

**National Organic Standards Board  
Handling Subcommittee  
Petitioned Material Proposal  
Ethylene  
February 4, 2025**

**Summary of Petition [\[link\]](#):**

In August 2023, the manufacturer of equipment that generates ethylene gas from ethanol submitted a petition to expand the currently allowed uses of ethylene gas in organic handling to include preventing sprouting in stored potatoes and onions.

**Summary of Review:**

The NOSB Handling Subcommittee (HS) ordered a limited scope Technical Report (2024 TR) to address questions and concerns related specifically to the use of ethylene in the petitioned applications (preventing sprouting of onions and potatoes). HS also relied on the full Technical Report ordered in 2023 (2023 TR) for the sunset evaluation of ethylene used for the ripening of tropical fruits and degreening of citrus. NOSB requested comments on the use of ethylene as a sprout inhibitor at the Fall 2024 meeting as the HS was waiting for the limited scope TR, and received comments from organic potato and onion growers, as well as the Washington State potato commission, all of whom were generally supportive of being able to try a new substance for sprout inhibition.

**Category 1: Classification**

1. Substance is for: ☒ **Handling** ☐ **Livestock**
2. For HANDLING and LIVESTOCK use:
  - a. Is the substance ☐ **Agricultural** or ☒ **Non-Agricultural**? Describe reasoning for this decision using [NOP 5033-2](#) as a guide.

Ethylene is not a mineral, bacterial culture, microorganism, a substance derived from crops or livestock, and, therefore, it is not an agricultural substance.

- b. If the substance is **Non-agricultural**, is the substance **Non-synthetic** or ☒ **Synthetic**?

Is the substance formulated or manufactured by a process that chemically changes a substance extracted from naturally occurring plant, animal, or mineral sources? [OFPA §6502(21)] If so, describe, using [NOP 5033-1](#) as a guide:

In this petition, the manufacturing process of ethylene via an onsite ethylene generator is through the catalytic conversion of ethanol. Ethylene is also manufactured as a pyrolysis product of petroleum hydrocarbon feedstocks and stored in cylinders for future use (2024 TR, lines 42-43). Both of these processes render the final product synthetic despite the fact that they are both chemically identical to naturally occurring ethylene.

**Category 2: Adverse Impacts**

1. What is the potential for the substance to have detrimental chemical interactions with other materials used in organic farming systems? [§6518(m)(1)]

Ethylene is typically used in its pure form or in combination with other allowed gases (nitrogen and carbon dioxide) (2023 TR, lines 197-201). It does not appear to have any detrimental chemical interactions with other materials used in organic farming.

2. What is the toxicity and mode of action of the substance and of its breakdown products or any contaminants, and their persistence and areas of concentration in the environment? [§6518(m)(2)]

There are no known negative effects of ethylene on invertebrates or birds which are the most likely to be exposed to ethylene, and there are no expected negative effects to aquatic organisms as ethylene gas does not end up in water. Additionally, concentrations of ethylene found to have adverse effects on rats are considerably higher than concentrations expected in the environment (2023 TR, lines 515-517). Terrestrial plants are highly sensitive to ethylene in air, yet Health Canada concluded through monitoring of industrial ethylene releases 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, lines 522-527). Ethylene used in ripening, degreening, or sprout prevention ultimately remains in the atmosphere and only negligible amounts will partition to soil, water and sediment (2023 TR, lines 501-502). The amount of ethylene released due to these uses is not known, but it is assumed to be lower than the 1.8 million pounds annually used to regulate pineapple flowering in the field (2023 TR, lines 511-512).

3. Describe the probability of environmental contamination during manufacture, use, misuse or disposal of such substance? [§6518(m)(3)]

The manufacture of ethylene does produce significant amounts of carbon dioxide, and by some estimates, is responsible for 16% of direct global CO<sub>2</sub> emissions (2023 TR, lines 479-483). Petroleum refineries are a major source of hazardous and toxic air pollutants. It is not known how much of the global production of ethylene is used for fruit ripening or degreening, but it is very little as compared to other industrial manufacturing uses of ethylene.

4. Discuss the effect of the substance on human health [§6517 (c)(1)(A)(i); §6517 (c)(2)(A)(i); §6518(m)(4)].

Ethylene used as a growth regulator to prevent sprouting in potatoes and onions requires concentrations of 10-15 ppm, and EPA concluded that ethylene in these concentrations would be considered nontoxic (2024 TR, lines 261-263). In the UK, a self-contained breathing apparatus is required for ethylene use only when concentrations are above 1000 ppm (2024 TR, lines 266-267). The EPA-approved label for the Restrained Generator (ethylene produced onsite) requires only long-sleeved shirt, long pants, shoes, and socks (2024 TR, lines 269-270).

5. Discuss any effects the substance may have on biological and chemical interactions in the agroecosystem, including the physiological effects of the substance on soil organisms (including the salt index and solubility of the soil), crops and livestock. [§6518(m)(5)]

Since ethylene used for preventing sprouting of potatoes and onions does not end up in the soil, its effects on soil organisms are negligible.

6. Are there any adverse impacts on biodiversity? (§205.200)

Health Canada concluded that the risk to biodiversity from the use of ethylene as a plant growth regulator was very low (2023 TR, lines 522-527).

### **Category 3: Alternatives/Compatibility**

1. Are there alternatives to using the substance? Evaluate alternative practices as well as non-synthetic and synthetic available materials. [§6518(m)(6)]

In potato and onion cultivation a number of management practices are used to produce crops that are better suited to storage conditions including cultivar choice, curing, irrigation practices, maturity at harvest, and nutrient management. In addition, storage conditions like light, temperature, and humidity are managed to prevent spoilage and sprouting (2024 TR, lines 304-316). Carbon dioxide can be used to control sprouting; however, CO<sub>2</sub> can also damage potato tissues if not managed carefully (2024 TR, line 407). Currently, handlers are also using nonsynthetic essential oils such as carvone, limonene, and eugenol with limited success in managing sprouting. Public commenters to NOSB in the Fall 2024 meeting indicated that use of eugenol (clove oil) can have negative effects on the skin and respiration of workers who must apply the substance regularly to achieve effectiveness.

2. **For Livestock substances, and Nonsynthetic substances used in Handling:** In balancing the responses to the criteria above, is the substance compatible with a system of sustainable agriculture? [§6518(m)(7)]

Ethylene does not appear to have significant negative impacts on the environment and appears to be able to replace some less effective and more harmful substances currently in use to prevent sprouting of potatoes and onions.

### **Category 4: Additional criteria for synthetic substances used in Handling** (does not apply to nonsynthetic or agricultural substances used in organic handling):

Describe how the petitioned substance meets or fails to meet each numbered criterion.

1. The substance cannot be produced from a natural source and there are no organic substitutes; (§205.600(b)(1)).

Ethylene does not appear to be readily available in a natural form.

2. The substance's manufacture, use, and disposal do not have adverse effects on the environment and are done in a manner compatible with organic handling; (§205.600(b)(2)).

Ethylene's use as a post-harvest substance does not appear to directly cause negative environmental effects. It is a product of the fossil fuel industry, which has significant negative impacts on the environment. However, the use of ethylene as a post-harvest substance represents a negligible percentage of total ethylene usage worldwide.

3. The nutritional quality of the food is maintained when the substance is used, and the substance, itself, or its breakdown products do not have an adverse effect on human health as defined by applicable Federal regulations; (§205.600(b)(3)).

Ethylene is a volatile substance that does not remain in or on food (2024 TR, line 216). Potatoes and onions are at peak nutritional quality at harvest. In delaying the sprouting event, ethylene maintains nutritional quality as well as safety (2024 TR, lines 225-226).

4. The substance's primary use is not as a preservative or to recreate or improve flavors, colors, textures, or nutritive value lost during processing, except where the replacement of nutrients is required by law; (§205.600(b)(4)).

Ethylene is not considered to be a preservative (2024 TR, line 221).

5. The substance is listed as generally recognized as safe (GRAS) by the Food and Drug Administration (FDA) when used in accordance with FDA's good manufacturing practices (GMP) and contains no residues of heavy metals or other contaminants in excess of tolerances set by FDA; (§205.600(b)(5)).

Ethylene is not considered GRAS since it is not regulated by FDA. It is considered a pesticide by EPA and exempt from any residue tolerance restriction at 40 CFR 180.1016 (2023 TR, lines 380-381).

6. The substance is essential for the handling of organically produced agricultural products. (§205.600(b)(6))

While prolonging storage times of annual temperate crops like potatoes and onions may not be essential to all organic stakeholders, having the ability to lengthen storage of these crops allows for longer marketing windows for producers and handlers, higher quality, less cullage, less reliance on shipping crops long distances for counter-seasonal supply, and, in the case of potatoes, an ability to produce higher quality seed tubers for the next year's production. Due to the limited efficacy of natural alternatives and management options, the use of ethylene for preventing sprouting in potatoes and onions is essential.

7. In balancing the responses to the criteria in Categories 2, 3 and 4, is the substance compatible with a system of sustainable agriculture [§6518(m)(7)] and compatible with organic handling? (see NOSB Recommendation, [Compatibility with Organic Production and Handling, April 2004](#))

Yes. It appears that ethylene is compatible with a system of organic agriculture. Its chief benefits are preventing spoilage of stored potatoes and onions, lengthening marketing windows for these crops, reducing reliance on crops shipped long distances to fill demand gaps, increasing quality of organic seed tubers, and reducing worker exposure to irritants from the natural alternatives for sprout inhibition, namely eugenol (clove oil). Additionally, ethylene is currently approved for preventing sprouting in potatoes and onions in Canada and the EU.

#### **Classification Motion:**

Ethylene is already classified as synthetic.

#### **National List Motion:**

Motion to amend the listing of ethylene at § 205.605(b)(14) Ethylene—allowed for postharvest ripening of tropical fruit, ~~and~~ degreening of citrus, and postharvest sprouting inhibition of potatoes and onions.

Motion by: Nate Lewis

Seconded by: Kyla Smith

Yes: 9 No: 0 Abstain: 0 Recuse: 0 Absent: 0