# Sunset 2025
# Meeting 2 - Reviews
# Crops Substances § 205.601 & § 205.602
# October 2023

**Introduction**

As part of the Sunset Process, the National Organic Program (NOP) announces substances on the National List of Allowed and Prohibited Substances (National List) that are coming up for sunset review by the National Organic Standard Board (NOSB). The following list announces substances that must be reviewed by the NOSB and renewed by the USDA before their sunset dates. This document provides the substance's current status on the National List, annotation, references to past technical reports, past NOSB actions, and regulatory history, as applicable. If a new technical report has been requested for a substance, it is noted in this list. Substances included in this document may also be viewed in the NOP's Petitioned Substances Index.

**Request for Comments**

Written public comments will be accepted through September 28, 2023 via www.regulations.gov. Comments received after that date may not be reviewed by the NOSB before the meeting.

Public comments are necessary to guide the NOSB's review of each substance against the criteria in the Organic Foods Production Act (7 U.S.C. 6518(m)) and the USDA organic regulations (7 CFR 205.600). The current substances on the National List were originally recommended by the NOSB based on evidence available to the NOSB at the time of their last review, which demonstrated that the substances were: (1) not harmful to human health or the environment, (2) necessary because of the unavailability of wholly nonsynthetic alternatives, and (3) consistent and compatible with organic practices.

Public comments should clearly indicate the commentor's position on the allowance or prohibition of substances on the National List and explain the reasons for the position. Public comments should focus on providing relevant new information about a substance since its last NOSB review. Such information could include research or data that may support a change in the NOSB's determination for a substance (*e.g.*, scientific, environmental, manufacturing, industry impact information, etc.). Public comment should also address the continuing need for a substance or whether the substance is no longer needed or in demand.

**For Comments that <u>Support</u> the Continued Use of §205.601 Substances in Organic Production:**

If you provide comments supporting the allowance of a substance at §205.601, you should provide information demonstrating that the substance is:

1. not harmful to human health or the environment;
2. necessary to the production of the agricultural products because of the unavailability of wholly nonsynthetic substitute products; and
3. consistent with organic crop production.

**For Comments that Do Not Support the Continued Use of §205.601 Substances in Organic Production:**
If you provide comments that do not support a substance at §205.601, you should provide reasons why the use of the substance should no longer be allowed in organic production. Specifically, comments that support the removal of a substance from the National List should provide new information since its last NOSB review to demonstrate that the substance is:

1. harmful to human health or the environment;
2. unnecessary because of the availability of alternatives; and/or
3. inconsistent with organic crop production.

**For Comments that Support the Continued Prohibition of §205.602 Substances in Organic Production:**
If you provide comments supporting the prohibition of a substance on the §205.602 section of the National List, you should provide information demonstrating that the substance is:

1. harmful to human health or the environment; and
2. inconsistent with organic crop production.

**For Comments that Do Not Support the Continued Prohibition of §205.602 Substances in Organic Production:**
If you provide comments that do not support the prohibition of a substance at §205.602, you should provide reasons why the use of the substance should no longer be prohibited in organic production. Specifically, comments that support the removal of a substance from the §205.602 section of the National List should provide new information since its last NOSB review to demonstrate that the substance is:

1. not harmful to human health or the environment; and/or
2. consistent with organic crop production.

**For Comments Addressing the Availability of Alternatives:**
Comments may include information about the viability of alternatives for a substance under sunset review. Viable alternatives include, but are not limited to:

1. Alternative management practices or natural substances that would eliminate the need for the specific substance;
2. Other substances that are on the National List that are better alternatives, which could eliminate the need for this specific substance; and/or
3. Other organic or nonorganic agricultural substances.

Your comments should address whether any alternatives have a function and effect equivalent to or better than the allowed substance, and whether you want the substance to be allowed or removed from the National List. Assertions about alternative substances, except for those alternatives that already appear on the National List, should, if possible, include the name and address of the manufacturer of the alternative. Further, your comments should include a copy or the specific source of any supportive literature, which could include: product or practice descriptions, performance and test data, reference standards, names and addresses of organic operations who have used the alternative under similar conditions and the date of use, and an itemized comparison of the function and effect of the proposed alternative(s) with substance under review.

Written public comments will be accepted through September 28, 2023 via www.regulations.gov. Comments received after that date may not be reviewed by the NOSB before the meeting.

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

- Alcohols: Ethanol
- Alcohols: Isopropanol
- Sodium carbonate peroxyhydrate
- Newspaper or other recycled paper, without glossy or colored inks (§205.601(b) - mulch)
- Newspaper or other recycled paper, without glossy or colored inks (§205.601(c) - compost feedstock)
- Plastic mulch and covers
- Aqueous potassium silicate (§205.601(e) - insecticide)
- Aqueous potassium silicate (§205.601(i) - plant disease control)
- Elemental sulfur (§205.601(e) - insecticide; §205.601(i) - plant disease control; §205.601(j) - plant or soil amendment
- Lime sulfur (§205.601(e) - insecticide)
- Lime sulfur (§205.601(i) - plant disease control)
- Hydrated lime
- Liquid fish products
- Sulfurous acid
- Ethylene gas
- Microcrystalline cheesewax

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

- Potassium chloride

## Alcohols: Ethanol

**Reference:** 205.601(a) As algicide, disinfectants, and sanitizer, including irrigation system cleaning systems.
(1) Alcohols. (i) Ethanol.
**Technical Report(s)**: 1995 TAP; 2014 TR
**Petition(s):** N/A
**Past NOSB Actions:** 11/1995 NOSB minutes and vote (pg. 17-18); 11/2005 NOSB sunset recommendation; 04/2011 NOSB sunset recommendation; 10/2015 NOSB sunset recommendation; 10/2018 NOSB sunset recommendation
**Regulatory Background:** Added to National List 04/21/2001 (65 FR 80547, 66 FR 15619); Sunset renewal notice published 10/16/2007 (72 FR 58469); Sunset renewal notice published 06/06/2012 (77 FR 33290); Sunset renewal notice published 03/15/2017 (82 FR 14420); Sunset renewal notice published 05/07/2020 (85 FR 27105)
**Sunset Date:** 6/22/2025

**Subcommittee Review**

**Use:**
Ethanol is used in organic crop production as an algicide, disinfectant, and sanitizer, including irrigation system cleaning.

**Manufacture:**
Ethanol can be produced by fermentation and chemical synthesis through direct or indirect hydration of ethylene. Fermentation to produce ethanol can use starch, sugar, or cellulose using either natural or genetically engineered strains of bacteria or yeast.

**International Acceptance:**
Canadian General Standards Board Permitted Substances List
Ethanol is listed as a synthetic for organic crop and livestock production.

European Economic Community (EEC) Council Regulation, EC No. 834/2007 and 889/2008
Ethanol is listed as a synthetic for organic crop and livestock production.

CODEX Alimentarius Commission, Guidelines for the Production, Processing, Labelling and Marketing of Organically Produced Foods (GL 32-1999)
Ethanol is listed as a synthetic for organic crop and livestock production.

International Federation of Organic Agriculture Movements (IFOAM)
Ethanol is listed as a synthetic for organic crop and livestock production.

Japan Agricultural Standard (JAS) for Organic Production
Ethanol is listed as a synthetic for organic crop and livestock production.

**Environmental Issues:**
According to the United States Environmental Protection Agency (EPA), the agency that regulates all non-food applications of ethanol, ethanol is practically non-toxic based on acute oral and inhalation

toxicity tests. Ethanol is biodegradable in air, soil, and water. Ethanol can contribute to smog but would be minimal in the quantities used.

**Discussion:**
During the Spring 2023 NOSB meeting, the Board reviewed both ethanol and isopropanol, noting that there is little to no environmental or human health impacts associated with the use of ethanol. Members were supportive of relisting. The NOSB also reviewed public comments. Farmers indicated that ethanol and isopropanol could be used for cleaning tools and pruning shears, cleaning drip lines that become clogged, and during post-harvest handling to sanitize and disinfect equipment. Ethanol and Isopropanol are readily available in rural areas.

One question was posed to the community about requiring organically-produced ethanol if sufficient quantities are available for organic production and there was agreement that this conversation points to a larger discussion about whether all crop inputs, including manures, should be sourced organically.

**Justification for Vote:**
The Subcommittee finds alcohols: ethanol compliant with the Organic Foods Production Act (OFPA) and/or 7 CFR 205.600 and is not proposing removal.

**Subcommittee Vote:**
Motion to remove alcohols: ethanol from the National List
Motion by: Logan Petrey
Seconded by: Brian Caldwell
Yes: 0 No: 7 Abstain: 0 Recuse: 0 Absent: 0

## Alcohols: Isopropanol

**Reference:** 205.601(a) As algicide, disinfectants, and sanitizer, including irrigation system cleaning systems.
(1) Alcohols. (ii) Isopropanol.
**Technical Report(s)**: 1995 TAP; 2014 TR
**Petition(s):** N/A
**Past NOSB Actions:** 11/1995 NOSB minutes and vote (pg. 17-18); 11/2005 NOSB sunset recommendation; 04/2011 NOSB sunset recommendation; 10/2015 NOSB sunset recommendation; 10/2018 NOSB sunset recommendation
**Regulatory Background:** Added to National List 04/21/2001 (65 FR 80547, 66 FR 15619); Sunset renewal notice published 10/16/2007 (72 FR 58469); Sunset renewal notice published 06/06/2012 (77 FR 33290); Sunset renewal notice published 03/15/2017 (82 FR 14420); Sunset renewal notice published 05/07/20 (85 FR 27105)
**Sunset Date:** 6/22/2025

**Subcommittee Review**

**Use:**
Isopropanol is used for a variety of industrial and consumer uses. In organic crop production, isopropanol can be used as an algicide, disinfectant, and sanitizer, including irrigation system cleaning. Isopropanol has broad-spectrum antimicrobial activity against vegetative bacteria, viruses, and fungi.

**Manufacture:**
Isopropanol is a synthetic compound that is manufactured by hydration of petroleum-derived propylene. Acetone can also be used as a hydrated base chemical over a metal catalyst.

**International Acceptance:**
Canadian General Standards Board Permitted Substances List
Canadian organic production standards permit the use of isopropanol for a number of agricultural applications.

European Economic Community (EEC) Council Regulation, EC No. 834/2007 and 889/2008
Alcohols, presumably including isopropanol, may be used for cleaning and disinfecting livestock building installations and utensils.

CODEX Alimentarius Commission, Guidelines for the Production, Processing, Labelling and Marketing of Organically Produced Foods (GL 32-1999)
"Need recognized by certification body or authority"

International Federation of Organic Agriculture Movements (IFOAM)
No information found

Japan Agricultural Standard (JAS) for Organic Production
No information found

**Environmental Issues:**
The United States Environmental Protection Agency (EPA) considers isopropanol slightly toxic to practically non-toxic on acute oral and inhalation toxicity tests. The alcohol can contribute to smog and ozone formation, but large-scale releases are unlikely based on prescribed use in organic agriculture.

**Discussion:**
The NOSB reviewed the use, manufacturing, and environmental concerns of isopropanol, and previous NOSB reviews, and supports relisting. The NOSB discussed comments from the Spring 2023 meeting. Farmers indicated that ethanol and isopropanol could be used for cleaning tools and pruning shears, cleaning drip lines that become clogged, and during post-harvest handling to sanitize and disinfect equipment. Ethanol and isopropanol are readily available in rural areas.

**Justification for Vote:**
The Subcommittee finds alcohols: isopropanol compliant with the Organic Foods Production Act (OFPA) and/or 7 CFR 205.600 and is not proposing removal.

**Subcommittee Vote:**
Motion to remove alcohols: isopropanol from the National List
Motion by: Logan Petrey
Seconded by: Amy Bruch
Yes: 0 No: 7 Abstain: 0 Recuse: 0 Absent: 1

## Sodium carbonate peroxyhydrate

**Reference:** 205.601(a) As algaecide, disinfectants, and sanitizer, including irrigation system cleaning systems.
(8) Sodium carbonate peroxyhydrate (CAS #-15630-89-4)—Federal law restricts the use of this substance in food crop production to approved food uses identified on the product label.
**Technical Report**: 2006 TR; 2014 TR
**Petition(s):** 2005
**Past NOSB Actions:** 11/2007 NOSB recommendation; 10/2014 NOSB sunset recommendation; 10/2018 NOSB sunset recommendation
**Regulatory Background:** Added to National List 12/13/2010 (75 FR 77521); Sunset renewal notice published 06/19/2015 (80 FR 35177); Sunset renewal notice published 05/07/2020 (85 FR 27105)
**Sunset Date:** 6/22/2025

**Subcommittee Review**

**Use:**
According to the 2014 TR and previous reviews by the Board, sodium carbonate peroxyhydrate (SCP) has been used in organic production as an algaecide in rice fields, ponds, ditches, and irrigation lines. It was added to the National List in 2007 as an alternative to materials such as copper and chlorine; it has been registered for use in rice since 2010. In wider legal uses of the substance, "In its primary registration by the US Environmental Protection Agency (EPA) as a biopesticide, use sites for sodium carbonate peroxyhydrate include ornamental plants, turf grasses, terrestrial landscapes, commercial greenhouses, garden centers, nurseries and storage areas. Target pests included algae, moss, liverworts, slime molds and their spores. There was no food use authorized. (TR 104-107)

**Manufacture:**
According to the 2014 TR, "Sodium carbonate peroxyhydrate is the chemical name for an addition product produced by drying hydrogen peroxide in the presence of sodium carbonate (CAS No. 497-19-8). The pure substance contains 32.5 % hydrogen peroxide and 67.5 % sodium carbonate (based on weight)" (TR 51-53).

The TR lists three common manufacturing processes via drying, crystallization and a spray granulation process. "The dry process involves spraying an aqueous stabilized hydrogen peroxide solution on solid sodium carbonate with continuous agitation. A solid-liquid reaction yields sodium carbonate peroxyhydrate" (TR 232-33). "In the spray granulation process, solutions of sodium carbonate and aqueous stabilized hydrogen peroxide are sprayed onto a bed of sodium carbonate peroxyhydrate nuclei in a fluid-bed granulator. The product bed is kept in movement by a stream of heated air. Product is continuously withdrawn from the dryer and the desired grain-size fraction is obtained by classification" (TR 235-238). "The crystallization process takes advantage of the high solubility of sodium carbonate peroxyhydrate. In this method, sodium carbonate peroxyhydrate is salted out of aqueous solutions with sodium chloride. A sodium carbonate/NaCl suspension is reacted with stabilized hydrogen peroxide under stirring and cooling. The crystallized sodium carbonate peroxyhydrate is separated from the mother liquor by centrifugation, and drying in a fluid-bed dryer" (TR 240-244).

**International Acceptance:**

Canadian General Standards Board Permitted Substances List

(As of 2014 TR) "Hydrogen peroxide is on the Canadian Organic Production Systems Permitted Substances Lists (CAN/CGSB-32.311-2006). It is listed for use as a fungicide. Sodium carbonate (soda ash) is considered a natural substance in the Canadian system. Sodium carbonate peroxyhydrate is not included in any of the Canadian permitted substance lists" (TR 168-171).

European Economic Community (EEC) Council Regulation, EC No. 834/2007 and 889/2008 (As of 2014 TR) "Sodium carbonate peroxyhydrate is not listed as a permitted substance for organic production"(TR 187)

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

(As of 2014 TR) "Although Codex Alimentarius permits the use of sodium carbonate peroxyhydrate as an anti-bactericide in raw milk, it is not included in any list for organic use" (TR 176-77).

International Federation of Organic Agriculture Movements (IFOAM) Norms

(As of 2014 TR) "Sodium carbonate peroxyhydrate is not listed or discussed for use in the IFOAM norms" (TR 201).

Japan Agricultural Standard (JAS) for Organic Production

(As of 2014 TR) "Sodium carbonate peroxyhydrate, hydrogen peroxide and sodium carbonate are not specifically listed in the Japanese Agricultural Standard for Organic Plants" (TR 195-196).

**Environmental Issues:**

An emission of sodium carbonate peroxyhydrate to the environment could occur during production, formulation, and use of the substance (TR lines 323-24). Sodium, carbonate, and hydrogen peroxide do not adsorb to sediment (TR line 333). No new concerns were raised about human health or environmental effects since the earlier review in 2006; however, the substance can have negative impacts on fish, birds and bees. "Aquatically, toxic effects of sodium carbonate peroxyhydrate on fish have been reported, but the sensitivity of different fish species depends on final hydrogen peroxide concentration, water temperature, and life stage" (TR 395-397). "Undissolved sodium carbonate peroxyhydrate is toxic to birds when ingested. However, once applied and dissolve in water sodium carbonate peroxyhydrate is not expected to be toxic to birds. Sodium carbonate peroxyhydrate is also highly toxic to bees and it should not be allowed to drift to flowering plants or used when contact with bees might occur" (TR 404-407).

**Discussion:**

The Crops Subcommittee took note of previous reviews of this substance. In the last review, the Subcommittee sought input comparing this material with copper sulfate for control of algal scum in rice production and asked if it could replace copper sulfate for that use. Limited and conflicting comments were received. Points raised in favor of renewing the substance stated that it provides better control of algae, and its breakdown components of water and oxygen are more favorable than the accumulation of elemental copper associated with copper sulfate. Additionally, when utilized in irrigation ponds sodium carbonate peroxyhydrate has fewer corrosion issues with irrigation equipment than copper sulfate.

The Subcommittee expressed value in the continued presence of the substance on the National List, even if it is not a commonly used material. Additionally, the potential for inadvertent use as a fungicide in branded products marketed for both uses was discussed by the Subcommittee.

Public comments from the Spring meeting were supportive of relisting with a couple of notable details. A couple of stakeholders reminded the community that SCP was originally considered for use as a replacement for copper sulfate in rice production, does not fall under an OPFA category for crops use and the NOSB should consider whether the intended use is happening in practice and whether the listing should be more narrowly annotated. Consulting the transcripts for previous decision making, the NOSB recommendation at the time reflects that the Crops Subcommittee was originally unconvinced of the need and compatibility of the substance but that "(R)esulting public comment at the full NOSB meeting presented additional information that convinced most board members that the material's environmental impacts were minimal and much more environmentally friendly than the copper sulfate now used as the principal farm pond and rice production algaecide".

A farmer group described SCP as functioning better than copper sulfate for algae control; specifically noting that copper sulfate only reduces bloom whereas SCP prevents the growth of algae. Another farmer noted that the loss of this material could negatively impact farm economies and organic agricultural production. Certifiers listed low levels of use in OSPs in most regions of the country, except in rice growing regions, where a certifier listed 127 users, specifically reflecting support for SCP as an alternative to copper use.

Other public comments support this listing as a variety of options are needed for each application in order to prevent the buildup of microbial resistance; noted that this material breaks down into hydrogen peroxide and sodium carbonate, which further qualifies SCP as a material compatible with National List evaluation and criteria. Another commenter noted that their organization has observed efficacy and utility of the substance in practice.

The Subcommittee has a question about the EPA designation of SCP as a biopesticide and may seek information from EPA on its definitions. This is not an NOSB/OFPA concern, but the Subcommittee is interested in receiving clarity from the EPA.

**Justification for Vote:**
The Subcommittee finds sodium carbonate peroxyhydrate (SCP) compliant with the Organic Foods Production Act (OFPA) and/or 7 CFR 205.600 and is not proposing removal.

**Subcommittee Vote:**
Motion to remove sodium carbonate peroxyhydrate from the National List at 205.601(a)(8)
Motion by: Mindee Jeffery
Seconded by: Brian Caldwell
Yes: 0 No: 6 Abstain: 0 Recuse: 0 Absent: 2

## Newspaper or other recycled paper, without glossy or colored inks

**Reference:** 205.601(b) As herbicides, weed barriers, as applicable.
(2) Mulches. (i) Newspaper or other recycled paper, without glossy or colored inks.
**Technical Report**: 1995 TAP; 2006 TR; 2017 TR
**Petition(s):** N/A
**Past NOSB Actions:** 11/1995 NOSB minutes and vote (pg. 19); 11/2005 NOSB sunset recommendation; 04/2011 NOSB sunset recommendation; 10/2015 NOSB sunset recommendation; 10/2018 NOSB sunset recommendation
**Regulatory Background:** Added to National List 04/21/2001 (65 FR 80547, 66 FR 15619); Sunset renewal notice published 10/16/2007 (72 FR 58469); Sunset renewal notice published 06/06/2012 (77 FR 33290); Sunset renewal notice published 03/15/2017 (82 FR 14420); Sunset renewal notice published 05/07/20 (85 FR 27105)
**Sunset Date:** 6/22/2025

**Subcommittee Review**

**Use:**
Newspaper and other recycled paper is commonly used in organic agriculture as a non-chemical means of weed management and soil moisture retention, soil temperature moderation, and boosts to soil organic matter. It is also used to shade out plant growth; it then degrades into the soil.

**Manufacture:**
A 2017 Technical Report (TR, line 82) on this material reports that one-third to one-half of all paper in the United States is recycled into other paper products, and reports EPA figures from 2013 data that paper is recycled at a rate of 63% in the United States (line 87).

Recycled paper comes from a number of different sources that affect the grade of the recycled paper product; old corrugated containers, mixed paper, old newspapers, high grade de-inked paper, and pulp substitutes. These larger categories are further segmented into as many as 50 different sub-grades of recycled paper. Paper recovered for recycling is ultimately shredded and pulped to produce new paper products.

Some recycled paper cannot be made into other paper products but can become a feedstock for compost products, while some recycled paper carries too many contaminants – some of it toxic -- including plastics, motor oil, paint, glass, and other non-paper materials.

An important consideration of newspaper and recycled paper in organic production relates to the inks that are printed onto the paper. Black ink has historically been derived from vegetable- or petroleum-based sources that involve the use of solvents that can damage the environment in a variety of ways. Increasingly, black inks have become water-based, though not 100% solvent-free. The use of various heavy metal compounds in colored ink has been an important consideration in excluding colored inks from use in organic production. Similarly, while glossy inks can gain their functional components from nonsynthetics like bentonite or kaolinite, those functions can also come from petrochemical synthetic polymers like acrylonitrile, polyethylene (LDPE), styrene, butadiene, vinyl acetate, and polyvinyl chloride, excluding them from any use in organic production.

Adhesives, glues, waxes, and resins are also among the materials that could be found in newspaper and recycled paper products and raise similar questions to those posed during prior reviews of the separate National List substance, biodegradable biobased mulch film.

Paper mulches are not regulated as an herbicide by the EPA and are considered inert.

It is worth noting that virgin, or non-recycled paper, comes from a variety of plant materials, including wood, trees, straw, hemp, sugarcane bagasse, bamboo, reeds, and kenaf, with the majority coming from wood fibers. As noted in the 2017 TR (line 68), most of the wood fibers derived from trees used for paper production do not incorporate methods considered to be excluded from organic production. However, some genetically modified trees are being produced that could potentially be used in paper production in the future. Some sources have reported that as many as 200 different chemicals can be used to make it possible to use tree fiber as a feedstock for paper production (Discover Magazine, April 4, 2014).

**International Acceptance:**
Canadian General Standards Board Permitted Substances List
Permitted for use but only "without glossy paper and coloured ink."

European Economic Community (EEC) Council Regulation, EC No. 834/2007 and 889/2008
Not specified as permitted for use.

CODEX Alimentarius Commission, Guidelines for the Production, Processing, Labelling and Marketing of Organically Produced Foods (CXG 32-1999)
Not specified as permitted for use.

International Federation of Organic Agriculture Movements (IFOAM) Norms
Not specified as permitted for use.

Japan Agricultural Standard (JAS) for Organic Production
Not specified as permitted for use.

**Environmental Issues:**
While recycled paper production is assumed to have fewer environmental impacts than virgin paper production, it still presents issues. Sodium hydroxide and other chemical additives and surfactants may be introduced into the process. The de-inking sludge – or wastewater byproduct – that is produced from paper recycling can contain a number of synthetic materials and is typically landfilled, burned, or co-composted with sewage and poultry litter.

That said, the use of recycled paper ensures that trees are not harvested for the production of paper, a process that has much more far-reaching impacts including the loss of habitat, disturbance or destruction of soils, and the destabilization of carbon sinks.

**Discussion:**
At the 2015 NOSB sunset review, it came to the attention of both the NOSB and the public that there are new, less toxic materials used in production of newspaper and other recycled paper products which could stimulate the NOSB to consider a change to the annotation for this material. A technical report

(TR) was requested and subsequently completed in summer 2017. The TR revisited the ingredients and colored inks in newspaper as well as their effect on the environment.

While there has been progress towards less toxic materials used in inks, and more recycling of paper products since the original listings and annotation of newspaper and recycled paper, it is difficult-to-impossible to determine if the inks present in the newspaper are ones that are less problematic. There is no methodology to distinguish between color inks that might be more acceptable for direct application to organic land and those that are not. When reviewing the 2017 TR, the Crops Subcommittee decided the current annotation for newspaper and recycled paper, which prohibits glossy or colored inks, should remain. This conclusion was presented as an update to the full NOSB at the Fall 2017 NOSB meeting. The NOSB unanimously voted to continue this listing at § 205.601(b) in 2018.

There was continued support for this material to remain on the National List with the current annotation. Certifiers, grower groups, and individual growers all submitted comments in favor of retaining this material in both locations on the National List (§§ 205.601(b) and 205.601(c)). While some stated there was currently not much use of this material in organic crop production, they also stated it should continue to be allowed for those who wish to continue using it. One certifier noted that newspaper could be included in manure that is cleaned out of livestock barns, supporting the relisting as a compost feedstock.

At the Spring 2023 NOSB meeting, the full Board discussed this material at some length. Discussion focused on whether it is reasonable to assume that all/most newspaper and other recycled paper would be produced with the inks required by the annotation and, if not, how that would create issues for certifiers. This discussion continued in subcommittee after the Spring 2023 meeting, noting that the assumption that all recycled paper is using less-problematic inks may not be correct. The Board considered whether the listing also included cardboard and confirmed its understanding that it did. The Board also discussed the separate Spring 2021 vote to approve paper pots and paper-based planting aids and the findings during that process that some of the materials of potential concern found in paper pots are also the components of newspaper and other recycled paper.

**Questions to our Stakeholders:**

1. Should there be an annotation for this listing that attempts to further clarify what uses are acceptable within organic production? Can certifiers appropriately oversee the ink requirement in this annotation?
2. How widely used are these materials in organic production?
3. What is the scale of use of this material for this purpose in organic production (specifically number of users, farms, acres, geographical reach)?

**Justification for Vote:**

The Subcommittee finds newspaper or other recycled paper, without glossy or colored inks compliant with the Organic Foods Production Act (OFPA) and/or 7 CFR205.601(b) and is not proposing removal.

**Subcommittee Vote:**

Motion to remove newspaper or other recycled paper, without glossy or colored inks from the National List at 7 CFR 205.601(b)
Motion by: Wood Turner
Seconded by: Mindee Jeffery
Yes: 0 No: 7 Abstain: 0 Recuse: 0 Absent: 1

## Newspaper or other recycled paper, without glossy or colored inks

**Reference:** 205.601(c) As compost feedstocks—Newspapers or other recycled paper, without glossy or colored inks.
**Technical Report**: 1995 TAP; 2006 TR; 2017 TR
**Petition(s):** N/A
**Past NOSB Actions:** 11/1995 NOSB minutes and vote (pg. 19); 11/2005 NOSB sunset recommendation; 04/2011 NOSB sunset recommendation; 10/2015 NOSB sunset recommendation; 10/2018 NOSB sunset recommendation
**Regulatory Background:** Added to National List 04/21/2001 (65 FR 80547, 66 FR 15619); Sunset renewal notice published 10/16/2007 (72 FR 58469); Sunset renewal notice published 06/06/2012 (77 FR 33290); Sunset renewal notice published 03/15/2017 (82 FR 14420); Sunset renewal notice published 05/07/2020 (85 FR 27105)
**Sunset Date:** 6/22/2025

**Subcommittee Review**

**Use:**
Newspaper and other recycled paper is commonly used in organic agriculture as a compost feedstock. Effectively, the newspaper or recycled paper is a carbon source – or food -- for active compost processing.

**Manufacture:**
A 2017 Technical Report (TR, line 82) on this material reports that one-third to one-half of all paper in the United States is recycled into other paper products, and reports EPA figures from 2013 data that paper is recycled at a rate of 63% in the United States (line 87).

Recycled paper comes from a number of different sources that affect the grade of the recycled paper product: old corrugated containers, mixed paper, old newspapers, high grade de-inked paper, and pulp substitutes. These larger categories are further segmented into as many as 50 different sub-grades of recycled paper.

Some recycled paper cannot be made into other paper products but can become a feedstock for compost products, while some recycled paper carries too many contaminants – some of it toxic -- including plastics, motor oil, paint, glass, and other non-paper materials.

An important consideration of newspaper and recycled paper in organic production relates to the inks that are printed onto the paper. Black ink has historically been derived from vegetable- or petroleum-based sources that involve the use of solvents that can damage the environment in a variety of ways. Increasingly, black inks have become water-based, though not 100% solvent-free. The use of various heavy metal compounds in colored ink has been an important consideration in excluding colored inks from use in organic production. Similarly, while glossy inks can gain their functional components from nonsynthetics like bentonite or kaolinite, those functions can also come from petrochemical synthetic polymers like acrylonitrile, polyethylene (LDPE), styrene, butadiene, vinyl acetate, and polyvinyl chloride, excluding them from any use in organic production.

Adhesives, glues, waxes, and resins are also among the materials that could be found in newspaper and recycled paper products and raise similar questions to those posed during prior reviews of the separate National List substance, biodegradable biobased mulch film.

Composting is not federally regulated therefore, neither is the use of paper as a compost feedstock. However, components of paper feedstock, such as heavy metals, could be regulated at the state level.

It is worth noting that virgin, or non-recycled paper, comes from a variety of plant materials, including wood, trees, straw, hemp, sugarcane bagasse, bamboo, reeds, and kenaf, with the majority coming from wood fibers. As noted in a 2017 TR (line 68), most of the wood fibers derived from trees used for paper production do not incorporate methods considered to be excluded from organic production. However, some genetically modified trees are being produced that could potentially be used in paper production in the future. Some sources have reported that as many as 200 different chemicals can be used to make it possible to use tree fiber as a feedstock for paper production (Discover Magazine, April 4, 2014).

**International Acceptance:**
Canadian General Standards Board Permitted Substances List
Permitted for use but only "without glossy paper and coloured ink."

European Economic Community (EEC) Council Regulation, EC No. 834/2007 and 889/2008
Not specified as permitted for use.

CODEX Alimentarius Commission, Guidelines for the Production, Processing, Labelling and Marketing of Organically Produced Foods (CXG 32-1999)
Not specified as permitted for use.

International Federation of Organic Agriculture Movements (IFOAM) Norms
Not specified as permitted for use.

Japan Agricultural Standard (JAS) for Organic Production
Not specified as permitted for use.

**Environmental Issues:**
While recycled paper production is assumed to have fewer environmental impacts than virgin paper production, it still presents issues. Sodium hydroxide and other chemical additives and surfactants may be introduced into the process. The de-inking sludge – or wastewater byproduct – that is produced from paper recycling can contain a number of synthetic materials and is typically landfilled, burned, or co-composted with sewage and poultry litter.

That said, the use of recycled paper ensures that trees are not harvested for the production of paper, a process that has much more far-reaching impacts including the loss of habitat, disturbance or destruction of soils, and the destabilization of carbon sinks.

**Discussion:**
At the 2015 NOSB sunset review, it came to the attention of both the NOSB and the public that there are new, less toxic materials used in production of newspaper and other recycled paper products which could stimulate the NOSB to consider a change to the annotation for this material. A technical report

(TR) was requested and subsequently completed in summer 2017. The TR revisited the ingredients and colored inks in newspaper as well as their effect on the environment.

While there has been progress towards less toxic materials used in inks, and more recycling of paper products since the original listings and annotation of newspaper and recycled paper, it is difficult to impossible to determine if the inks present in the newspaper are ones that are less problematic. There is no methodology to distinguish between color inks that might be more acceptable for direct application to organic land and those that are not. When reviewing the 2017 TR, the Crops Subcommittee decided the current annotation for newspaper and recycled paper, which prohibits glossy or colored inks, should remain. This conclusion was presented as an update to the full NOSB at the Fall 2017 NOSB meeting. The NOSB unanimously voted to reinstate continue this listing at § 205.601© in 2018.

There was continued support for this material to remain on the National List with the current annotation. Certifiers, grower groups, and individual growers all submitted comments in favor of retaining this material in both locations on the National List (§§ 205.601(b) and 205.601(c)). While some stated there was currently not much use of this material in organic crop production, they also stated it should continue to be allowed for those who wish to continue using it. One certifier noted that newspaper could be included in manure that is cleaned out of livestock barns, supporting the relisting as a compost feedstock.

At the Spring 2023 NOSB meeting, the full Board discussed this material at some length. Discussion focused on whether it is reasonable to assume that all/most newspaper and other recycled paper would be produced with the inks required by the annotation and, if not, how that would create issues for certifiers. This discussion continued in subcommittee after the Spring 2023 meeting, noting that the assumption that all recycled paper is using less-problematic inks may not be correct. The Board considered whether the listing also included cardboard and confirmed its understanding that it did. The Board also discussed the separate Spring 2021 vote to approve paper pots and paper-based planting aids and the findings during that process that some of the materials of potential concern found in paper pots are also the components of newspaper and other recycled paper. Finally, the board noted that municipal compost is allowed within organic production and could, thus, include some of the elements of potential concern by virtue of newspaper being a municipal compost feedstock in certain contexts. The Board acknowledged that it would be extremely helpful to understand this issue in terms of what substances are present at the end of the compost process as a means of understanding whether and what adverse impact may result.

**Questions to our Stakeholders:**

1. Should there be an annotation for this listing that attempts to further clarify what uses are acceptable within organic production? Can certifiers appropriately oversee the ink requirement in this annotation?
2. How widely used are these materials in organic production?
3. What is the scale of use of this material for this purpose in organic production (specifically number of users, farms, acres, geographical reach)?

**Justification for Vote:**

The Subcommittee finds newspaper or other recycled paper, without glossy or colored inks compliant with the Organic Foods Production Act (OFPA) and/or 7 CFR205.601(c) and is not proposing removal.

**Subcommittee Vote:**
Motion to remove newspaper or other recycled paper, without glossy or colored inks from the National List 7 CFR 205.601(c)
Motion by: Wood Turner
Seconded by: Jerry D'Amore
Yes: 0 No: 7 Abstain: 0 Recuse: 0 Absent: 1

## Plastic mulch and covers

**Reference:** 205.601(b) As herbicides, weed barriers, as applicable.
(2) Mulches. (ii) Plastic mulch and covers (petroleum-based other than polyvinyl chloride (PVC)).
**Technical Report**: 1995 TAP
**Petition(s):** N/A
**Past NOSB Actions:** 11/1995 NOSB minutes and vote (pg. 20); 11/2005 NOSB sunset recommendation; 04/2011 NOSB sunset recommendation; 10/2015 NOSB sunset recommendation; 10/2018 NOSB sunset recommendation
**Regulatory Background:** Added to National List 04/21/2001 (65 FR 80547, 66 FR 15619); Sunset renewal notice published 10/16/2007 (72 FR 58469); Sunset renewal notice published 06/06/2012 (77 FR 33290); Sunset renewal notice published 03/15/2017 (82 FR 14420); Sunset renewal notice published 05/07/2020 (85 FR 27105)
**Sunset Date:** 6/22/2025

**Subcommittee Review**

**Use:**
Plastic mulches and covers provide multiple functions in organic production including, but not limited to, weed barrier, soil, nutrient and water retention, soil warming, soil solarizing, high and low tunnels, and reflective barriers for insect pests.

**Manufacture:**
Plastic mulches and covers are thermoplastic resins of high melt viscosity, usually polyethylene. Resin pellets are melted into an extruder and pumped or blown through a die or tube to form the plastic in the desired shape.

**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.

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

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

International Federation of Organic Agriculture Movements (IFOAM) Norms
No reference

Japan Agricultural Standard (JAS) for Organic Production
Plastic mulch (limited to those to be removed after use)

**Environmental Issues:**
Although there is significant support for its relisting, plastic mulch has many environmental concerns, most of which are related to disposal after each season. The recycling of plastic mulch seems to be a diminishing option. The product is easily damaged and contaminated, which makes recycling a less viable option. Other concerns include the breakdown of microplastics and litter from damaged product remaining in the field. These pieces are considered foreign materials and contaminate organic soils. The labor cost to remove plastic is very expensive and often is a challenge for growers. Because of this, many growers are excited for the development of biodegradable mulches.

**Discussion:**
The Crops Subcommittee discussed the use, manufacturing, and environmental issues with plastic mulches. The expansiveness of the listing and annotations were reviewed, and it was noted that the term, "covers," can refer to high and low tunnels as well as ground coverings. Members of the Subcommittee discussed the significance of recycling as a diminishing option and reviewed the social concerns about recycling of plastic mulches not being a viable option. Many members of the Subcommittee have expressed concern in the lack of progress in reducing the dependency of plastic mulch and covers in certain areas of organic production.
Plastic mulch is discussed directly in the Organic Foods Production Act (OFPA). OFPA 6508(c)(2) prohibits the use plastic mulches unless such mulches are removed at the end of each growing or harvest season. Because of this listing, plastic mulch is also found in the crop, pest, weed and disease management practice standard under §205.206(c)(6):

> Plastic or other synthetic mulches: *Provided,* That, they are removed from the field at the end of the growing or harvest season.

Under this Practice Standard listing, all synthetic mulches are permitted. The listing for Plastic Mulch and Covers in the National List (§205.601(b)(2)(ii)) broadens the allowance of "plastic or other synthetic mulches" to include "covers" and prohibits polyvinyl chloride (PVC).

**Questions to our Stakeholders:**
1. Which crops depend most on plastic mulch, and why?
2. What alternatives are there for weed management?

**Justification for Vote:**
After much discussion, the Subcommittee concluded that removing plastic mulch and covers from the National List would not prohibit the use of plastic mulch in organic production. If plastic mulch and covers were removed from the National List, all plastic mulches would be allowed, due to the allowance of plastic mulch in OFPA and the organic regulation practice standard at §205.206. Additionally, removing plastic mulch and covers from the National List would remove the prohibition of PVC-based

mulch., therefore allowing PVC mulch to be used. While there is strong support in the Subcommittee to encourage organic producers to reduce their dependency on plastic mulch and covers, the Subcommittee does not intend to remove a restrictive annotation that keeps PVC mulch out of organic production.

The Subcommittee vote was ambiguous, however, at this time, the Subcommittee finds plastic mulches and covers compliant with the Organic Foods Production Act (OFPA) and/or 7 CFR 205.600 and is not proposing removal.

**Subcommittee Vote:**
Motion to remove plastic mulch and covers from the National List
Motion by: Logan Petrey
Seconded by: Mindee Jeffery
Yes: 0 No: 3 Abstain: 4 Recuse: 0 Absent: 1

## Aqueous potassium silicate

**Reference:** 205.601(e) As insecticides (including acaricides or mite control).
(2) Aqueous potassium silicate (CAS #-1312-76-1)—the silica, used in the manufacture of potassium silicate, must be sourced from naturally occurring sand.
**Technical Report**: 2003 TAP; 2014 TR; 2023 Limited Scope TR
**Petition(s):** 2002; 2006 (Addendum #1)
**Past NOSB Actions:** 11/2007 NOSB recommendation; 10/2014 NOSB sunset recommendation; 10/2018 NOSB sunset recommendation
**Regulatory Background:** Added to National List 12/13/2010 (75 FR 77521); Sunset renewal notice published 06/19/2015 (80 FR 35177); Sunset renewal notice published 05/07/2020 (85 FR 27105).
**Sunset Date:** 6/22/2025

**Subcommittee Review**

**Use:**
Aqueous potassium silicate is used as an insecticide for insects and mites. Formulations of aqueous potassium silicate are either sprayed on the foliage of plants or incorporated in the soil with the goal of plant uptake across root and leaf boundaries. The silica tetrahedra are purported to be incorporated in boundary cells (in roots and leaves) inhibiting insect feeding and the onset of plant disease infection. The action of applying potassium silicate in a foliar spray serves to induce production of phytoalexins, chitinases and that in turn strengthen stroma and cell walls.

**Manufacture:**
Aqueous potassium silicate is manufactured by combining high purity silica sand and potassium carbonate (both mined materials) and heating to a high temperature (2000 degrees F). The potassium carbonate and silicon dioxide fuse to form a molten potassium silicate glass with the evolution of carbon dioxide gas. This glass can either be 1) cooled and ground into a powder or 2) dissolved in water to form

a potassium silicate solution. The solution may subsequently be spray dried to form hydrous powder granules of potassium silicate.

**International Acceptance:**
Canadian General Standards Board Permitted Substances List
Potassium silicate is listed as approved for crop protection.

European Economic Community (EEC) Council Regulation, EC No. 834/2007 and 889/2008
No silicates were listed at this website.

CODEX Alimentarius Commission, Guidelines for the Production, Processing, Labelling and Marketing of Organically Produced Foods (GL 32-1999)
Silicates allowed only as ground powders.

International Federation of Organic Agriculture Movements (IFOAM)
Silicates are allowed as plant protectants.

Japan Agricultural Standard (JAS) for Organic Production
No information found.

**Environmental and Health Issues:**
The 2014 Technical Report (TR) states that:

- "Potassium silicate will not adversely affect birds."
- It is "practically non-toxic to fish."
- "Potassium silicate is not toxic to honeybees at the concentration administered for the foliar spray."
- "The overall toxicological risk from human exposure to potassium silicate is negligible."
- "Risks from aggregate exposure via oral, dermal and inhalation exposure are … considered negligible."

**Discussion:**
Written comments submitted to the NOSB prior to the April 2023 NOSB meeting were mostly in favor of relisting, with 4 in favor, 1 opposed, and 1 unclear.

Based on information in the 2014 TR, concerns were raised by NOSB members in 2018, during the 2020 sunset review. Concerns raised by the NOSB included:

1. Skin irritation from handling aqueous potassium silicate.
2. Effects on farmworkers making the foliar application.
3. Effects on human or animal consumers because of its reported effect of making forage plants less digestible.
4. Its reported effect of elongation and thickening of stems.
5. Delayed antithesis and flower deformation in some plant species.
6. Whether it is essential to and compatible with organic production.

Following up on these concerns (please refer to the 2014 TR for references):

- Investigation of the effect of aqueous potassium silicate on flowers showed that the articles cited (TR pp. 487-490) were greenhouse studies in soilless media. One study showed that

applications of potassium silicate "either increased or decreased height, diameter, fresh weight, dry weight, flower diameter, and leaf thickness." The other study found that drenches with higher rates of potassium silicate resulted in stunted plants with deformed flowers. However, substrate pH was not carefully controlled with the addition of such high-pH drenches. These studies have little to do with use of aqueous potassium silicate as a foliar spray in organic agriculture.

- Similarly, the study (TR pp. 477-481) showing that aqueous potassium silicate could make forages "more difficult to chew and digest" was unrelated to the use pattern of aqueous potassium silicate in organic agriculture. The study looked at forages harvested at different growth stages and showed that overmature grass forages contained high levels of silicon and were less digestible.
- A new, 2023 limited scope TR says that aqueous potassium silicate does not present an inhalation hazard to farmworkers.
- Aqueous potassium silicate products are used by some organic fruit and vegetable growers. Public comments that these organic producers submitted to the NOSB prior to the April 2023 NOSB Meeting did not report adverse effects on their produce, in contrast to the suggestion (TR pp. 479-481) that produce might become less palatable. On the contrary, they advocated for its relisting. One grower reported that two early sprays of aqueous potassium silicate eliminated several late sprays of sulfur.

The Subcommittee requested a limited scope technical report (TR) in 2022 to address the following questions:

1. What is the fate of potassium silicate on the plant leaf surface? When sprayed, potassium silicate dries on the leaves. What happens to it there? Does it stay in that form for several days and act as a barrier? Does it transform and become absorbed into the plant as silicic acid? Does it re-dissolve and run off to the ground in rains?

2. What is its effect on the plant leaf microbial community?

3. When sprayed under low humidity conditions, can aqueous potassium silicate crystallize in the air and present an inhalation hazard?

The 2023 limited scope TR indicated that aqueous potassium silicate was very unlikely to be hazardous to the applicator. Its presence on leaves tends to favor bacterial over fungal organisms, which may account for some of its fungicidal effects. Its fate on the leaf surface is highly dependent on the pH of the spray mixture. At lower pH values, close to 5, aqueous potassium silicate may be deposited just below the leaf cuticle layer and present a barrier to fungus infection. At higher pH values, surface deposits (quickly washed off by rain or irrigation) may perform the same function. The 2023 limited scope TR mentioned that aqueous potassium silicate in spray solution can form nanoparticles, but these are common in nature. The TR did not mention any adverse effects from nanoparticles.

The 2023 limited scope TR clarified important points but did not report any negative information regarding the safety of the product. Reviewing its environmental and health effects, the Crops Subcommittee finds that aqueous potassium silicate is compatible with organic agriculture.

**Justification for Vote:**
The Subcommittee finds aqueous potassium silicate compliant with the Organic Foods Production Act (OFPA) and/or 7 CFR 205.600 and is not proposing removal.

**Subcommittee Vote:**
Motion to remove aqueous potassium silicate from the National List at §205.601(e)(2)
Motion by: Brian Caldwell
Seconded by: Wood Turner
Yes: 0 No: 7 Abstain: 0 Recuse: 0 Absent: 1

## Aqueous potassium silicate

**Reference:** 205.601(i) As plant disease control.
(1) Aqueous potassium silicate (CAS #-1312-76-1)—the silica, used in the manufacture of potassium silicate, must be sourced from naturally occurring sand.
**Technical Report**: 2003 TAP; 2014 TR; 2023 Limited Scope TR
**Petition(s):** 2002; 2006 (Addendum #1)
**Past NOSB Actions:** 11/2007 NOSB recommendation; 10/2014 NOSB sunset recommendation; 10/2018 NOSB sunset recommendation
**Regulatory Background:** Added to National List 12/13/2010 (75 FR 77521); Sunset renewal notice published 06/19/2015 (80 FR 35177); Sunset renewal notice published 05/07/2020 (85 FR 27105).
**Sunset Date:** 6/22/2025

**Subcommittee Review**

**Use:**
Aqueous potassium silicate is used as a crop protectant for disease control and suppression. Formulations of aqueous potassium silicate are either sprayed on the foliage of plants or incorporated in the soil with the goal of plant uptake across root and leaf boundaries. The silica tetrahedra are purported to be incorporated in boundary cells (in roots and leaves) inhibiting insect feeding and the onset of plant disease infection. The action of applying potassium silicate in a foliar spray serves to induce production of phytoalexins, chitinases and that in turn strengthen stroma and cell walls.

**Manufacture:**
Aqueous potassium silicate is manufactured by combining high purity silica sand and potassium carbonate (both mined materials) and heating to a high temperature (2000 degrees F). The potassium carbonate and silicon dioxide fuse to form a molten potassium silicate glass with the evolution of carbon dioxide gas. This glass can either be 1) cooled and ground into a powder or 2) dissolved in water to form a potassium silicate solution. The solution may subsequently be spray dried to form hydrous powder granules of potassium silicate.

**International Acceptance:**
Canadian General Standards Board Permitted Substances List
Potassium silicate is listed as approved for crop protection.

European Economic Community (EEC) Council Regulation, EC No. 834/2007 and 889/2008
No silicates were listed at this website.

CODEX Alimentarius Commission, Guidelines for the Production, Processing, Labelling and Marketing of Organically Produced Foods (GL 32-1999)
Silicates allowed only as ground powders.

International Federation of Organic Agriculture Movements (IFOAM)
Silicates are allowed as plant protectants.

Japan Agricultural Standard (JAS) for Organic Production
No information found.

**Environmental and Health Issues**
The 2014 Technical Report (TR) states that:

- "Potassium silicate will not adversely affect birds."
- It is "practically non-toxic to fish."
- "Potassium silicate is not toxic to honeybees at the concentration administered for the foliar spray."
- "The overall toxicological risk from human exposure to potassium silicate is negligible."
- "Risks from aggregate exposure via oral, dermal and inhalation exposure are … considered negligible."

**Discussion:**
Written comments submitted to the NOSB prior to the April 2023 NOSB meeting were mostly in favor of relisting, with 4 in favor, 1 opposed, and 1 unclear.

Based on information in the 2014 TR, concerns were raised by NOSB members in 2018, during the 2020 sunset review. Concerns raised by the NOSB included:

7. Skin irritation from handling aqueous potassium silicate.
8. Effects on farmworkers making the foliar application.
9. Effects on human or animal consumers because of its reported effect of making forage plants less digestible.
10. Its reported effect of elongation and thickening of stems.
11. Delayed antithesis and flower deformation in some plant species.
12. Whether it is essential to and compatible with organic production.

Following up on these concerns (please refer to the 2014 TR for references):

- Investigation of the effect of aqueous potassium silicate on flowers showed that the articles cited (TR pp. 487-490) were greenhouse studies in soilless media. One study showed that applications of potassium silicate "either increased or decreased height, diameter, fresh weight, dry weight, flower diameter, and leaf thickness." The other study found that drenches with higher rates of potassium silicate resulted in stunted plants with deformed flowers. However, substrate pH was not carefully controlled with the addition of such high-pH drenches. These studies have little to do with use of aqueous potassium silicate as a foliar spray in organic agriculture.

- Similarly, the study (TR pp. 477-481) showing that aqueous potassium silicate could make forages "more difficult to chew and digest" was unrelated to the use pattern of aqueous potassium silicate in organic agriculture. The study looked at forages harvested at different growth stages and showed that overmature grass forages contained high levels of silicon and were less digestible.
- A new, 2023 limited scope TR says that aqueous potassium silicate does not present an inhalation hazard to farmworkers.
- Aqueous potassium silicate products are used by some organic fruit and vegetable growers. Public comments that these organic producers submitted to the NOSB prior to the April 2023 NOSB Meeting did not report adverse effects on their produce, in contrast to the suggestion (TR pp. 479-481) that produce might become less palatable. On the contrary, they advocated for its relisting. One grower reported that two early sprays of aqueous potassium silicate eliminated several late sprays of sulfur.

The Subcommittee requested a limited scope technical report (TR) in 2022 to address the following questions:

1. What is the fate of potassium silicate on the plant leaf surface? When sprayed, potassium silicate dries on the leaves. What happens to it there? Does it stay in that form for several days and act as a barrier? Does it transform and become absorbed into the plant as silicic acid? Does it re-dissolve and run off to the ground in rains?
2. What is its effect on the plant leaf microbial community?
3. When sprayed under low humidity conditions, can aqueous potassium silicate crystallize in the air and present an inhalation hazard?

The 2023 limited scope TR indicated that aqueous potassium silicate was very unlikely to be hazardous to the applicator. Its presence on leaves tends to favor bacterial over fungal organisms, which may account for some of its fungicidal effects. Its fate on the leaf surface is highly dependent on the pH of the spray mixture. At lower pH values close to 5, aqueous potassium silicate may be deposited just below the leaf cuticle layer and present a barrier to fungus infection. At higher pH values, surface deposits (quickly washed off by rain or irrigation) may perform the same function. The 2023 limited scope TR mentioned that aqueous potassium silicate in spray solution can form nanoparticles, but these are common in nature. The TR did not mention any adverse effects from nanoparticles.

The 2023 limited scope TR clarified important points but did not report any negative information regarding the safety of the product. Reviewing its environmental and health effects, the Crops Subcommittee finds that aqueous potassium silicate is compatible with organic agriculture.

**Justification for Vote:**
The Subcommittee finds aqueous potassium silicate compliant with the Organic Foods Production Act (OFPA) and/or 7 CFR 205.600 and is not proposing removal.

**Subcommittee Vote:**
Motion to remove aqueous potassium silicate from the National List at §205.601(i)(1)
Motion by: Brian Caldwell
Seconded by: Jerry D'Amore
Yes: 0 No: 7 Abstain: 0 Recuse: 0 Absent: 1

## Elemental sulfur

**Reference:** 205.601(e) As insecticides (including acaricides or mite control). (5) Elemental sulfur.
**Reference:** 205.601(i) As plant disease control. (10) Elemental sulfur.
**Reference:** 205.601(j) As plant or soil amendments. (2) Elemental sulfur.
**Technical Report**: 1995 TAP; 2018 TR
**Petition(s):** 2017 (slug or snail bait, separate sunset review)
**Past NOSB Actions:** 04/1995 NOSB minutes and vote (pg. 345); 11/2005 NOSB sunset recommendation; 04/2010 NOSB sunset recommendation; 10/2010 NOSB sunset recommendation; 10/2015 NOSB sunset recommendation; 10/2018 NOSB sunset recommendation
**Regulatory Background:** Added to National List 04/21/2001 (65 FR 80547, 66 FR 15619); Sunset renewal notice published 10/16/2007 (72 FR 58469); Sunset renewal notice published 06/06/2012 (77 FR 33290); Sunset renewal notice published 03/15/2017 (82 FR 14420); Sunset renewal notice published 05/07/2020 (85 FR 27105)
**Sunset Date:** 6/22/2025

**Subcommittee Review**

**Use:**
Approved legal uses of the substance (TR 67-75): Elemental sulfur is currently on the National List of Allowed and Prohibited Substances as a synthetic substance allowed for use in organic crop production for the following categories:

1. For uses as an insecticide, including acaricides or mite control (7 CFR 205.601 (e)(5).
2. For plant disease control (7 CFR 205.601(i)(10)).
3. As plant or soil amendments (7 CFR 205.601(j)(2)).

The current sunset review includes all three listings of sulfur, used as an insecticide, plant disease control, and as a plant or soil amendment.

Sulfur is an essential plant nutrient, naturally present in our food and soil, and is part of normal human biochemistry. When sulfur is used as a soil amendment it can have a strong acidifying effect by replacing sodium with calcium in high pH alkali soils. Sulfur is considered the fourth major plant nutrient after nitrogen, phosphorus, and potassium-. Sulfur can also be used to control insects and/or diseases. It is approved for use on conventional and organic crops to help control fungi and other pests and is commonly used on farms domestically and internationally.

**Manufacture:**
Sulfur is one of few elements found in its elemental form in nature, typically in limestone/gypsum formations, limestone/anhydrite formations associated with salt domes, or volcanic rock (d'Aquin 2007).

Currently, elemental sulfur is produced as a by-product from natural gas or petroleum operations and refinery processes. The latter is the primary source of most elemental sulfur currently being used.

**International Acceptance:**

Canadian General Standards Board Permitted Substances List

Sulfur is allowed by the Canadian Organic Standards. The Canadian General Standards Board (CGSB) includes non-synthetic elemental sulfur as a permitted substance for organic production systems (CAN/CGSB-32.311-2015) for use as a soil amendment and as a foliar application. The CGSB also permits using sulfur to control 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

European Economic Community (EEC) Council Regulation (EEC No 2092/91), 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 (GL 32-1999)

Codex Alimentarius Commission (CAC GL 32-1999) permits the use of sulfur for pest and disease control when the certification body or authority recognizes the need for plant protection (Codex, 2013).

International Federation of Organic Agriculture Movements (IFOAM)

The International Federation of Organic Agriculture Movements (IFOAM) lists sulfur as an approved substance for use as pest and disease control, fertilizer/soil conditioner, and 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:**

Elemental sulfur is relatively innocuous in the environment when used according to the product label. It is also low in toxicity. It should not be used within one month of any horticultural oil product, as currently stated on most sulfur labels.

An updated Technical Report (TR) was completed on April 19, 2018. There was no new information contradicting historical information that characterizes sulfur as an important and relatively safe material for organic agriculture.

Although low in acute toxicity, sulfur is a respiratory, ocular, and dermal irritant that can significantly impact farmworker health. Farmworker exposures can be mitigated if label recommendations and proper PPE recommendations are followed.

**Discussion:**

**2018 NOSB Review:** Historically, there has been strong support for the continued listing of sulfur, particularly for use against various bacterial and fungal diseases, insects, and as a plant and soil amendment. It was noted that several agricultural commissioners in California had encouraged a shift to wettable formulations in vineyard applications, and anecdotal information suggests fewer drift and regulatory problems.

Based on the extensive public comment and discussions, new technical reviews, previous committee votes & discussions, and historical public comment, the 2018 NOSB review concluded that elemental sulfur still appears to be necessary in organic crop production. The NOSB should continue to monitor sulfur use in organic agriculture and respond to any new information raising environmental or, in particular, public health concerns.

**2023 NOSB Review:** The NOSB reviewed all three listings for elemental sulfur. In the public comments, farmer advocacy groups and consultants spoke about the importance of this substance, that elemental sulfur has been included on the original national list since 1995, and that alternatives are not as effective.

There were a few comments from advocacy groups that wanted further annotations for worker protection due to respiratory concerns, and potential limits to control heavy contamination since synthetic elemental sulfur comes from scrubbers from fossil fuel plants. The Board reviewed in further detail respiratory concerns and the potential increased risk that children have, and discussed both a journal article, and a study completed at Oregon State University about the effects on children's respiratory health.

The Board also reviewed the insight gained from the question regarding the use of wettable sulfur products. Some in the community favored a potential annotation, however it was learned that it is common for produce growers to use both dusting sulfur and wettable sulfur in rotation with each other due to different efficacies. When fruit is present, wettable formulations increase the risk of residue on the fruit, and specialized application equipment for dusting sulfur can be used to reduce dusting sulfur drift.

*NOTE: in the listing at 205.601(e), the Board recommends consistency with definitions -As a**caricides need not be insecticides** and insecticides need not be acaricides. During the review, the NOP suggested that this could be a technical correction as part of the inerts rulemaking.*

**Questions to our Stakeholders**
None.

**Justification for Vote:**
The Subcommittee finds all listings of elemental sulfur compliant with the Organic Foods Production Act (OFPA) and/or 7 CFR 205.600 and is not proposing removal.

**Subcommittee Vote:**
Motion to remove elemental sulfur from the National List at 205.601(e)
Motion by: Amy Bruch
Seconded by: Mindee Jeffery
Yes: 0 No: 6 Abstain: 0 Recuse: 0 Absent: 2

**Subcommittee Vote:**
Motion to remove elemental sulfur from the National List at 205.601(i)
Motion by: Amy Bruch
Seconded by: Wood Turner
Yes: 0 No: 6 Abstain: 0 Recuse: 0 Absent: 2

**Subcommittee Vote:**
Motion to remove elemental sulfur from the National List at 205.601(j)
Motion by: Amy Bruch
Seconded by: Mindee Jeffery
Yes: 0 No: 6 Abstain: 0 Recuse: 0 Absent: 2

## Lime sulfur

**Reference:** 205.601(e) As insecticides (including acaricides or mite control). (6) Lime sulfur—including calcium polysulfide.
**Technical Report**: 2014 TR
**Petition(s):** N/A
**Past NOSB Actions: Actions:** 04/1995 NOSB minutes and vote (pg. 341); 11/2005 NOSB sunset recommendation; 10/2010 NOSB sunset recommendation; 10/2015 NOSB sunset recommendation; 10/2018 NOSB sunset recommendation
**Regulatory Background:** Added to National List 04/21/2001 (65 FR 80547, 66 FR 15619); Sunset renewal notice published 10/16/2007 (72 FR 58469); Sunset renewal notice published 06/06/2012 (77 FR 33290); Sunset renewal notice published 03/15/2017 (82 FR 14420); Sunset renewal notice published 05/07/2020 (85 FR 27105)
**Sunset Date:** 6/22/2025

**Subcommittee Review**

**Use:**
Lime sulfur is on the National List at §205.601(e)(6) as an insecticide (including acaricide or mite control) and at §205.601 (j)(6) for plant disease control. As an insecticide, lime sulfur is used to control mites (spider mites and rust mites), aphid, and San Jose scale in tree fruit and other organic crops.

**Manufacture:**
Lime sulfur is often referred to by its chemical name, calcium polysulfide. It is considered to be synthetic and is produced by reacting boiling calcium hydroxide [$CaOH2_2$] and ground sulfur (2014 TR).

**International Acceptance:**
Canadian General Standards Board Permitted Substances List
Allowed as a production aid

European Economic Community (EEC) Council Regulation, EC No. 834/2007 and 889/2008
Permits the use of lime sulphur (calcium polysulfide) as a fungicide, insecticide, acaricide.

CODEX Alimentarius Commission, Guidelines for the Production, Processing, Labelling and Marketing of Organically Produced Foods (GL 32-1999)
Does not appear on this listing

International Federation of Organic Agriculture Movements (IFOAM)
Allowed as a crop protectant

Japan Agricultural Standard (JAS) for Organic Production
Lime sulfur powder allowed as Substances for Plant Pest and Disease Control

**Environmental Issues:**
Residues of lime sulfur are exempt from the requirement of a tolerance under 40 CFR 180.1232 as determined by the U.S. EPA because the calcium polysulfides found in lime sulfur products rapidly degrade to calcium hydroxide and sulfur in the environment and human body.

**Discussion:**
All public commenters were in favor of relisting lime sulfur for control of fungal and bacterial diseases as well as its uses for various insects. One commenter requested specifying only essential uses. Use is widespread across many crops and regions, and many comments note that there are not viable alternatives for its various uses.
Lime sulfur can cause phytotoxicity in some crops, however, rate and timing of application can be used to avoid this problem. In fact, lime sulfur pesticide applications during and shortly after bloom can have a desirable crop-thinning effect on apples. The TR notes that lime sulfur may impair some beneficial insects and mites, but timing of use can minimize the negative effects. It also noted potential human health concerns from lime sulfur primarily due to the highly caustic nature of the undiluted product or the release of hydrogen sulfide. This concern can be mitigated if proper safety procedures are followed during mixing and label directions including personal protective equipment (PPE) are followed. The TR also provided an extensive list of alternative materials and practices, however, if an outbreak of mites or scale occurs, lime sulfur is an effective option.
The Crops Subcommittee (CS) discussion noted that some label-allowed uses of lime sulfur could negatively affect beneficial arthropods. To avoid this, the CS requested a separate work agenda item for an annotation change regarding timing and rates of lime sulfur use.

**Justification for Vote:**
The Crops Subcommittee finds lime sulfur compliant with the Organic Foods Production Act (OFPA) and/or 7 CFR205.600 and is not proposing removal.

**Subcommittee Vote**:
Motion to remove lime sulfur from the National List at 205.601(e)(6)
Motion by: Brian Caldwell
Seconded by: Jerry D'Amore
Yes: 0 No: 7 Abstain: 0 Recuse: 0 Absent: 1

## Lime sulfur

**Reference:** 205.601(i) As plant disease control. (6) Lime sulfur.
**Technical Report**: 2014 TR
**Petition(s):** N/A
**Past NOSB Actions: Actions:** 04/1995 NOSB minutes and vote (pg. 341); 11/2005 NOSB sunset recommendation; 10/2010 NOSB sunset recommendation; 10/2015 NOSB sunset recommendation; 10/2018 NOSB sunset recommendation
**Regulatory Background:** Added to National List 04/21/2001 (65 FR 80547, 66 FR 15619); Sunset renewal notice published 10/16/2007 (72 FR 58469); Sunset renewal notice published 06/06/2012 (77 FR 33290); Sunset renewal notice published 03/15/2017 (82 FR 14420); Sunset renewal notice published 05/07/2020 (85 FR 27105)
**Sunset Date:** 6/22/2025

**Subcommittee Review**

**Use:**
Lime sulfur is on the National List at §205.601(e)(6) as an insecticide (including acaricide or mite control) and at §205.601 (j)(6) for plant disease control. As a fungicide, it is used to control powdery mildew, anthracnose, scab, peach leaf curl, fire blight, and several other plant diseases in tree fruit and berry crops.

**Manufacture:**
Lime sulfur is often referred to by its chemical name, calcium polysulfide. It is considered to be synthetic and is produced by reacting boiling calcium hydroxide [$CaOH2_2$] and ground sulfur (2014 TR).

**International Acceptance:**
Canadian General Standards Board Permitted Substances List
Allowed as a production aid

European Economic Community (EEC) Council Regulation, EC No. 834/2007 and 889/2008
Permits the use of lime sulphur (calcium polysulfide) as a fungicide, insecticide, acaricide.

CODEX Alimentarius Commission, Guidelines for the Production, Processing, Labelling and Marketing of Organically Produced Foods (GL 32-1999)
Does not appear on this listing

International Federation of Organic Agriculture Movements (IFOAM)
Allowed as a crop protectant

Japan Agricultural Standard (JAS) for Organic Production
Lime sulfur powder allowed as Substances for Plant Pest and Disease Control

**Environmental Issues:**
Residues of lime sulfur are exempt from the requirement of a tolerance under 40 CFR 180.1232 as determined by the U.S. EPA because the calcium polysulfides found in lime sulfur products rapidly degrade to calcium hydroxide and sulfur in the environment and human body.

**Discussion:**
All public commenters were in favor of relisting lime sulfur for control of fungal and bacterial diseases as well as its uses for various insects. One commenter requested specifying only essential uses. Use is widespread across many crops and regions, and many comments note that there are not viable alternatives for its various uses.
Lime sulfur can cause phytotoxicity in some crops, however, rate and timing of application can be used to avoid this problem. In fact, lime sulfur pesticide applications during and shortly after bloom can have a desirable crop-thinning effect on apples. The TR notes that lime sulfur may impair some beneficial insects and mites, but timing of use can minimize the negative effects. It also noted potential human health concerns from lime sulfur primarily due to the highly caustic nature of the undiluted product or the release of hydrogen sulfide. This concern can be mitigated if proper safety procedures are followed during mixing and label directions including personal protective equipment (PPE) are followed. The TR also provided an extensive list of alternative materials and practices; however, an important benefit of lime sulfur is that it can be effective even after a fungus infection has taken place. Almost all other organic alternatives have only preventative action.
The Crops Subcommittee (CS) discussion noted that some label-allowed uses of lime sulfur could negatively affect beneficial arthropods. To avoid this, the CS requested a separate work agenda item for an annotation change regarding timing and rates of lime sulfur use.

**Justification for Vote:**
The Subcommittee finds lime sulfur compliant with the Organic Foods Production Act (OFPA) and/or 7 CFR 205.600 and is not proposing removal.

**Subcommittee Vote**:
Motion to remove lime sulfur from the National List at 205.601(i)(6)
Motion by: Brian Caldwell
Seconded by: Jerry D'Amore
Yes: 0 No: 7 Abstain: 0 Recuse: 0 Absent: 1

## Hydrated lime

**Reference:** 205.601(i) As plant disease control.
(4) Hydrated lime.
**Technical Report**: 1995 TAP; 2001 TAP; 2002 TR (calcium hydroxide); 2015 TR (Livestock)
**Petition(s):** N/A
**Past NOSB Actions:** 04/1995 NOSB minutes and vote (pg. 345); 04/2006 sunset recommendation; 10/2010 NOSB sunset recommendation; 10/2015 NOSB sunset recommendation; 10/2018 NOSB sunset recommendation

**Regulatory Background:** Added to National List 04/21/2001 (65 FR 80547, 66 FR 15619); Technical correction annotation change published 10/31/2003 (68 FR 61987); Sunset renewal notice published 10/16/2007 (72 FR 58469); Sunset renewal notice published 06/06/2012 (77 FR 33290); Sunset renewal notice published 03/15/2017 (82 FR 14420); Sunset renewal notice published 05/07/2020 (85 FR 27105)
**Sunset Date:** 6/22/2025

**Subcommittee Review**

**Use:**
Hydrated lime is a synthetic substance limited for use in organic crop production for plant disease control (7 CFR 205.601(i)(4). It is also allowed as an external pest control in livestock production 21 (7 CFR 205.603(b)(5)). Regarding livestock applications, the final rule states that hydrated lime may not be used to cauterize physical alterations (medical treatment) or deodorize animal wastes. Hydrated Lime, also known as calcium hydroxide, is listed for handling as an allowed synthetic, nonagricultural substance which may be used as an ingredient in or on processed products (7 CFR 205.605(b)(8).

**Manufacture:**
According to the technical review (TR), the "industrial production of hydrated/slaked lime involves two elementary reactions beginning with naturally occurring limestone deposits. In the first step, ground limestone—which contains predominantly calcium carbonate (CaCO3) with smaller amounts of magnesium, silicon, aluminum and iron oxide compounds—is thermally transformed into quicklime (Oates, 2010). Specifically, heating raw or minimally processed limestone to temperatures in excess of 900 ºC results in conversion of the calcium carbonate content of limestone to calcium oxide (CaO) in a material known as quicklime (equation 1). This thermal transformation occurs with liberation of carbon dioxide (CO2) gas. In the slaking process, quicklime reacts exothermically (releases heat) with two equivalents of water to produce hydrated/slaked lime consisting primarily of calcium hydroxide [Ca(OH)2] (equation 2). The normal hydration process is carried out at atmospheric pressure and temperatures of approximately 100 ºC (Kenny & Oates, 2007). A variation of the normal hydration process involves reaction of quicklime and water under a high steam pressure of up to 1 MPa and at temperatures approaching 180 ºC to form hydrates. After hydration, the hydrated lime product is dried, milled, and air classified" (TR 231-243).

**International Acceptance:**
Canadian General Standards Board Permitted Substances List
Hydrated lime is also listed in Section 4.3—Crop Production Aids and Materials—for use as a plant disease control agent only (CAN, 2011). Canadian organic regulations also permit the use of hydrated lime as a health care product and/or production aid in organic livestock production under Section 5.3 of the Permitted Substances Lists. According to this rule, hydrated lime is not allowed for use to cauterize physical alterations (medical treatment) or deodorize animal wastes. (2015 TR 177-181)

European Economic Community (EEC) Council Regulation, EC No. 834/2007 and 889/2008
Annex I of the European regulations allow "industrial lime from sugar production"—a byproduct of sugar production from sugar beet—as a fertilizer or soil conditioner. Calcium hydroxide may be used as a fungicide on fruit trees to control Nectria galligena in organic crop production under Annex II and as a processing aid in the production of processed organic foods of plant origin under Annex VIII (EC, 2008). European Union Organic regulations from the European Union do not permit the use of hydrated lime/calcium hydroxide 189 as an external parasiticide in livestock production. (TR 188-93)

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

The Codex Guidelines for the Production, Processing, Labeling and Marketing of Organically Produced Foods (CAC/GL 32-1999) do not list hydrated lime/calcium hydroxide for use in organic livestock or crop production. However, calcium hydroxide is included in the list of "processing aids which may be used for the preparation of products of agricultural origin referred to in Section 3 of these guidelines" (Codex, 2013). (TR 183-86)

International Federation of Organic Agriculture Movements (IFOAM) Norms

IFOAM Norms permit the use of "milk of lime" (i.e., hydrated/slaked lime, calcium hydroxide) for pest and disease control and disinfection in livestock housing and equipment (Appendix 5). Likewise, calcium hydroxide (slaked lime) is included in the "Indicative List of Equipment Cleansers and Equipment Disinfectants" (Appendix 4 – Table 2) for organic handling/processing. Calcium hydroxide is also listed as an approved food additive for maize tortilla flour and processing aid for sugar (Appendix 4 – Table 1). Lastly, application of calcium hydroxide (hydrated lime) is allowed on aerial plant parts only for plant disease control according to Appendix 3 of the IFOAM Norms (IFOAM, 2014). Hydrated lime is not explicitly listed as an approved miticide according to IFOAM. (TR 201- 208).

Japan Agricultural Standard (JAS) for Organic Production

Calcium hydroxide derived from calcium oxide (slaked lime) is listed in Table 1 of the standard as an approved fertilizer and soil improvement substance (JMAFF, 2012). Hydrated lime is not explicitly approved as a miticide according to Japanese organic regulations. (TR 195-199)

**Environmental Issues:**

Hydrated lime is released to the environment through various industrial waste streams and according to its use in agricultural production. Both calcium and hydroxide—the principal atomic/molecular subunits of hydrated lime—are abundantly present in natural waters; therefore, it is unlikely that small to moderate releases will adversely affect the aquatic or terrestrial environment. Large-volume accidental releases, however, could significantly raise pH of receiving waters and soils, resulting in toxic effects to non-target organisms. Hydrated lime is considered practically non-toxic to slightly toxic to freshwater fish and invertebrates when added in quantities that do not lead to significant changes in water pH. While certain strains of soil bacteria can tolerate extreme pH levels (e.g., pH 1.0 or 11.0), larger soft-bodied soil organisms are significantly more sensitive to changes in soil pH. Earthworms, for example, can only survive in the physiological pH range of 4.0 to 8.0. Changes in soil pH due to application of alkaline hydrated lime can also affect the bioavailability of toxic heavy metal contaminants as well as essential micronutrients. It is highly unlikely that hydrated lime from livestock treatments will be released to nearby soils in sufficient quantities to adversely impact the environment. Industrial production of the chemical precursor, quicklime (CaO), uses considerable amounts of energy and may release dust into the atmosphere. The use of more efficient modern kilns and bag filters can minimize the environmental impact of this process.

**Discussion:**

The Crops Subcommittee (CS) discussed this substance and the way it is listed and used across all areas of the National List, including Crops, Livestock, and Handling, on which it is listed as calcium hydroxide. Two Technical Advisory Panels (TAPs) and a Technical Report (TR) were compiled in 1995, 2001 and 2015, respectively. The use of hydrated lime (as has been practiced in organic production) is known to be an effective disease suppression practice. A previous sunset review noted that the use of hydrated lime in Bordeaux mix to make copper available for disease suppression is highly effective and widely

used by fruit and vegetable growers. The Subcommittee discussed the history of the substance and expressed a desire to receive further information on the current extent of the use of the substance.

Public comments from the Spring 2023 NOSB meeting were supportive of relisting hydrated lime. Growers illuminated the importance of this substance in organic tree fruit production to control diseases. A producer group emphasized that allowed alternatives such as horticultural oils and elemental sulfur may have limited efficacy. Use of the material is important as an ingredient in Bordeaux mixes, especially for treating bacterial gummosis in organic cherries. Growers were clear in the importance of hydrated lime as a tool for integrated pest management. An association expressed support for relisting, reporting a wide range of applications including in Bordeaux mix, fire blight, leaf curl, downy mildew, powdery mildew, peacock spot, walnut blight, etc. Certifiers listed low levels of users in Organic System Plans (OSPs) in some regions of the country, but listed numerous uses in regions with a higher density of orchards and vineyards. A stakeholder also noted that hydrated lime does not demonstrate phytotoxicity on either leaves or fruit.

The Crops Subcommittee discussed the potential for environmental issues especially in regard to aquatic environments. The TR notes that there is very little chance of contamination and the CS expressed comfort with continuing to list this material.

**Justification for Vote:**
The Crops Subcommittee finds hydrated lime compliant with the Organic Foods Production Act (OFPA) and/or 7 CFR205.600 and is not proposing removal.

**Subcommittee Vote:**
Motion to remove hydrated lime from the National List
Motion by: Mindee Jeffery
Seconded by: Amy Bruch
Yes: 0 No: 6 Abstain: 0 Recuse: 0 Absent: 2

## Liquid fish products

**Reference:** 205.601(j) As plant or soil amendments.
(8) Liquid fish products - 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**: 1995 TAP; 2006 TR (fish-based fertilizers); 2019 TR (liquid fish products)
**Petition(s):** N/A
**Past NOSB Actions:** 04/1995 NOSB minutes and vote (pg. 346); 11/2005 NOSB sunset recommendation; 10/2010 NOSB sunset recommendation; 10/2015 NOSB sunset recommendation; 10/2018 NOSB sunset recommendation
**Regulatory Background:** Added to National List 04/21/2001 (65 FR 80547, 66 FR 15619); Sunset renewal notice published 10/16/2007 (72 FR 58469); Sunset renewal notice published 06/06/2012 (77 FR 33290); Sunset renewal notice published 03/15/2017 (82 FR 14420); Sunset renewal notice published 05/07/2020 (85 FR 27105)
**Sunset Date:** 6/22/2025

**Subcommittee Review**

**Use:**
Liquid fish products are used as fertilizers in the production of organic crops. Liquid fish products contain fundamental nutrients and many trace minerals critical for use in organic farming. Liquid fish foliar application can deliver important nutrients that can reduce certain nutrient stresses which can, in turn, improve crop yields.

**Manufacture:**
Liquid fish products are fish hydrolysates that are made from chopped fish byproducts that are (1) enzymatically digested and heated, or (2) enzymatically processed without heat (cold processing). Liquid fish products are then stabilized with an acid, such as phosphoric, sulfuric, or citric acid, to prevent microbial growth. The use of formic acid is prohibited due to phytotoxicity. A third method of liquid fish product manufacture utilizes fermentation by bacteria that produce lactic acid, which preserves the fish. All three methods of liquid fish product manufacture cannot result in a pH below 3.5.

**International Acceptance:**
Canadian General Standards Board Permitted Substances List
The Canadian Organic Standard allows for the use of liquid fish products. Acids are permitted to lower the pH to 3.5, but no prohibited preservatives can be used.

European Economic Community (EEC) Council Regulation, EC No. 834/2007 and 889/2008
Liquid fish is not on the EU Annex I list of approved fertilizers, but the EU does allow fish meals.

CODEX Alimentarius Commission, Guidelines for the Production, Processing, Labelling and Marketing of Organically Produced Foods (GL 32-1999)
Contingent upon recognition from a certification body or authority.

International Federation of Organic Agriculture Movements (IFOAM)
The International Federation of Organic Agriculture Movements (IFOAM) permits using 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.

**Environmental Issues:**
Nutrient runoff from excessively or improperly applied fertilizers can cause eutrophication of surface waters, potentially harming fish, and other aquatic animals.

Global impacts of commercial fisheries on marine ecosystems include documented fish population decline (and in some cases, ecosystem collapse) due to overharvesting. Liquid fish products are derived from several sources, including fish waste and bycatch/mortalities. To a lesser extent, fish are harvested for meal, oil, and solubles (also known as the wet reduction process). Large-scale population declines have occurred, with at least three fish species harvested for meal, oil, and soluble production. Considering this information, during the previous sunset review, conducted in 2018, the Crops Subcommittee added a work agenda item regarding liquid fish products. At the October 2020 meeting, the Board proposed, approved, and recommended to the NOP to add an annotation to liquid fish

products at § 205.601(j)(8) to limit the use to fish sourced from waste left over aftermarket food fish are processed for human consumption, bycatch, and invasive species.

**Discussion:**
**Previous NOSB sunset review summary**: Historically, there has been strong support for keeping liquid fish products on the National List, and public comment at the October 2018 NOSB meeting reiterated the strength of that support. Farmers consider liquid fish products essential for many crops, including foliar and other applications. Concerns about the sustainability of source fish, including the possible use of wild fish harvested for the sole purpose of producing liquid fertilizers, were raised by the Crops Subcommittee, and extensive discussion during the October 2018 NOSB meeting focused on production methods and sources of raw fish material for the production of fish-based fertilizers. These discussions resulted in a work-agenda request to assess the environmental impact of harvesting wild, native fish for all fertilizer purposes, to protect natural fish populations, and to ensure that liquid fish and other fish-based fertilizer products used in organic production are not harmful to the environment. Information from this review could inform future policy recommendations regarding the use of wild fish for organic fertilizers but is beyond the scope of review for this sunset review.

The current Crops Subcommittee discussed the uses of liquid fish products as a plant or soil amendment, the manufacturing process, and environmental issues. The Subcommittee also reviewed the October 2020 NOSB recommendation on Wild, Native Fish for Liquid Fish Products, which the NOP has not implemented; it is currently listed as "Closed" in the NOSB Recommendations Library.

**Spring 2023 Sunset Review:** The NOSB reviewed liquid fish products, and Board members and commenters supported relisting, as liquid fish products deliver needed nutrients to a wide variety of crops and growing environments. Two commenters requested more rigor with the annotations to reduce environmental impact. The community also expressed support for the 2020 NOSB Recommendation on Wild Native Fish and called for its implementation. The 2020 recommendation limits liquid fish products to be made with fish "sourced only from fish waste, bycatch, or invasive species." The NOP stated at the Spring 2023 meeting that the recommendation regarding the annotation was currently on hold.
The Subcommittee continued discussing the importance of the annotation and reviewed the history of previous marine material votes, including the fish oil annotation (handling) from the Fall 2021 NOSB meeting, which included the reliance on a third-party certification until organic aquaculture standards are approved. The Subcommittee also reviewed the 2016 NOSB recommendation to add squid byproducts to the National List with the rationale that "the addition of squid byproducts is consistent with the National List listing for liquid fish products that are pH adjusted with synthetic sulfuric, citric or phosphoric acid (7 CFR 205.601(j)(7)). Only squid byproducts originating from the food processing waste stream are acceptable for use in organic agriculture. Whole squid caught for fertilizer purposes would not be included in this listing". Since there seems to be a precedent for the term byproducts (similar to bycatch) being accepted, the Subcommittee was hopeful that the liquid fish annotation from 2020 could eventually be completed. At the time of this writing, the

The NOSB Recommendations Library lists the recommendation for Wild, Native Fish for Liquid Fish Products, as closed, and the reason stated is "technical complexity of marine environments makes rulemaking on these topics problematic. NOP does not currently plan to move this item forward".

Commenters also expressed concerns that even if fish do not have commercial value they may have ecological value. Commenters also noted that use of discarded fish parts for fertilizer may remove food

from marine ecosystems; there' a  potential for contamination with PFAS, and more restrictive annotations could be added to reduce environmental impact.  The Board also considered that farming practices need to be leveraged when applying liquid fish products.

Lastly, one commenter noted concerns about the potential of fortification with phosphorus.  The Board will review further information regarding the essentiality of phosphorus versus the other acids allowed for use to adjust pH listed in the annotation.

**Justification for Vote:**
The Subcommittee finds liquid fish products compliant with the Organic Foods Production Act (OFPA) and/or 7 CFR 205.600 and is not proposing removal.

**Subcommittee Vote:**
Motion to remove liquid fish products from the National List
Motion by: Amy Bruch
Seconded by:  Mindee Jeffery
Yes: 0 No: 7 Abstain: 0 Recuse: 0 Absent: 1

## Sulfurous acid

**Reference:** 205.601(j) As plant or soil amendments.
(11) Sulfurous acid (CAS # 7782-99-2) for on-farm generation of substance utilizing 99% purity elemental sulfur per paragraph (j)(2) of this section.
**Technical Report**: 2010 TR; 2014 TR; 2023 Limited Scope TR
**Petition(s):** 2008
**Past NOSB Actions:** 05/2009 NOSB recommendation; 10/2014 NOSB sunset recommendation; 10/2018 NOSB sunset recommendation
**Regulatory Background:** Added to National List 07/07/2010 (75 FR 38693); Sunset renewal notice published 06/19/2015 (80 FR 35177); Sunset renewal notice published 05/07/2020 (85 FR 27105)
**Sunset Date:** 6/22/2025

**Subcommittee Review**

**Use:**
The primary use of sulfurous acid is as an acidifying agent to neutralize and reduce excessive alkalinity in soil and/or water. The resulting acidic irrigation water can be helpful with nutrient deficiencies that arise when saline or alkaline conditions tie up essential micronutrients. This use supports improved crop yields and can help to reduce soil degradation from salinity build up.

**Manufacture:**
The primary ingredients used in the preparation of sulfurous acid are water and elemental sulfur. Almost all elemental sulfur is produced as a byproduct of coal, natural gas, and petroleum refinement. Sulfurous acid is manufactured by spraying water through smoke and fumes created by burning

elemental sulfur. Several substances are created in this process, including sulfur dioxide, hydrogen sulfide, and hydrogen sulfite.

**International Acceptance:**

Canadian General Standards Board Permitted Substances List
Sulfurous acid can be used in the production of Canadian Organic Products as a preservative in alcoholic beverages made from grapes or other fruit, although minimum use is recommended. No mention is made of sulfurous acid as a soil amendment (CGSB, 2011a,b).

European Economic Community (EEC) Council Regulation, EC No. 834/2007 and 889/2008
Sulfurous acid is allowed in wine production only.

CODEX Alimentarius Commission, Guidelines for the Production, Processing, Labelling and Marketing of Organically Produced Foods (GL 32-1999)
Sulfurous acid is allowed in wine production only.

International Federation of Organic Agriculture Movements (IFOAM)
Sulfurous acid is allowed by IFOAM in wine production, as a pH adjuster in sugar production, and is a permitted soil amendment.

Japan Agricultural Standard (JAS) for Organic Production
JAS does not mention sulfurous acid but allows sulfuric acid as a pH adjuster in sugar production.

**Environmental Issues:**

Sulfurous acid appears on the EPA non-food inert list and does not require a tolerance or an exemption from tolerance. According to a sulfurous acid manufacturer (and noted in the 2014 TR, lines 229-232) sulfur dioxide released into the atmosphere by a sulfurous acid generator is minimal. The EPA does not regulate this emission. Sulfurous acid contains no persistent substances of record. Hydrogen sulfite present in the solution is metabolized by sulfite-reducing bacteria and plants that recycle sulfurous acid into bioavailable sulfur compounds. Water and other dissolved compounds leach into the soils. Functionally sulfurous acid serves to condition soils by adjusting pH.

Regarding human health concerns and per the 2014 TR, sulfurous acid is not expected to be carcinogenic (2014 TR, lines 370-371). Sulfur dioxide is approved by the US Food and Drug administration for use as a food preservative and food colorant (2014 TR, lines 371-372).

**Discussion:**

During the Fall 2018 meeting, the NOSB voted unanimously to keep sulfurous acid on the National List. Most of the written comments at the Fall 2018 meeting supported the relisting, several indicated “no reported use” and one commented that no synthetic fertilizers should be permitted.

The NOSB discussed this listing at its Spring 2023 meeting with some members referencing stakeholder comments, which declared sulfurous acid highly essential in the Pacific Northwest. The Board also noted that sulfurous acid has broader base applications as it removes contaminants as well as adjusts pH.

A limited scope TR was received by the Crops Subcommittee in early February 2023 and was declared sufficient during the Subcommittee meeting held on February 9th, 2023. The TR authors did a seemingly complete job of listing potential alternatives and then evaluating these alternatives as being less effective than sulfurous acid.

**Questions to our Stakeholders:**
None.

**Justification for Vote:**
The Subcommittee finds sulfurous acid compliant with the Organic Foods Production Act (OFPA) and/or 7 CFR 205.600 and is not proposing removal.

**Subcommittee Vote:**
Motion to remove sulfurous acid from the National List
Motion by: Jerry D'Amore
Seconded by: Brian Caldwell
Yes: 0 No: 7 Abstain: 0 Recuse: 0 Absent: 1

## Ethylene gas

**Reference:** 205.601(k) As plant growth regulators.
(1) Ethylene gas—for regulation of pineapple flowering.
**Technical Report**: 1999 TAP; 1999 TAP (handling) (pg. 14-54); 2000 TAP (supplemental information); 2007 TAP; 2011 Limited Scope TR; 2023 TR (crops, handling)
**Petition(s):** N/A
**Past NOSB Actions:** 10/1999 NOSB recommendation (handling) (pg. 443); 10/2001 recommendation (handling) (pg. 2); 11/2005 NOSB sunset recommendation; 04/2011 NOSB sunset recommendation; 10/2015 NOSB sunset recommendation; 10/2018 NOSB sunset recommendation
**Regulatory Background:** Added to National List 04/21/2001 (65 FR 80547, 66 FR 15619); Technical correction annotation change published 10/31/2003 (68 FR 61987); Sunset renewal notice published 10/16/2007 (72 FR 58469); Sunset renewal notice published 06/06/2012 (77 FR 33290); Sunset renewal notice published and was effective 03/15/2017 (82 FR 14420); Sunset renewal notice published 05/07/2020 (85 FR 27105)
**Sunset Date:** 6/22/2025

**Subcommittee Review**

**Use:**
Ethylene gas is on the National List for use as a plant growth regulator, for organic pineapple production only. Ethylene gas is used to induce uniform flowering in pineapples and is applied 7-15 months after planting. Application can be repeated two to three times after the initial application (2011 TR 53-56). Ethylene gas is made from hydrocarbon feedstocks, such as natural gas liquids or crude oil. Operators should be well trained and prepared. However, the safety concern to workers is limited when correctly used and monitored (2007 TAP, pg. 4).

**Manufacture:**
The principal source of commercial ethylene is from thermal or catalytic cracking of hydrocarbon feedstocks such as natural gas or crude oil. During this process chemical bonds within the hydrocarbon molecules are broken, and a different chemical substance is produced.

Ethylene is the petrochemical produced in the largest quantities worldwide (IARC, 1994). In 2014, world ethylene production was 134 million (metric) tonnes (Lazonby, 2017). As of 1994, over 95% of worldwide annual production is based on thermal "cracking" of petroleum hydrocarbons with steam (IARC, 1994). These fractions are obtained from drilling (or hydrofracturing) of oil or natural gas. Thermal cracking (sometimes referred to as pyrolysis) is a chemical process by which long chain hydrocarbons with higher molecular masses are converted to short chain hydrocarbons of lower molecular mass [2023 TR 304-309].

All of these methods involve reactions that produce a chemically changed substance (ethylene) from either petroleum feedstocks, or from dehydration of ethanol mediated by catalysts. Thus, all these forms should be considered synthetic (NOP, 2016a) and from nonagricultural sources (NOP, 2016b). [2023 TR 369-371]

Various feedstocks, including ethane, propane, butanes, naphthas, and gas oils are used to produce ethylene, depending on availability, price, and products desired (Lazonby, 2017). Naphthas are the principal raw material used in western Europe and Japan, accounting for over 80% of the ethylene produced. Ethane is the primary feedstock in the U.S., followed by propane, naphthas, gas oils, and butane (Zimmerman & Waltz, 2011) [2022 TR 311-315].

In thermal cracking, the feedstock gases (ethane, propane or butane) or the liquids (naphtha or gas-oil) are preheated and vaporized, and are mixed with steam and heated to 1050-1150 K (777-877 °C) in a tubular reactor. The high temperature and pressure cause the long chain hydrocarbon to be converted to low relative molecular mass alkenes plus by-products (Lazonby, 2014). [2022 TR 317-320]

Catalytic cracking
Catalytic cracking uses a catalyst, typically a zeolite, which adsorbs the long-chain hydrocarbon feedstocks and removes hydrogen atoms. [1] This causes the long chains to split into shorter chain molecules with double bonds, which are useful to the petrochemical industry. The feedstock is gas oil, which is vaporized, passed through a fine zeolite powder, and heated to 700-800 K (427 - 527 °C) in a reactor. The products behave like a fluid and continuously flow out of the furnace with the cracking products. The temperature, residence time, and the catalyst determine the product proportions (Lazonby, 2014) [2022 TR 332-338].

Dehydration of ethanol
Dehydration of ethanol is another commercial route to ethylene (IARC, 1994; Zimmerman & Waltz, 2011; Fan 2013). In the catalytic dehydration of ethanol to form ethylene, an acid catalyst first protonates the hydroxyl group, which leaves as a water molecule. The conjugate base of the catalyst then deprotonates the methyl group, and the hydrocarbon rearranges into ethylene (Fan, 2013). This method is not commonly used to produce large volumes of ethylene, as it is endothermic with a high optimal reaction temperature (180-500 °C), which makes the ethylene expensive to produce. Dehydration of bioethanol is occurring in Brazil and India and holds promise for producing ethylene from non-fossil fuel sources (bioethanol from sugar cane or cellulose). At present, the output is relatively

limited and used for further production of polyethylene (Fan, 2013; Lazonby, 2017; Schill, 2010) [2022 TR 340-349].

Catalytic generators
Small catalytic generators are used in sealed ripening rooms to dehydrate ethanol into ethylene, and can deliver controlled levels of ethylene gas to ripen fruit, e.g., 100-150 ppm for bananas. (NWHort 2008, Catalytic Generators 2022). This process uses dehydration of ethanol by passing it over a bed of solid catalyst held at high temperatures. The catalysts are typically activated alumina and phosphoric acid or zinc oxide with alumina (Kays & Beaudry, 1987) [TR 351-356].

**International Acceptance:**
Canadian General Standards Board Permitted Substances List
Allowed for use in Canadian organic production for post-harvest ripening of tropical fruit and de-greening of citrus and to control sprouting of potatoes post-harvest in holding bins.

European Economic Community (EEC) Council Regulation, EC No. 834/2007 and 889/2008
Allowed for use in Europe organic production in the degreening of bananas, kiwis, and kakis; Degreening of citrus fruit only as part of a strategy for preventing fruit fly damage in citrus; Flower induction of pineapple; sprouting inhibition in potatoes and onions.

CODEX Alimentarius Commission, Guidelines for the Production, Processing, Labelling and Marketing of Organically Produced Foods (GL 32-1999)
CODEX indicates:
"For degreening of citrus for fruit fly prevention and as a flowering agent for pineapples. As sprouting inhibitor for potatoes and onions: Need recognized by the certification body or authority for sprout inhibition of stored potatoes and onions where varieties that have long dormancy characteristics are not available, or these varieties are not suited to local growing conditions. Must be used in a manner that minimizes exposure to operators and workers."

International Federation of Organic Agriculture Movements (IFOAM)
Ethylene gas is allowed in organic production by IFOAM for the de-greening and ripening of citrus.

Japan Agricultural Standard (JAS) for Organic Production
JAS limits the allowed use of ethylene gas to the ripening of bananas, kiwifruits, and avocados after harvest.

**Environmental Issues:**
According to the 2023 TR, the manufacturing process through cracking is highly energy intensive. Extraction and transport contribute significantly to increasing greenhouse gas emissions, acidification and eco-toxicity (air and water). [TR 479-482]

Petroleum refineries are a major source of hazardous and toxic air pollutants. In the TR, manufacture of ethylene does produce "significant" amounts of carbon dioxide, and notes that this may be a factor in development of alternative technologies for production of ethylene. Ethylene, one of the most important chemicals in use, consumes 30% of the total energy of the chemical industry. This study found that China reduced $CO_2$ emissions by 29.4% per ton of ethylene produced from 2000-2016 due to improvements in technology and evaluated various methods for future increased reductions (2022 TR 488-495).

As for ethylene's impact on the environment during postharvest handling, the 2023 TR states that since the ethylene is a gas at environmental temperatures, this is the primary route of exposure to the environment. Health Canada considered environmental modelling studies and found that ethylene released to the air will remain in the air, and that only negligible amounts will partition to soil, water and sediment [TR 507-511]. The same study concluded that there is little risk of harm to the environment or to organisms since the substance is not present in quantities or concentrations that could cause long term harmful effects on the environment or biodiversity. [2023 TR 531-536]

If every acre in pineapple production (organic and conventional) was treated with high application rates, it would be 5% of the total ethylene emissions (2023 TR lines 513-521). No new issues of human health or environmental concerns were raised that had not been addressed in previous NOSB Sunset review cycles. The main safety concern in relation to ethylene use has been the explosive nature of the gas in the air. Operators should be well trained and prepared, though the safety concern to workers is low when correctly used and monitored (2007 TAP, pg. 4). Ethylene is not considered a food ingredient, and is not regulated by FDA. It is exempt from residue tolerances established by EPA when used as a postharvest plant growth regulator on food crops (2023 TR lines 455-457).

**Discussion:**
The Crops Subcommittee discussed the use, manufacturing, and environmental issues, and previous NOSB reviews of ethylene gas.

As part of the Spring 2018 public meeting, the Crops Subcommittee requested additional information regarding the issue of scale and the use of ethylene and alternative technologies. Written and oral commenters expressed continued support for this material.

At the Spring 2023 public meeting, the Crops Subcommittee requested additional information on the need for expanding the use of this material and if there were any alternatives. Again, written and oral commenters expressed continued support for this material, stating that it is an essential tool for the commercial production of pineapples for the export market and no viable alternatives exist. Without ethylene, commenters said, it would be impossible to achieve the uniform ripening necessary for timing the harvest for fruit shipment. There were 13 commenters that supported the relisting of this material with only one in opposition, stating that the material does not fit any OPFA criteria, and it is not essential to produce the crop but rather is employed for economic reasons. One member of the Subcommittee expressed concern about the use of this material to produce the crop during unfavorable growing times, which results in poor quality fruit.

**Justification for Vote:**
The Subcommittee finds ethylene gas compliant with the Organic Foods Production Act (OFPA) and/or 7 CFR 205.600 and is not proposing removal.

**Subcommittee Vote**:
Motion to remove ethylene gas from the National List
Motion by: Logan Petrey
Seconded by: Jerry D'Amore
Yes: 1 No: 6 Abstain: 0 Recuse: 0 Absent: 1

## Microcrystalline cheesewax

**Reference:** 205.601(o) As production aids.
(1) Microcrystalline cheesewax (CAS #'s 64742-42-3, 8009-03-08, and 8002-74-2)-for use in log grown mushroom production. Must be made without either ethylene-propylene co-polymer or synthetic colors.
**Technical Report**: 2018 TR
**Petition(s):** 2007; 2008 (Addendum #1)
**Past NOSB Actions:** 05/2008 NOSB recommendation; 10/2015 NOSB sunset recommendation; 10/2018 NOSB sunset recommendation
**Regulatory Background:** Added to National List 03/15/2012 (77 FR 8089); Sunset renewal notice published 03/15/2017 (82 FR 14420); Sunset renewal notice published 05/07/2020 (85 FR 27105)
**Sunset Date:** 6/22/2025

**Subcommittee Review**

**Use:**
Microcrystalline cheesewax has been used in agriculture as a production aid in log-grown shiitake mushrooms since the 1980s, and has been allowed in organic agriculture since 2012. Microcrystalline cheesewax is used to seal holes in hardwood logs (commonly oak) after the shiitake spawn is inserted.

**Manufacture:**
Microcrystalline cheesewax is a food-grade product made up of a mixture of microcrystalline wax, paraffin wax, and petroleum. All three of these materials come from refining crude oil, where these petroleum waxes are separated by fractional distillation followed by fractional crystallization.

**International Acceptance:**
Canadian General Standards Board Permitted Substances List
CAN/CGSB-32.311 “Table 6.5 Processing aids” prohibits microcrystalline wax “either alone or in formulation with paraffin wax.”

European Economic Community (EEC) Council Regulation, EC No. 834/2007 and 889/2008
Neither microcrystalline cheesewax, nor its components, are listed in EC No. 834-2007 nor EC No.889/2008.

CODEX Alimentarius Commission, Guidelines for the Production, Processing, Labelling and Marketing of Organically Produced Foods (GL 32-1999)
Neither microcrystalline cheesewax, nor its components, are listed in the CODEX (GL 32-1999).

International Federation of Organic Agriculture Movements (IFOAM)
Neither microcrystalline cheesewax, nor its components are listed in IFOAM.

Japan Agricultural Standard (JAS) for Organic Production
Neither microcrystalline cheesewax, nor its components, are listed in the JAS for organic food production.

**Environmental Issues (and human health concerns):**
Per the 2018 TR and referenced studies: "There have been no reports that indicate the likelihood of the bioaccumulation of either microcrystalline cheesewax or its breakdown products, nor any reports of associated ecotoxicity." Microcrystalline cheesewax is widely regarded as "readily biodegradable" [232-239].
Also, per the 2018 TR, "...microcrystalline cheesewax, its components, and its breakdown products are chemically stable and are not known to be health risks." [308-309]. Microcrystalline cheesewax is sometimes heated just before being used as a sealant, at which time caution should be used to avoid inhaling the vapor as this could cause respiratory irritation [317].

**Discussion:**
At the Fall 2018 meeting, the NOSB voted unanimously to keep microcrystalline cheesewax on the National List. Some of the written comments reviewed during the Fall 2018 meeting focused on the current need for microcrystalline cheesewax, saying that the production method (inoculated logs) was no longer used. This notion was countered by the assertion that there was still wide use by small growers.

During the April 2023 NOSB meeting this same question of continued use was discussed and reaffirmed as essential for small growers.

**Questions to our Stakeholders:**
None

**Justification for Vote:**
The Subcommittee finds microcrystalline cheesewax compliant with the Organic Foods Production Act (OFPA) and/or 7 CFR205.601(o) and is not proposing removal.

Motion to remove microcrystalline cheesewax from the National List
Motion by: Jerry D'Amore
Seconded by: Brian Caldwell
Yes: 0 No: 7 Abstain: 0 Recuse: 0 Absent: 1

## Potassium chloride

**Reference:** 205.602(e) Potassium chloride—unless derived from a mined source and applied in a manner that minimizes chloride accumulation in the soil.
**Technical Report**: 1995 TAP; 2023 TR
**Petition(s):** N/A
**Past NOSB Actions:** 11/1995 NOSB minutes and vote (pg. 22); 11/2005 NOSB sunset recommendation; 10/2010 NOSB sunset recommendation; 10/2015 NOSB sunset recommendation; 10/2018 NOSB sunset recommendation
**Regulatory Background:** Added to National List 04/21/2001 (65 FR 80547, 66 FR 15619); Sunset renewal notice published 10/16/2007 (72 FR 58469); Sunset renewal notice published 06/06/2012 (77 FR 33290); Sunset renewal notice published 03/15/2017 (82 FR 14420); Sunset renewal notice published 05/07/2020 (85 FR 27105)
**Sunset Date:** 6/22/2025

**Subcommittee Review**

**Use:**
Potassium is required for health in humans, plants, and microorganisms (1995 TAP pg. 4, 14). Potassium is an essential element for plants as they use it to regulate movement of water and nutrients within the plant, photosynthesis regulation, and enzyme activation. While potassium is found in many soils, it may not exist naturally in a high enough concentration for optimal plant growth, and/or it may be present but in a bound format rendering it unavailable. Potassium is commonly used by growers either alone, as a complex in potassium chloride, or as an ingredient in a fertilizer blend for soil supplementation.

Chloride is also an essential element for plants (TAP pg. 12); however, monitoring of chloride use is required to assure soil salinity is managed appropriately. The current annotation in the USDA organic regulations stipulates chloride monitoring when potassium chloride is used to prevent chloride accumulation in soils.

**Manufacture:**
Potassium chloride is a mineral that occurs naturally and is a product of potash mining where water is forced into the ground to dissolve potassium chloride deposits (1995 TAP, pg. 3). Brine is brought back to the surface where the water is evaporated off to isolate the potassium chloride. Potassium chloride can similarly be produced from sea water extraction via solar evaporation.

**International Acceptance:**
Canadian General Standards Board Permitted Substances List
Permitted for use from mined sources such as sylvite, carnalite, and potash.

European Economic Community (EEC) Council Regulation, EC No. 834/2007 and 889/2008
Not specified as permitted for use.

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

International Federation of Organic Agriculture Movements (IFOAM)
Permitted for use.

Japan Agricultural Standard (JAS) for Organic Production
Permitted as “fertilizers and soil improvement substances.”

**Environmental Issues:**
Potassium chloride is derived from energy-intensive mining activities, and there are impacts associated with its extraction and the processing wastes that can be generated. While heavy metals have been known to concentrate near potassium chloride production, there has not been widespread concern about significant impacts.

**Discussion:**
At the Fall 2018 meeting, the NOSB unanimously voted to relist potassium chloride at 7 CFR 205.602.

During 2018 meetings, public commenters were also unanimously supportive of continued listing with the current annotation, and there were no other non-chloride types reported by the public. At the time, one certifier recommended that the NOSB request a technical report (TR) on potassium chloride to thoroughly consider the use of synthetic dust suppressants or other synthetic additives.

A draft TR was provided to the Crops Subcommittee on December 2, 2022 and was deemed sufficient, although the Subcommittee requested additional information on effective organic alternatives to potassium chloride. This 2023 TR was pending at the time of deadlines for the Spring 2023 meeting and received by the board thereafter. The technical report is helpful in reiterating the importance of potassium in crop nutrition and outlines ongoing research for recent years into the complex relationship between potassium, plant tissue, and the environment, particularly with respect to plant resilience and stress response. Similarly, the report describes ongoing challenges in understanding the relationship between potassium and nitrogen in crop growth. It also discusses the tension between chlorine deficiency and excess chlorine in plants. Chloride ions are quite soluble and not easily absorbed by organic matter or clay in soils, hence the requirement to closely monitor chlorine accumulation that could result in the application of the listed substance (the TR offers some critique of the high end of the range of rates of application of the substance sometimes recommended by agronomists). The main concern with overapplication of potassium chloride is its contribution to soil and groundwater salinity (and the highest salt index of any common dry fertilizer), but little data could be present to suggest its toxicity to fauna. The TR did allude to the energy intensiveness of the production of potassium chloride and the associated contribution that production can have to atmospheric carbon concentrations and climate change.

The Crops Subcommittee has had anecdotal discussions about whether or not potassium chloride (per this listing) is being used by organic growers. Subcommittee members have acknowledged that potassium chloride is an inexpensive means of dealing with potassium deficiencies in the soil and is likely very geographically specific in its application (potassium is prevalent in high mineral soils, for example, and thus minimal need for supplemental potassium), but also noted that potassium sulfate may be another good cost-effective alternative with less adverse effect. Subcommittee members also discussed the nature of the annotated listing itself and whether it has been successful in reducing chloride leaching – and associated environmental impact -- where it is applied, and also noted that if chloride buildup in the soil is an issue that merits monitoring, there are likely other problematic accumulations in the soil in such contexts as well. The Crops Subcommittee discussed the wide use of potassium chloride in conventional agriculture and the fact that conventional growers are able to mitigate salt concerns by virtue of the conventional toolkit.

The full Board discussed this listing at its Spring 2023 meeting in the wake of strong continued support from the community for the listing to continue in its current incarnation. Board members noted that potassium chloride is used by some organic producers as a less expensive potassium source and without creating the chloride accumulation that was the primary concern from the annotation on this listing. Members also discussed the use of potassium sulfate as an alternative to potassium chloride and acknowledged the lower potassium levels in potassium sulfate and the substance's potential for soil acidification.

The Subcommittee discussed monitoring guidelines for chloride concentration.

**Questions to our Stakeholders**

1. Is potassium chloride widely used by producers of organic crops?

2. What is the process at certification for monitoring chloride concentration when this substance is listed for use on an organic system plan?

**Justification for Vote:**
The Subcommittee finds this listing of potassium chloride compliant with the Organic Foods Production Act (OFPA) and/or 7 CFR 205.600 and is not proposing removal.

**Subcommittee Vote:**
Motion to remove potassium chloride from the National List at 7 CFR 205.602(e)
Motion by: Wood Turner
Seconded by: Mindee Jeffery
Yes: 0 No: 7 Abstain: 0 Recuse: 0 Absent: 1