2020

25(b) Inert Ingredient Guidance

THIS GUIDANCE PROVIDES DETAILED INFORMATION FOR STATE REGULATORS ON THE INERT INGREDIENTS LISTED IN 40 CFR 152.25(F).

AAPCO 25(B) WORKGROUP

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Background Information

State Lead Agencies (SLAs) have a difficult job properly assessing and regulating 25(b) products due to questionable claims and limited guidance. Exempted products require significant monitoring and it is time consuming and burdensome for SLAs to fully review and assess if a product complies with the exemptions. One area of growing concern, and limited guidance, is connected to the acceptable inert ingredients when formulating a 25(b) minimum risk pesticide product, as provided in Condition 2 by US EPA.

Inert Ingredients and Their Function

Through research and review of proposed 25(b) products, SLAs are questioning whether or not certain inert ingredients are, in actuality, functioning as active ingredient in a formulation. This would be a violation of US EPA Conditions 1 and 2. EPA Condition 1 states that only specific active ingredients can be used within the formulation. Condition 2 states that a company can use inert ingredients, in whatever amount needed to result in an effective product when combined with the listed actives. However, the same condition also provides the definition of an inert ingredient to include all ingredients that are not active. Therefore, if a listed inert ingredient is primarily functioning as an active ingredient, it is not, in fact an inert.

When it is not clear to an agency how an ingredient is truly functioning and the reason for its inclusion in the formulation, the SLA may request that the company submit efficacy data both with and without the ingredient of possible concern. If there are statistically significant differences in efficacy between product formulated with and without the ingredient of possible concern, the SLA may conclude that the ingredient listed as an inert, could be serving as an undeclared active ingredient.

If the company is not willing or unable to provide comparative efficacy data, then the SLA may determine that insufficient information is available to be able to register the product. If either route points to the ingredient as an active and the company does not change their formulation, the State could choose not to register the product, and also make a referral to EPA.

Safety Claims

If the SLA concludes that all ingredients are listed properly but believes that a product is incorrectly labelled as “Safe and Effective”, the SLA may choose to point to the “false and misleading” label statements as a violation of EPA Condition 6, and disqualification of 25(b) exempt status. The SLAs may also require label revisions prior to registration of the product in their respective state or notify the company that their product must be registered with the US EPA if they do not change their formulation and/or labeling.

Future Research

The FIFRA 25(b) Workgroup is open to discuss the development and reevaluation of the listing of both active and inert ingredients, and to provide maximum percentages of certain ingredients that are available for use in pesticide products exempted by FIFRA in 40 CFR 152.25(f). The development and implementation of new processes continue to strengthen and improve the registration and regulation of 25(b) pesticides.

Reference: https://www.epa.gov/minimum-risk-pesticides/conditions-minimum-risk-pesticides

State Group Guidelines

This guidance provides detailed information for state regulators on the inert ingredients listed in 40 CFR 152.25(f). Some inert ingredients on the 25(b) list are active ingredients in other EPA regulated pesticides. They may actually be performing pesticidal action in a 25(b) product as an active ingredient although they are listed as an inert ingredient in the formula. The function of an inert ingredient may be incorrectly listed on the statement of formula provided. This guidance gives thresholds for when a state regulator may want to question or ask for additional clarification on the function of an inert ingredient.

For industry, this document can help determine which ingredients are acceptable in their 25(b) product formulation as true inert ingredients. It can also inform industry when an inert ingredient is actually acting as an active ingredient which disqualifies it from exemption as a FIFRA 25(b) product. It could help industry consider reformulating a product to meet the 25(b) exemption or maintain their formulation and become federally registered. This guidance could help industry be prepared for questions or requests for clarification from regulators on inert ingredients that may come into question in a formulation.

Summary

The table is not all encompassing and does not address mitigation. Additional research can be added as reviewed and assessed by State Lead Agencies (SLA). This document is for reference purposes. An SLA can question the function and percentage of any ingredient within any 25(b) pesticide product. An SLA can also have more restrictive guidelines against specific ingredients.

Diatomaceous Earth - <60%* (dust formulations and lower concentrations of DE in combination with other inerts, such as the silicates, are still being reviewed and researched).

Carbon - Reassess later if/when a 25(b) product identified with this inert.

Carbon Dioxide - The reaction of the yeast, sugar and water creates carbon dioxide (CO_2). Reassess later if/when a 25(b) product identified with this inert (without yeast & sugar)

Kaolin - < 90% when used on plants in an insecticide, miticide or fungicide

Sulfur – Allowed maximum concentrations differs by formulation. WP/WDG (80% maximum), EC (52% max) Dust (49% max), SC/FC (12% max), G/Pellet (1% max)

Yeast - < 5% as an attractant

Castor oil – Can be used as an active or inert

Cod oil - Not for use on food crop. Limit < 1.5%

Fish oil - Not for use on food crop. Limit < 1.5%

Mineral oil < 80%

Wintergreen oil – Not acceptable in insecticide, miticides, acaracide or animal repellents. Limit < .02% in other pesticide products

Isopropyl alcohol – < 70% insecticides, <25% herbicides

Isopropyl myristate – < 50% insecticides

Citric acid – Active at 0.6%

Decanoic acid - 0.68% (approved for food use)

Fumaric acid - 50% (approved for food use)

Oleic acid - 0.15% (approved for food use)

Stearic acid - 0.3% (approved for food use)

Silica - 8-10% (depending on form, silica gel or silicon dioxide) (approved for food use)

Soap - The concentration of potassium salts of fatty acids must be less than or equal to 1% when used as an inert ingredient in Ready-to-Use (RTU) minimum risk pesticide products. The amount of “soap” in products requiring dilution with water, must be no more than an equivalent amount of 1% in the final solution when claimed as an inert ingredient. Potassium laurate is not an allowed inert on aquatic sites. Detergents are not “soap”.

Group 1: Pesticides

Diatomaceous Earth

Researcher: Ed White, Office of Indiana State Chemist
Inert Ingredient: Diatomaceous Earth [OPP Chem Code 72605 // CAS Number 61790-53-2 or 7631-86-9]
Chemical Synonyms: Silicon dioxide, Amorphous silicon dioxide [non-crystalline], Celite

1. Research
    a. What % is in current section 3 registered products – DE [72605] 67-92%
        i. Range – 67-92%
    b. What is the action/function/mode of action
        i. Insecticide
        ii. Scarifies insect exoskeleton, promoting loss of moisture and death by dehydration
    c. Signal Words / Hazards
        i. SIGNAL WORD - CAUTION
        ii. KOOROC Required; PPE not
        iii. NIOSH respiratory protection required for workers exposed to DE with greater than 1% crystalline silica
        iv. Hazards associated with the ingredient: IRRITATING TO SKIN, EYES & MUCOUS MEMBRANES. FDA approved as an anti-caking food additive. Calcinated DE is used as a filter medium for filtering beer and wine. Calcining [heat treating] increases the crystalline content and makes the DE unsuitable for "food grade".
        v. Silica is dangerous when inhaled, causing lung damage/disease in workers exposed to silica dust.
    d. Qualifiers for the ingredient
        i. Label display name: Diatomaceous Earth
        ii. Chemical Names: Kieselguhr or Diatomite or Amorphous Silicon Dioxide
        iii. Specific grades: Must contain less than 1% crystalline silica
        iv. Health issues: Greater content of crystalline silica likely to promote lung damage/silicosis

Example of 25(b) Pesticide Containing DE: Nature-Cide Insectidal Dust

Communication in 2018, from EPA, Region 10 – Packaged, labeled and sold (as a dust), the DE is acting as the killing agent.

Per the National Pesticide Information Center, *"Products containing diatomaceous earth are most commonly dusts. Other formulations include wettable powders and pressurized liquids. Currently, there are over 150 products registered for use inside and outside of buildings, farms, gardens, and pet kennels. Some products can also be used directly on dogs and cats. Diatomaceous earth products are registered for use against bed bugs, cockroaches, crickets, fleas, ticks, spiders, and many other pests."*

Resources:

National Pesticide Information Center: http://npic.orst.edu/ingred/de.html

NPIRS Active Ingredient Information: http://npirspublic.ceris.purdue.edu/ppis/chemical.aspx

Carbon

Researcher: Jolynn Mahmoudi-Haeri, California Department of Pesticide Regulation

CAS Reg. No. 7440-44-0
PC Code: 16601
Possible Names for this Chemical: Carbon

There are 14 active products federally registered. Carbon is formulated with several other pesticide active ingredients (sodium and potassium nitrates and sulfur). The range of carbon products is 8% to 28%. All products have a signal word of "WARNING," and contain similar precautionary statements. See table 2 for product information.

Carbon is used as a rodenticide, predacide and insecticide in six pyrotechnic fumigant gas cartridge products. When the cartridges are ignited and placed in pest burrows, they produce carbon monoxide and other gases which asphyxiate target pests, including pocket gophers, moles, ground squirrels, prairie dogs, rats, skunks, woodchucks, red foxes, coyotes, and ground wasps.

Dry ice pellets placed in burrows and covered. Suffocates pest as it sublimates from a solid to a gas.

Table 2. Carbon products

Product Name	EPA Reg. No.	Active Ingredients (%)	Signal Word	Precautionary/PPE	Use/Pest/Application
AMDRO GOPHER GASSER	73342-8	8-Carbon 45-Potassium Nitrate 45-Sulfur	Warning	Causes eye irritation. Harmful if absorbed through skin. Avoid contact with eyes, skin or clothing. Wash thoroughly with soap and water after handling. After ignition, cartridge produces toxic gases. Fumes may be harmful if inhaled.	-rats, gophers, squirrels -ornamental, rangeland, rodent burrows -gas cartridge, fumigation
APHIS-ONLY GAS CARTRIDGE	56228-2	28-Carbon 53-Sodium nitrate	Warning	Causes substantial but temporary eye injury. Harmful if absorbed through skin. Harmful if swallowed. Do not get in eyes or on clothing. Avoid contact with skin. Wear protective eyewear (goggles, face shield, or safety glasses). Wash thoroughly with soap and water after handling and before eating, drinking, chewing gum, using tobacco or using the toilet. Remove and wash contaminated clothing before reuse. After ignition, cartridge produces toxic gases, such as carbon monoxide. Fumes may be harmful if inhaled.	-squirrels, marmot, prairie dog -ornamental, rangeland, rodent burrows, nonfood/feed crop areas -gas cartridge, fumigation
APHIS-ONLY LARGE GAS CARTRIDGE	56228-21	28-Carbon 53-Sodium nitrate	Warning	Causes substantial but temporary eye injury. Harmful if absorbed through skin. Harmful if swallowed. Do not get in eyes or on clothing. Avoid contact with skin. Wear protective eyewear (goggles, face shield, or safety glasses). Wash thoroughly with soap and water after handling and before eating,	-coyotes, skunks, red fox -ornamental, rangeland, nonfood crop areas -gas cartridge, fumigation

				drinking, chewing gum, using tobacco or using the toilet. Remove and wash contaminated clothing before reuse. After ignition, cartridge produces toxic gases, such as carbon monoxide. Fumes may be harmful if inhaled.	
Gas Cartridge	56228-61	28-Carbon 53-Sodium nitrate	Warning	Causes substantial but temporary eye injury. Harmful if absorbed through skin. Harmful if swallowed. Do not get in eyes or on clothing. Avoid contact with skin. Wear protective eyewear (goggles, face shield, or safety glasses). Wash thoroughly with soap and water after handling and before eating, drinking, chewing gum, using tobacco or using the toilet. Remove and wash contaminated clothing before reuse. After ignition, cartridge produces toxic gases, such as carbon monoxide. Fumes may be harmful if inhaled.	-beaver, woodchuck, squirrels, marmot, prairie dog, indigo snake -ornamental, rangeland, nonfood crop areas -gas cartridge, fumigation
Large Gas Cartridge	56228-62	28-Carbon 53-Sodium nitrate	Warning	Causes substantial but temporary eye injury. Harmful if absorbed through skin. Harmful if swallowed. Do not get in eyes or on clothing. Avoid contact with skin. Wear protective eyewear (goggles, face shield, or safety glasses). Wash thoroughly with soap and water after handling and before eating, drinking, chewing gum, using tobacco or using the toilet. Remove and wash contaminated clothing before reuse. After ignition, cartridge produces toxic gases, such as carbon monoxide. Fumes may be harmful if inhaled.	-coyotes, skunks, red fox - ornamental, rangeland, nonfood crop areas -gas cartridge, fumigation
QUICK-STRIKE MOLE AND GOPHER GASSER	36488-67	9-Carbon 50-Sodium nitrate 38-Sulfur	Warning	Causes eye irritation. After ignition cartridge produces toxic gases such as oxides of sulfur and carbon monoxide. Fumes from ignited cartridge may be harmful if inhaled. Avoid contact with eyes, skin or clothing. Avoid breathing fumes. Wash thoroughly with soap and water after handling.	-rats, gophers, squirrels, moles, skunks, woodchucks -ornamental, rangeland, nonfood crop areas, parks, rodent burrows -gas cartridge, fumigation
REVENGE RODENT SMOKE BOMB	9086-4	9.3-Carbon 38.8 Potassium nitrate 39.4-Sulfur	Warning	Causes eye irritation. Harmful if absorbed through skin. After ignition, cartridge produces toxic gases (such as oxides of sulfur gases and carbon monoxide). Fumes from ignited cartridge may be harmful if inhaled. Do not get in eyes or on skin or clothing. Do not breathe fumes. Wash thoroughly with soap and water after handling.	-rats, gophers, squirrels, moles, skunks, woodchucks -ornamental, rangeland, nonfood crop areas, parks, rodent burrows -gas cartridge, fumigation
SMOKE CARTRIDGE	36488-67	9-Carbon 50-Sodium nitrate 38-Sulfur	Warning	See Quick Strike	See Quick Strike

SWEENY'S MOLE AND GOPHER GASSER	36488-67	9-Carbon 50-Sodium nitrate 38-Sulfur	Warning	See Quick Strike	See Quick Strike
SWEENY'S QUICK-STRIKE MOLE AND GOPHER GASSER	36488-67	9-Carbon 50-Sodium nitrate 38-Sulfur	Warning	See Quick Strike	See Quick Strike
THE GIANT DESTROYER	10551-1	9-Carbon 50-Sodium nitrate 38-Sulfur	Warning	Causes eye irritation. After ignition cartridge produces toxic gases such as oxides of sulfur and carbon monoxide. Fumes from ignited cartridge may be harmful if inhaled. Avoid contact with eyes, skin or clothing. Avoid breathing fumes. Wash thoroughly with soap and water after handling.	-rats, gophers, squirrels, moles, skunks, woodchucks -ornamental, rangeland, nonfood crop areas, parks, rodent burrows, gold courses -gas cartridge, fumigation
VICTOR MOLE AND GOPHER GASSER	36488-67	9-Carbon 50-Sodium nitrate 38-Sulfur	Warning	See Quick Strike	See Quick Strike
VICTOR QUICK-STRIKE MOLE AND GOPHER GASSER	36488-67	9-Carbon 50-Sodium nitrate 38-Sulfur	Warning	See Quick Strike	See Quick Strike
VICTOR V QUICK-STRIKE MOLE AND GOPHER GASSER	36488-67	9-Carbon 50-Sodium nitrate 38-Sulfur	Warning	See Quick Strike	See Quick Strike

References:

Carbon and Carbon Dioxide U.S. EPA RED Facts
https://www3.epa.gov/pesticides/chem_search/reg_actions/reregistration/fs_G-18_1-Sep-91.pdf

NPIRS Active Ingredient Information
http://npirspublic.ceris.purdue.edu/ppis/chemical.aspx

Carbon dioxide

Researcher: Jolynn Mahmoudi-Haeri, California Department of Pesticide Regulation

CAS Reg. No. 124-38-9
PC Code: 16601
Possible Names for this Chemical: Carbon dioxide, Carbonic acid gas, Carbonic anhydride, Dry ice

There are 9 active products federally registered. Almost all products contain 100% of carbon dioxide. One product, PROPOXIDE 892, contains 92% carbon dioxide and 8% propylene oxide. The signal word for all products is "Warning," with the exception of PROPOXIDE 892 with a signal word of "DANGER." See Table 1 for product information.

Table 1. Carbon dioxide products

Product Name	EPA Reg. No.	Active Ingredients (%)	Signal word	Precautionary/PPE	Use/Pest/Application
ANT ZAP	87766-1	100-Carbon dioxide	Warning	May be fatal if inhaled. Do not breathe vapor. Exposure may cause suffocation and death. Liquid can cause frostbite. Do not get liquid on skin or in eyes. Exposure to high levels may occur without warning or detection by user	-Ant, moles -Soil fumigation
CARBON DIOXIDE	38719-5	99.95-Carbon dioxide	Warning	May be fatal if inhaled. Do not breathe vapor. Exposure may cause suffocation and death. Ventilate areas before entering. For handling activities in enclosed areas during and after fumigation, use either a supplied-air respirator with NIOSH approval number TC-19C or a self-contained breathing apparatus (SCBA) with NIOSH approval number TC-13F.	- beetles, moths, psocoptera (louse) -silos, storages, trucks, trailers, sealed railroad cars, and ships, agricultural commodities -fumigation
CARBON DIOXIDE	CA920007	99.95-Carbon dioxide	Warning	Label not available	-black widows -grapes -fumigation
Carbon Dioxide - Carp	6704-95	100-Carbon dioxide	Warning	May be fatal if inhaled. Do not breathe vapor.	-carp -aquatic areas
IGI CARBON DIOXIDE	91274-1	99.9-Carbon dioxide	Warning	May be fatal if inhaled. Do not breathe vapor. Exposure may cause suffocation and death. Ventilate areas before entering. For handling activities in enclosed areas during and after application, use either a supplied-air respirator with NIOSH approval number TC-19C or a self-contained breathing apparatus (SCBA) with NIOSH approval number TC-13F.	-burrows, silos, storages, trucks, trailers, sealed railroad cars, and cargo ships, agricultural commodities, golf courses, etc. - beetles, moths, psocoptera (louse), agricultural pests (thrips, spider mites), burrowing rodents (voles, moles, ants, rats, ground squirrels, pocket gophers
MOLE ZAP	87766-1	100-Carbon dioxide	Warning	May be fatal if inhaled. Do not breathe vapor. Exposure may cause suffocation and death. Liquid can cause frostbite. Do not get liquid on skin or in eyes. Exposure	-Ant, moles -Soil fumigation

				to high levels may occur without warning or detection by user	
PROPOXIDE 892	47870-3	92-Carbon dioxide 8-Propylene oxide	Danger	Corrosive: Fatal if swallowed. Fatal if absorbed through skin. Fatal if inhaled. Causes irreversible eye damage. Causes skin burns. Do not get in eyes, on skin, or on clothing. Do not breathe vapor or spray mist. Prolonged or frequently repeated skin contact may cause allergic reactions in some individuals. Wear protective eyewear such as full face shield and splash-proof goggles when opening cylinders or handling product. Avoid touching gloves or hands to eyes after handling until possible residues are washed off of hands. Wash thoroughly with soap and water after handling and before eating, drinking, chewing gum, or using tobacco. Remove and wash contaminated clothing before reuse. EXPOSURE MAY CAUSE SUFFOCATION AND DEATH. The vapors of propylene oxide are heavier than air and may spread long distances; distant ignition and flashback are possible. Propylene oxide can react with water and a runaway reaction might occur. Propylene oxide is very reactive with chlorine, ammonia strong oxidizing agents and acids. Restricted Use Pesticide due to toxicity categories. For retail sale to and use only by Certified Applicators or persons under their direct supervision and only for those uses covered by the Certified Applicator's certification.	For non food use as an insecticidal fumigant for the control of stored product insects in cosmetic articles and ingredients, non-edible gums, ores, packaging, pigments, pharmaceutical materials, books, and discarded nut shells prior to disposal. To aid in the control of microbiological spoilage and as an insecticidal fumigant for the control of stored products' insects in the following food commodities:
RADAR	87942-1	100-Carbon dioxide		May be fatal if inhaled. Do not breathe vapor. Concentrations of >10% carbon dioxide can produce unconsciousness or death. High concentrations may cause asphyxiation; symptoms include loss of mobility and/or unconsciousness. Wear waterproof gloves when cleaning the unit and handling rodent bodies	-mice -indoor applications only; food processing plants
Rat Ice	12455-148	100-Carbon dioxide (dry ice)		May be fatal if inhaled. Do not breathe vapor. Exposure may cause suffocation and death. Exposure to high levels may occur without warning or detection to user.	- Norway rats, roof rats, Polynesian rats -Outdoor use; around industrial, commercial, public and residential areas. -bait application

Kaolin

Researcher: Gary Vetter, Washington State Department of Agriculture

Chemical Code: 100104

CAS # 1332-58-7

Kaolin (china clay) is a hydrated aluminum silicate crystalline mineral (kaolinite), formed from weathered granite that once sat below the earth's surface.

Physical Description:KAOLIN is an odorless white to yellowish or grayish powder. It is chemically inert. It contains mainly the clay mineral kaolinite (Al_2O_3 $(SiO_2)_2(H_2O)$ 2), a hydrous aluminosilicate. Kaolinite has mp 740-1785°C and density 2.65 g/cm3. Kaolin is insoluble in water but darkens and develops an earthy odor when wet.

What % is in current section 3?

1) There are 3 companies with 7 registered pesticides with Kaolin.
2) They range from 90-100% active ingredient

What is the Action/function/mode of Action?

Kaolin has a nontoxic mode of action. It acts as a repellent / Protectant, and forms a barrier film to protect plants from insects, mites and disease.
Kaolin is not expected to cause unreasonable adverse effects when used according to label instructions. The current label and by the data presented in this document. It is believed that this pesticidal active ingredient will not cause any unreasonable adverse effects, in the control of damage to plants by insects, mites, fungi, and bacteria. The toxicological properties of this product are less toxic than any other conventional pesticide product currently in use.

180.1180 Kaolin; exemption from the requirement of a tolerance.

Kaolin is exempted from the requirement of a tolerance for residues when used on or in food commodities to aid in the control of insects, fungi, and bacteria (food/feed use).

Signal words/Hazards

For the kaolin products, "**CAUTION**: Causes moderate eye irritation. Avoid contact with eyes or clothing. May cause irritation of the respiratory system. Avoid breathing dust. Wash thoroughly with soap and water after handling. Remove contaminated clothing, and wash before reuse."

Hazards associated with Kaolin

Human Health Assessment-The information submitted supports the lack of toxicity of kaolin based on its long history of use by humans without any indication of deleterious effects. Kaolin is a naturally occurring mineral found in huge deposits worldwide. It is used as an indirect food additive.

Environmental Fate and Ground Water Data

The need for environmental fate and groundwater data (Tier II) was not triggered under current requirements (40 CFR Section 158.690(d)(2)(vii through xv) because of practically non-toxic results indicated in Tier I studies. Risk to nontarget species is minimal due to the use pattern, application methods, and mitigation of nontarget aquatic organism toxicity with appropriate precautionary label statements under "Environmental Hazards."

Ecological Exposure and Risk Characterization
A potential for exposure exists to nontarget insects, fish, and other wildlife with foliar spray applications. However, test results indicate that the compound is practically nontoxic to birds and freshwater fish, and, at most, slightly toxic to aquatic invertebrates. BPPD also believes that low toxicity, and mitigating label language present minimal to nonexistent risk to wildlife.

Example of 25(b) Pesticide Containing Kaolin:

References:

Kaolin (100104) Registration Eligibility Document: https://www3.epa.gov/pesticides/chem_search/reg_actions/reregistration/red_PC-100104_1-Apr-00.pdf

e-CFR: https://www.ecfr.gov/cgi-bin/text-idx?SID=9eeac0c0ee148da742eb86e8582f4df3&mc=true&node=se40.26.180_11180&rgn=div8

NPIRS- http://npirspublic.ceris.purdue.edu/ppis/chemical2.aspx

Sulfur

Researcher: Sarah K Caffery, Office of Indiana State Chemist

1. Research
    a. NPIRS Search

        Sulfur is found in 125 active section 3, EPA registered products. This includes: Sulfur dioxide extract of petroleum (63401), Lime sulfur (76702), Sulfur (Wettable powder sulfur, Sunbelt wettable sulfur, Colloidal Sulfur, Liquid Sulfur 6) (77501) and Sulfur dioxide (77601)

    b. What % is in current section 3

Formulation Type	Percentage	Signal Words
Dust	Single AI (Active Ingredient): 49.35 – 99.99% Combined: 25 – 96.75%	CAUTION on the majority DANGER (2 products, single AI 49.35-90%) WARNING (5 products all fungicides, combined AI – sulfur @ 25-30%)
Emulsifiable Concentrate	Single AI: 52-53% Combined: 10-30%	CAUTION on the majority DANGER (1 product, single AI 27.5% Calcium polysulfide) WARNING (1 product, combined AI – 27.25% sulfur, 19.15% chlorothalonil)
Flowable Concentrate	Single AI: 12-65% Combined AL: 1 product, 50% sulfur	CAUTION
Formulation Intermediate	1 product, single AI: 70%	CAUTION
Granular	Single AI (2 products) 1-80% Combined (1 product) 28%	CAUTION
Impregnated Materials	Combined (3 products) 38-45% sulfur. All 3 products include CARBON and potassium nitrate or sodium nitrate	WARNING – Poison, single dose
Pellet	Combined (2 products) .5-38% sulfur	CAUTION/WARNING
Pressurized Gas	Single AI (2 products) 100%	DANGER 1 RUP product
Soluble Concentration	Single AI 12-52% Sulfur, 27-29% Calcium polysulfide	CAUTION sulfur products DANGER calcium polysulfide products

	Combined (1 product) 6.48%	
Solution-Ready To Use	Single AI (2 products) 1-80% Combined (1 product) 28%	CAUTION .2-10% WARNING 28% DANGER, RUP 99.9% 4 NO DATA (<1% sulfur)
Water Dispersible Granules	Single AI 80-90% Combined (2 products) 70-80%	CAUTION
Wettable Powder	Single AI 80-97%	CAUTION
Wettable Powder/Dust	Single AI 80-97%	CAUTION

c. What is the action/function/mode of action

Function/Mode of Action	Details
Fungicide / Insecticide / Miticide	
Insecticide	Sulfur kills insects if they touch or eat it (i). Sulfur spray is effective against thrips, spider mites and psyllids (vii).
Fungicide	Sulfur kills fungi on contact (i). It is used for the control and prevention of black spot, rusts, leaf spots and powdery mildew on roses, other ornamentals, fruits and vegetables (iii).
Rodenticide	In the form of a gas cartridge, it will suffocate burrowing animals.

d. Signal Words / Hazards
   i. Required protections
      1. All end-use outdoor sulfur product labels must bear an updated water contamination warning, and a 24-hour reentry statement and protective clothing requirements to protect handlers and field workers from adverse skin and eye effects (v).
   ii. What hazards are associated with that ingredient – at what percentage
      1. If an animal eats too much sulfur it can be toxic and fatal (i).

2. Sulfur in excess can cause brain cell death, resulting in brain damage. Signs associated with brain damage can include blindness, incoordination, seizures, death, and others (i).
3. Miners, with excessive/repeated exposure are at risk for breathing and sinus problems (iv).

e. Include any qualifiers for the ingredient
   i. Approved for use on food / non-food crops
      1. May be used on food crop up to the day of harvest (iii).
   ii. Sulfur is also commonly found in soil amendments or fertilizers

f. Include References

   i. NPIC http://npic.orst.edu/ingred/sulfur.html
   ii. Block, E. (1981). Low-molecular-weight organosulfur compounds in nature: the search for new pesticides. American Chemical Society. Retrieved from https://pubs.acs.org/doi/pdf/10.1021/bk-1981-0158.ch001
   iii. https://www.missouribotanicalgarden.org
   iv. Cornell University, Pesticide Information Profile: http://pmep.cce.cornell.edu/profiles/extoxnet/pyrethrins-ziram/sulfur-ext.html
   v. EPA R.E.D. Facts https://archive.epa.gov/pesticides/reregistration/web/pdf/0031fact.pdf
   vi. University of California IPM http://ipm.ucanr.edu/TOOLS/PNAI/pnaishow.php?id=67
   vii. Home guides: https://homeguides.sfgate.com/make-sulfur-spray-pesticide-26954.html

Yeast

Researcher: Jolynn Mahmoudi-Haeri, California Department of Pesticide Regulation

CAS Reg. No. 68876-77-7
PC Code: 100054
Possible Names for this Chemical: Baker's yeast, yeast, *Saccharomyces cerevisiae*

There are a total of 9 active products federally registered. All from the same company, Bull Run Scientific, under the EPA registration number 84565-2. See table for information for primary product.

Yeast is naturally occurring. Yeast is used as an attractant in traps for flies in federally registered products. The mode of action of yeast, when activated, is to produce odors that attract filth flies. As part of a water-soluble attractant insert in a disposable or re-useable trap, it draws filth flies into the apparatus where they are trapped.

Table 3. Yeast primary product

Product Name	EPA Reg. No.	Active Ingredients (%)	Signal Word	Precaution/PPE	Use/Pest/Application
BULL RUN FLY ATTRACTANT	84565-2	5.5-Yeast 18-Egg solids 42.1-Sucrose 0.2-Indole 2.8-Trimethylamine	CAUTION	none	-house fly, bottle fly, etc. -camp areas, dog runs, recreational areas, garbage areas -attract & trap

References:

U.S. EPA PPLS
https://iaspub.epa.gov/apex/pesticides/f?p=113:6:::NO::P6_XCHEMICAL_ID:4420

Yeast U.S. EPA Biopesticide Fact Sheet
https://www3.epa.gov/pesticides/chem_search/reg_actions/registration/fs_PC-100054_01-Jun-09.pdf

U.S. EPA's Biopesticide Registration Action Document
https://www3.epa.gov/pesticides/chem_search/reg_actions/registration/decision_PC-100054_26-May-09.pdf

Group 2: Oils

Castor Oil

By Denise Clanton, Mississippi Department of Agriculture & Commerce

Castor Oil – OPP Chem Code 031608 CAS Reg. No. 8001-79-4

Hydrogenated Cator Oil – CAS Reg. No. 8001-78-3

1. Castor Oil can be used as either an Active or an Inert Ingredient. Castor Oil is produced from the castor bean by first removing the hull and then pressing ripe seeds. The hull is removed because it contains ricin, a known dangerous toxin. Therefore, castor beans should not be grown around children or pets due to the poison on the outer shell of the beans.
2. Castor oil with CAS Reg. No. 8001-79-4 has use as a Fragrance and appears on both permitted active and inert lists for minimal risk pesticides. Hydrogenated castor oil, CAS Reg. No. 8001-78-3 appears on the permitted inert list. It is not listed as a fragrance. Both CAS Reg. No. 8001-79-4 and 8001-78-3 are cleared for both Food and Nonfood Use sites.
3. What percent is in current Section 3 registrations:
   - One Section 3 product was found with Castor Oil as an active ingredient. The percentage of castor oil as a single active ingredient is 14.85. The product is a mole repellent, Messina Wildlife's Mole Stopper Smoke, EPA reg # 39775-4.
4. **Example of 25(b) Pesticide -** There are numerous 25b products on the market containing castor oil as an active ingredient for mole control. As a single ingredient, the percentage ranges from 9.9% - 100%. As a combined ingredient, the percentage ranges from 9.9% to 68.75%.
5. What is the action/function/mode of action:
   - Repellent/Insecticide/Rodenticide/Antimicrobial
   - Castor oil can be used as a repellent for burrowing animals, such as moles, gophers, voles, armadillos, etc. Castor oil tastes bitter and has an unpleasant smell which repels the burrowing critters from the area. The products containing castor oil will need to be directly applied to the soil and may need to be reapplied weekly for best results.
   - As an insecticide, castor oil can be used to coat stored food products such as green gam or mung beans, pigeonpeas, chickpeas, and cowpeas. In an experiment, they were treated with various amounts of castor oil. Results showed castor oil effectively prevented the emergence of pulse beetle in the mung bean and pigeoneas, and bruchid pests *Callosobruchus maculatus* and Callosobruchus phaseoli in chickpeas, and *C. maculate* in cowpeas. A second experiment reported Castor oil reduced wood loss from termite damage on wooden stakes which were dipped in concentrations of 10%, 15%, and 20% castor oil. A third finding concluded castor oil kills the fall armyworm at the larval and pupal stage. I have not found any products in my system with castor oil as an insecticide.
   - As a Rodenticidde, when combined with dehydrating agents such as linseed oil, soybean oil, corn gluten meal, cottonseed oil, or sodium chloride, castor oil can function to kill rats by basically choking them to death (it clogs their pharynx, larynx, and esophagus). I have not found any products in my online system with castor oil used as a rodenticide.
6. Signal Words/Hazards
   - Product labels viewed have "Caution" listed as the signal word.
7. References:
   - NPIRS Active Ingredient Search http://npirspublic.ceris.purdue.edu/ppis/chemical.aspx
   - Castor Oil For Garden Use: Tips on Treating Pests with Castor Oil

https://www.gardeningknowhow.com/plant-problems/pests/animals/treating-pests-with-castor-oil.htm

- **Castor Oil Profile** Active Ingredient Eligible for Minimum Risk Pesticide Use
  https://ecommons.cornell.edu/bitstream/handle/1813/56115/castor-oil-MRP-NYSIPM.pdf?sequence=1&isAllowed=y
  Cornell Cooperative Extension IPM Program: Castor Oil Profile

Cod Liver Oil

By Denise Clanton, Mississippi Department of Agriculture & Commerce

Cod Liver Oil – CAS Reg. No. 8001-69-2

1. Cod Liver Oil is the oil extracted from the liver of cod fish and is a great source of nutrients. It is also a great source of omega 3 fatty acids, as well as vitamin A and Vitamin D.

2. What percent is in current Section 3 registrations:
    - Currently there are no registered Section 3 products which contain cod liver oil as an active ingredient.
3. What is the action/function/mode of action:
    - No available data, but likely a sufficant when used as a Miticide or Insecticide.
4. Signal Words/Hazards
    - Cod liver oil is listed as safe in general with low toxicity to humans, wildlife and pets. Cod liver oil is taken as a health supplement.

5. Include any Qualifiers for the Ingredient
    - Cod Liver oil is approved for use on food crops.
6. References:
    - See Fish Oil list

Fish Oil

By Denise Clanton, Mississippi Department of Agriculture & Commerce

Fish Oil – OPP Chem Code 122401, CAS Reg. No. 8016-13-5

1. Fish oil is pressed from entire fish in contrast to cod liver oil which is from pressed liver.
2. Fish Oil is used as an inert ingredient and usually combined with plant oils. Fish oil's quality and composition are difficult for a manufacturer to verify due to geographic origin and species of the extracted fish oil. Therefore, fish oil is normally combined with other oils such as neem.
3. What percent is in current Section 3 registrations:
    - NO Section 3 products were found with Fish Oil as an active ingredient.
4. What is the action/function/mode of action:
    - Insecticide/Miticide/Repellent/Fungicide/Adjuvant
    - As an Insecticide/Miticide/Repellent: Products containing fish oil coat the pests' bodies, disrupt their respiration, and cause suffocation. These products work as a mite/insect repellent as well by deterring feeding on an oil-covered plant surface. Oil based products target soft-bodied arthropods such as "mites, aphids, whiteflies, thrips, mealybugs, and scale insects." Their residual activity is low and must be sprayed directly on the insect/mite completely covering the pest. A product containing fish oil may also kill insect or mite eggs by penetrating the shell and killing the embryo.
    - As a Fungicide: When applied directly to the plant surface, products containing fish oil will smother the growth of fungi and reduce the germination of spores. These products are beneficial in suppressing powdery mildew and black spot on rose.

- Animal Repellent: Fish oil is recognized by EPA as a mammal and bird repellent.
- As an Adjuvant/Surfactant: Products containing fish oil can be used as an adjuvant with other pesticides by enhancing the effectiveness of the application. This increased efficiency of the application is because the fish oil can improve plant coverage and aiding in the pesticide penetrating the surface.

5. Signal Words/Hazards
   - None found. The oil's activity is only for a short time, evaporates quickly, and does not pollute the soil or groundwater. I would guess a Caution signal word would be appropriate
6. Include any Qualifiers for the Ingredient
   - Fish oil is not approved for use on food crops most likely as a result of people's fish allergies.
7. References:
   - NPIRS Active Ingredient Search http://npirspublic.ceris.purdue.edu/ppis/chemical.aspx
   - Using Oils as Pesticides http://counties.agrilife.org/upshur/files/2011/03/Using-Oils-as-Pesticides.pdf
   - Pests in the Urban Landscape https://ucanr.edu/blogs/blogcore/postdetail.cfm?postnum=13099
   - Uses for Fish Oil in the Garden https://homeguides.sfgate.com/uses-fish-oil-garden-102993.html
   - PAN Pesticide Database – Chemicals http://www.pesticideinfo.org/Search_Chemicals.jsp
   - https://www3.epa.gov/pesticides/chem_search/reg_actions/registration/fs_G-112_01-Mar-01.pdf

Mineral Oil, White Mineral Oil

Researcher: Sarah Caffery, Office of Indiana State Chemist

1. Research

   a. What % is in current section 3

      With the NPIRS search, there are 104 active EPA registered products with Mineral Oil and 115 active products with White Mineral Oil.

Ingredient	Percentage	Signal Word
Mineral Oil **63502: Mineral oil - includes paraffin oil from 063503, Mineral seal oil & Mineral oil, mineral seal oil or white mineral oil**	Single AI (Active Ingredient): 80-100% Only ACTIVE registration w/combined = 75% (other AI Malathion 5%)	All labels list CAUTION
White Mineral Oil **63502: Mineral oil, mineral seal oil or white mineral oil** **63510: White mineral oil (from 063502)**	Single AI: 80-100% Only ACTIVE registration w/combined = 75% (other AI Malathion 5%)	

   b. What is the action/function/mode of action

Function/Mode of Action	Details
Fungicide / Insecticide / Miticide / Virucide	Because oils are only effective when applied directly to the pest, good plant coverage (top and underside of leaves) and correct application timing are critical. Never apply horticultural oil as a preventative: oil does not provide residual control if the pest is not present. Oils do not work as soil drenches either; they must be applied to aerial plant parts. (e.viii)
Insecticide	White oil works by coating soft body insects, like aphids and mites, in oil. The soap helps the oil stick to the insect while the water loosens the mixture enough to be sprayed on easily. When combined, these two ingredients work to suffocate the insects. (e.vii) Regardless of the source, petroleum or vegetable, these oils kill eggs, larvae, and nymphs of insects and mites by smothering them. It also works on all life stages of soft-bodied insects. Insects with waxy exoskeletons or dense body hairs are harder to kill because the oil cannot cover their body surfaces uniformly. (e.viii)

	(repellent) Oils will also deter some insects from laying eggs, if the plant is sprayed while females are looking for good egg-laying sites, and it may deter other pests from feeding. (e.viii)
Fungicide	As a fungicide, oils work by interfering with fungal attachment to the host plant and by suffocating spores. (e.viii)

c. Signal Words / Hazards
    i. What level/percentage would increase the signal word
        1. Products already include highest percentage – highest signal word = CAUTION
        2. Higher signal words would come from other ingredients

d. Include any qualifiers for the ingredient
    i. Allergen issues
        1. No

e. Include References
    i. https://extension.colostate.edu/docs/pubs/insect/05569.pdf
    ii. http://counties.agrilife.org/upshur/files/2011/03/Using-Oils-as-Pesticides.pdf
    iii. Effects of crude plant extracts and mineral oil on reproductive performance of the codling moth https://pdfs.semanticscholar.org/8799/388aa899ea8cf197b8b8cabb3d2cbdf43706.pdf
    iv. Pests in the Urban Landscape https://ucanr.edu/blogs/blogcore/postdetail.cfm?postnum=13099
    v. A Literature Review of Insecticide and Mineral Oil Use in Preventing the Spread of Non-persistent Viruses in Potato Crops https://potatoes.ahdb.org.uk/sites/default/files/publication_upload/Review%20of%20Spray%20Oils%20Insecticides%20and%20Potyvirus%20Transmission.pdf
    vi. White Oil Recipe: insecticide - https://www.gardeningknowhow.com/plant-problems/pests/pesticides/white-oil-insecticide.htm
    vii. Pesticide Ingredient: Horticultural Oil Home Garden Series http://cru.cahe.wsu.edu/CEPublications/FS184E/FS184E.pdf
    viii. NPIRS product search

Wintergreen Oil

Researcher: Ed White, Office of Indiana State Chemist

Inert Ingredient: Oil of Wintergreen aka Methyl Salicylate [OPP Chem Code 76601 or 176601 // CAS R/N 119-36-8 or 68917-75-9]

Wintergreen oil aka methyl salicylate is a naturally occurring plant oil, but can also be synthesized.

In small quantities it is known to be an attractant for male orchid bees. It is suspected that when herbivorous insects feed on some plants, that the plants release methyl salicylate which in turn attracts predatory/beneficial insects to prey upon the herbivorous insects. Interestingly, EPA has classified wintergreen oil as an attractant when used as an inert, and has also classified it as an insect repellent when used as an active in food packaging (40 CFR 180.1189).

The human body metabolizes methyl salicylate into salicylates, including acetylsalicylic acid (aspirin). Just as 2 aspirin are medicinal but 50 aspirin are lethal, dose presents a safety concern with methyl salicylate.

1. Research
    - **a.** What % is in current section 3 registered products – **oil of wintergreen [176601]**
        - i. Range – 0.001% a.i. for three active products [0618_2019]
        - ii. When single active, when combined all three products
    - b. What is the action/function/mode of action
        - i. INSECTICIDE, MITICIDE, ACARACIDE, animal repellent
        - ii. CONTROL MITES,THRIPS, etc. ON ORNAMENTALS & FOOD CROPS
    - c. Signal Words / Hazards
        - i. Six pack study on the product – what does the signal word mean?
        - ii. NO SIGNAL WORD REQUIRED
        - iii. KOOROC, PPE REQUIRED
        - iv. What hazards are associated with that ingredient – IRRITATING TO SKIN, EYES & MUCOUS MEMBRANES. FDA GRAS when used as a flavor in gum & candy at 0.04% or less. Can cause dermatitis and/or be an inhalation hazard.
    - d. Include any qualifiers for the ingredient
        - i. EPA final rule list
        - ii. Specific grades
        - iii. Allergen issues
    - e. Include References
        - i. See attached documents
2. Research
    - **a.** What % is in current section 3 registered products – **methyl salicylate [76601]**
        - i. EPA data contains 209 products with methyl salicylate as a.i. Only 4 have currently active registrations. Others cancelled for “generic exemption data call-in”
        - ii. Range – 0.02-5.9% a.i. for four active products [0618_2019]
        - iii. All 4 active products combined with other a.i.’s, mostly other essential oils
    - b. What is the action/function/mode of action
        - i. INSECTICIDE, MITICIDE, ACARACIDE, animal REPELLENT
        - ii. CONTROL MITES,THRIPS, etc. ON ORNAMENTALS & FOOD CROPS
    - c. Signal Words / Hazards

   i. Six pack study on the product – what does the signal word mean?
   ii. Three products SIGNAL WORD caution
   iii. All 4 products KOOROC
   iv. One product , PPE REQUIRED
   v. What hazards are associated with that ingredient – IRRITATING TO SKIN, EYES & MUCOUS MEMBRANES. FDA GRAS when used as a flavor in gum & candy at 0.04% or less. Can cause dermatitis and/or be an inhalation hazard.

d. Include any qualifiers for the ingredient
   i. EPA final rule list
   ii. Specific grades
   iii. Allergen issues

e. Include References
   i. EPA Plant Oils Fact Sheet: https://www3.epa.gov/pesticides/chem_search/reg_actions/registration/fs_G-114_01-Jul-01.pdf
   ii. Reregistration Eligibility Decision (RED) for Methyl salicylate https://www3.epa.gov/pesticides/chem_search/reg_actions/reregistration/red_PC-076601_9-Nov-05.pdf
   iii. NPIRS Active Ingredient Search http://npirspublic.ceris.purdue.edu/ppis/chemical.aspx

Group 3: Solvents

Isopropyl Alcohol

Researcher: Denise Clanton, Mississippi Department of Agriculture & Commerce

Isopropyl Alcohol – CAS Reg. No. 67-63-0

1. Isopropyl Alcohol, Isopropanol, or 2-Propanol, is approved for use as an inert ingredient as either a food or non-food use in 25b products. It is also used in many Section 3 registrations as an active ingredient. Isopropyl Alcohol is colorless with a sharp odor with both antibacterial and solvent properties. It will dissolve in water, ethanol, ether and chloroform but is insoluble in salt solutions.
2. What percent is in current Section 3 registrations:
    - When I ran Isopropyl Alcohol in NPIRS, PPLS and Kelly Solutions, I found many Section 3 registrations containing Isopropanol as the active ingredient. These products were antimicrobials and were disinfectant and sanitizer type properties on the labels. In PPLS, there are ninety-six products containing Isopropanol. Of the ninety-six, ninety-one are combined with other ingredients and five are single ingredient. Of the combined products, the lowest percentage of Isopropanol is 5.48% and the highest is 63.25%. Of the single ingredient products, the lowest percentage of Isopropanol is 62.7% and the highest is 70%.
    - As a 25b inert ingredient, my online system does not track inerts, but we have begun to log in these ingredients into a spreadsheet, and we have reviewed several with Isopropanol as an inert ingredient. The percentages range from 2% through 20%. We are logging the product name, company name, whether it is an active or inert, the percentage of the ingredient, and the function listed on the CSF.
3. What is the action/function/mode of action:
    - Disinfectant(sanitizer,bactericide,fungicide,etc.)/Solvent/Carrier/Surfactant
    - As a disinfectant/sanitizer, products containing Isopropanol are great sterilizers for removing bacteria, viruses, or fungi from various cutting tools. These products are great for sanitizing hospital surfaces and instruments. Beauty shops utilize Isopropanol products to sanitize their cutting styling equipment. The following explains the process of Isopropanol as a Disinfectant: "Isopropanol functions as a disinfectant through the dissolution of lipid membranes and rapid denaturation of proteins. Because proteins are denatured more quickly in the presence of water, enhanced bactericidal activity is generally observed for mixtures of isopropanol and water when compared to concentrated isopropanol, which functions as a dehydrating agent."
    - As an adjuvant or surfactant, products containing Isopropanol can aid pesticide applications.
    - In the 25b products we found so far that contain Isopropanol as an inert ingredient, the products are for fleas and ticks, bed bugs and flying insects. The function listed on the CSF for these products was either solvent or carrier.
    - I did find the following where it might be used to kill aphids:
      "Seventy percent isopropyl alcohol is sold for antiseptic use. At this concentration, it may safely be sprayed on plants to kill aphids. If the plant is watered with rubbing alcohol, the effects are similar to those of ethanol. At 5 percent concentration, plant growth is stunted, while concentrations higher than 25 percent tend to damage or kill the plant."
4. Signal Words/Hazards
    - Isopropanol is considered to have a low safety concern and is a chemical found under the EPA's Safer Choice program when a product falls under their criteria. When at low levels and only in certain products, this program labels chemicals that are safer for human health and for the environment and are considered the least hazardous class of chemicals.

- The labels for all but three of the registered Section 3 products had either Caution or Warning, whether they were single ingredients or combined. The three remaining products had Isopropanol as the single ingredient, at 70% percentage, and Danger as the signal word.

5. Include any Qualifiers for the Ingredient
6. References:
    - NPIRS Active Ingredient Search http://npirspublic.ceris.purdue.edu/ppis/chemical.aspx
    - PubChem – Isopropyl Alcohol https://pubchem.ncbi.nlm.nih.gov/compound/Isopropyl-alcohol
    - The EPA Safer Choice https://www.epa.gov/saferchoice
    - Isopropanol https://www.ams.usda.gov/sites/default/files/media/Isopropanol%201%20TR%202014.pdf
    - Isopropyl Alcohol http://scorecard.goodguide.com/chemical-profiles/html/isopropyl_alcohol.html
    - The Effect of Alcohol on Plants https://sciencing.com/effect-alcohol-plants-8006187.html

Isopropyl Myristate

(Tetradecanoic acid, 1-methylethyl ester)

Researcher: Mary Tomlinson, Maine Board of Pesticides Control

Research

1. What % is in current Section 3 pesticides?
    a. Only one federally registered product contains isopropyl myristate: Resultix TM, EPA Reg. No. 86865-1 (NPIRS Fed Reg Data 2019)

    b. Range (single active): The percent is 50.00%. (NPIRS Fed Reg Data 2019)

    c. Canceled products contained isopropyl myristate in combination with other actives with a range of 0.28% -1.68%. Two products were canceled when there was a generic data call-in, one had no deliverable address. (NPIRS Fed Reg Data 2019)

2. What is the action/function/mode of action?
    a. Insecticide
    Pests controlled: Ticks (pest code: DBAHAAA01) (NPIRS All Pests Summary 2019)

    b. Canceled products pests controlled for: Animal pathogenic bacteria (Pest code ILAAACA01) Sanitizer (0.28% -1.68%); bacteriostat and fungicide/fungistat (1.68%) (NPIRS All Pests Summary 2019)

3. Signal Words / Hazards
    a. Signal Word
        i. Label & SDS – Caution
        ii. UN GHS Classification – Warning Skin corrosion/irritation
    b. Required protections:
        i. Label – none listed
        ii. UN GHS Classification - Wear protective gloves, protective clothing, eye protection, face protection
        iii. Product SDS – Chemically resistant gloves, safety glasses with side-shields
    c. What hazards are associated with that ingredient – at what percentage
        i. Dermal and eye irritation at 50% (Piedmont Animal Health 2011)
        ii. Toxic to invertebrates and fish (Piedmont Animal Health 2011)
        iii. Exposure studies produced no sensitization. (Christian 1982)

4. Include any qualifiers for the ingredient
    a. EPA final rule list – inert ingredient
    b. Specific grades
    c. Allergen issues
    d. PC Code 207
    e. CAS Reg. No. 110-27-0

5. References

Bayer HealthCare. Safety Data Sheet Resultix. 2011. Version 1.0

Christian M, ed; J American College of Toxicology 1 (4): 55-80 (1982) – unable to find a title for article

Piedmont Animal Health LLC. 2011. Resultix (label)

National Pesticide Information Retrieval System (NPIRS). 1998-2019. All Pests Summary. http://nspirs.ceris.purdue.edu/htbin/print9s.com. Accessed 5/16/2019.

National Pesticide Information Retrieval System (NPIRS). 1998-2019. Federal Registration Data. http://nspirs.ceris.purdue.edu/htbin/print9s.com. Accessed 5/16/2019.

U.S. National Library of Medicine. PubChem. Compound Summary Isopropyl myristate. https://pubchem.ncbi.nlm.nih.gov/compound/8042. Accessed 6/14/2019.

Group 4: Acids

Citric Acid (CAS No. 77-92-9)

Researcher: Jerin Borrego, Montana Department of Agriculture

1. Research
    a. What % is in current section 3?
        i. Citric acid is an active ingredient in about 40 federally registered products from 22 companies.
        ii. Range (multiple ingredients) : 0.5 to 66%
        iii. Range (single ingredient): 0.6 to 25%
    b. What is the action/function/mode of action?
        i. Virucide, Bacteriocide, Disinfectant, Sanitizer, Tuberculocide, Fungistat, and Fungicide: used to kill odor-causing bacteria, mildew, pathogenic fungi, certain bacteria and some viruses, remove dirt, soap scum, rust, slime and calcium deposits. Products are used to clean bathrooms or in dairy or food processing equipment.
        ii. Herbicide: Citric acid can be an effective synergist.
    c. Signal Words / Hazards
        i. Signal word on labels range from Caution to Danger
        ii. Six pack study on the product – what does the signal word mean?
            1. (10.56%): Causes skin irritation [Warning Skin corrosion/irritation]
            2. (10.39%): Causes serious eye damage [Danger Serious eye damage/eye irritation]
            3. (88.85%): Causes serious eye irritation [Warning Serious eye damage/eye irritation]
        iii. What level/percentage would increase the signal word EPA
        iv. Required protections: googles and protective gloves
        v. What hazards are associated with that ingredient – at what percentage?
            1. Severe eye and moderate skin irritant. Inhalation of dust irritates nose and throat. Contact with eyes causes irritation.
    d. Include any qualifiers for the ingredient
        i. EPA final rule list
        ii. Specific grades
        iii. Allergen issues: “While presumably aqueous solutions (2% in one case, not stated in the other) may produce pain or "sting", patch testing of 60 eczema patients with 2.5% citric acid in petrolatum did not produce any irritant or allergic reactions; thus, the reaction appears to reflect mainly the acid effect of the substance...”
    e. Include References
        i. NPIRS product search 6/14/19: Federally Active, Active Ingredient: CAS#77-92-9
        ii. Pub Chem Citric Acid Compound. https://pubchem.ncbi.nlm.nih.gov/compound/Citric-acid#section=Safety-and-Hazards
        iii. EPA Citric Acid (RED) June 1992. https://archive.epa.gov/pesticides/reregistration/web/pdf/4024fact.pdf

Decanoic Acid

Researcher: Erica Millette, New Mexico Department of Ag

Inert Ingredient: Decanoic acid, monoester with 1,2,3-propanetriol

1. Research
    a. What % is in current section 3 – 3 products registered federally
        i. Range – 0.68% to 88.21%
        ii. all products are combined with another active. No single active products registered.
    b. What is the action/function/mode of action
        i. Insecticide to control mites and Antimicrobial on stored food
            1. Research suggests they work by disrupting microbial membranes
    c. Signal Words / Hazards - Caution
        i. all products are Caution even the product that is 88.21%
    d. Include References
        i. Any websites/links/etc…
        NPIRS product search
        https://www3.epa.gov/pesticides/chem_search/reg_actions/registration/fs_G-104_20-Oct-04.pdf

Fumaric Acid

Researcher: Erica Millette, New Mexico Department of Ag

1. Research
    a. What % is in current section 3 – no current section 3 products registered. One product was registered with this active from 1951-1989.
        i. Range – Product contained 50% fumaric acid.
        ii. When single active, when combined – fumaric acid was combined with 50% sodium benzoate.
    b. What is the action/function/mode of action - Antimicrobial
        i. Product was labeled as a fungistatic and bacteriostatic agent on food.
        ii. Ex: soap – acceptable / non-approved soap
            1. Sodium potassium salts of fatty acids
    c. Signal Words / Hazards – GHS lists signal word as Warning due to eye irritation.
        i. Eye Irritant at 100%.
    d. Include References
        i. Any websites/links/etc…
        NPIRS Product Search
        https://www.sigmaaldrich.com/MSDS/MSDS/DisplayMSDSPage.do?country=US&language=en&productNumber=47910&brand=SIAL&PageToGoToURL=https%3A%2F%2Fwww.sigmaaldrich.com%2Fcatalog%2Fsearch%3Fterm%3D110-17-8%26interface%3DCAS%2520No.%26N%3D0%2B%26mode%3Dpartialmax%26lang%3Den%26region%3DUS%26focus%3Dproduct

        https://pubchem.ncbi.nlm.nih.gov/compound/Fumaric-acid#section=GHS-Classification

Oleic Acid

Researcher: Erica Millette, New Mexico Department of Ag

1. Research
    a. No currently registered section 3 products. Previously were 7 products registered. All registration were cancelled in between 1985-1987
        i. Range – 0.15%-8.00%
        ii. all products had oleic acid combined with several active ingredients.
    b. What is the action/function/mode of action
        i. Insecticide
        ii. Also can be an insect pheromone. Oleic acid is emitted by the decaying corpses of a number of insects, including bees and *Pogonomyrmex* ants, and triggers the instincts of living workers to remove the dead bodies from the hive. If a live bee or ant is dabbed with oleic acid, it is dragged off for disposal as if it were dead.
    c. Signal Words / Hazards – Products previously registered had a signal word of Caution. GHS classifies signal word as Warning.
        i. Required protections – Eye protection, gloves, and impervious clothing.
        ii. What hazards are associated with that ingredient – Causes skin irritation, seriouseye irritation, and my cause respiratory irritation.
    d. Include any qualifiers for the ingredient
        i. EPA final rule list
        ii. Specific grades
        iii. Allergen issues
    e. Include References
        i. Any websites/links/etc…
        NPIRS Product Search
        https://pubchem.ncbi.nlm.nih.gov/compound/445639#section=Isomeric-SMILES

        https://www.sigmaaldrich.com/MSDS/MSDS/DisplayMSDSPage.do?country=US&language=en&productNumber=O1008&brand=SIAL&PageToGoToURL=https%3A%2F%2Fwww.sigmaaldrich.com%2Fcatalog%2Fsearch%3Fterm%3D112-80-1%26interface%3DCAS%2520No.%26N%3D0%2B%26mode%3Dpartialmax%26lang%3Den%26region%3DUS%26focus%3Dproduct
        https://en.wikipedia.org/wiki/Oleic_acid

Stearic Acid

Researcher: Erica Millette, New Mexico Department of Ag

1. Research
    a. What % is in current section 3 – no currently registered products containing this active ingredient. Previously there were 2 products registered with this active ingredient.
        i. Range – 0.30%-3.00%
        ii. Both products had this ingredient combined with Scilliroside.
    b. What is the action/function/mode of action – adjuvant, solvent
        i. Previously registered products were rodenticides.
    c. Signal Words / Hazards – Previous products had a signal word of Caution. GHS classifies signal word as Warning.
        i. Required protections – Use eye protection, gloves, and appropriate protective clothing.
        ii. What hazards are associated with that ingredient
            1. Causes skin irritation, serious eye irritation, may cause respiratory irritation, and harmful to aquatic life with long lasting effects.
    d. Include any qualifiers for the ingredient
        i. EPA final rule list
        ii. Specific grades
        iii. Allergen issues
    e. Include References
        i. Any websites/links/etc…

        NPIRS Product Search
        http://www.pesticideinfo.org/Detail_Chemical.jsp?Rec_Id=PRI5974

        https://pubchem.ncbi.nlm.nih.gov/compound/5281

        https://www.sigmaaldrich.com/MSDS/MSDS/DisplayMSDSPage.do?country=US&language=en&productNumber=S4751&brand=SIGMA&PageToGoToURL=https%3A%2F%2Fwww.sigmaaldrich.com%2Fcatalog%2Fsearch%3Fterm%3D57-11-4%26interface%3DCAS%2520No.%26N%3D0%2B%26mode%3Dpartialmax%26lang%3Den%26region%3DUS%26focus%3Dproduct

Group 5: Silica

Researcher: Buzz Vance

Inert Ingredient: Silica gel (synthetically produced) and Silicon dioxide

Silica does not appear naturally in pure form, but does appear as silicon dioxide
Silica gel is manufactured from silicon dioxide and is non-crystalline (amorphous)
Both silica gel and DE are comprised of silicon dioxide, but DE is mined and silica gel manufactured.
Silica nanoparticles (nano silica) synthesized amorphous silica powder consisting of silica particles with diameters between 10-100 nm. (may have electrostatic charge)
Silica gel and colloid: aggregation of sub-colloidal silicic acid to larger colloidal particles
Diatomaceous Earth (DE) contains both crystalline silica and non-crystalline silica

Pesticide Registration:

Silica gel appears as insecticidal dust or added to pressurized liquid formulations. Used to control insect pests in stored grain, food handling areas, hospitals, commercial and residential buildings, sewage systems, on animals/pets and their living quarters.
Silicon dioxide, normally as diatomaceous earth, is applied as a dust to control insect pests in the same use sites as silica gel.
Silicon dioxide and silica gel have been exempted from tolerance or legal residue limit requirements. See Reregistration Eligibility Decision Facts sheet from 1991.

Forms of silica and silicates within list 4A

12168-85-3	Calcium oxide silicate
12207-97-5	Magnesium oxide silicate, monohydrate
1343-90-4	Magnesium silicate, hydrate
14987-04-3	Magnesium silicon oxide
63231-67-4	Silica gel
112926-00-8	Silica gel, precipitated, crystalline-free
122945-52-5	Silica, amorphous, fumed, crystalline-free
7699-41-4	Silica, amorphous, precipitated and gel
10279-57-9	Silica, hydrate
60676-86-0	Silica, vitreous
13776-74-4	Silicic acid, magnesium salt
12003-51-9	Silicic acid, aluminum sodium salt
12736-96-8	Silicic acid, aluminum potassium sodium salt
1335-30-4	Silicic acid, aluminum salt
1344-00-9	Silicic acid, aluminum sodium salt
1344-95-2	Silicic acid, calcium salt
1343-88-0	Silicic acid, magnesium salt
7631-86-9	Silicon dioxide (crystalline-free forms only)

Absorptive quality is useful for holding essential oils in repellent products.

1. Research Q&A
    a. What percentage of silica gel or silicon dioxide is in current section 3 pesticide products?
        i. Range: Silica gel 10-40%,
            Silicon dioxide 8-95%
        ii. When single active, when combined
            Silicon dioxide 8% blended with pyrethrins, or 67-95% alone
            Silicon dioxide often present in diatomaceous earth, so % a combo of both

    b. What is the action/function/mode of action?
        i. Drying agent, anti-caking agent
        ii. Absorbs cuticular waxes of insect exoskeletons (vs abrading like DE)

    c. What are Signal Words / Hazards?
        If a signal word is present on section 3 label, it is always CAUTION, even for products which are 95% active ingredient.

        As a dust and drying agent, silica gel can irritate eyes and respiratory tract

        Silicon dioxide/diatomaceous earth can abrade respiratory tract, leading to more serious conditions.

        Respiratory protection appears on some labels.

        Hand washing after use can resolve drying of skin which can occur during use.

        Acute oral LD50 comparable to table salt. Silica gel is often added to foods.

    d. Silica gel found in the following section 3 products.

432-992	Drione Insecticide pyrethrin 1%, PBO 10%, silica gel 40%	
499-429	Tri-Die Silica & Pyrethrin Dust	same as Drione above
66923-2	Protect-It	D.E.90% silica gel 10%

Amorphous silicon dioxide found in the following section 3 labels

73729-12	Cimexa insecticide dust	92.1%
73079-12	Maggie's Farm Supply Effective Fed Bug Killer	92.1%
499-385	PT 239 Tri-Die pyrthrins .6%, PBO 4.8%, amorphous	8%

    e. Include References
        i. Any websites/links/etc…
        https://www.pctonline.com/article/pct0814-silica-gel-research-bed-bugs/

        www.kellysolutions.com/ne

        https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=P100AFMK.txt

Group 6: Soaps

Soap

Researcher: Steve Foss, Washington State Dept. of Agriculture

Registration Guidelines & Limitations for SOAP

- The concentration of potassium salts of fatty acids (potassium laurate, PC Code 079021) must be less than or equal to 1% when used as an inert ingredient in Ready-to-Use (RTU) minimum risk pesticide products intended for insect control. The amount of "soap" in 25b products, which needs to be diluted with water, must be no more than an equivalent amount of 1% in the final solution when claimed as an inert ingredient. Otherwise, the claim could be considered as false and misleading and would not qualify for the FIFRA 25(b) exemption from EPA regulation.
- 25b products containing potassium laurate as an inert may not be used on aquatic sites.
- Detergents, such as "Dawn", should not be considered as an allowed "soap". A soap derived from neem oil would not be an allowed soap.

Background

- Soap is an allowed inert in minimum risk pesticides and is qualified on EPA's list as "The water soluble sodium or potassium salts of fatty acids produced by either the saponification of fats and oils, or the neutralization of fatty acid".
- Soap" is a chemical category rather than the name of a particular chemical.
- The soap salts case (case 4083) is comprised of three active ingredients (PC Codes 031801, 079009 and 079021). Two of the three active ingredients are
  - Potassium salts of fatty acids ([C12-C18 saturated and C18 unsaturated]) includes potassium laurate, potassium myristate, potassium oleate and potassium ricinoleate and is combined as a single active ingredient under the PC Code formerly assigned to potassium laurate (PC Code: 079021);
- Sodium salts of fatty acids including sodium oleate (PC Code 079009).
- C12-C18 fatty acid potassium salts are exempt from the requirement of a tolerance for all residues in or on all raw agricultural commodities in accordance with 40 CFR 180.1068.

Research Q& A

1. **What percentage of "soap" is used as an active ingredient in current section 3 pesticide products?**

   Potassium salts of fatty acids (potassium laurate, PC Code 079021) is an active ingredient in about 45 federally registered products from seven companies.

   RANGE (single ingredient): The percentage of potassium laurate in active section 3 products ranges from 1 to about 49.52%. The amount of potassium laurate in fourteen EPA registered products is equal to or less than 2%.

   RANGE (multiple ingredients): The percentage of potassium laurate in combination with other actives (insecticides/fungicides) ranges from 0.4 to 37.6%

   Sodium salts of fatty acids (sodium oleate, PC Code 079009) is an active ingredient in one federally registered product. The product Deer No No Deer Repellent (EPA Reg. No. 69274-1) contains 85% soap.

2. **What is the action/function/mode of action?**
   iv. **Insecticide / Fungicide** (lowest percentages)
      1. Example of Pests: Adelgids, aphids, earwigs, grasshoppers, lacebugs, mealybugs, mites, plant bugs, leafhoppers, psyllids, sawfly larvae, scale insects, tent caterpillars thrips, whitefly and powdery mildew (EPA Reg. No. 67702-13-4)

v. **Moss & Algae Killer** (2% potassium salts of fatty acid, EPA Reg. No 59913-5)
   - (EPA Reg. No. 67702-13-4)

vi. **Insecticide/ Fungicide/Miticide** (Highest percentage)
General Hydroponics Exile Insecticide Fungicide Miticide (GH MPMT, EPA Reg. No. 91865-2)
   - 49% active ingredient
   - Signal word: WARNING
   - PRECAUTION STATEMENTS - Causes substantial but temporary eye injury and skin irritation. PPE (Coveralls, long-sleeved shirt and long pants, chemical-resistant gloves, protective eyewear, shoes plus socks).
   - REI = 12hrs.
   - Stand Alone Rate: GH MPMT rates as low as 0.25% v/v or as high as 4% v/v may be used. The 2% v/v rate is the most frequently used stand-alone rate.
   - 1 gallon of GH MPMT weights 8.50 lb at 68°F and contains 3.8 lb active ingredient per gallon (456 g ai/L)
   - This product provides curative control of powdery mildew.

3. What are the hazards, precautions (including signal words)?

25b products containing potassium laurate as an inert may not be used on aquatic sites.
Rationale: NEW1128 RTU (EPA Reg. No. 67702-13) contains 1% potassium laurate and includes the following Environmental Hazards statement: **This product may be hazardous to aquatic invertebrates.**

Plants such as sweet pea, nasturtiums, delicate ferns, tomatoes, cherries and plum may be sensitive to soaps (https://ucanr.edu/blogs/blogcore/postdetail.cfm?postnum=18009).

4. What are some examples section 3 pesticides with soap as the sole active ingredient?

% Potassium laurate (soap)	EPA Reg. No.	Product Name
1	67702-13	NEU1128 RTU https://www3.epa.gov/pesticides/chem_search/ppls/067702-00013-20180131.pdf
1	67702-13-4	Bonide Insecticidal Soap
1	67702-13-39609	Garden Safe Insecticidal Soap Insect Killer
2	59913-5	Safer Brand Moss & Algae Killer & Surface Cleaner RTU http://cru66.cahe.wsu.edu/~picol/pdf/WA/43200.pdf
25	48222-5	Super Insecticidal Soap Concentrate
49	91865-2	General Hydroponics Exile Insecticide Fungicide Miticide (GH MPMT) http://cru66.cahe.wsu.edu/~picol/pdf/WA/65408.pdf
49	10163-324	M-Pede Insecticide Miticide Fungicide

5. What are some examples of 25(b) products containing "soap" as an "inert"?

Product Name	WA Reg. Number	Active / Percentage
FINITO [273	1677-11002	Citric acid (0.21%)
KEYSTONE LIQUID INSECTICIDE [275	1677-11003	Citric acid (0.21%)
PUREFORCE CONTACT BUG ELIMINATOR [29	541-11001	Citric acid (0.21%)
CONTACT BUG ELIMINATOR [30	541-13001	Citric acid (0.21%)
STOP BUGGING ME! RTU INSECTICIDE [3	58300-16002	2-phenylethyl propionate (3%) Eugenol (0.5%), Sodium lauryl sulfate (0.5%), geraniol (0.2%), cinnamon oil (0.1%)

BED BUG FIX [1	998500-11001	2-phenylethyl propionate (3%) Eugenol (0.5%), Sodium lauryl sulfate (0.5%), geraniol (0.2%), cinnamon oil (0.1%)

References

- Potassium Salts of Fatty Acids. August 2001. NPIC. http://npic.orst.edu/factsheets/psfagen.pdf
- Soap Salts RED (Sept 1992) https://archive.epa.gov/pesticides/reregistration/web/pdf/4083fact.pdf
- Soap Sprays as Insecticides. 2015. Scott Oneto. UC Cooperative Extension https://ucanr.edu/blogs/blogcore/postdetail.cfm?postnum=18009
- Soap-Based Algicide/Demossers. 2015. USDA https://www.ams.usda.gov/sites/default/files/media/Soap%20Based%20Technical%20Report%202015_0.pdf
- Inerts allowed in minimum risk pesticides URL: https://www.epa.gov/sites/production/files/2016-11/documents/minrisk_inert_ingredients_w_tolerances_2016-11-16.pdf