TAP; 2011 TR.
Petition: N/A
Past NOSB Actions: 10/1995 minutes and vote; 11/2005 sunset recommendation; 4/2011 sunset recommendation; 10/2015 sunset recommendation; 11/2017 sunset recommendation.
Recent Regulatory Background: Sunset renewal notice effective 3/15/2017 (82 FR 14420). Sunset renewal notice effective 10/30/2019 (84 FR 53577)
Sunset date: 10/30/2024

Subcommittee Review

Use
Copper sulfate was reviewed and approved for continued use during the October 2015 NOSB meeting. Coppers were considered to be an important tool for organic producers as part of a comprehensive approach to disease management in many crops. For example, copper products became an integrated part of fire blight control in pome fruits after antibiotics were removed from the National List. While some copper minerals and compounds occur in nature, products for agriculture are made from by-products of processing copper ores and are considered synthetic. Copper is on the list of exemptions for synthetic materials in OFPA at § 6517(c)(1)(B)(i). Fixed coppers is also undergoing sunset review, and the Crops Subcommittee has submitted a separate review.

Manufacture
Copper sulfate is manufactured by treating copper ore with concentrated sulfuric acid. It is also known as copper vitriol. In order to enhance its fungicidal properties, copper sulfate is mixed with calcium hydroxide to produce a "Bordeaux mixture" which is sprayed on crops for disease control.

International Acceptance
Canadian General Standards Board Permitted Substances List

- Permitted for use as a wood preservative, fungicide on fruit and vegetables or for disease control.
- Shall be used with caution to prevent excessive copper accumulation in the soil. Copper buildup in soil may prohibit future use.
- Visible residue of copper products on harvested crops is prohibited.

European Economic Community (EEC) Council Regulation, EC No. 834/2007 and 889/2008

- The EEC states that, "it is appropriate to restrict the use of plant protection products containing copper compounds to a maximum application rate of 28 kg/ha of copper over a period of 7 years (i.e., on average 4 kg/ha/year) in order to minimize the potential accumulation in soil and the exposure for not target organisms, while considering agro-climatic conditions occurring periodically in Member States leading to an increase of the fungal pressure. When authorizing products Member States should pay attention to certain issues and strive for the minimization of application rates."

CODEX Alimentarius Commission, Guidelines for the Production, Processing, Labelling and Marketing of Organically Produced Foods (CXG 32-1999)

- Copper in the form of copper hydroxide, copper oxychloride, (tribasic) copper sulfate, cuprous oxide, Bordeaux mixture and Burgundy mixture are listed in Annex 2 (Permitted substances for the production of organic foods), Table 2 (Substances for plant pest and disease control) of —Guidelines for the production, processing, labeling, and marketing of organically produced foods‖ (CODEX-GL 32, 1999).

International Federation of Organic Agriculture Movements (IFOAM) Norms
Copper is only mentioned as a soil amendment and trace soil nutrient under IFOAM.

Japan Agricultural Standard (JAS) for Organic Production
Copper sulfate is only permitted in organic agriculture as a fungicidal spray.

Environmental Issues
Run-off from treated fields can contain high levels of copper. Copper is readily dissolved and suspended in the water and is lethal to fish and other aquatic organisms at fairly low concentrations. In the soil, it tends to concentrate heavily in the topsoil and leads to copper resistant fungal strains over time, as well as altering the soil microbiota and killing soil-dwelling animals such as earthworms. Copper toxicity in the soil can reduce the growth and nutrient value of crop plants, as well as damage the integrity of root systems (Van Assche and Clijsters, 1990). Because copper accumulates in the soil over time and eventually results in poor plant outcomes, its use as a sustainable practice may be questioned.
Copper sulfate has been shown to be toxic to bees, particularly in tropical environments. At sub-lethal levels, the heavy metal also changes behavior and movement ability. Despite this, there are multiple statements on the National Pesticide Information Center (NPIC) and in US Environmental Protection Agency Office of Pesticide Programs documents stating that copper sulfate is virtually non-toxic to bees. This is an important point to clarify. The role that bees play in the pollination of commercial crops globally should make this a concern to farmers and the general public alike.

Copper sulfate has been classified as a human carcinogen by the European Chemicals Agency (ECHA), with specific concern for renal cancers (Buzio et al, 2002). Chronic exposure to fungicidal sprays elevated the risk of renal cancers by almost 3 times. While copper binds to soils readily, copper contamination of drinking water sources would also be a concern.

Discussion
Copper sulfate is a difficult substance to evaluate, as there appears to be broad consensus throughout the US, EU, and Canada that it is hazardous to both human health and the environment. Despite this, the use period for copper has been extended in all three jurisdictions, as there isn't yet a viable organic alternative in certain applications, including in the lucrative organic wine industry. Banning the use of copper sulfate entirely could eliminate organic wine production, as there are no other widely available and effective tools for controlling downy mildew. While there is not yet a broadly accepted alternative to copper sulfate for controlling downy mildew, research has pointed to plant extracts from yucca and salvia, as well as another fungus, *Trichoderma harzianum*, as a possible means of biological control (Dagostin et al., 2011). However, some organic vineyards

have also withdrawn from the organic label in order to allow for use of copper alternatives in their vineyards, citing toxic copper build-up in the soil. One way to mitigate this issue would be to implement regular soil testing in organic vineyards and mandate soil remediation once a toxic threshold is approached.

One method to remove toxic copper levels from the soil of vineyards uses plants and bacteria to pull the heavy metal from the soil (Mackie et al, 2012). Phytoremediation with mustard (*Brassica juncea*) can help remove toxic copper levels from the soil (Ariyakanon and Winaipanich, 2006). There appears to be varying tolerance of crops to copper levels in the soil, suggesting that copper-tolerant crops could be rotated into place after a period of copper sulfate intensive cropping. While this would clearly not work for long-lived perennial crops like grapes, annual crops such as potatoes and melons might benefit from this type of crop rotation.

2017 NOSB Review

Copper sulfate and fixed coppers used for plant disease control (§205.601(i)(2) and §205.601(i)(3)) were reviewed in 2015 ahead of the 2017 sunset date. There was strong public support for relisting of copper materials and the NOSB voted 2 "Yes" and 12 "No" on the motion to remove copper. Although there was some discussion regarding the annotation, the final public comment was that the current annotation is adequate. Given the extensive use and documented need for copper sprays, the NOSB found copper sulfate compliant with OFPA criteria, and did not recommend removal from the National List.

2022 Crops Subcommittee Review

Overview: Distinguishing between copper sulfate and fixed coppers seems redundant as they are used in a similar manner and are reviewed in the same technical reports (TRs). In the scientific literature, they are grouped as CBACs (copper-based antimicrobial compounds). Copper sulfate contains more "free" copper ions vs. "fixed" and is therefore often combined with lime to bind the copper ions. The free copper ions contribute to its solubility in water and its higher uptake by plants.

Main Considerations in 2022 Review

- Copper compounds readily dissolve in water and are highly toxic to many aquatic organisms. They disperse quickly in water.
- Copper compounds bind to soil and tend to accumulate significantly in clay soils and with increasing soil pH. Soils with pH over 6.5 are particularly susceptible to metal toxicity from repeated application.
- Copper compounds can damage the plants they are applied to, as well as impact the appearance and taste of the crop.
- Widespread use of copper compounds has led to the evolution of copper-resistant disease varietals.
- There is a well-studied link between dysfunctional copper metabolism and Alzheimer's disease. Recent research finds a link between the epidemic of Alzheimer's disease and the agricultural use of copper for disease management in plants.
- Foliar spray of copper mixtures has long been recognized to impact lung and liver function in agricultural workers.

In December 2021, the Crops Subcommittee discussed the need for an updated TR. Not only has ten years passed since the previous report was written, but there are also new concerns regarding human and environmental health. The Subcommittee requested that the new TR highlight five areas that should be expanded and updated with the latest research: human health concerns, soil health and microbiota, application rates and accumulation in the soil, copper in the aquatic environment, and alternatives to copper-based products. We also asked that the future TR use consistent units of measurement when discussing rates of application and copper concentrations.

In July 2022, just prior to the deadline to submit proposals for the Fall meeting, the Crops Subcommittee received a draft copy of the copper TR, which it found comprehensive, thorough, and sufficient. The 2022 TR contained updated and expanded information regarding environmental and human health concerns, and the Crops Subcommittee will continue to review the TR and public comment. Although the Subcommittee found the TR sufficient, it did submit additional clarifying questions for the authors of the TR, and expects those answers some time prior to the Fall NOSB meeting. .

Questions to our Stakeholders

1. Are there organic alternatives to copper sulfate that are more suitable for use as a fungicide?
2. Are there viable practices that can be used *in situ* to offset the toxic build-up of copper in soil and water?

NOSB Review

The NOSB acknowledges that copper can be harmful to both human health and the environment when used improperly, and also acknowledges that copper is essential to control plant disease in organic farming. The Crops Subcommittee received a technical report in mid-July, and found it sufficient, but it was not available in time for the stakeholder comment period. The TR will be available during the next sunset period.

Based on the Subcommittee review and public comment, the NOSB finds these materials compliant with OFPA criteria, and does not recommend removal from the National List.

Justification for Vote

The NOSB finds copper sulfate compliant with the Organic Foods Production Act (OFPA) and/or 7 CFR 205.600(b) and is not proposing removal.

NOSB Vote

Motion to remove copper sulfate from the National List
Motion by: Jerry D'Amore
Seconded by: Amy Bruch
Yes: 2 No: 13 Abstain: 0 Recuse: 0 Absent: 0

Motion failed

References

1. Ariyakanon N, Winaipanich B (2006) Phytoremediation of copper contaminated soil by *Brassica juncea* (L.) Czern and *Bidens alba* (L.) DC. var. *radiate*. J Sci Res Chula Univ 31(1):49–56
2. Buzio L, Tondel M, De Palma G, et al. (2002) Occupational risk factors for renal cell cancer. An Italian case-control study. La Medicina del Lavoro. 93(4):303-309.
3. Dagostin S, Schärer H, Pertot I, Tamm, L (2011). Are there alternatives to copper for controlling grapevine downy mildew in organic viticulture? Crop Protection. 30(7):776-788.
4. Mackie KA, Müller T, Kandeler E (2012) Remediation of copper in vineyards—a mini review. Environmental Pollution 167:16–26.
5. Van Assche F, Clijsters H (1990) Effects of metals on enzyme activity in plants. Plant Cell Environ. 13:195-206.

Polyoxin D zinc salt

Reference: §205.601(i) As plant disease control.
(11) Polyoxin D zinc salt.
Technical Report: 2012 TR; 2017 Limited Scope TR; 2021 Lmt'd Scope TR Pending
Petition: 2016 (Addendum #1, #2, #3).
Past NOSB Actions: 04/2018 recommendation.
Recent Regulatory Background: Added to National List on 11/22/2019 (84 FR 56673).
Sunset Date: 11/22/2024

Subcommittee Review

Use
Polyoxin D zinc salt is used as an agricultural fungicide. It has a locally systemic function, meaning that it is absorbed into surface plant tissues. It currently appears on the National List as plant disease control at 7 CFR 205.601(i). Few fungicides used in organic production are systemic, and polyoxin D zinc salt products may have greater efficacy against some plant disease organisms.

Manufacture
Polyoxin D is produced by controlled fermentation of the naturally occurring (non-GMO) soil microorganism *Streptomyces cacaoi* var. asoensis. While polyoxin D might be considered a nonsynthetic product, its chemical conversion to a zinc salt makes it synthetic. The zinc salt makes this product more useful by lessening its high water-solubility, thereby preventing the product from washing off the application area too quickly.

International Acceptance
Polyoxin D zinc salt does not appear on any of the following lists:

Canadian General Standards Board Permitted Substances List

European Economic Community (EEC) Council Regulation, EC No. 834/2007 and 889/2008

CODEX Alimentarius Commission, Guidelines for the Production, Processing, Labelling and Marketing of Organically Produced Foods (CXG 32-1999)

International Federation of Organic Agriculture Movements (IFOAM) Norms

Japan Agricultural Standard (JAS) for Organic Production

Environmental Issues
The 2012 Technical Review (TR) states that polyoxin D zinc salt rapidly degrades on plant surfaces, in approximately 2-3 days, and has a half-life of 16 days in soil. The 2018 NOSB review concluded there was low environmental risk, and further that there is no concern during the manufacture, use, or disposal of polyoxin D zinc salt other than that this product should not be used nearby to, or in, water since it is moderately toxic to aquatic invertebrates and fish. The 2017 TR concurs and states "Based on the results [of numerous studies cited], polyoxin D zinc salt is presumed to carry very low environmental risk and because polyoxin D zinc salt is formed through fermentation, it is considered to be less toxic to the environment than a fungicide that was chemically manufactured such as copper, sulfur, or petroleum distillates."

Polyoxin D zinc salt has a unique, non-toxic mode of action. No other active ingredient registered for use in North America has the same mode of action (FRAC Code 19). As described in the 2012 petition (page 18): "The active portion of polyoxin D zinc salt is polyoxin D which is produced by a microorganism that is naturally occurring in the soil. Polyoxin D inhibits the growth of phytopathogenic fungal cell wall chitin by competitively inhibiting chitin synthetase. Without chitin, susceptible fungi are unable to continue growing and infecting plant cells. Polyoxin D zinc salt does not kill the fungi; it simply stops the fungal growth. The action of Polyoxin D is highly specific; it does not affect bacteria, viruses, or mammals."

In response to NOSB questions of toxicity to beneficial soil fungi, honeybees, or ladybird beetles, the petitioner commissioned their own studies and found no negative effects of polyoxin D zinc salt on any of these organisms. If directly mixed with products used by organic producers containing living beneficial fungi, the fungi could be rendered ineffective.

Human Health Issues
The 2017 TR of polyoxin D zinc salt states there is very low acute toxicity to humans by oral, dermal, or inhalation routes, and it did not demonstrate mutagenic potential. There are warnings on the label about possible skin and eye irritation effects. Polyoxin D zinc salt is poorly absorbed after ingestion with the vast majority of the product (>90%) being excreted unchanged, directly in the feces. Polyoxin D zinc salt has been in use as an antifungal agent for over 40 years in Japan on rice, without any notable, consistent, adverse human reactions being recorded. It has been approved in the USA and Mexico on food crops for over 5 and 3 years, respectively and for non-food crops in the USA for over 16 years. The direct risk to humans is considered to be extremely low.

A separate issue relates to how its agricultural use could affect anti-fungal medicines in human health. Considerable research has focused on polyoxins as less-toxic alternatives to currently available therapeutic antifungal medications in humans. These studies have led to mostly unsuccessful results, and polyoxins are not used clinically at the present time. Polyoxin D has thus far been ineffective in therapeutic exploratory studies for potential human use against fungi, except at very high concentrations. It has shown some efficacy against yeasts, but is considered unlikely to be used as a human medicine. Thus, human pathogen resistance to polyoxin D would have little or no medical impact.

It is possible that from polyoxin D use in agriculture, cross-resistance could develop to related antibiotics such as Nikkomycin Z, currently being tested as a human anti-fungal medicine. In order for such resistance to develop, polyoxin D would need to be used widely. A human fungal pathogen would need to acquire the resistance to polyoxin D, either from direct exposure or via transfer from other resistant organisms. Finally, the pathogen's resistance to polyoxin D would need to confer resistance to the to-be-developed new medicine. This seems to be a highly unlikely chain of events.

NOSB Review
The majority of written and oral comments in 2022 were in favor of retaining polyoxin D zinc salt on the National List. Producers reiterated that it is an effective and valuable material. Discussion highlighted its efficacy, low environmental impact, short soil half-life, and low risk to human health.

Justification for Vote
The NOSB finds that polyoxin D zinc salt continues to be compliant with the Organic Foods Production Act (OFPA) and/or 7 CFR 205.600(b) and is not proposing removal.

NOSB Vote
Motion to remove polyoxin D zinc salt from the National List

Motion by: Brian Caldwell
Seconded by: Amy Bruch
Yes: 0 No: 15 Abstain: 0 Recuse: 0 Absent: 0

Motion failed

Humic acids

Reference: §205.601(j) As plant or soil amendments.
3) Humic acids - naturally occurring deposits, water and alkali extracts only.
Technical Report: 1996 TAP; 2006 TR; 2012 TR (oxidized lignite/humic acid derivatives).
Petition: N/A
Past NOSB Actions: 09/1996 minutes and vote; 4/2006 sunset recommendation; 10/2010 sunset recommendation; 10/2015 sunset recommendation; 11/2017 sunset recommendation.
Recent Regulatory Background: Sunset renewal notice effective 3/15/2017 (82 FR 14420). Sunset renewal notice effective 10/30/2019 (84 FR 53577)
Sunset date: 10/30/2024

Subcommittee Review

Use
Humic acids can be soil-applied or foliar applied depending on the specific product. Humic acid affects soil fertility by making micronutrients more readily available to plants rather than contributing additional nutrients to the soil. According to the 2006 Technical Report (TR), humic substances can chelate (bind) soil nutrients, improve nutrient uptake, reduce the need for nitrogen fertilizer, remove toxins from soils, stimulate soil biological activity, solubilize minerals, improve soil structure, and improve water holding capacity.

Manufacture
According to the 2006 TR, humic substances (which includes humic acids) naturally constitute a significant fraction of the organic matter in the soil and are formed through the process known as "humification." Humification is the natural conversion of organic matter into humic substances by microorganisms in the soil (Mayhew, 2004).

Commercially available humic acids are derived from leonardite, lignite, or coal. Extracts from non-synthetic humates by hydrolysis using synthetic or non-synthetic alkaline materials are permitted, including the use of sodium, potassium, or ammonium hydroxide. The TR states that the process begins with separating organic matter from the inorganic matrix of sand, silt, and clay. The terrestrial source is leached with hydrochloric acid (HCl) to remove calcium and other positively charged ions and to increase the efficiency of extraction of organic matter with alkaline reagents. Next, a stronger sodium hydroxide solution creates a liquid solution (Weber, undated). The extracted liquid solution is incompatible with acids because it is very alkaline, in the range of 8 to 12 pH, and can be treated with an acid to precipitate out the humic acid portion (Mayhew, 2004). Alkali extraction can also be carried out using potassium hydroxide, a common reagent used by manufacturers to extract humic acid from leonardite.

International Acceptance
Canadian General Standards Board Permitted Substances List

As noted in the 2012 TR, humates, humic acids and fulvic acids are permitted if mined; produced through microbial activity; extracted by physical processes; or with: a) Table 4.2 Extractants; or b) potassium hydroxide—potassium hydroxide levels used in the extraction process shall not exceed the amount required for extraction. Levels (mg/kg) of arsenic, cadmium, chromium, lead, and mercury shall not exceed the limits (category C1) specified in Guidelines for the Beneficial Use of Fertilizing Residuals. Shall not cause a build-up of heavy metals or micronutrients in soil.

European Economic Community (EEC) Council Regulation, EC No. 834/2007 and 889/2008
Humic acid derivatives and oxidized lignite do not appear on Annex I, Fertilizers, soil conditioners and nutrients referred to in Article 3(1) and Article 6d(2) (EC, 2008). The EU requires all substances used as a fertilizer, soil conditioner or nutrient in organic production in the EU appear on that Annex (EC, 2007). However, humic acids do appear on Annex VII, Products for Cleaning and Disinfection (EC, 2008).

CODEX Alimentarius Commission, Guidelines for the Production, Processing, Labelling and Marketing of Organically Produced Foods (CXG 32-1999)
No information was identified at the listed site.

International Federation of Organic Agriculture Movements (IFOAM) Norms
Humic acid derivatives do not appear on Appendix 2: Fertilizers and Soil Conditioners. However, the use of humic acids are covered under a derogation found in §4.4.6, which reads: "Mineral fertilizers shall be applied in the form in which they are naturally composed and extracted and shall not be rendered more soluble by chemical treatment, other than addition of water and mixing with other naturally occurring, permitted inputs."

Japan Agricultural Standard (JAS) for Organic Production
The Japanese Agricultural Standard for Organic Production does not include humic acid derivatives or oxidized lignite on Table 1, Fertilizers and Soil Improvement Substances (JMAFF, 2012). Alkali extracted humic acid is banned for use on products grown for export to Japan under the Equivalency Agreement between the Japanese Ministry of Agriculture, Forestry and Fisheries and the USDA's National Organic Program, the only such substance currently to have that status (Arai, 2008).

Environmental Issues
Humic acids themselves are not known to cause environmental issues. When evaluating the manufacturing process, the TR states that there is no information available from EPA to suggest that environmental contamination results from the manufacture, use, misuse, or disposal of humic acids. Improper disposal of acids or bases used in the extraction process could be a source of environmental contamination. The mining of lignite/leonardite or other source materials may have environmental impacts.

Discussion
The Crops Subcommittee reviewed humic acid and discussed the role that humic acid products play in crop development.

Questions to our Stakeholders
None

NOSB Review
In 2022, the majority of the comments submitted to the NOSB regarding humic acid substances were supportive of continued listing. Various certifying bodies indicated the widespread usage on multiple crops.

The NOSB discussed information in the TR about a lack of standardized analysis for substances marketed as humic acid substances, resulting in the marketing of some products that produce minimal to no results. However, scientists have researched and documented the benefits of using humic acid substances in agriculture.

The Board reviewed concerns from stakeholders, including environmental impact, the risk of synthetic fortification of extractants. The NOSB also reviewed the Fall 2012 NOSB vote to prohibit oxidized lignite (humic acids derived from coal by oxidation with hydrogen peroxide) due to environmental and health impacts, lack of essentiality, and incompatibility with organic production. The NOSB suggested that an annotation could help clarify parameters for using the alkali extractant to reduce the potential for humic acids to be fortified with synthetic extractants.

Justification for Vote
The NOSB finds humic acids compliant with the Organic Foods Production Act (OFPA) and/or 7 CFR 205.600(b) and is not proposing removal.

NOSB Vote
Motion to remove humic acids from the National List
Motion by: Amy Bruch
Seconded by: Rick Greenwood
Yes: 0 No: 15 Abstain: 0 Recuse: 0 Absent: 0

Motion failed

Micronutrients: soluble boron products

Reference: §205.601(j) As plant or soil amendments. (7) Micronutrients—not to be used as a defoliant, herbicide, or desiccant. Those made from nitrates or chlorides are not allowed. Micronutrient deficiency must be documented by soil or tissue testing or other documented and verifiable method as approved by the certifying agent.
(i) Soluble boron products.
Technical Report: 2010 TR (Micronutrients); 2021 Lmt'd Scope TR pending
Petition: N/A
Past NOSB Actions: 04/1995 minutes and vote; 11/2005 sunset recommendation; 10/2010 sunset recommendation; 10/2015 sunset recommendation; 10/2015 micronutrient annotation change; 11/2017 sunset recommendation.
Recent Regulatory Background: Sunset renewal notice effective 3/15/2017 (82 FR 14420). Sunset renewal notice effective 1/28/2019 (83 FR 66559)
Sunset Date: 01/28/2024

Subcommittee Review

Use
Soluble boron is a crop micronutrient that can be soil applied or applied foliarly. According to the Technical Report (TR), boron deficiency is the most common when compared to the other recognized plant micronutrient deficiencies. Every year, boron deficiency is responsible for significant crop losses, whether in volume or quality.

Soluble boron products have appeared on the National List for use as micronutrients since it was first published in 2000.

Manufacture

The TR states that all soluble boron products are derived from mined borate mineral deposits. Borate minerals can be extracted by surface mining or solution mining (Garrett, 1998).

Borax/borate salts

Refined sodium borate salts are typically produced by crushing solid borate ores and dissolving in water alongside trona (a double salt of sodium carbonate and sodium bicarbonate), or supersaturating brine with carbon dioxide in the case of solution mining (Office of Energy Efficiency and Renewable Energy, 2002; Smith, 2000). Insoluble waste materials are filtered out of the liquid, and disodium tetraborate pentahydrate and decahydrate are selectively crystallized by temperature control and vacuum crystallization, followed by centrifugation and drying (Smith, 2000). To prevent crystallization water loss and caking, disodium tetraborate decahydrate crystals are sometimes washed with a boric acid solution that coats the crystals with a thin layer of the pentahydrate variety (Smith, 2000).

High purity borax can also be produced by reacting boric acid with hot sodium hydroxide (Smith, 2000). Various dehydration and rehydration methods can selectively produce the different hydration states of disodium tetraborate (Smith, 2000). Boric acid reactions with sodium hydroxide can produce disodium octaborate tetrahydrate (Kutcel, 2001).

Boric acid

In the United States, boric acid is typically prepared by reacting naturally occurring solid sodium borate minerals with strong mineral acids like sulfuric acid (Smith, 2000). This results in a concentrated solution of boric acid and sodium sulfates, after which the boric acid is crystallized by evaporation.

International Acceptance

Canadian General Standards Board Permitted Substances List

The Canadian Organic Standards permit soluble boron products at CAN/CGSB 32.311-2020 Table 4.2, column 1, entry for boron. Borate (boric acid), sodium tetraborate (borax and anhydrous), and sodium octaborate are permitted only when one of the following has been established:

- soil and plant deficiencies are documented by visual symptoms
- testing of soil or plant tissue demonstrates the need
- the need for a preventative application can be documented (CGSB, 2020)

European Economic Community (EEC) Council Regulation, EC No. 834/2007 and 889/2008

Several boron substances are allowed for soil management and fertilization by the European Union organic regulations. EC Regulation No. 889/2008 Article 3 permits the use of substances appearing in Annex I when the nutritional needs of plants cannot be met by certain preventative measures (European Parliament, Council of the European Union, 2008). Annex I permits the use of boric acid, sodium borate, calcium borate, and boron ethanolamine (European Parliament, Council of the European Union, 2003).

CODEX Alimentarius Commission, Guidelines for the Production, Processing, Labelling and Marketing of Organically Produced Foods (CXG 32-1999)

The Codex guidelines include “Trace elements (e.g., boron, copper, iron, manganese, molybdenum, zinc)” in Table 1, substances for use in soil fertilizing and conditioning (FAO 2007).

International Federation of Organic Agriculture Movements (IFOAM) Norms

Boric acid, sodium borate, calcium borate, and “borethanolamin” (presumably referring to boron ethanolamine) of mineral origin are permitted as fertilizers and soil conditioners in the IFOAM NORMS, where soil or plant nutrient deficiency can be documented by soil or tissue testing or diagnosed by an independent expert. Chloride and nitrate forms are prohibited, as are micronutrients used as defoliants, herbicides, or desiccants (IFOAM Organics International, 2019).

Japan Agricultural Standard (JAS) for Organic Production
Trace elements (manganese, boron, iron, copper, zinc, molybdenum, and chlorine) are permitted by the Japanese Agricultural Standard for Organic Plants as fertilizers and soil improvement substances if a crop cannot grow normally because of a micronutrient shortage (MAFF, 2017).

Environmental Issues
Mining borate minerals could cause an environmental impact. In addition, the TR states that sulfuric acid is used as a reactant to make boric acid from colemanite, and calcium sulfate is sometimes produced as a by-product. This results in a significant waste stream and can have environmental consequences related to the build-up of industrial waste. Wastewater discharge is also a source of boron pollution since boron appears in some soaps and washing chemicals.

Discussion
The Crops Subcommittee reviewed soluble boron products and discussed the role that soluble boron products play in crop development.

NOSB Review
In 2022, the NOSB received several comments in support of relisting soluble boron on the National List. Comments indicated that boron is an essential nutrient for plant development. There was an over-arching theme stating that having the ability to correct nutrient deficiencies in organic production is critical to creating strong, healthy, resilient soils. Commenters also mentioned the final rule. effective in January 2019, that specifies deficiency "must be documented by soil or tissue testing or other documented and verifiable method as approved by the certifying agent." An advocacy group was in favor of delisting due to environmental, health, essentiality, and compatibility concerns – indicating that investigation is needed to determine if non-synthetic borates can meet the need.

Justification for Vote
The NOSB finds soluble boron compliant with the Organic Foods Production Act (OFPA) and/or 7 CFR 205.600(b) and is not proposing removal.

NOSB Vote
Motion to remove soluble boron from the National List
Motion by: Amy Bruch
Seconded by: Jerry D'Amore
Yes: 0 No: 15 Abstain: 0 Recuse: 0 Absent: 0

Motion failed

Micronutrients: sulfates, carbonates, oxides, or silicates of zinc, copper, iron, manganese, molybdenum, selenium, and cobalt

Reference: §205.601(j) As plant or soil amendments. (7) Micronutrients—not to be used as a defoliant, herbicide, or desiccant. Those made from nitrates or chlorides are not allowed. Micronutrient deficiency must be documented by soil or tissue testing or other documented and verifiable method as approved by the certifying agent.

(ii) Sulfates, carbonates, oxides, or silicates of zinc, copper, iron, manganese, molybdenum, selenium, and cobalt.

Technical Report: 2010 TR (Micronutrients).
Petition: N/A
Past NOSB Actions: 04/1995 minutes and vote; 11/2005 sunset recommendation; 10/2010 sunset recommendation; 10/2015 annotation change recommendation; 10/2015 sunset recommendation; 11/2017 sunset recommendation.
Recent Regulatory Background: Sunset renewal notice effective 3/15/2017 (82 FR 14420). Sunset renewal notice effective 1/28/2019 (83 FR 66559)
Sunset Date: 01/28/2024

Subcommittee Review

Use
Micronutrients are essential for plant growth and are used across all types of crop production, but are typically required in very small quantities. Although some forms of micronutrients are found naturally in the soil, many producers find deficiencies of some or all of the micronutrients on the National List. These deficiencies can be a limiting factor in water and macro-nutrient uptake, and can result in limited growth and vitality of crops.

Manufacture
Plant micronutrients at this listing are made up of both compounds and natural minerals. After physical processing such as breaking and grinding, these natural minerals might be used as micronutrients in agriculture. Many commercial micronutrients are manufactured as by-products or intermediate products of metal mining and processing industries.

International Acceptance
Canadian General Standards Board Permitted Substances List
The Canadian Organic Production Systems Permitted Substances List permits micronutrients with a similar annotation to the USDA.

European Economic Community (EEC) Council Regulation, EC No. 834/2007 and 889/2008
European organic regulations do not reference micronutrients.

CODEX Alimentarius Commission, Guidelines for the Production, Processing, Labelling and Marketing of Organically Produced Foods (CXG 32-1999)
CODEX does not reference micronutrients.

International Federation of Organic Agriculture Movements (IFOAM) Norms
Micronutrient use is restricted to cases where soil/plant nutrient deficiency is documented by soil or tissue testing or diagnosed by an independent expert. Micronutrients in either chloride or nitrate forms are prohibited. Micronutrients may not be used as a defoliant, herbicide, or desiccant.

Japan Agricultural Standard (JAS) for Organic Production
JAS does not reference micronutrients.

Environmental Issues
Simple inorganic compounds such as Co, Cu, Fe, Mn, Mo, Se, and Zn, are found naturally in soil. Applied micronutrients are not expected to be significantly different from naturally occurring compounds in terms of concentration and physiological activity, when applied under set limits. Micronutrients are “heavy metals”, but the annotation prevents contamination by restricting their use to correct a deficiency.

Discussion
Micronutrients are crucial for organic production and stakeholders were overwhelmingly supportive of relisting.

Questions to our Stakeholders:
None

NOSB Review
In 2022, the comments received by the NOSB supported relisting micronutrients. Comments highlighted the essentiality to plant development and limiting soil availability. Many crops have specific and critical timing needs for these nutrients. One advocacy group was in favor of removing micronutrients from the list due to their classification as synthetic, and environmental, health, essentiality, and compatibility concerns.

Justification for Vote
Based on the current review and public comment, the NOSB finds micronutrients: sulfates, carbonates, oxides, or silicates of zinc, copper, iron, manganese, molybdenum, selenium, and cobalt, compliant with the OFPA criteria, and does not recommend removal from the National List.

NOSB Vote
Motion to remove micronutrients: sulfates, carbonates, oxides, or silicates of zinc, copper, iron, manganese, molybdenum, selenium, and cobalt from the National List
Motion by: Logan Petrey
Seconded by: Amy Bruch
Yes: 0 No: 15 Abstain: 0 Recuse: 0 Absent: 0

Motion failed

Vitamins C and E

Reference: §205.601(j) As plant or soil amendments.
(9) Vitamins C and E.
Technical Report: 1995 TAP; 2015 TR.
Petition: N/A
Past NOSB Actions: 10/1995 minutes and vote; 11/2005 sunset recommendation; 10/2010 sunset recommendation; 10/2015 sunset recommendation; 11/2017 sunset recommendation (relist C and E, remove B_1).
Recent Regulatory Background: Sunset renewal notice effective 3/15/2017 (82 FR 14420). Sunset renewal notice effective 10/30/2019 (84 FR 53577)
Sunset date: 10/30/2024

Subcommittee Review
Vitamins, including synthetically derived C (ascorbic acid) and E (tocopherols), are generally considered non-toxic essential nutrients for terrestrial and aquatic organisms. Vitamins C and E are used to promote both growth and yields and to protect plants from oxidative stress due to salinity. During the previous sunset review (11/2017), vitamin B1 (thiamine) – which had been previously paired with the other two vitamins on the

National List – was recommended for removal from the list on the basis that foliar and soil applications of the material did not stimulate root growth in transplanted crops, and it was subsequently removed.

A Technical Report was completed on these materials in 2015. While it relied on peer-reviewed scientific literature to assess its alignment with OFPA criteria, it does not include practical information regarding the use of Vitamins C and E.

Manufacture
Although Vitamins C and E are naturally occurring in commonly consumed foods, they are typically derived for commercial use from laboratory processes.

International Acceptance
Canadian General Standards Board Permitted Substances List
Vitamin C is listed for crop production; Vitamin E is not listed.

European Economic Community (EEC) Council Regulation, EC No. 834/2007 and 889/2008
Neither substance is listed.

CODEX Alimentarius Commission, Guidelines for the Production, Processing, Labelling and Marketing of Organically Produced Foods (CXG 32-1999)
Neither substance is listed.

International Federation of Organic Agriculture Movements (IFOAM) Norms
Neither substance is listed.

Japan Agricultural Standard (JAS) for Organic Production
Neither substance is listed.

Environmental Issues
It is unclear whether there are particular environmental concerns regarding the manufacture and use of Vitamins C and E for plant or soil amendments.

Discussion
The Subcommittee has had a general discussion of the historical review of these materials and what was involved in the separate, now-delisted Vitamin B1 from this section. Stakeholders and the Subcommittee are supportive of relisting vitamins C and E, and added a question about use in organic crop production to be considered for the next sunset review.

Questions to our Stakeholders
1. How are Vitamins C and E being used in organic crop production?
2. Are Vitamins C and E being used by significant numbers of organic growers?

NOSB Review
There were eight written public comments about Vitamins C and E during the Fall 2022 meeting cycle. While the majority of comment supported keeping this substance on the National List due to specifically described use in organic production, three commenters – one grower group and two non-profits – opposed relisting out of concern about either essentiality or the suggestion that the materials could be produced via excluded methods.

Justification for Vote
The NOSB finds vitamins C and E compliant with the Organic Foods Production Act (OFPA) and/or 7 CFR 205.600(b) and is not proposing removal.

NOSB Vote
Motion to remove vitamins C and E from §205.601(j) of the National List
Motion by: Wood Turner
Seconded by: Brian Caldwell
Yes: 0 No: 15 Abstain: 0 Recuse: 0 Absent: 0

Motion failed

Squid byproducts

Reference: §205.601(j) As plant or soil amendments.
(10) Squid byproducts—from food waste processing only. Can be pH adjusted with sulfuric, citric, or phosphoric acid. The amount of acid used shall not exceed the minimum needed to lower the pH to 3.5.
Technical Report: 2016 TR.
Petition: 2015 (Amendment #1).
Past NOSB Actions: 04/2016 recommendation.
Recent Regulatory Background: Added to National List on 01/28/2019 (83 FR 66559).
Sunset Date: 01/28/2024

Subcommittee Review

Background
Squid are littoral invertebrates classified into the phylum Mollusca, class Cephalopoda and order Loligo (later renamed Doryteuthis). There are an estimated 300 squid species known throughout the world. Common to the northeastern Atlantic coast is the longfin squid, species *Doryteuthis (Loligo) pealli*. Common to the US west coast is the market squid, species *Doryteuthis (Loligo) opalescens*. The use of squid and squid byproducts in agriculture dates back to the 1800's when much of the product was shipped from California market squid fisheries to Asian countries for consumption and fertilizer applications.

Use
Squid and squid byproducts are the starting ingredients in the production of enzymatically produced hydrolysates with N-P-K values ranging from 2-2-2 to 3.3-7.3-2 or more. Seafood derived hydrolysates, including squid and squid byproducts, have been used both as foliar sprays and soil amendments for propagating cranberries, cherries, and apples.

Manufacture
Squid byproducts make up 52% of the total body weight and include the squid ink, pen, skin, milt, liver, and viscera and are typically discarded as waste. In general, squid byproducts are chopped, heated, digested with natural enzymes, and stabilized with an acid such as phosphoric, sulfuric, or citric acid to prevent microbial growth.

International Acceptance
Canadian General Standards Board Permitted Substances List
The Canadian Organic Standard allows for the use of fish products; in Canadian fisheries, the definition of fish

includes marine invertebrates such as squid.

European Economic Community (EEC) Council Regulation, EC No. 834/2007 and 889/2008
The EU Organic Standard allows the use of molluscan (squid) products from sustainable fisheries and may be used in organic production of feeds for non- herbivores; squid products are not explicitly authorized for use in organic production.

CODEX Alimentarius Commission, Guidelines for the Production, Processing, Labelling and Marketing of Organically Produced Foods (CXG 32-1999)
CODEX does not reference squid byproducts.

International Federation of Organic Agriculture Movements (IFOAM) Norms
IFOAM permits the use of fish and shell products and food processing of animal origin.

Japan Agricultural Standard (JAS) for Organic Production
The Japanese Organic Standard permits the use of food industry byproducts of fish origin if they are derived from natural sources; mollusks (squid) are included in Japanese fisheries.

Environmental Issues
Squid are commercially harvested using nets directly above spawning grounds during mating season primarily for calamari. Fisherman target spawning squid because they die shortly after reproduction. There are two main squid fisheries in the US including along the Atlantic coast for long-finned squid and along the Pacific coast for market squid. The US Pacific squid fishery is managed by the California Department of Fish and Game, the National Oceanographic and Atmospheric Administration (NOAA) Fisheries, and the Pacific Fishery Management Council. Atlantic squid are managed in federal waters by NOAA Fisheries in conjunction with the Mid-Atlantic Fishery Management Council. Management includes seasonal catch limits, timed fishery closures, administration of permit issuance, and limitations on using lights to attract squid to ensure uninterrupted spawning.

Discussion
The manufacturing and use of squid byproducts has little to no environmental impact or human health concerns and provides organic growers with another nitrogen source. Most commenters support the relisting of squid byproducts with the current annotation. No further discussion in subcommittee.

Questions to our Stakeholders
None

NOSB Review
At the Fall 2022 meeting, there were no oral comments and 11 written comments, 10 of which were in support of relisting squid byproducts. One advocacy group did not support its listing because it is a synthetic product and stated that it is not needed. Given widespread support among stakeholders, the NOSB determined that squid byproducts should continue to be listed.

Justification for Vote
The NOSB finds squid byproducts compliant with the Organic Foods Production Act (OFPA) and/or 7 CFR 205.600(b) and is not proposing removal.

NOSB Vote
Motion to remove squid byproducts from the National List

Motion by: Logan Petrey
Seconded by: Brian Caldwell
Yes: 0 No: 15 Abstain: 0 Recuse: 0 Absent: 0

Motion failed

Lead salts

Reference: §205.602(d) Lead salts.
Technical Report: N/A
Petition: N/A
Past NOSB Actions: 04/1995 minutes and vote; 11/2005 sunset recommendation; 10/2010 sunset recommendation; 10/2015 sunset recommendation; 11/2017 sunset recommendation.
Recent Regulatory Background: Sunset renewal notice effective 3/15/2017 (82 FR 14420). Sunset renewal notice effective 10/30/2019 (84 FR 53577)
Sunset date: 10/30/2024

Subcommittee Review

Use
Lead salts are used as both pesticides and herbicides.

Manufacture
Lead salts are usually produced using the following reaction, which leads to formation of the desired product as a solid precipitate:

$$Pb(NO_3)_2 + H_3AsO_4 \rightarrow PbHAsO_4 + 2\ HNO_3$$

International Acceptance
None found

Environmental Issues
Lead poisoning can cause a number of adverse human health effects but is particularly detrimental to the neurological development of children. Since lead accumulates in soils, it is important to avoid soil applications of materials containing lead, whether the lead is in synthetic materials or naturally occurring (nonsynthetic) lead salts. Notably, the Centers for Disease Control and Prevention (CDC) has found that there is no safe level of lead exposure and in 2021 lowered the reference level from 5 ug/dl to 3.5 ug/dl.
Discussion
Public comments received in previous sunset reviews were in favor of keeping lead salts on the list of nonsynthetic substances prohibited for use in organic crop production. One commenter suggested that it would be worthwhile to add more detail about the scientific and regulatory rationale (i.e., OFPA) for why lead salts should continue to be prohibited. The Crops Subcommittee consulted the Toxicological Profile from the Agency for Toxic Substances (ATSDR 2007, Toxicological Profile: Lead. P. 304. http://www.atsdr.cdc.gov/toxprofiles/tp13.pdf.) and noted the following:
Occurrence and Prevalence:
Lead (PB) occurs naturally in soils in small amounts and in ore deposits throughout the world. Lead is also given off as an emission from combustion of leaded gasoline (now banned in the US), and was used in house paint until 1978. Lead was widely used as an insect disease control in the early part of the 1900s on tree fruit, and

residual lead in old orchard areas can still be detected. People can be exposed to lead in ambient air, drinking water, foods, soil, and dust.

Lead does not break down in the environment. Particles of lead can be transported through air, water, and soil. Once in soil, it does not leach. It's availability to be taken up by plants is limited but lead can be in the soil adhering to root crops.

Health and Environmental Hazards of Lead:
Toxicity of lead in humans has been known for over 2000 years and is not disputed. There is vast literature on the health effects of lead exposure. More details on the exact symptoms of too much lead, and details of the many studies, can be found in the ATSDR report cited above. There are a few treatments to facilitate removing lead from the body, but they are not easily accessible and take a lot of time. Livestock can also be exposed to high levels of lead through dust and air pollution.

While the most polluting forms of lead from auto emissions and lead paint are no longer being generated, much of the lead that they put out into the environment is still there. Additional sources of lead pollution may come from lead-acid batteries if not disposed of properly, lead in ammunition used for hunting, air pollution from aircraft using fuel with lead in it, and smelting of lead ore. Industries continue to release large amounts of lead into waterways. Sediments from these waterways can end up in agricultural soils from flooding and dredging.

Lead is very slow to leach out of soils, although it can slowly migrate down through soils. However, soils with high organic matter create conditions for the lead molecules to be bound to organic matter, thereby lessening its migration.

The Crops Subcommittee supports keeping lead salts in its prohibited status on the National List and the NOSB will vote on the proposal at the Fall 2022 meeting. The NOSB concurred that lead salts should stay on the National List in prohibited status.

Questions to our Stakeholders
None

NOSB Review
Board discussion was brief, and the NOSB and stakeholders support continued prohibition of lead salts.

Justification for Vote
The NOSB supports continued prohibition of lead salts and is not proposing removal from the National List.

NOSB Vote
Motion to remove lead salts from the National List
Motion by: Javier Zamora
Seconded by: Amy Bruch
Yes: 0 No: 15 Abstain: 0 Recuse: 0 Absent: 0

Motion failed

Tobacco dust (nicotine sulfate)

Reference: §205.602(j) Tobacco dust (nicotine sulfate).
Technical Report: N/A
Petition: N/A
Past NOSB Actions: 04/1995 minutes and vote; 11/2005 sunset recommendation; 10/2010 sunset recommendation; 10/2015 sunset recommendation; 11/2017 sunset recommendation.
Recent Regulatory Background: Sunset renewal notice effective 3/15/2017 (82 FR 14420). Sunset renewal notice effective 10/30/2019 (84 FR 53577)
Sunset date: 10/30/2024

Subcommittee Review

Use
Nicotine is a natural insecticide produced as a secondary metabolite in tobacco. Tobacco dust can be used in agriculture for pest control.

Manufacture
Tobacco dust is a by-product of agro-industrial waste from the commercial processing of tobacco products. It was noted during a previous review that tobacco dust is no longer commercially available as a crop pest control product, however it could still be homemade by mixing tobacco with water.

International Acceptance
Canadian General Standards Board Permitted Substances List
There is no reference to tobacco dust.

European Economic Community (EEC) Council Regulation, EC No. 834/2007 and 889/2008
There is no reference to tobacco dust.

CODEX Alimentarius Commission, Guidelines for the Production, Processing, Labelling and Marketing of Organically Produced Foods (CXG 32-1999)
There is no reference to tobacco dust.

International Federation of Organic Agriculture Movements (IFOAM) Norms
There is no reference to tobacco dust.

Japan Agricultural Standard (JAS) for Organic Production
There is no reference to tobacco dust.

Environmental Issues
Classified as super toxic on the National Library of Medicine's Hazardous Substances Data Bank (HSDB) and regulated by the Environmental Protection Agency (EPA) as a pesticide. EPA published a Federal Register notice [74 FR 26695] in June 2009 indicating that as of January 1, 2014, the EPA would no longer register nicotine products.

Discussion
Tobacco dust (nicotine sulfate) has been present on the National List as a prohibited substance since the inception of the USDA organic regulations. Due to the negative human health effects caused by this material, it has been relisted as a prohibited nonsynthetic on the National List at every sunset review, with no objections from the public or from the NOSB. It is present on the Hazardous Substance list and regulated by OSHA and the

EPA as well as other agencies.

Previous public comments indicated that certifiers, businesses, and public interest organizations agree that tobacco dust should remain listed as a prohibited nonsynthetic. The Crops Subcommittee supports keeping tobacco dust on the National List at §205.602.

Questions to our Stakeholders
None

NOSB Review
There were no oral comments for tobacco dust and all of the written comments were in favor of relisting tobacco dust as a prohibited material. There was little additional discussion at the meeting, and the NOSB was unanimous in its decision to relist.

Justification for Vote
The NOSB supports continued prohibition of tobacco dust and is not proposing removal from the National List at § 205.602.

NOSB Vote
Motion to remove tobacco dust (nicotine sulfate) at § 205.602
Motion by: Logan Petrey
Seconded by: Wood Turner
Yes: 0 No: 15 Abstain: 0 Recuse: 0 Absent: 0

Motion failed