Item A—Please indicate which section or sections the petitioned substance will be included on and/or removed from the National List.
Synthetic substances allowed for use in organic livestock production, § 205.603.

Item B—Please provide concise and comprehensive responses in providing all of the following information items on the substance being petitioned:
1. The substance's chemical or material common name.

sulfur/elemental sulfur (synthetically produced)

2. The manufacturer's or producer's name, address and telephone number and other contact information of the manufacturer/producer of the substance listed in the petition.

Manufacturer: Georgia Gulf Sulfur Corporation
1729 Dow Street
Valdosta, GA 31601

Contact: Jesse Maranville
Email: jesse@georgiagulfsulfur.com
Phone: 229-244-0000

3. The intended or current use of the substance such as use as a pesticide, animal feed additive, processing aid, nonagricultural ingredient, sanitizer or disinfectant. If the substance is an agricultural ingredient, the petition must provide a list of the types of product(s) (e.g., cereals, salad dressings) for which the substance will be used and a description of the substance's function in the product(s) (e.g., ingredient, flavoring agent, emulsifier, processing aid).

Current use is as a pesticide (repellent for mites, fleas & ticks) for domestic livestock (chickens, turkeys, ducks, geese, game birds, pigeons, equine, cattle, swine, sheep, and goats; also for use on dogs.
Dust liberally and rub into feathers or hair. Also, for treatment of listed animals/livestock living quarters. Apply thoroughly to all interior surfaces of quarters. Force spray into cracks and crevices.

4. A list of the crop, livestock or handling activities for which the substance will be used. If used for crops or livestock, the substance's rate and method of application must be described. If used for handling (including processing), the substance's mode of action must be described.

Chickens, turkeys, ducks, geese, game birds, pigeons, equine, cattle, swine, sheep, and goats (also for use on dogs):
To treat livestock, dust animal liberally with product and rub into hair or feathers.
To treat livestock living quarters apply (90% sulfur product) 200-250 pounds per 20,000 square feet. Apply thoroughly to all interior surfaces. Repeat application as needed.

5. The source of the substance and a detailed description of its manufacturing or processing procedures from the basic component(s) to the final product. Petitioners with concerns for confidential business information may follow the guidelines in the Instructions for Submitting CBI listed in #13.

Elemental sulfur is recovered from the oil and natural gas refining process. Hydrogen sulfide is separated from natural gas and/or crude oil thru heat and pressure, then sulfur is separated from the hydrogen through the process in Appendix 1. Technical material is 99.9% pure. Georgia Gulf Sulfur mills the material to a fineness suitable (93% passing thru 325 US screen) for use.

6. A summary of any available previous reviews by State or private certification programs or other organizations of the petitioned substance. If this information is not available, the petitioner should state so in the petition.

This substance has been reviewed by EPA and states and is registered for use on livestock. See Appendix 3 Sulfur Registration Review Summary Document.

7. Information regarding EPA, FDA, and State regulatory authority registrations, including registration numbers. If this information does not exist, the petitioner should state so in the petition.

EPA Reg. Nos. 6325-13, 6325-23
See Appendix 2 for copies of the labels.

8. The Chemical Abstract Service (CAS) number or other product numbers of the substance and labels of products that contains the petitioned substance. If the substance does not have an assigned product number, the petitioner should state so in the petition.

CAS No. 7704-34-9
See Appendix 2 for copies of the labels.

9. The substance's physical properties and chemical mode of action including
(a) Chemical interactions with other substances, especially substances used in organic production;

Chlorates, nitrates, and other oxidizing agents. Interaction with other substances used in organic production is not known.

(b) toxicity and environmental persistence;

See Appendix 3 Sulfur Registration Review Summary Document and Appendix 4 Safety Data Sheet.

(c) environmental impacts from its use and/or manufacture;

Use: See attached Appendix 3 Sulfur Registration Review Summary Document and Appendix 4 Safety Data Sheet.
Manufacture: Environmental impact is none.

(d) effects on human health; and,

See Appendix 3 Sulfur Registration Review Summary Document and Appendix 4 Safety Data Sheet.

(e) effects on soil organisms, crops, or livestock.

See Appendix 3 Sulfur Registration Review Summary Document and Appendix 4 Safety Data Sheet.

10. Safety information about the substance including a Material Safety Data Sheet (MSDS) and a substance report from the National Institute of Environmental Health Studies. If this information does not exist, the petitioner should state so in the petition.

See Appendix 3 Sulfur Registration Review Summary Document and Appendix 4 Safety Data Sheet.

11. Research information about the substance which includes comprehensive substance research reviews and research bibliographies, including reviews and bibliographies which present contrasting positions to those presented by the petitioner in supporting the substance's inclusion on or removal from the National List. For petitions to include non-organic agricultural substances onto the National List, this information item should include research concerning why the substance should be permitted in the production or handling of an organic product, including the availability of organic alternatives. Commercial availability does not depend upon geographic location or local market conditions. If research information does not exist for the petitioned substance, the petitioner should state so in the petition.

Synthetically produced elemental sulfur purity exceeds 99.9%. Lab analysis (i.e. SGS Mineral Services-may be provided upon request) for arsenic, selenium, lead, tellurium, cadmium and mercury collectively are less than 0.1%. Supply availability in North America is approximately 60,000 tons, market requirements are less than 1,000 tons. There are currently 3 manufacturers of this product. Supply has not been interrupted for the last 40 years due to natural phenomenon or any trade related issues.

There is currently no natural supply of sulfur in the US. The material has not been mined in the US since 1994. It is available in other countries however it contains toxicologically significant impurities at levels >0.1%.

12. A “Petition Justification Statement” which provides justification for any of the following actions requested in the petition:

A. Inclusion of a Synthetic on the National List, §§ 205.603.

Explain why the synthetic substance is necessary for the production or handling of an organic product.

Sulfur is a naturally occurring pesticide however, there is currently no natural supply of sulfur in the US. The material has not been mined in the US since 1994. It is available in other countries however it contains toxicologically significant impurities at levels >0.1%. Synthetically produced elemental sulfur purity exceeds 99.9%. Lab analysis (i.e. SGS Mineral Services-may be provided upon request) for arsenic, selenium, lead, tellurium, cadmium and mercury collectively are less than 0.1%.

Sulfur works as a repellent to mites, fleas, and ticks. Mites, fleas, and ticks are extremely prevalent in livestock and are known vectors of disease. Having synthetically produced sulfur for use on organically produced livestock would be beneficial to organic livestock farmers to have an alternative to existing organic materials and cultural practices. Sulfur has been used effectively for many years to aid in the control of mites, fleas and ticks.

Describe any non-synthetic substances, synthetic substances on the National List or alternative cultural methods that could be used in place of the petitioned synthetic substance.

We were unable to locate any non-synthetic treatment options found on the National List. Alternative non synthetic treatment substances <u>not</u> found on the National List: D-Limonene, pyrethrins, diatomaceous earth, Garlic Powder, soap, oils (canola, soy), and neem oil.

Cultural methods of preventing flea, tick and mite infestations include:

- Quarantine of new animals for at least 3 weeks.
- Separate animals that display signs of infestation.
- Provide proper nutrition for livestock.
- Reduce the stress level of animals by limiting the number of animals held in one area, allow for proper exercise and access to outdoors, and provide enough space for animals to feed.

Keep living quarters clean.
Source: http://www.organicvalley.coop/pdf/pools/controlling_parasites.pdf

Describe the beneficial effects to the environment, human health, or farm ecosystem from use of the synthetic substance that support its use instead of the use of a non-synthetic substance or alternative cultural methods.

Synthetically produced sulfur has significantly lower levels of toxicologically significant impurities than mined sulfur reducing the exposure of these impurities to humans, environment and farm ecosystems.

13. Confidential Business Information Statement
This petition does not contain any confidential business information.

Appendix 1
Manufacturing Process

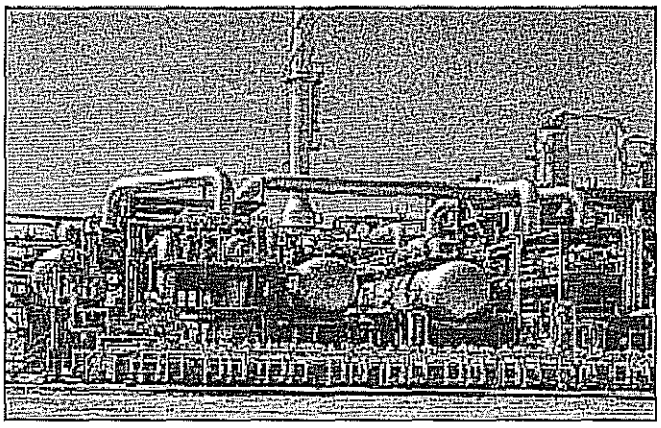
Schematic flow diagram and description

The Claus reaction to convert H_2S into elemental sulfur requires the presence of one mole of SO_2 for each two moles of H_2S:

(1) $2H_2S + SO_2 \rightarrow 3S + 2H_2O$

To provide that ratio of components, the first step in the Claus process is the combustion of one-third of the H_2S in the feed gas:

(2) $H_2S + 1.5\ O_2 \rightarrow SO_2 + H_2O$

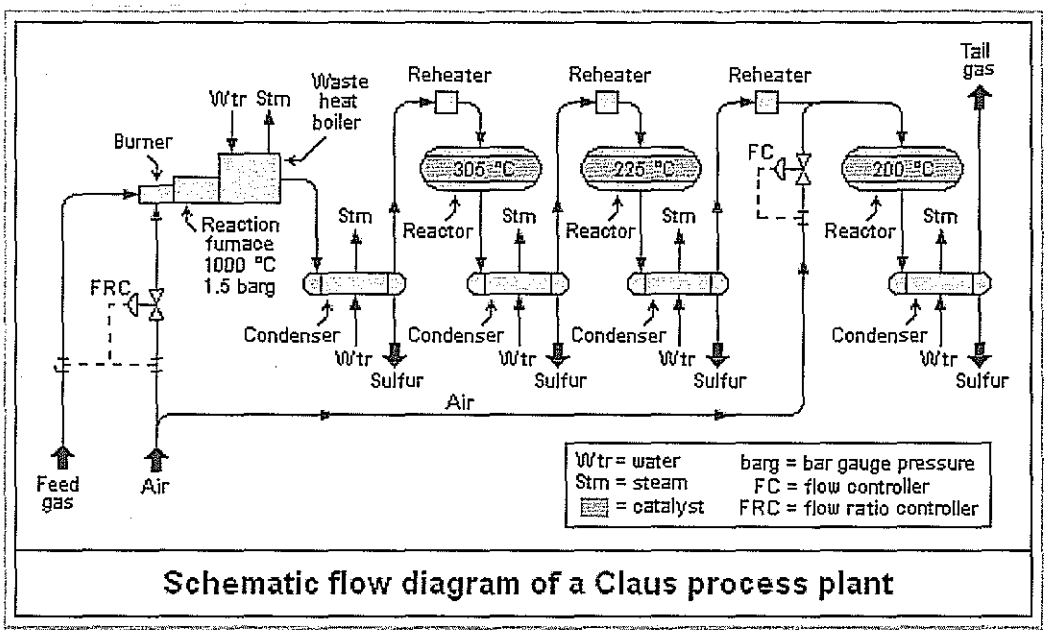


A Claus process plant

Combining equations (1) and (2), the overall process reaction is:

(3) $2H_2S + O_2 \rightarrow 2S + 2H_2O$

As shown in the schematic diagram below, the feed gas to a Claus process unit is burned in a reaction furnace using sufficient combustion air to burn only one-third of the H_2S it contains. That is accomplished by using a *flow ratio controller* to provide the required ratio of combustion air to feed gas.



Schematic flow diagram of a Claus process plant

The reaction furnace pressure and temperature is maintained at about 1.5 bar gauge (barg) and about 1,000 °C. At those conditions, the Claus reaction occurs thermally in the reaction furnace (i.e., without requiring any catalyst). About 70% of the H_2S in the feed gas is thermally converted into elemental sulfur in the reaction furnace.

The hot reaction product gas, containing gaseous sulfur, is used to produce steam in a boiler (called a *waste heat boiler*) which results in cooling the gases. The gas is then further cooled and condensed in a heat exchanger while producing additional steam. The condensed liquid sulfur is separated from the remaining unreacted gas in the outlet end of the condenser and sent to product storage.

The separated gas is then reheated and enters the first catalytic reactor maintained at an average temperature of about 305 °C where about 20% of the H_2S in the feed gas is converted into elemental sulfur. The outlet product gas from the first reactor is cooled in another condenser while also producing steam. Again, the condensed liquid sulfur is separated from the remaining unreacted gas in the outlet end of the condenser and sent to product storage.

The separated gas from the second condenser is sent to another reheater and the sequence of gas reheat, catalytic reaction, condensation and separation of liquid sulfur from unreacted gas is repeated for the second and third reactors at successively lower reactor temperatures. About 5% and 3% of the H_2S in the feed gas is thermally converted into elemental sulfur in the second reactor and third reactors, respectively. For a well-designed and operated Claus sulfur recovery plant having three catalytic reactors (as shown in the flow diagram), an overall conversion of at least 98% can be achieved. In fact, the latest modern designs can achieve up to 99.8% conversion of hydrogen sulfide into product sulfur that is 99+% saleable "bright yellow sulfur".

The remaining gas separated from the last condenser is referred to as "tail gas" and is either burned in an incinerator or further desulfurized in a "tail gas treatment unit" (TGTU).

Appendix 2
Product Labels

6325-13 8/4/2014 1/12

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, DC 20460

OFFICE OF
CHEMICAL SAFETY AND
POLLUTION PREVENTION

Crystal Layton
Regulatory Agent for Georgia Gulf Sulfur Corporation
c/o Landis International, Inc.
P.O. Box 5126
Valdosta, Georgia 31603-5126

AUG 4 2014

Subject:	Application for Pesticide Notification (PRN 98-10)
Submission Date:	7/11/14
Product Name:	Yellow Jacket Wettable Sulfur II
EPA Reg. No.:	6325-13
EPA Decision Number:	493240

Dear Ms. Layton:

The Agency is in receipt of your Application for Pesticide Notification under Pesticide Registration Notice (PRN) 98-10. The Registration Division (RD) has conducted a review of this request for its applicability under PRN 98-10 and finds that the action requested falls within the scope of PRN 98-10.

The Agency acknowledges you have replaced a duplicate statement and added 500 lb and 2000 lb plastic sacs to the Storage and Disposal section.

If you have questions concerning this letter, please contact Heather Garvie at 703-308-0034 or me at 703-305-5410.

Sincerely,

Hope A. Johnson
Product Manager 21
Fungicide Branch
Registration Division (7505P)

2/12

United States
Environmental Protection Agency
Washington, DC 20460

☐ Registration
☐ Amendment
☒ Other

OPP Identifier Number

Application for Pesticide - Section I

1. Company/Product Number	2. EPA Product Manager	3. Proposed Classification
GEORGIA GULF SULFUR CORPORATION/6325-13	Hope Johnson	☒ None ☐ Restricted
4. Company/Product (Name)	PM #	
Yellow Jacket Wettable Sulfur II	21	

5. Name and Address of Applicant *(Include Zip Code)*
GEORGIA GULF SULFUR CORPORATION
P.O. Box 1165, VALDOSTA, GEORGIA 31603-1165
c/o Landis International, Inc., PO BOX 5126 Valdosta, GA 31603-5126
☐ *Check if this is a new address*

6. **Expedited Review.** In accordance with FIFRA Section 3(c)(3)(b)(i), my product is similar or identical in composition and labeling to:
EPA. Reg. No. _____
Product Name _____

Section - II

☐ Amendment - Explain Below
☐ Resubmission in Response to Agency Letter Dated _____
☒ Notification - Explain Below
☐ Final Printed Labels in Response to Agency Letter Dated _____
☐ "Me Too" Application
☐ Other - Explain Below

Explanation: Use additional pages(s) if necessary. (For Section I and Section II.)
Notification of removal of "Precaution" statement below Cucurbits (page 6) as it is duplicated language from "Product Precautions" (page 3), deletion of "... during these periods of high temperatures and under certain climatic conditions", and addition of 500 and 2000 pound package sizes per PR Notice 98-10.

This notification is consistent with the provisions of PR Notice 98-10 and EPA regulations at 40 CFR 152.46, and no other changes have been made to the labeling or the confidential statement of formula of this product. I understand that it is a violation of 18 U.S.C. Sec. 1001 to willfully make any false statement to EPA. I further understand that if this notification is not consistent with the terms of PR Notice 98-10 and 40 CFR 152.46, this product may be in violation of FIFRA and I may be subject to enforcement action and penalties under sections 12 and 14 of FIFRA.

Section - III

1. Material This Product Will be Packaged In:

Child-Resistant Packaging	Unit Packaging		Water Soluble Packaging		2. Type of Container
☐ Yes ☒ No ***Certification Must be Submitted**	☐ Yes If "Yes" Unit Packaging Weight.	☒ No Number per Container	☐ Yes If "Yes" Package Weight.	☒ No Number per Container	☐ Metal ☒ Plastic ☐ Glass ☒ Paper ☐ Other (Specify) _____

3. Location of Net Contents Information	4. Size(s) Retail Container	5. Location of Label Directions
☒ Label ☐ Container	50 LBS., (22.7 KG), 500 LBS. (226.8 KG), and 2000 LBS (907.2 KG)	☒ On Label ☐ On Leaflet Accompanying Label

6. Manner in Which Label is Affixed to Product
☒ Lithographed
☐ Paper Glued
☐ Stenciled
☐ Other _____

Section - IV

1. Contact Point *(Complete items directly below for identification of individual to be contacted, if necessary, to process this application)*

Name	Title	Telephone Number (Include Area Code)
Crystal Layton	Regulatory Agent	229-247-6472

Certification
I certify that the statements I have made on this form and all attachments thereto are true, accurate and complete. I acknowledge that any knowingly false or misleading statement may be punishable by fine or imprisonment or both under applicable law.

6. Date Application Recieved
(Stamped)

2. Signature	3. Title	
CDayton	Regulatory Agent	
4. Typed Name	5. Date	
Crystal Layton	07/11/2014	

EPA Form 8570-1 (Rev. 3-94) Previous editions are obsolete. **White - EPA File Copy (original)** **Yellow - Applicant Copy**

3/12

7/16

LANDIS INTERNATIONAL
R & D MANAGEMENT

July 11, 2014

Via Fedex

Ms. Hope Johnson (PM 21) 703-305-5410
U.S. Environmental Protection Agency
Office of Pesticide Programs 7505P (NOTIF)
One Potomac Yard
2777 South Crystal Drive
Arlington, VA 22202

Subject: Notification for Yellow Jacket Wettable Sulfur II EPA REG. NO. 6325-13 per PR Notice 98-10

Dear Ms. Johnson,

On behalf of GEORGIA GULF SULFUR CORPORATION, we are submitting a notification to remove "Precaution.." statement below Cucurbits (page 6) as it is duplicated language from "Product Precautions" (page 3) and addition of 500 and 2000 pound package sizes per PR Notice 98-10.
In addition, per my phone conversation with Heather Garvie on 7/8/2014 we are also deleting the following from the Product Precautions section on page 3: "…during these periods of high temperatures and under certain climatic conditions".

Please find the following enclosed to support this notification:

- Application for Pesticide EPA Form 8570-1
- Yellow Jacket Wettable Sulfur II EPA REG. NO. 6325-13 "mark-up" label
- Yellow Jacket Wettable Sulfur II EPA REG. NO. 6325-13 "clean" label

Please contact me via phone at 229-247-6472 or via e-mail at clayton@landisintl.com if you have any questions or concerns.

Sincerely,

Crystal Layton
Regulatory Agent for GEORGIA GULF SULFUR CORPORATION

3185 Madison Highway ▪ P. O. Box 5126 ▪ Valdosta, Georgia 31603-5126 USA ▪ (229) 247-6472 ▪ Fax (229) 242-1562 ▪ landis@landisintl.com

4/12

FOR ORGANIC PRODUCTION

NOTIFICATION
AUG 04 2014

Yellow Jacket Wettable Sulfur II

For Aerial or Ground Dusting or Spraying

ACTIVE INGREDIENT	
Sulfur	90.0%
OTHER INGREDIENTS	10.0%
TOTAL	100.0%

FINENESS, Not less than 93% passing 325 mesh

This product does not kill or control yellow jackets.

KEEP OUT OF REACH OF CHILDREN

CAUTION

	FIRST AID
If In Eyes	• Hold eye open and rinse slowly and gently with water for 15-20 minutes. • Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. • Call a poison control center or doctor for further treatment advice.
If On Skin Or Clothing	• Take off contaminated clothing. • Rinse skin immediately with plenty of water for 15-20 minutes. • Call a poison control center or doctor for further treatment advice.
For emergency information, call 1-229-244-0000, or your poison control center.	
Have the product container or label with you when calling a poison control center or doctor or going for treatment.	
See Side/Back Panels for Additional Precautionary Statements	

GEORGIA GULF SULFUR CORPORATION

P.O. Box 1165 VALDOSTA, GEORGIA 31603-1165

EPA REG. NO. 6325-13 EPA EST. NO. 6325-TX-1 EPA EST. NO. 6325-GA-1

NET CONTENTS 50 LBS., (22.7 KG), 500 LBS. (226.8 KG), and 2000 LBS (907.2 KG)

PRECAUTIONARY STATEMENTS
HAZARDS TO HUMANS & DOMESTIC ANIMALS
CAUTION

Harmful if absorbed through skin. Causes moderate eye irritation. Avoid contact with skin, eyes or clothing. Wash thoroughly with soap and water after handling.

PERSONAL PROTECTIVE EQUIPMENT

Some materials that are chemical-resistant to this product are listed below. If you want more options, follow the instructions for Category A on an EPA chemical-resistance category selection chart.
Applicators and other handlers other than mixers and loaders must wear long-sleeved shirt and long pants, chemical-resistant gloves made of any waterproof material such as polyethylene or polyvinyl chloride, shoes plus socks and protective eyewear.
Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables exist, use detergent and hot water. Keep and wash PPE separately from other laundry.

ENGINEERING CONTROLS STATEMENT

When handlers use closed systems, enclosed cabs or aircraft in a manner that meets the requirements listed in the Worker Protection Standard (WPS) for agricultural pesticides [40 CFR 170.240(d)(4-6)], the handler PPE requirements may be reduced or modified as specified in the WPS.

USER SAFETY RECOMMENDATIONS

Users should:
Wash hands before eating, drinking, chewing gum, using tobacco or using the toilet.
Remove PPE immediately after handling this product. Wash the outside of gloves before removing.
As soon as possible, wash thoroughly and change into clean clothing.

ENVIRONMENTAL HAZARDS

This product is toxic to fish. Do not apply directly to water, to areas where surface water is present or to intertidal areas below the mean high water mark. Do not apply where runoff conditions are likely to occur. Do not apply when weather conditions favor drift from treated areas. Do not contaminate water when disposing of equipment washwaters.

PHYSICAL AND CHEMICAL HAZARDS

Sulfur dust suspended in air ignites easily. Keep away from heat, sparks, or flame. Do not smoke while applying this product.

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.
Do not apply this product in a way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area during application. For any requirements specific to your State or Tribe, consult the agency responsible for pesticide regulation.
Do not allow spray or dust to drift from the application site and contact people, structures people occupy at any time and the associated property, parks and recreation areas, nontarget crops, aquatic and wetland areas, woodlands, pastures, rangelands, or animals. When used as directed, this product will provide effective and economical control of listed diseases and insects and promote healthy lush growth.

6/12

AGRICULTURAL USE REQUIREMENTS

Use this product only in accordance with its labeling and with the Worker Protection Standard, 40 CFR part 170. This Standard contains requirements for the protection of agricultural workers on farms, forests, nurseries, and greenhouses, and handlers of agricultural pesticides. It contains requirements for training, decontamination, notification and emergency assistance. It also contains specific instructions and exceptions pertaining to the statements on this label about personal protective equipment (PPE) and restricted-entry interval. The requirements in this box only apply to uses of this product that are covered by the Worker Protection Standard.

Do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 24 hours. PPE required for early entry to treated areas that is permitted under the Worker Protection Standard and that involves contact with anything that has been treated, such as plants, soil, or water, is coveralls, chemical-resistant gloves made of any water proof material, shoes plus socks, and protective eyewear.

PRODUCT PRECAUTIONS

Apply this product only as directed on this label. This material may be applied with ground equipment or aircraft depending upon local conditions. Sulfur will cause severe fruit and leaf injury to sulfur-sensitive crops. Anjou and comice pears, cranberries, cucurbits (cucumber, squash and some varieties of melons), filberts, spinach, tung trees, walnuts and other sensitive plants may be injured by sulfur under certain climatic conditions. When shade temperatures exceed or are likely to exceed 90°F, sulfur may burn foliage and fruit.

PRODUCT RESTRICTIONS

Do not use this product for any uses other than those specified on this label. Do not use sulfur in combination with oil or within 21 to 60 days of an oil spray. Do not apply this product through any type of irrigation system. To do so may result in severe fruit and leaf injury. When growing crops for processing, consult the processor before applying sulfur.

APPLICATION DIRECTIONS

Yellow Jacket Wettable Sulfur II is formulated for use as a dust or for use in water as a spray on fruits, vegetables and field crops, flowers and ornamentals, and poultry for control of certain fungus, diseases, and mites. It may be combined in the spray tank with most of the commonly used fungicides and insecticides.

DIRECTIONS FOR SPRAYING: Pour the specific amount of this product on the surface of water in the spray tank. Add balance of water to fill the tank. Keep agitator running during filling and spraying operations. Do not allow mixture to stand. Do not use in low volume gear-type spray equipment. Do not combine with emulsifiable liquids unless previous use of mixture has proven physically compatible and safe to plants.

DIRECTIONS FOR DUSTING: Avoid drift. Apply when air is calm. For best results, apply at night or in early morning hours. Repeat as needed.

7/12

SPRAY DRIFT DIRECTIONS
FOR ALL CROPS USED LISTED ON THE PRODUCT LABEL
(for both ground and air applications)

Dusting sulfur can create situations where drift to non-target of sensitive areas can occur. To minimize the occurrence of drift incidents, the following conditions must be met:

ADDITIONAL DIRECTIONS FOR USE IN CALIFORNIA

In addition to specific instructions under directions for use, the following conditions must also be followed for use in California.

1. The operator of the property and the applicator must establish a buffer zone of enough distance to prevent drift onto nontarget areas (hospitals, clinics, residential areas, schools, and any other area designated by the county agricultural commissioner).
2. The operator of the property and the applicator must evaluate the method and equipment for each site to ensure proper and safe use. Evaluations shall include, but not be limited to the appropriateness of ground or air application.
3. Sulfur shall not be added when the wind velocity exceeds 10 miles per hour. Applicators should be aware that in some areas of California, "dead calm" conditions are often associated with an inversion situation. In these areas, applying sulfur when there is minimum air movement of 2 miles per hour will help ensure that an inversion situation does not exist.
4. All applicators, prior to use of dust formulations, should read and understand the Sulfur Best Application Practices manual. This document may be accessed at http://www.curesworks.org/publications/sulfur.pdf .

The specific directions on this label conform to the most common application rates and methods for the crop listed. Consult State Agricultural Station or State Agricultural Extension Service Specialist for additional information as the timing, application method, application rate and frequency will vary with local conditions. All spray dosages given on this label are for dilute sprays (1x concentration). For use in concentrate sprays, increase the dosage of Yellow Jacket Wettable Sulfur II to apply the equivalent amount per acre. For example, if normal use is 5 pounds of product per 100 gallons of water applied to one acre, the 5x concentrate rate will be 25 pounds of product per 100 gallons of water applied to 5 acres. When used as a dust, use the dosage rates listed omitting the water. Apply to coat the foliage and fruit with a light uniform residue. Apply often enough to keep new growth covered.

IMPORTANT: Use the higher specified dosage during periods of frequent and heavy rainfall. Spray often enough to keep susceptible growth covered. This may require weekly or bi-weekly applications during periods of rapid growth and frequent rainfall.

FRUIT & NUT CROPS

ALMONDS – Brown Rot, Powdery Mildew, Leaf Spot, Scab - Apply 8 to 30 lbs. of product per 100 gals of water or 40 to 50 lbs of product per acre in pre-bloom, bloom, and post-bloom periods. Apply when disease threatens during rain periods and repeat at 7 to 10 day intervals. Mites - Brown, Almond, European Red, Two-Spotted, Pacific, Strawberry (Atlantic) Silver, Flat - 8 to 30 lbs. of product per 100 gals of water or 40 to 50 lbs of product per acre as needed when infestation is noted. Do not apply within two (2) weeks of an oil application.

APPLES – Scab, Powdery Mildew - 3 to 7.6 lbs. of product per 100 gals. of water or 7.5 to 59 lbs. of product per acre - Apply prebloom, bloom, petal fall, shuck and as a cover spray throughout the season. Mites - Blister

European Red, and Two-Spotted - 3 to 7.6 lbs. of product per 100 gals. of water or 7.5 to 59 lbs. of product per acre as needed when infestation is noted.

AVOCADOS – Brown Mite - 30 lbs. of product per acre as needed.

CANE FRUITS – Blackberries, Blueberries, Boysenberries, Currents, Dewberries, Gooseberries, Huckleberries, Loganberries, Raspberries: Powdery Mildew - Apply 5.8 to 7.8 lbs. of product per 100 gals. of water or 10 to 30 lbs. of product per acre when new shoots are 6 inches long and before blossoms open. Repeat at 10-day intervals as necessary.

CHERRIES – Blossom Blight, Brown Rot, Powdery Mildew, Leaf Spot, Rust - 3.6 to 9.5 lbs. of product per 100 gals. of water or 20 to 59 lbs. of product per acre - Apply pre-bloom, bloom, petal fall, and as a cover spray at 7 to 14 day intervals and as a post- harvest foliar treatment for leaf spot. Mites - Silver and Flat - 3.6 to 9.5 lbs. of product per 100 gals. of water or 20 to 59 lbs. of product per acre as needed.

CITRUS – Rust Mite - Use 4.75 to 7.70 lbs. of product per 100 gallons of water or 100 to 125 lbs. of product per acre according to size and type of tree. For additional information, consult your State Citrus Spray Guide. Begin applications at first signs of damage and repeat as necessary. Rust mites should be controlled at all times of the year in order to prevent russeting of fruit and greasy spot on leaves. Scale crawlers – Add 5 to 9 lbs. of product to each 100 gallons of tank strength lime sulfur solution.

DATES – To control BANKS GRASS MITES. Use 30-100 lbs. of product per acre by ground or air. Thorough coverage is essential. Repeat as necessary.

FIGS – Fig Rust Mite - Apply 44 lbs. of product per acre when mites first appear. Since the effectiveness of sulfur varies in different localities, State Agricultural Experiment Stations should be consulted as to the effectiveness before application.

GRAPES – Powdery Mildew, Bud Mites, Blister Mites, Red Spider - 1.9 to 6 lbs. of product per 100 gals. of water or 3.8 to 25 lbs. of product per acre, preferably by ground equipment, beginning when shoots are 6-8 inches long and continuing at 7-10 day intervals. Concord and other Labrusca type grapes may be injured by sulfur.

MACADAMIA – To control Mites – Apply 8-16 lbs. of product per acre. Repeat as necessary.

MANGOES – Powdery Mildew - 4.75 lbs. of product per 100 gals. of water or 10 to 30 lbs. of product per acre. Begin before bloom. Repeat in bloom, after fruit set and 3 weeks later or as necessary.

OLIVES – For control of Olive Mite - Apply 55 to 76 lbs. of product per acre. Do not use sulfur in hot weather as damage may result to crop and foliage.

PEACHES AND NECTARINES – Brown Rot Blossom Blight, Coryneum Blight, Rust, Powdery Mildew, Scab - Apply 10 to 18 lbs. of product per 100 gals. of water or 40 to 50 lbs. of product per acre in pre-bloom, bloom and post-bloom periods. Apply when disease threatens during rain periods and repeat at 7 to 10 day intervals. Peach Silver Mites - 10 to 18 lbs. of product per 100 gals. of water or 40 to 50 lbs. of product per acre as needed when infestations appear.

PEARS – Scab, Powdery Mildew - 3 to 9.7 lbs. of product per 100 gals. of water or 10 to 60 lbs. of product per acre - Pre-bloom, petal fall, shuck and as a cover spray throughout the season. Mites-Blister, European Red, Two-Spotted - 3 to 9.7 lbs. of product per 100 gals. of water or 10 to 60 lbs. of product per acre as needed. Sensitive varieties such as D'Anjou and Comice may be injured by sulfur under certain climatic conditions. Consult State Agricultural Experiment Stations or the State Agricultural Extension Service for further information on crop injury related to sulfur use.

PECANS – For Control of Powdery Mildew, leaf spot, sooty mild, flat mite, two-spotted mite, red spider mite, and Eriophyid mites (including pecan and hickory). Apply 4-12 lbs. of product per acre throughout the season as needed.

9/12

PRECAUTION: Some varieties of pecans are sensitive to sulfur under certain conditions. Do not apply unless varieties are known to be tolerant of sulfur.

PISTACHIOS – Citrus Flat Mite - 55 lbs. of product per acre. Apply when mites first appear and repeat as necessary. May be applied by ground or air.

PLUMS AND PRUNES – Brown Rot Blossom Blight, Scab, Powdery Mildew, Rust, Leaf Spot - Apply 10 to 18 lbs. of product per 100 gals. of water or 40 to 50 lbs. of product per acre in pre-bloom, bloom and post-bloom periods. Apply when disease threatens during rain periods and repeat at 7 to 10 day intervals. Silver Mites 10 to 18 lbs. of product per 100 gals. of water or 40 to 50 lbs. of product per acre as needed.

POMEGRANATES: To control Mites – Use 50 lbs. of product per acre. Apply when mites first appear and repeat as necessary. Do not apply when temperatures are likely to exceed 90° F, fruit and foliage damage can occur.

QUINCE – Brown Rot, Powdery Mildew, Scab - Apply 8 to 60 lbs. of product per acre. Begin before diseases are expected to appear. Repeat at 7 to 10 day intervals or as necessary.

STRAWBERRIES – Powdery Mildew - 1.8 to 4.9 lbs. of product per 100 gals. of water or 3 to 50 lbs. of product per acre. Sulfur may injure strawberries under certain climatic conditions. Consult State Agricultural Experiment Stations or the State Agricultural Extension Service for further information on crop injury related to sulfur use.

WALNUTS – Mites - European Red, Pacific, Almond, Two-Spotted - 2 to 4 lbs. of product per 100 gals. of water. Apply with miticides sprays to increase effectiveness. Certain varieties of walnuts are sensitive to sulfur. Do not apply unless the variety is known to be sulfur tolerant.

VEGETABLE CROPS

ARTICHOKES – Globe - Leaf Spot - Apply 27 to 38 lbs. of product per acre. Begin when disease first appears and repeat at 7 to 10 day intervals as necessary.

ASPARAGUS – Rust - Through the cutting season and after cutting has stopped, but before the fern season, apply 10 to 20 lbs. of product per acre at 7 to 10 day intervals. During the fern season apply 10 to 20 lbs. of product per acre at 2 to 3 week intervals. For Two-Spotted and Brown Mites - Use 4 to 6 lbs. of product per acre as necessary.

BEANS AND PEAS: Powdery Mildew, Rust, and Leaf Spot - 4 to 7.8 lbs. of product per 100 gals. of water or 3.8 to 36 lbs. of product per acre at first sign of infection and every 7 to 14 days as necessary. Mites - Two-Spotted, Pacific, Strawberry (Atlantic) - 4 to 7.8 lbs. of product per 100 gals. of water or 3.8 to 38 lbs. of product per acre as necessary.

CARROTS – Powdery Mildew - 10 to 50 lbs. of product per acre. Begin at first sign of disease and repeat at 7 to 10 day intervals.

CELERY – Early and late Blight – Use 6-12 lbs. of product per acre as soon as plants emerge. Repeat at 7-10 day intervals or as necessary.

COLE CROPS – Broccoli, Brussels Sprouts, Cabbage, Cauliflower, Collards, Kale, Mustard Greens, Rutabagas, Turnips -Powdery Mildew - 6 to 25 lbs. of product per acre beginning in early leaf stage and repeating every 10 to 14 days as needed, or immediately after rain. Mites - Two-Spotted, Pacific, Strawberry (Atlantic) - 6 to 25 lbs. of product per acre as necessary.

CUCURBITS – (Cucumbers, Melons, Squash) For powdery mildew apply 25 lbs. of product per acre when disease first appears and repeat as necessary.

EGGPLANTS – Powdery Mildew - Apply 22 to 38 lbs. of product per acre. Begin when first true leaves appear. Repeat at weekly intervals. ONIONS AND GARLIC – Powdery Mildew - 18.75 to 37.5 lbs. of product per acre. Begin before disease is expected to appear and repeat as necessary.

10/12

LETTUCE – Powdery mildew. Use 10-15 lbs. of product per acre. Begin at first sign of disease. Repeat as necessary.

PEPPERMINT AND SPEARMINT – Powdery Mildew - Apply 4 to 5 lbs. of product per acre when mint is 5 to 6 inches tall or when disease appears. Repeat twice, at 30-day intervals. Do not apply within 30 days of harvest.

PEPPERS – Powdery Mildew, Leaf Spot - 7.5 to 37.5 lbs. of product per acre beginning in the early leaf stage and repeating every 10 to 14 days as necessary.

POTATOES – Powdery Mildew, Leaf Spot - 4.0 to 12.5 lbs. of product per acre. Apply when disease first appears and repeat at 3 to 4 week intervals. Two-Spotted Mites - 4.0 to 12.5 lbs. of product per acre as necessary.

SPINACH – Powdery Mildew, Rust (Puccinia) - Apply 9 to 33 lbs. of product per acre. Apply when diseases first appear. Repeat at 7 to 10 day intervals.

TOMATOES – Tomato Russet Mite - 6 to 10 lbs. of product per acre in sufficient water to assure thorough coverage or 20 to 40 lbs. of product per acre as a dust. Begin when infestation first occurs and repeat as necessary, or with the regularly scheduled insect program.

FIELD CROPS

ALFALFA – Lygus Mites, Pacific Mites, Strawberry Mites - 6 to 25 lbs. of product per acre as necessary. Repeat at two-week intervals.

CLOVER – Powdery Mildew, Spider Mites - Apply 16 to 27 lbs. of product per acre. Begin when crop is in bud stage or at first sign of disease. Repeat at 7-10 day intervals, repeating as necessary.

CORN AND SORGHUM – Powdery Mildew - 3 to 5 lbs. of product per acre. Apply when disease appears and repeat as necessary. Two-Spotted Mites, Pacific Mites - 3 to 5 lbs. of product per acre when infestation first appears, repeating as necessary.

COTTON – Strawberry (Atlantic) Mites, Lygus Mites -15 to 30 lbs. of product per acre beginning when infestation first occurs and every 7 to 14 days as necessary.

COWPEAS – Rust - Apply 6 to 27 lbs. of product per acre. Begin soon after seedlings emerge. Repeat at 7 to 10 day intervals through the season.

FLAX – Powdery Mildew - Apply 22 to 33 lbs. of product per acre. Begin at first sign of disease. Repeat at 7 to 10 day intervals or as necessary.

GRASS SEED CROPS – Timothy Mite - Apply 33 lbs. of product per acre. Begin at first sign of infestation. Repeat at 5 to 10 day intervals. Repeat as necessary.

HOPS – Mite Suppression - Apply 33 to 44 lbs. of product per acre. Begin when infestation first appears and repeat at 5 to 10 day intervals. Repeat as necessary.

PEANUTS – Rust, Powdery Mildew, Leaf Spot - 8 to 24 lbs. of product per acre beginning in early leaf stage and repeating every 10 to 24 days as necessary.

SMALL GRAINS – Barley, Oats, Rye, Wheat - Powdery Mildew - 3 to 5 lbs. of product per acre. Apply when disease appears and repeat as necessary. Two-Spotted Mites, Pacific Mites, Strawberry (Atlantic) Mites - 3 to 5 lbs. of product per acre as necessary.

SOYBEANS – Leaf spot, Powdery Mildew. Use 8-15 lbs. of product per acre. Apply at first sign of disease. Repeat at 7-10 day intervals.

SUGAR BEETS – Powdery Mildew - 8 to 10 lbs. of product per 100 gals. of water or 30 to 50 lbs. of product per acre beginning when disease first appears, repeating at 3 to 4 week intervals.

VETCH – Rust - Apply 27 to 44 lbs. of product per acre. Begin at first sign of disease. Repeat at 7 to 10 day intervals.

11/12

FLOWERS AND ORNAMENTALS

APPLICATION: To control the diseases and red spiders listed below, use Yellow Jacket Wettable Sulfur II as a dust or spray using 6 lbs. of product per 100 gals. of water. Applications should be made at 5 to 7 day intervals, beginning when the disease or mites first appear and continuing until all danger from the disease is past. During periods of humid or rainy weather it may be necessary to make applications as often as every 2 to 3 days.

POWDERY MILDEW – Aster, Chrysanthemum, Cosmos, Dahlia, Daisy, Delphinium, Dogwood, Euonymus Golden Fleece, Hibiscus, Honeysuckle, Hydrangea, Lady's Mantle, Ligustrum, Lilac, Crepe Myrtle, Phlox, Poplar, Silver Vine, Rose, Spiraea, Sunflower, Verbena, Willow and Zinnia.

LEAF SPOT – Calendula, Cherry Laurel, Clematis, Columbine, English Ivy, Foxglove, Hydrangea, Petunia, Phlox, Sage, Smilax and Snapdragon.

BLACK SPOT – Rose.

BOTRYTIS BLIGHT – Hydrangea.

RED SPIDERS – Arborvitae, Carnation, Cedars, Chrysanthemums, Clematis, Hydrangea, Rose, Snapdragon and Sweetpeas.

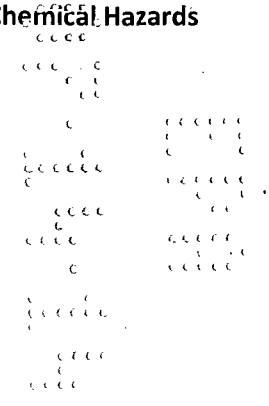
CHIGGER CONTROL - For control of chiggers on turf and in garden areas. Use approximately 2 lbs. of product per 1000 sq. ft. in enough water for thorough coverage. Treatment should be made a day or two before protection is desired and should be repeated at weekly intervals.

POULTRY

CHICKENS, TURKEYS, DUCKS, GEESE, GAME BIRDS AND PIGEONS – To control depluming mites, dust liberally on birds and rub into feathers. To treat poultry houses, apply 200 - 250 lbs. of product per 20,000 square feet as a spray (25 - 50 lbs. of product per 100 gallons of water). Apply thoroughly to all interior surfaces of poultry houses. Force spray into cracks and crevices. Repeat application as needed. **Note Physical and Chemical Hazards when applying this product.**

ANIMALS

For use on domestic livestock (equine, cattle, swine, sheep and goats). Also for use on dogs: to control fleas and ticks, dust animal liberally and rub into hair. To treat quarters, apply 200-250 lbs. of product per 20,000 square feet as a spray (25-50 lbs. of product per 100 gallons of water). Apply thoroughly to all interior surfaces of quarters. Force spray into cracks and crevices. Repeat application as needed. **Note Physical and Chemical Hazards when applying this product.**



STORAGE & DISPOSAL

Do not contaminate water, food or feed by storage or disposal.

PESTICIDE STORAGE: Store in a cool dry place.

PESTICIDE DISPOSAL: Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.

CONTAINER HANDLING:

Nonrefillable container. Do not reuse or refill this container.

Completely empty bag into application equipment. Then offer for recycling if available or dispose of empty bag in a sanitary landfill or by incineration or, if allowed by state and local authorities, by burning. If burned, stay out of smoke.

WARRANTY DISCLAIMER AND NOTICE

THE DIRECTIONS FOR USE OF THIS PRODUCT ARE BELIEVED TO BE ADEQUATE AND MUST BE FOLLOWED CAREFULLY. IT IS IMPOSSIBLE TO ELIMINATE ALL RISKS INHERENTLY ASSOCIATED WITH THE USE OF THIS PRODUCT. CROP INJURY, INEFFECTIVENESS, OR OTHER UNINTENDED CONSEQUENCES MAY RESULT DUE TO SUCH FACTORS AS WEATHER CONDITIONS, PRESENCE OR ABSENCE OF OTHER MATERIALS, OR THE MANNER OF USE OR APPLICATION, ALL OF WHICH ARE BEYOND THE CONTROL OF GEORGIA GULF SULFUR CORPORATION, THE MANUFACTURER OR SELLER.

TO THE EXTENT CONSISTENT WITH APPLICABLE LAW,THE PRODUCTS SOLD TO YOU ARE FURNISHED "AS IS" BY GEORGIA GULF SULFUR CORPORATION, THE MANUFACTURER OR SELLER, AND ARE SUBJECT ONLY TO THE MANUFACTURER'S WARRANTIES, IF ANY, WHICH APPEAR ON THE LABELS TO THE PRODUCTS SOLD TO YOU. EXCEPT AS WARRANTED BY THIS LABEL, GEORGIA GULF SULFUR CORPORATION, THE MANUFACTURER OR SELLER MAKES NO WARRANTIES, GUARANTEES, OR REPRESENTATIONS OF ANY KIND TO BUYER OR USER, EITHER EXPRESS OR IMPLIED, OR BY USAGE OF TRADE, STATUTORY OR OTHERWISE, WITH REGARD TO THE PRODUCT SOLD OR USE OF THE PRODUCT, INCLUDING, BUT NOT LIMITED TO MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, USE OF ELIGIBILITY OF THE PRODUCT FOR ANY PARTICULAR TRADE USE TO THE EXTENT CONSISTENT WITH APPLICABLE LAW, BUYER'S OR USER'S EXCLUSIVE REMEDY, AND GEORGIA GULF SULFUR CORPORATION, THE MANUFACTURER'S OR SELLER'S TOTAL LIABILITY, SHALL BE LIMITED TO DAMAGES NOT EXCEEDING THE COST OF THE PRODUCT. NO AGENT OR EMPLOYEE OF GEORGIA GULF SULFUR CORPORATION OR SELLER IS AUTHORIZED TO AMEND THE TERMS OF THIS WARRANTY DISCLAIMER OR THE PRODUCT'S LABEL OR TO MAKE A REPRESENTATION OR RECOMMENDATION DIFFERENT FROM OR INCONSISTENT WITH THE LABEL OF THIS PRODUCT.

TO THE EXTENT CONSISTENT WITH APPLICABLE LAW, GEORGIA GULF SULFUR CORPORATION, THE MANUFACTURER OR SELLER SHALL NOT BE LIABLE FOR CONSEQUENTIAL, SPECIAL OR INDIRECT DAMAGES OR EXPENSE RESULTING FROM THE USE, HANDLING, APPLICATION, STORAGE OR DISPOSAL OF THIS PRODUCT OR FOR DAMAGES IN THE NATURE OF PENALTIES AND THE BUYER AND USER WAIVE ANY RIGHT THEY MAY HAVE TO SUCH DAMAGES.

CLL 20140711 NOTIF
CLL 20140220 AMEND
CLL 20140325 EPA requested edits

6325-23 8/26/2010 1 of 10

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

AUG 26 2010

OFFICE OF CHEMICAL SAFETY
AND POLLUTION PREVENTION

Mr. Williams Ronald Landis, Ph.D.
Georgia Gulf Sulfur
C/O Landis International, Inc
PO Box 5126
Valdosta, GA 31603-5126

Subject: Label Notification(s) for Pesticide Registration Notice 2007-4

Dear Registrant:

The Agency is in receipt of your Application(s) for Pesticide Notification under Pesticide Registration Notice (PRN) 2007-4 dated July 19, 2010 for:

EPA Registration 6325-23 Superfine Wettable Sulfur

The Registration Division (RD) has conducted a review of this request for applicability under PRN 2007-4 and finds that the label change(s) requested falls within the scope of PRN-2007-4. The label has been date-stamped "Notification" and will be placed in our records.

Please be reminded that 40 CFR Part 156.140(a)(4) requires that a batch code, lot number, or other code identifying the batch of the pesticide distributed and sold be placed on nonrefillable containers. The code may appear either on the label (and can be added by non-notification/PR Notice 98-10) or durably marked on the container itself.

If you have any questions, please contact me directly at 703-305-5335 or Banza Djapao of my staff at 703-305-7269.

Sincerely,

Rachel C. Holloman for

Paul Mastradone, Acting Leader
Notifications & Minor Formulations Team Leader
Registration Division (7505P)
Office of Pesticide Programs

437747

2 of 10

Please read instructions on reverse before completing form. Form Approved. OMB No. 2070-0060, Approval expires 2-28-95

United States
Environmental Protection Agency
Washington, DC 20460

- [ ] Registration
- [ ] Amendment
- [x] Other

OPP Identifier Number

Application for Pesticide - Section I

1. Company/Product Number	2. EPA Product Manager	3. Proposed Classification
Georgia Gulf Sulfur Corporation/ 6325-23	Mary Waller	[ ] None [ ] Restricted
4. Company/Product (Name)	**PM#**	
Georgia Gulf Sulfur Corporation/ Superfine Wettable Sulfur	21	

5. Name and Address of Applicant *(Include ZIP Code)*

Georgia Gulf Sulfur Corporation
c/o Landis International, Inc.
PO Box 5126 Valdosta, GA 31603-5126

[ ] *Check if this is a new address*

6. Expedited Reveiw. In accordance with FIFRA Section 3(c)(3)(b)(i), my product is similar or identical in composition and labeling to:

EPA Reg. No. _____

Product Name _____

Section - II

- [ ] Amendment - Explain below.
- [ ] Resubmission in response to Agency letter dated _____
- [x] Notification - Explain below.
- [ ] Final printed labels in repsonse to Agency letter dated _____
- [ ] "Me Too" Application.
- [ ] Other - Explain below.

NOTIFICATION
AUG 26 2010

Explanation: Use additional page(s) if necessary. (For section I and Section II.)

This notification is consistent with the guidance of PR Notice 2007-4 and the requirements of EPA's regulations at 40 CFR 156.10, 156.140, 156.144, 156.146, and 156.156. No other changes have been made to the labeling or the Confidential Statement of Formula of this product. I understand that it is a violation of 18 U.S.C. Sec. 1001 to willfully make any false statement to the EPA. I further understand that if the amended label is not consistent with the requirements of 40 CFR 156.10, 156.140, 156.144, 156.146, and 156.156, this product may be in violation of FIFRA and I may be subject to enforcement action and penalties under Sections 12 and 14 of FIFRA.

Section - III

1. Material This Product Will Be Packaged In:

Child-Resistant Packaging	Unit Packaging	Water Soluble Packaging	2. Type of Container
[ ] Yes	[ ] Yes	[ ] Yes	[ ] Metal
[x] No	[x] No	[x] No	[ ] Plastic
Certification must be submitted	If "Yes" Unit Packaging wgt. / No. per container	If "Yes" Package wgt / No. per container	[x] Glass [x] Paper [ ] Other (Specify) _____

3. Location of Net Contents Information	4. Size(s) Retail Container	5. Location of Label Directions
[x] Label [ ] Container	30, 50 lbs.	[x] on label and leaflet

6. Manner in Which Label is Affixed to Product: [x] Lithograph / Paper glued / Stenciled [ ] Other _____

Section - IV

1. Contact Point *(Complete items directly below for identification of individual to be contacted, if necessary, to process this application.)*

Name	Title	Telephone No. (Include Area Code)
Peggy M. Galloway	Regulatory Agent	229-247-6472

Certification

I certify that the statements I have made on this form and all attachments thereto are true, accurate and complete. I acknowledge that any knowlingly false or misleading statement may be punishable by fine or imprisonment or both under applicable law.

2. Signature	3. Title	6. Date Application Received
Peggy M. Galloway	Regulatory Agent	(Stamped)
4. Typed Name	**5. Date**	
Peggy M. Galloway	July 19, 2010	

YELLOW JACKET

For Organic Production

SUPERFINE WETTABLE SULFUR

For Spraying Fruits, Vegetables, & Ornamentals

NOTIFICATION

AUG 2 6 2010

ACTIVE INGREDIENT:

Sulfur..... 80.0%

OTHER INGREDIENTS..... 20.0%

TOTAL..... 100.0%

FIRST AID	
If Swallowed	• Call poison control center or doctor for treatment advice. • Do not induce vomiting unless told to do so by the poison control center or doctor. • Have person sip a glass of water if able to swallow. • Do not give anything by mouth to an unconscious person.
If In Eyes	• Hold eye open and rinse slowly and gently with water for 15 - 20 minutes. • Remove contact lenses, if present, after the first 5 minutes, and then continue rinsing the eye. • Call a poison control center or doctor for further treatment advice.
If On Skin Or Clothing	• Take off contaminated clothing. • Rinse skin immediately with plenty of water for 15 - 20 minutes. • Call a poison control center or doctor for further treatment advice.
For emergency information, call 1-229-244-0000, or your poison control center.	
Have the product container or label with you when calling a poison control center or doctor, or going for treatment.	
See Side Panels for Additional Precautionary Statements	

GEORGIA GULF SULFUR CORPORATION
P.O. BOX 1165
VALDOSTA, GA 31603-1165

EPA REG. NO. 6325-23 EPA EST. NO. 49668-TX-1

NET CONTENTS: 30, 50 LBS. (13.6, 22.7 KG)

PRECAUTIONARY STATEMENTS
HAZARDS TO HUMANS & DOMESTIC ANIMALS
CAUTION

Harmful if swallowed. Avoid breathing vapors or spray mist. May cause irritation of nose, throat or skin. Avoid contact with eyes, skin and clothing. Do not contaminate food or feed products. Keep out of reach of children.

PERSONAL PROTECTIVE EQUIPMENT

Applicators and other handlers must wear:
- Long-sleeved shirt and long pants.
- Chemical-resistant gloves made of any waterproof material.
- Shoes plus socks.
- Protective eyewear.

Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry.

USER SAFETY RECOMMENDATIONS

User should:
- Wash hands before eating, drinking, chewing gum, using tobacco, or using toilet.
- Remove clothing immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing.
- Remove PPE immediately after handling this product.
- Wash the outside of gloves before removing. As soon as possible, wash thoroughly and change into clean clothing.

ENVIRONMENTAL HAZARDS

This product is toxic to fish and wildlife. Do not apply directly to water, to areas where surface water is present, or to intertidal areas below the mean high water mark. Do not apply where runoff is likely to occur. Do not apply where weather conditions favor drift from areas treated. Do not contaminate water when disposing of rinsate or equipment washwater.

PHYSICAL AND CHEMICAL HAZARDS

Sulfur dust suspended in air ignites easily. Keep away from heat, sparks or flames. Do not smoke while applying this product.

STORAGE & DISPOSAL

Do not contaminate water, food or feed by storage or disposal.

PESTICIDE STORAGE: Store unused product in original container only in cool, dry area out of reach of children and animals.

PESTICIDE DISPOSAL: Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.

CONTAINER HANDLING ~~DISPOSAL~~: Nonrefillable container. Do not reuse or refill this container. Completely empty bag by shaking and tapping sides and bottom to loosen clinging particles. Empty residue into application equipment. Offer for recycling if available. Then dispose of bags in a sanitary landfill or by incineration if allowed by state and local authorities.

DIRECTIONS FOR USE

It is a violation of Federal Law to use this product in a manner inconsistent with its labeling. Do not apply this product in a way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area during application.
For any requirements specific to your State or Tribe, consult the agency responsible for pesticide regulation.

AGRICULTURAL USE REQUIREMENTS

Use this product only in accordance with its labeling and with the Worker Protection Standard, 40 CFR part 170. This Standard contains requirements for the protection of agricultural workers on farms, forests, nurseries, and greenhouses, and handlers of agricultural pesticides. It contains requirements for training, decontamination, notification and emergency assistance. It also contains specific instructions and exceptions pertaining to the statements on this label about personal protective equipment (PPE) and restricted-entry interval. The requirements in this box only apply to uses of this product that are covered by the Worker Protection Standard.
Do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 24 hours. PPE required for early entry to treated areas that is permitted under the Worker Protection Standard and that involves contact with anything that has been treated, such as plants, soil, or water is:
- Coveralls.
- Chemical-resistant gloves made of any waterproof material.
- Shoes plus socks.
- Protective eyewear.

GENERAL INFORMATION

Apply this product only as specified on this label. Do not use this product for any uses other than those specified on this label. Superfine Wettable Sulfur is formulated for use in water as a spray on fruit, vegetable and ornamental crops for the control of certain fungus diseases and mites. It may be combined in the spray tank with most commonly used fungicides and insecticides. Pour the specific amount of this product on surface of water in nearly filled spray tank or pre-mix in a bucket before pouring into spray tank. Add balance of water to fill tank. Keep agitators running during filling and spraying operations. Do not allow mixture to stand. Do not use in low volume gear type spray equipment. Do not combine with emulsified liquids unless previous use of the mixture has proven physically compatible and safe to plants
NOTE: Do not use sulfur in combination with oil or within 21 days of an oil spray. Do not use sulfur on apples or other sensitive crops when shade temperatures exceed, or are likely to exceed 90 °F. Do not apply or allow sulfur to drift to Cucurbits (cucumber, cantaloupe, melon, and squash) or tung. Do not apply to or allow spray drift on sulfur-sensitive plants such as D'Anjou pears, apricots, chrysanthemums, cranberries, spinach, or other sensitive crops listed on this labeling. To do so may result in severe fruit and leaf injury. When growing crops for processing, consult the processor before applying sulfur.

CHEMIGATION

Apply this product only through sprinkler including center pivot, lateral move, end tow, side (wheel), roll, traveler, big gun, solid set, or hand move irrigation systems. Do not apply this product through any other type of irrigation system. Crop injury, lack of effectiveness or illegal pesticide residues in the crop can result from nonuniform distribution of treated water. If you have questions about calibration, you should contact State Extensive Service Specialists, equipment manufacturers or other experts. A person knowledgeable of the chemigation system and responsible for its operation, or under the supervision of the responsible person, shall shut the system down and make necessary adjustments should the need arise. DO NOT STOP AGITATION WITH SULFUR IN SUPPLY TANK. SULFUR IS HIGHLY CORROSIVE AND EQUIPMENT SHOULD BE CLEANED THOROUGHLY.

For center pivots, apply during one full revolution of the system.
For portable or solid set systems, apply during the final 15 minutes of the irrigation system. DO NOT OPERATE IRRIGATION SYSTEM AFTER APPLICATION UNTIL DEPOSIT HAS THOROUGHLY DRIED.
Public water system means a system for the provision to the public of piped water for human consumption if such system has at least 15 serviced connections or regularly serves an average of at least 25 individuals daily at least 60 days out of the year. Do not connect an irrigation system (including greenhouse systems) used for pesticide application to a public water system unless the pesticide label-prescribed safety devices for public water systems are in place. Chemigation systems connected to public water systems must contain a functional, reduced-pressure zone, backflow preventer (RPZ) or the functional equivalent in the water supply line upstream from the point of pesticide introduction. As an option to the RPZ, the water from the public water system should be discharged into a reservoir tank prior to pesticide introduction. There shall be a complete physical break (air gap) between the outlet end of the fill pipe and the top or overflow rim of the reservoir tank of at least twice the inside diameter of the fill pipe. For non-public water sprinkler chemigation systems, the system must contain a functional check valve, vacuum relief valve, and low pressure drain appropriately located on the irrigation pipeline to prevent water source contamination from backflow.
The pesticide injection pipeline must contain a functional, automatic, quick-closing check valve to prevent the flow of fluid back toward the injection pump. The pesticide injection pipeline must also contain a functional, normally closed, solenoid-operated valve located on the intake side of the injection pump and connected to the system interlock to prevent fluid from being withdrawn from the supply tank when the irrigation system is either automatically or manually shut down. The system must contain functional interlocking controls to automatically shut off the pesticide injection pump when the water pump motor stops, or in cases where there is no water pump, when the water pressure decreases to the point where pesticide distribution is adversely affected.
Systems must use a metering pump, such as a positive displacement injection pump (e.g. diaphgram pump) effectively designed and constructed of materials that are compatible with pesticide and capable of being fitted with a system interlock. Do not apply when wind speed favors drift beyond the area intended for treatment.

DILUTE GROUND APPLICATION

A - Orchard application - Apply specified rate in 100-800 gallons of water per acre.
B - All other applications - Apply specified rate in 20-60 gallons of water per acre.

CONCENTRATE GROUND APPLICATION

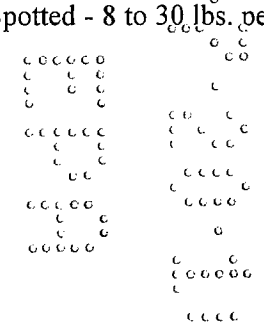
A - Orchard application - Apply specified rate in 20-100 gallons of water per acre.
B - All other applications - Apply specified rate in not less than 5 gallons of water per acre.

AERIAL APPLICATION

A - Orchard application - Should not be applied in less than 10 gallons of water per acre.
B - All other applications - Apply specified rate in 5-20 gallons of water per acre.
Recommendations: Pour needed amount into spray tank under agitation. If necessary, add a few drops of oil to avoid foaming.

FRUIT AND NUT CROPS

ALMONDS - Brown Rot, Powdery Mildew, Leaf Spot, Scab - Apply 8 to 30 lbs. per acre in pre-bloom, bloom, and post-bloom periods. Apply when disease threatens during rain periods and repeat at 7 to 10 day intervals. Mites - Brown, Almond, European Red, Two-Spotted, Pacific, Strawberry (Atlantic) Silver, Flat - 8 to 30 lbs. per acre as needed when infestation is noted.
APPLES - Scab, Powdery Mildew - 8 to 30 lbs. per acre - Apply pre-bloom, bloom, petal fall, shuck and as a cover spray throughout the season. Mites - Blister European Red, and Two-Spotted - 8 to 30 lbs. per acre as needed when infestation is noted.
AVOCADOS - Brown Mite - 8 to 30 lbs. per acre as needed.



CANE FRUITS - Blackberries, Blueberries, Boysenberries, Currants, Dewberries, Gooseberries, Huckleberries, Loganberries, Raspberries: Powdery Mildew - Apply 6 to 12 lbs. per acre when new shoots are 6 inches long and before blossoms open. Repeat at 10 day intervals as necessary.
CHERRIES - Blossom Blight, Brown Rot, Powdery Mildew, Leaf Spot, Rust - 3.6 to 9.5 lbs. per acre - Apply pre-bloom, bloom, petal fall, and as a cover spray at 7 to 14 day intervals and as a postharvest foliar treatment for leaf spot. Mites - Silver and Flat - 3.6 to 9.5 lbs. per acre as needed.
CITRUS - Rust Mite - Use 8 to 20 lbs. of sulfur per acre according to size and type of tree. For additional information, consult your State Citrus Spray Guide. Begin applications at first signs of damage and repeat as necessary. Rust mites should be controlled at all times of the year in order to prevent russeting of fruit and greasy spot on leaves. Do not apply within 30 days of oil application.
FIGS - Fig Rust Mite - Apply 8 to 20 lbs. per acre when mites first appear. Since the effectiveness of sulfur varies in different localities, State Agricultural Experiment Stations should be consulted as to the effectiveness before application.
GRAPES - Powdery Mildew, Bud Mites, Blister Mites, Red Spider - 1.9 to 6 lbs. per acre, beginning when shoots are 6-8 inches long and continuing at 7-10 day intervals. Concord and other Labrusca type grapes may be injured by sulfur.
MANGOES - Powdery Mildew - 10 to 30 lbs. per acre. Begin before bloom. Repeat in bloom, after fruit set and 3 weeks later or as necessary.
MELONS - Powdery Mildew - Apply 10 to 20 lbs. per acre. Treat when the disease first appears and repeat as necessary. Sulfur can injure plants especially when the temperature exceeds 90 °F. Do not use on sulfur sensitive varieties.
OLIVES - For control of Olive Mite - Apply 8 to 30 lbs. per acre. Do not use sulfur in hot weather as damage may result to crop and foliage.
PEACHES AND NECTARINES - Brown Rot Blossom Blight, Coryneum Blight, Rust, Powdery Mildew, Scab - Apply 10 to 18 lbs. per acre in pre-bloom, bloom and post-bloom periods. Apply when disease threatens during rain periods and repeat at 7 to 10 day intervals. Peach Silver Mites - 10 to 18 lbs. per acre as needed when infestations appear.
PEARS - Scab, Powdery Mildew - 8 to 30 lbs. per acre - Pre-bloom, petal fall, shuck and as a cover spray throughout the season. Mites-Blister, European Red, Two-Spotted - 8 to 30 lbs. per acre as needed. Sensitive varieties such as D'Anjou and Comice may be injured by sulfur under certain climatic conditions.
PECANS - Powdery Mildew, Leaf Spot, Silver Mite, Flat Mite, Red Spider Mite - Apply 10 to 20 lbs. per acre at bloom or early petal fall. Repeat as necessary, usually 10 to 14 days or after a period of wet weather.
PISTACHIOS - Citrus Flat Mite - 8 to 30 lbs. per acre. Apply when mites first appear and repeat as necessary.
PLUMS AND PRUNES - Brown Rot Blossom Blight, Scab, Powdery Mildew, Rust, Leaf Spot - Apply 10 to 18 lbs. per acre in pre-bloom, bloom and post-bloom periods. Apply when disease threatens during rain periods and repeat at 7 to 10 day intervals. Silver Mites - 10 to 18 lbs. per acre as needed.
QUINCE - Brown Rot, Powdery Mildew, Scab - Apply 8 to 30 lbs. per acre. Begin before diseases are expected to appear. Repeat at 7 to 10 day intervals or as necessary.
STRAWBERRIES - Powdery Mildew, Red Spider Mite - 5 to 10 lbs. per acre. Start in early leaf stage, repeat applications at 10-14 day intervals with or without other pesticides. For Powdery mildew, begin at first signs of disease and repeat as necessary. Sulfur may injure strawberries under certain climatic conditions.
WALNUTS - Mites - European Red, Pacific, Almond, Two-Spotted, Red Spider - 8 to 30 lbs. per acre. Apply with mite sprays during season to increase the effectiveness of miticides. **Note to User:** Certain varieties are sensitive to sulfur sprays under certain conditions. Do not apply unless the varieties are known to be tolerant of sulfur. Certain varieties of walnuts are sensitive to sulfur. Do not apply unless the variety is known to be sulfur tolerant.

VEGETABLE CROPS

ARTICHOKES - Globe - Leaf Spot - 3 to 10 lbs. per acre. Begin when disease first appears and repeat at 7 to 10 day intervals as necessary.

ASPARAGUS - Rust - Apply 10 to 20 lbs. per acre after cutting stops, and at 7 to 10 day intervals through the season, during the fern period, apply at 2 to 3 week intervals or with a regular insect program. For Two-Spotted and Brown Mites - Use 4 to 6 lbs. per acre as necessary.

BEANS AND PEAS - Powdery Mildew, Rust, and Leaf Spot - 4 to 7.8 lbs. per acre at first sign of infection and every 7 to 14 days as necessary. Mites - Two-Spotted, Pacific, Strawberry (Atlantic) - 4 to 7.8 lbs. per acre as necessary.

CARROTS - Powdery Mildew - 3 to 10 lbs. per acre. Begin at first sign of disease and repeat at 7 to 10 day intervals.

COLE CROPS - Broccoli, Brussels Sprouts, Cabbage, Cauliflower, Collards, Kale, Mustard Greens, Rutabagas, Turnips - Powdery Mildew 3 to 10 lbs. per acre beginning in early leaf stage and repeating every 10 to 14 days as needed, or immediately after rain. Mites - Two-Spotted, Pacific, Strawberry (Atlantic)- 3 to 10 lbs. per acre as necessary.

EGGPLANTS - Powdery Mildew - Apply 3 to 10 lbs. per acre. Begin when first true leaves appear. Repeat at weekly intervals.

ONIONS AND GARLIC - Powdery Mildew - 3 to 10 lbs. per acre. Begin before disease is expected to appear and repeat as necessary.

PEPPERMINT AND SPEARMINT - Powdery Mildew - Apply 4 to 5 lbs. per acre when mint is 5 to 6 inches tall or when disease appears. Repeat twice, at 30 day intervals. Do not apply within 30 days of harvest.

PEPPERS - Powdery Mildew, Leaf Spot - 3 to 10 lbs. per acre beginning in the early leaf stage and repeating every 10 to 14 days as necessary.

POTATOES - Powdery Mildew, Leaf Spot - 3 to 10 lbs. per acre. Apply when disease first appears and repeat at 3 to 4 week intervals. Two-Spotted Mites - 4.0 to 12.5 lbs. per acre as necessary.

SPINACH - Powdery Mildew, Rust (Puccinia) - Apply 3 to 10 lbs. per acre. Apply when diseases first appear. Repeat at 7 to 10 day intervals.

TOMATOES - Tomato Russet Mite - 8 to 30 lbs. per acre. Begin when infestation first occurs and repeat as necessary.

FIELD CROPS

ALFALFA - Lygus Mites, Pacific Mites, Strawberry Mites - 3 to 5 lbs. per acre as necessary. Repeat at two week intervals.

CLOVER - Powdery Mildew, Spider Mites - Apply 3 to 5 lbs. per acre. Begin when crop is in bud stage or at first sign of disease. Repeat at 7-10 day intervals, repeating as necessary.

CORN AND SORGHUM - Powdery Mildew - 3 to 5 lbs. per acre. Apply when disease appears and repeat as necessary. Two-Spotted Mites, Pacific Mites - 3 to 5 lbs. per acre when infestation first appears, repeating as necessary.

COTTON - Strawberry (Atlantic) Mites, Lygus Mites - 3 to 5 lbs. per acre beginning when infestation first occurs and every 7 to 14 days as necessary.

COWPEAS - Rust - Apply 3 to 10 lbs. per acre. Begin soon after seedlings emerge. Repeat at 7 to 10 day intervals through the season.

FLAX - Powdery Mildew - Apply 3 to 10 lbs, per acre. Begin at first sign of disease. Repeat at 7 to 10 day intervals or as necessary.

GRASS SEED CROPS - Timothy Mite - Apply 3 to 10 lbs. per acre. Begin at first sign of infestation. Repeat at 5 to 10 day intervals. Repeat as necessary.

HOPS - Mite Suppression - Apply 3 to 5 lbs. per acre. Begin when infestation first appears and repeat at 5 to 10 day intervals. Repeat as necessary.
PEANUTS - Rust, Powdery Mildew, Leaf Spot - 3 to 10 lbs. per acre beginning in early leaf stage and repeating every 10 to 24 days as necessary.
SMALL GRAINS - Barley, Oats, Rye, Wheat - Powdery Mildew - 3 to 5 lbs. per acre. Apply when disease appears and repeat as necessary. Two-Spotted Mites, Pacific Mites, Strawberry (Atlantic) Mites - 3 to 5 lbs. per acre as necessary.
SOYBEANS - Powdery Mildew - 3 to 10 lbs. per acre. Apply when disease appears and repeat as necessary. Two-Spotted Mites, Pacific Mites, Strawberry (Atlantic) Mites - 3 to 10 lbs. per acre beginning when infestation is first noted, repeating as necessary.
SUGAR BEETS - Powdery Mildew - 10 to 20 lbs. per 100 gals. of water or 30 to 50 lbs. per acre beginning when disease first appears, repeating at 3 to 4 week intervals.
VETCH - Rust - Apply 3 to 10 lbs. per acre. Begin at first sign of disease. Repeat at 7 to 10 day intervals.

FLOWERS AND ORNAMENTALS

APPLICATION: To control the diseases and red spiders listed below, use spray using 6 lbs. per acre. Applications should be made at 5 to 7 day intervals, beginning when the disease or mites first appear and continuing until all danger from the disease is past. During periods of humid or rainy weather it may be necessary to make applications as often as every 2 to 3 days.
POWDERY MILDEW - Aster, Chrysanthemum, Cosmos, Dahlia, Daisy, Delphinium, Dogwood, Euonymus Golden Fleece, Hibiscus, Honeysuckle, Hydrangea, Lady's Mantle, Ligustrum, Lilac, Crepe Myrtle, Phlox, Poplar, Silver Vine, Rose, Spiraea, Sunflower, Verbena, Willow and Zinnia.
LEAF SPOT - Calendula, Cherry Laurel, Clematis, Columbine, English Ivy, Foxglove, Hydrangea, Petunia, Phlox, Sage, Smilax and Snapdragon.
BLACK SPOT - Rose. **POWDERY MILDEW** - Rose.
BOTRYTIS BLIGHT - Hydrangea.
RED SPIDERS - Arborvitae, Carnation, Cedars, Chrysanthemums, Clematis, Hydrangea, Rose, Snapdragon and Sweetpeas.

POULTRY

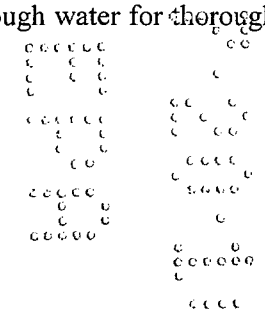
CHICKENS, TURKEYS, DUCKS, GEESE, GAME BIRDS AND PIGEONS - To control depluming mites, dust liberally on birds and rub into feathers. To treat poultry houses, apply 200 - 250 pounds per 20,000 square feet as a spray (25 - 50 pounds per 100 gallons of water). Apply thoroughly to all interior surfaces of poultry houses. Force spray into cracks and crevices. Repeat applications as needed. **Note Physical and Chemical Hazards when applying this product.**

ANIMALS

For use on domestic livestock (equine, cattle, swine, sheep and goats) to control ticks, lice, fleas, and sheep ked. Also for use on dogs: to control fleas and ticks, dust animal liberally and rub into hair. To treat quarters, apply 200 - 250 pounds per 20,000 square feet as a spray (25 - 50 pounds per 100 gallons of water). Apply thoroughly to all interior surfaces of quarters. Force spray into cracks and crevices. Repeat application as needed. **Note Physical and Chemical Hazards when applying this product.**

CHIGGERS

CHIGGER CONTROL: For control of chiggers in yard, cover entire lawn, flower garden, shrubs and any place chiggers may hide. This should be done a day or two before protection is desired and should be repeated at weekly intervals. Use approximately 2 pounds per 1000 sq. ft. in enough water for thorough coverage.



IMPORTANT: USE ONLY ACCORDING TO STATE RECOMMENDATIONS. WHEN USED AS DIRECTED THIS PRODUCT WILL PROVIDE EFFECTIVE AND ECONOMICAL CONTROL OF LISTED DISEASES AND INSECTS AND PROMOTE HEALTHY LUSH GROWTH.

WARRANTY STATEMENT

GEORGIA GULF SULFUR CORPORATION warrants that this product in its unopened package conforms to the chemical description on the label and is reasonably fit for the purposes set forth on the label when used according to directions under normal use conditions on the crops specified. There are no other warranties, expressed or implied, concerning the use of this product other than indicated on the label. This warranty does not extend to the handling or use of this product contrary to label instruction or under abnormal conditions or under conditions not reasonably foreseeable to seller and buyer assumes all risk of any such use.

ASP 071910

Appendix 3
Sulfur Registration Review Summary Document

Docket Number: EPA-HQ-OPP-2008-0176
www.regulations.gov

Sulfur Registration Review Summary Document: Initial Docket March 2008

Case #0031

Approved By:

3/19/08

Steve Bradbury, Ph.D.
Director, Special Review and
Reregistration Division

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I. PRELIMINARY WORK PLAN

Introduction:

The Food Quality Protection Act of 1996 mandated a new program: registration review. All pesticides distributed or sold in the United States generally must be registered by EPA, based on scientific data showing that they will not cause unreasonable risks to human health, workers, or the environment when used as directed on product labeling. The new registration review program is intended to make sure that, as the ability to assess risk evolves and as policies and practices change, all registered pesticides continue to meet the statutory standard of no unreasonable adverse effects. Changes in science, public policy, and pesticide use practices will occur over time. Through the new registration review program, the Agency periodically reevaluates pesticides to make sure that as change occurs, products in the marketplace can be used safely. Information on this program is provided at: http://www.epa.gov/oppsrrd1/registration_review/.

The Agency has begun to implement the new registration review program, and will review each registered pesticide every 15 years to determine whether it continues to meet the FIFRA standard for registration. The public phase of registration review begins when the initial docket is opened for each case. The docket is the Agency's opportunity to state what it knows about the pesticide and what additional risk analyses and data or information it believes are needed to make a registration review decision. After reviewing and responding to comments and data received in the docket during this initial comment period, the Agency will develop and commit to a final work plan and schedule for the registration review of sulfur.

Elemental sulfur is a naturally occurring component of the earth's core and crust and is ubiquitous in the environment. Sulfur has been used as a pesticide in the United States since the 1920s, and is currently registered for use as an insecticide and fungicide on a wide range of field and greenhouse-grown food and feed crops, livestock (and livestock quarters), and indoor and outdoor residential sites. Use sites include tree fruit, berries, vegetables, root crops, field crops, pets (dogs), ornamentals, and turf (including residential lawns and golf courses). Sulfur is also one of the active ingredients in four fumigant (gas-producing) cartridge products which are used for rodent control on lawns, golf courses, and in gardens.

Anticipated Risk Assessment and Data Needs:

Ecological Risk:

The Agency anticipates conducting a comprehensive ecological risk assessment, including an endangered species assessment, for all outdoor and gas-cartridge uses of sulfur. No additional data are required at this time.

- In 1991, the EPA issued a Reregistration Eligibility document (RED) for sulfur. The Agency concluded that since sulfur is a ubiquitous element in the

environment and an essential nutrient for some organisms, it appears to pose little risk to non-target species.

- Available acute toxicity studies support this conclusion, indicating that sulfur is practically nontoxic on an acute basis to birds, mammals, insects, freshwater fish, and freshwater and estuarine/marine invertebrates.

- All other ecological effects data are waived at this time. EPA will complete an open literature search using the ECOTOX database to look for toxic effects in non-target taxa. If additional data exist, an evaluation will be made as to whether or not the data are adequate for use in a risk assessment.

- All environmental fate data requirements for sulfur also have been waived because sulfur is a naturally occurring element whose behavior in the environment is well-understood and described in published literature.

- The Agency plans to conduct a new ecological risk assessment for the outdoor and gas-cartridge uses of sulfur to support a complete endangered species determination. The planned assessment will allow the Agency to determine whether sulfur use has "no effect" or "may affect" federally listed threatened or endangered species (listed species) or their designated critical habitat. If the assessment indicates that sulfur "may affect" a listed species or its designated critical habitat, the assessment will be refined. The refined assessment will allow the Agency to determine whether the use of sulfur is "likely to adversely affect" the species or critical habitat or "not likely to adversely affect" the species or critical habitat. When an assessment concludes that a pesticide's use "may affect" a listed species or its designated critical habitat, the Agency will consult with the U.S. Fish and Wildlife Service and/or National Marine Fisheries Service (the Services), as appropriate.

Human Health Risk:

The Agency anticipates conducting new occupational and residential exposure assessments for all uses of sulfur. Based on reported incidents, a subchronic inhalation study is required to assess risk to handlers.

- The most recent and comprehensive human health risk assessment for sulfur was conducted in 1990 to support the 1991 RED. Based on the natural occurrence of sulfur in food and in the environment, EPA determined that sulfur is generally recognized as safe for use as a pesticide and is exempted from tolerances. As a result, no dietary, residential, or aggregate risk assessment was conducted. No new dietary or aggregate risk assessment is needed at this time.

- The EPA Inert Ingredient Focus Group assessed sulfur as a member of the "weathered materials" inert ingredients in 2002. EPA re-evaluated and reaffirmed the tolerance exemption for sulfur at that time.

- In response to California incident data, a qualitative occupational risk assessment was conducted which recommended that a 24-hour re-entry interval be established for foliar applications, and that workers wear personal protective equipment such as coveralls, chemical-resistant gloves, and goggles during mixing, loading and application.

- Acute toxicity is low. Acute oral toxicity is category IV, while acute dermal and inhalation are category III. Sulfur is an eye and skin irritant (Category III), but it is not a skin sensitizer. No subchronic or chronic toxicity studies are available.

- However, due to the large number of reported incidents associated with the use of sulfur, in particular incidents related to respiratory problems, a subchronic inhalation study is required to assess risk to handlers.

- During registration review, EPA will further examine reported incidents for sulfur and will revise the human health incident report prior to issuing a DCI. If the revised report indicates that current PPE requirements are adequate to protect handlers, or if the Agency receives information during the comment period to indicate that a subchronic inhalation study is unnecessary, a DCI will not be issued.

- EPA will conduct a quantitative occupational and residential exposure assessment.

Timeline:
EPA has created the following estimated timeline for the completion of the sulfur registration review.

Registration Review of Sulfur: Projected Registration Review Timeline	
Activities	**Estimated Year/Month**
Phase 1: Opening the docket	
Open Public Comment Period for Sulfur	2008 — March
Close Public Comment Period	2008 — June
Phase 2: Case Development	
Final Work Plan (FWP)	2008 — July–Sept.
Issue DCI	2009 — April–June
Data Submission	2011 — April–June
Preliminary Risk Assessment and Public Comment	2012 — Oct.–Dec.
Close Public Comment Period	2013 — Jan.–March
Phase 3: Registration Review Decision	
Proposed Registration Review Decision	2013 — April–June
Public Comment Period	2013 — July–Sept.

Final Registration Review Decision and Begin Post-Decision Follow-up	2013 — Oct.–Dec.
Total (years)	5

Guidance for Commenters:

The public is invited to comment on EPA's preliminary registration review work plan and rationale. The Agency will carefully consider all comments as well as any additional information or data provided prior to issuing a final work plan for the sulfur case.

Through the registration review process, the Agency intends to solicit information on trade irritants and, to the extent feasible, take steps toward facilitating irritant resolution. Growers and other stakeholders are asked to comment on any trade irritant issues resulting from lack of Maximum Residue Levels (MRLs) or disparities between U.S. tolerances and MRLs in key export markets, providing as much specificity as possible regarding the nature of the concern. There are no U.S. tolerances for sulfur, nor are there Codex MRLs, so trade irritants are not expected for sulfur.

Sulfur is not identified as a cause of impairment for any water bodies listed as impaired under section 303(d) of the Clean Water Act, based on information provided at http://oaspub.epa.gov/tmdl/waters_list.impairments?p_impid=3. The Agency invites submission of water quality data for this pesticide. To the extent possible, data should conform to the quality standards in Appendix A of the "OPP Standard Operating Procedure: Inclusion of Impaired Water Body and Other Water Quality Data in OPP's Registration Review Risk Assessment and Management Process" (see: http://www.epa.gov/oppfead1/cb/ppdc/2006/november06/session1-sop.pdf), in order to ensure they can be used quantitatively or qualitatively in pesticide risk assessments.

EPA seeks to achieve environmental justice, the fair treatment and meaningful involvement of all people, regardless of race, color, national origin, or income, in the development, implementation, and enforcement of environmental laws, regulations, and policies. To help address potential environmental justice issues, the Agency seeks information on any groups or segments of the population who, as a result of their location, cultural practices, or other factors, may have atypical, unusually high exposure to sulfur used as a pesticide, compared to the general population. Please comment if you are aware of any sub-populations that may have atypical or unusually high exposure compared to the general population.

Stakeholders are also specifically asked to provide information and data that will assist the Agency in refining the human health and ecological risk assessments, including any species-specific effects determinations. The Agency is interested in the following information:

1. Confirmation on the following label information.
    a. sites of application
    b. formulations
    c. application methods and equipment

    d. maximum application rates in units related to mass per unit area of treatment zone
    e. frequency of application, application intervals, and maximum number of applications per season
    f. geographic limitations on use.
2. Use or potential use distribution (*e.g.*, acreage and geographical distribution of relevant uses).
3. Use history.
4. Median and 90th percentile reported use rates (lbs. a.i./acre) from usage data – national, state, and county.
5. Application timing (date of first application and application intervals) by use – national, state, and county.
6. Sub-county crop location data.
7. Usage/use information for non-agricultural uses (*e.g.*, golf courses, athletic fields, ornamentals).
8. Directly acquired county-level usage data (not derived from state level data).
    a. maximum reported use rate (lbs. a.i./acre) from usage data – county
    b. percent crop treated – county
    c. median and 90th percentile number of applications – county
    d. total pounds per year – county
    e. the year the pesticide was last used in the county/sub-county area
    f. the years in which the pesticide was applied in the county/sub-county area
9. Typical application interval (days).
10. State or local use restrictions.
11. Ecological incidents (non-target plant damage and avian, fish, reptilian, amphibian and mammalian mortalities) not already reported to the Agency.

Next Steps:

After the comment period closes, the Agency will review the comments received, and then issue a Final Work Plan for this pesticide.

II. FACT SHEET

Background Information:

- Sulfur Registration Review Case Number: 0031
- Sulfur PC Code: 077501
- Sulfur CAS#: 7704-34-9
- Technical Registrants (company number): Wilbur Ellis Co. (2935), Georgia Gulf Sulfur Corp. (6325), Gowan Co. (10163), Drexel Chemical Co. (19713), Quimetal Industrial S.A. (62562), Biesterfeld U.S., Inc. (62575), Arysta Lifescience North America Corp. (66330), Integro, Inc. (79702), and Martin Operating Partnership, LP (82571).
- First U.S. registration in the 1920s.
- No U.S. tolerances.
- Special Review and Reregistration Division (SRRD), Chemical Review Manager (CRM): Véronique C. LaCapra (lacapra.veronique@epa.gov)
- Registration Division (RD) contacts: Tamue Gibson (gibson.tamue@epa.gov) and Mary Waller (waller.mary@epa.gov)

Use & Usage Information:

For additional details, please refer to the BEAD *Appendix A* document in the sulfur docket.

- Sulfur is an insecticide and fungicide.
- Based on the natural occurrence of sulfur in food and in the environment, EPA determined that sulfur is exempt from tolerances.
- Sulfur is currently registered for use under FIFRA Section 3 as an insecticide and fungicide on a wide range of field and greenhouse-grown food and feed crops, livestock (and livestock quarters), and indoor and outdoor residential sites. Use sites include tree fruit, berries, vegetables, root crops, field crops, pets (dogs), ornamentals, and turf (including residential lawns and golf courses). Sulfur is also one of the active ingredients in four fumigant (gas-producing) cartridge products which are used for rodent control on lawns, golf courses, and in gardens.
- Sulfur is formulated as a dust, wettable powder, water dispersible granules (dry flowable), emulsifiable concentrate, flowable concentrate, liquid, liquid ready-to-use, and gas cartridge.
- Sulfur can be applied via aircraft, groundboom, ground dust rig, sprinkler irrigation, soil incorporation, pneumatic applicator, handheld sprayer, backpack sprayer, hand-held duster, spoon, and by hand.

Recent Actions:

- The most recent and comprehensive ecological and human health risk assessments for sulfur were completed in support of the 1991 Reregistration Eligibility Decision (RED). Since the RED was completed, there have been no new regulatory actions for sulfur (other than “me-too” registrations).

Ecological Risk Assessment Status:
Please refer to Section III, Ecological Risk Assessment Problem Formulation, for a detailed discussion of the anticipated ecological risk assessment needs. The following ecological outcomes and anticipated data needs are based on the limited data and risk assessments currently available:

- Since sulfur is a naturally-occurring element that is ubiquitous in the environment, it appears to pose little risk to non-target species. Available acute toxicity studies support this conclusion. All other ecological toxicity data requirements are waived, and no new data are required at this time.
- All environmental fate data requirements for sulfur have been waived because sulfur is a naturally occurring element whose behavior in the environment is well-understood and described in published literature.
- The Agency plans to conduct new ecological risk assessments for the outdoor and gas-cartridge uses of sulfur to support a complete endangered species determination.
- The Agency is interested in obtaining specific use information and other data outlined in Section III of this document.

Human Health Risk Assessment Status:
Please refer to Section IV of this document, Human Health Effects Scoping Document, for a detailed discussion of the anticipated risk assessment needs for human health. The following is a summary of those anticipated needs:

- The acute toxicity of sulfur is low: sulfur is classified as category IV for acute oral toxicity and category III for acute dermal and inhalation toxicity. Sulfur is an eye and skin irritant (category III), but it is not a skin sensitizer. No subchronic or chronic toxicity studies are available.

Dietary (Food and Water):

- Sulfur is a naturally-occurring element in food and the environment, and is insoluble in water. Consequently, sulfur is exempt from tolerances and no dietary risks are anticipated from exposure to sulfur in food or drinking water.
- The EPA Inert Ingredient Focus Group assessed sulfur as a member of the "weathered materials" inert ingredients in 2002. EPA also reassessed the tolerance exemption for sulfur.
- No new dietary (food or drinking water) assessment is needed at this time.

Residential:

- EPA did not conduct a residential risk assessment for the 1991 RED. Due to the large number of reported incidents for sulfur, EPA will conduct a residential risk assessment in Registration Review.

Occupational:

- In response to reported incidents in California, EPA conducted a qualitative occupational risk assessment for sulfur. Resulting mitigation included a 24-hour re-entry interval for foliar applications and the requirement that handlers wear

personal protective equipment such as coveralls, chemical-resistant gloves, and goggles during mixing, loading and application.

- Based on the large number of reported incidents, including many involving respiratory symptoms, EPA is requiring a subchronic inhalation study and will conduct a quantitative occupational risk assessment.
- Prior to issuing a DCI, EPA will complete a refined incident report. If the revised report indicates that current PPE requirements are adequate to protect handlers, or if the Agency receives information during the comment period to indicate that a subchronic inhalation study is unnecessary, a DCI will not be issued.

Incidents:

Ecological incidents:

- The Ecological Incident Information System (EIIS) lists three incidents associated with the use of sulfur, all resulting in damage to terrestrial plants. In one incident, there was reported damage to 127 acres of citrus treated directly with sulfur. The certainty index for this incident was "probable". A second incident report indicated damage to 44 acres of a grape vineyard treated directly with sulfur and trifloxysrobin. The symptoms noted were spotting and speckling. The certainty index for this incident was "possible" for sulfur and "probable" for trifloxystrobin. In the third reported incident a tank mixture of sulfur, fenarimol, and oxyfluorfen applied to 20-acre plot of grapes may have caused burnt leaves and berries. The certainty index for this incident was "unlikely" for sulfur and fenarimol, and "probable" for oxyfluorfen.
- No ecological incidents have been reported associated with the use of the rodent control, gas-producing cartridge products of sulfur.

Human health incidents:

- EPA has conducted a preliminary review of incident data for sulfur used as a pesticide.
- Sulfur was the active ingredient responsible for the largest numbers of acute occupational pesticide-related illnesses in the 1998-1999 Sensor data (78 cases). Most were cases involving farm workers performing routine work activities other than pesticide application. A preliminary review of other available data indicates that there are incidents associated with the application of sulfur pesticide products, as well.
- EPA will conduct a complete review of human incident data for sulfur prior to issuing a final Registration Review work plan.

Data Call-In Status:

No Data Call-In has been issued for sulfur.

Tolerances:

Currently no U.S. tolerances or Mexican, Canadian, or CODEX MRLs exist for sulfur.

Labels:
Nine technical registrations, one-hundred and fourteen end-products, and three Special Local Need registrations are currently active for sulfur. A full list of these products is available in the docket. Labels can be obtained from the Pesticide Product Label System (PPLS) website: http://oaspub.epa.gov/pestlabl/ppls.home. Technical registration numbers are listed, below:

Sulfur Technical Registrations			
Registration Number	**Product name**	**Company Name**	**Active Ingredient**
2935-480	Wilbur-Ellis Technical Sulfur	Wilbur Ellis Co.	Sulfur
6325-14	Yellow Jacket Sulfur Flowers	Georgia Gulf Sulfur Corp.	Sulfur
10163-141	Sulfur Base	Gowan Co.	Sulfur
19713-315	Drexel Sulfur Technical	Drexel Chemical Co.	Sulfur
62562-5	Sulphur Technical	Quimetal Industrial S.A.	Sulfur
62575-10	Global Technical Suffa	Biesterfeld U.S., Inc.	Sulfur
66330-229	Superfine Flour Sulfur	Arysta Lifescience N.A. Corp.	Sulfur
79702-2	Integro Sulfur Tech	Integro, Inc.	Sulfur
82571-2	CSC Technical Sulfur	Martin Operating Partnership, LP	Sulfur

III. ECOLOGICAL RISK ASSESSMENT PROBLEM FORMULATION

This section includes two problem formulation documents, the first of which begins on p. 13, and the second on p. 37.

The first addresses the majority of sulfur outdoor pesticidal uses. Sulfur is registered for use as an insecticide and fungicide on a wide range of field-grown food and feed crops, livestock (and livestock quarters), and outdoor residential sites. Use sites include tree fruit, berries, vegetables, root crops, field crops, ornamentals, and turf (including residential lawns and golf courses). The ecological problem formulation document that addresses these uses of sulfur is entitled, *"Problem Formulation for Ecological Risk Assessment for Sulfur."*

Sulfur is also one of the active ingredients in four fumigant (gas-producing) cartridge products which are used for rodent control on lawns, golf courses, and in gardens. These products also include the active ingredients carbon and inorganic (potassium or sodium) nitrate. The ecological problem formulation document that addresses these uses of sulfur is entitled,"*Problem Formulation for Ecological Risk Assessment, for Carbon Dioxide and Gas Fumigant Producing Cartridges: Carbon, Sawdust, Sodium Nitrate, Potassium Nitrate and Sulfur."*

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
PREVENTION, PESTICIDES AND
TOXIC SUBSTANCES

PC Code	077501
Case No.	0031
DP Barcode	346696

MEMORANDUM

DATE: February 7, 2008

SUBJECT: Problem Formulation for Ecological Risk Assessment for Sulfur

FROM: José Luis Meléndez, Chemist
Jean Holmes, DVM, Risk Assessment Process Leader
Environmental Risk Branch V
Environmental Fate and Effects Division (7507P)

THROUGH: Mah T. Shamim, Ph.D., Chief
Environmental Risk Branch V
Environmental Fate and Effects Division (7507P)

TO: Veronique LaCapra, Chemical Review Manager
Margaret Rice, Chief
Reregistration Branch II
Special Review and Reregistration Division

Please find attached the ecological risk assessment problem formulation for all sulfur uses except for the gas cartridge use. The sulfur gas cartridge use was addressed in the "Problem Formulation for Ecological Risk Assessment for Carbon Dioxide and Gas Fumigant Producing Cartridges: Carbon, Sawdust, Sodium Nitrate, potassium Nitrate and Sulfur".

Problem Formulation,
For Ecological Risk Assessment,
For Sulfur

List A
Case Number #0031

Environmental Fate and Effects Division
Office of Pesticide Programs
U.S. Environmental Protection Agency

Table of Contents

Problem Formulation

The purpose of this problem formulation is to provide the foundation for the ecological risk assessment that will be conducted for sulfur. It includes all sulfur uses except for the gas cartridge use. As such, it articulates the purpose and objectives of the risk assessment, evaluates the nature of the problem, and provides a plan for analyzing the data and characterizing the risk (EPA, 1998).

A. Nature of Regulatory Action

This report summarizes the Environmental Fate and Effects Division's Problem Formulation for the Registration Review of Sulfur. This chemical belongs to List A Case Number 0031. In 1991, the USEPA issued a Reregistration Eligibility document for Sulfur, which serves as the basis for this assessment (USEPA,1991). At the time, it was concluded that since sulfur is a ubiquitous element in the environment and an essential nutrient for some organisms, it appears to pose a small hazard to non-target organisms. This was supported by data that showed low order toxicity to various species tested.

B. Stressor Source and Distribution

1. Nature of the Chemical Stressor

Sulfur accounts for 15% of the inner core of the earth and 0.052% of its crust. It occurs both in free state and in combination, mainly as sulfides and sulfates (HSDB). Sulfur (CAS No. 7704-34-9; PC Code 077501) is a fungicide and insecticide with an atomic mass of 32.06 g/mol. It is insoluble in water. Table II.1 provides some basic characteristics of sulfur. The Fungicide Resistance Action Committee (FRAC) has designated sulfur as FRAC Code M2 (the only chemical in the group); the chemical belongs to the broader mode of action (MOA) of multi-site contact activity, belonging to the target site and code inorganic. Sulfur disrupts electron transport along the cytochromes. Its resistance risk is generally considered low.

Elemental Sulfur, when applied as a pesticide, will become incorporated into the natural sulfur cycle. The main processes and dissipation of elemental sulfur are oxidation into SO_4^{2-} and reduction into S^{2-} . These processes are mainly mediated by microbes.

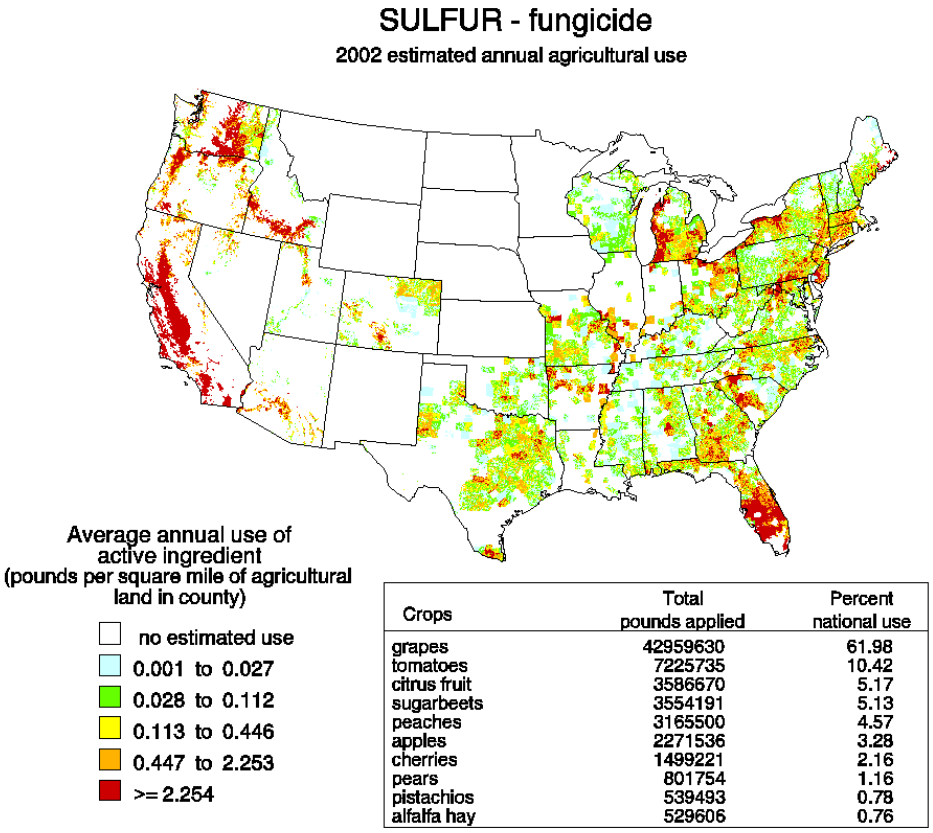
Figure II.1. Sulfur Deposit

Table II.1. Nature of the Chemical Stressor	
Common name	*Sulfur*
Chemical name	*Sulfur*
Pesticide type	*Fungicide, Insecticide, Acaricide*
Chemical class	*NA*
CAS number	*7704-34-9*
Empirical formula	*S*
Atomic mass (g/mol)	*32.064*
Color/Form	*Precipitated sulfur is in form of very fine, pale yellow, amorphous or microcrystalline powder*
Odor/Taste	*Odorless/Tasteless or Faint Taste*
Melting Point	*112.8 to 120°C*
Boiling Point	*444.6 °C*
Vapor pressure	*$3.95X10^{-6}$ mm Hg at 30.4°C*
Henry's Law Constant (atm-m^3/mol)	*NA*
Solubility in water	*Insoluble in Water*
Solubilities	*1 g/2 ml carbon disulfide* *~2.4% in benzene @ 30°C* *Sol in Toluene* *2.65% dissolves in acetone @ 25°C* *9.1% dissolves in methylene iodide @ 10°C* *~1.5% dissolves in chloroform @ 18°C*
log K_{OW}	*N/A*
PK_a/PK_b	*N/A*
NA=Not Available; Source HSDB (web); N/A=Not Applicable.	

2. Overview of Pesticide Usage

Sulfur is considered both a fungicide and an insecticide. Sulfur may be used on numerous crops and there are numerous products containing sulfur as the active ingredient. According to the USGS map (see Fig. II.2 below), sulfur is used all throughout the continental United States, but primarily in the East and West, South, and Midwest regions. The map does not represent a specific year, but rather shows typical use patterns over the five year period 1999 through 2004, with emphasis on the 2002 Census of Agriculture.

The Screening Level Usage Analysis (SLUA) represents available estimates of pesticide usage for sulfur when used on agricultural crops in the US. It can be assumed that data are the average pounds of active ingredient applied (sulfur) obtained by merging a variety of data sources. Also, the SLUA provides the average percent of crop treated and the maximum percent of crop treated. The SLUA does not provide data on non-agricultural uses.



Crops	Total pounds applied	Percent national use
grapes	42959630	61.98
tomatoes	7225735	10.42
citrus fruit	3586670	5.17
sugarbeets	3554191	5.13
peaches	3165500	4.57
apples	2271536	3.28
cherries	1499221	2.16
pears	801754	1.16
pistachios	539493	0.78
alfalfa hay	529606	0.76

- **Fig. II.2. 2002 Pesticide Use Maps, Sulfur fungicide**

Caution: The pesticide use maps available from the USGS site (http://ca.water.usgs.gov/pnsp/pesticide_use_maps/) show the average annual pesticide use intensity expressed as average weight (in pounds) of a pesticide applied to each square mile of agricultural land in a county. The area of each map is based on state-level estimates of pesticide use rates for individual crops that were compiled by the CropLife Foundation, Crop Protection Research Institute, based on information collected during 1999 through 2004 and on 2002 Census of Agriculture county crop acreage. The maps do not represent a specific year, but rather show typical use patterns over the five year period 1999 through 2004. Use intensity rates are expressed as the pounds applied per square mile of mapped agricultural land in a county. The area of mapped agricultural land for each county was obtained from an enhanced version of the 1992 USGS National Land Cover Data (NLCD). The key limitations of the data used to produce these maps include the following: (1) state use coefficients represent an average for the entire state and consequently do not reflect the local variability of pesticide management practices found within states and counties, (2) pesticide use estimates are not for a specific year, but represent typical use patterns for the five year period, (3) state pesticide use coefficients may not have been available for all states where a pesticide may have been applied to agricultural land, and therefore, are not displayed on the maps, (4) the county crop acreage is based on the 2002 Census of Agriculture and may not represent all crop acreage because of Census nondisclosure rules, and (5) agricultural land area used to calculate the pesticide use intensity and display the data was derived from 30-meter satellite remote sensing data that may over estimate or underestimate the actual agricultural land area. The maps are not intended for making local-scale estimates of pesticide use, such as estimates at the county level. Please refer to Method for Estimating Pesticide Use for a detailed discussion of how the pesticide use data were developed.

The SLUA, which is dated 12/05/2007, indicates that the crops of major use for sulfur are as summarized in Table II.2. It is noted that the first nine-ten crops in the SLUA and the USGS map are grapes, tomatoes, peaches, citrus, apples, cherries, sugar beets, pistachios and pears (approximately in the same order in both lists).

Table II.2. Sulfur Major Crops (at or exceeding 500,000 lb a.i. applied) According to SLUA dated 12/05/07.

Crop	lb a.i. applied	% Crop Trtd Ave	% Crop Trtd Max
Grapes	45,200,000	80	90
Tomatoes	6,400,000	50	60
Peaches	2,800,000	60	70
Oranges	1,600,000	10	20
Apples	1,600,000	30	35
Cherries	1,200,000	50	50
Grapefruit	1,000,000	40	65
Sugar beets	800,000	5	5
Pistachios	600,000	35	45
Pears	600,000	50	65
Strawberries	500,000	45	60
Prunes	500,000	25	40
Carrots	500,000	25	55

On the other hand, usage data available for the state of California [1] indicate that for the years 2003-2005, there was an increase in the total use of sulfur, as a pesticide, from 53,180,000 lb in 2003 to 61,230,000 lb in 2005. The major crops involved were tomatoes (processing), sugar beets, pistachios tomatoes and strawberries, approximately in that order.

Sulfur may be applied by chemigation, soil band treatment (ground sprayer, aircraft), soil treatment (soil incorporation treatment), low volume spray concentrate (low volume ground concentrate), high volume spray or dilute (high volume ground sprayer), or dust (ground or aircraft). Formulations include dust (D), water dispersible granules or dry flowable (DF), emulsifiable concentrate (EC), flowable concentrate (F1C), liquid (L), liquid ready-to-use (RTU), wettable powder (WP), and wettable powder/Dust (WP/P).

A sample label, Golden-Dew (Fungicide and Insecticide, Reg. No. 2935-407), provides some insight on how its registrant divided its use sites into various major categories:

Field Crops: such as alfalfa, cereals, clover, cotton, grass seed crops, hops, peanuts, soybeans, sugar beets, spearmint and peppermint

[1] California Department of Pesticide Regulations or CDPR, http://www.cdpr.ca.gov/docs/pur/purmain.htm), in a usage analysis prepared by BEAD on 11/28/07

Vegetable Crops: such as asparagus, beans and peas, carrots, garlic, peppers and onions, celery, broccoli, cauliflower and others, lettuce, melons and squash, turnips and others, potatoes, and tomatoes.

Fruits, Nuts and Berries: such as almond, apples, avocadoes, berries (various), citrus, figs, grapes, mangos, pears, pecans, pistachios, stone fruits (various), strawberries, walnuts and macadamias.

Ornamentals: such as laurels, chrysanthemums, juniper, spruce, English ivy, petunia, sage, cosmos, dogwood, hibiscus, holly, Lady's, lilac, sunflower and violets.

In this sample label, application rates for sulfur range from 3 to 30 lb a.i./A. Variation in application rate is probably related to crop and their tolerance to the chemical. However, there are a few other labels with application rates up to 122.5 1b a.i./A.

C. Receptors

1. Aquatic and Terrestrial Effects

The receptor is the biological entity that is exposed to the stressor (EPA, 1998.) Due to the outdoor uses of sulfur, the types of receptors that may be exposed to sulfur include both aquatic and terrestrial receptors, such as plants, birds, reptiles, mammals and freshwater and estuarine/ marine fish and non-target invertebrates. This list may not be comprehensive.

Consistent with the process described in the Overview Document (EPA, 2004), this risk assessment uses a surrogate species approach in its evaluation of sulfur. Toxicological data generated from surrogate test species, which are intended to be representative of broad taxonomic groups, are used to extrapolate to potential effects on a variety of species (receptors) included under these taxonomic groupings.

There are seven acceptable studies on the ecological effects of sulfur. These studies indicate that sulfur is practically nontoxic on an acute basis. An eight day dietary study conducted on bobwhite quail resulted in an LC_{50} value of > 5620 ppm. In that study, one mortality was reported at a test concentration of 1780 ppm. An acute oral rat toxicity study resulted in an LD_{50} value of > 5g/kg with no mortalities reported. A study conducted on two fish species, rainbow trout and bluegill sunfish, resulted in an LC_{50} value of >180 ppm. The study results of a 48 hour acute toxicity study conducted on daphnia and a 96 hour mysid shrimp study resulted in LC_{50} values of >5,000 and 736 ppm respectively. Two beneficial insect studies demonstrated that sulfur is low in toxicity to the honey bee through contact and ingestion. All other ecological effects data are waived. No additional aquatic data are required due to the insoluble nature of sulfur and the low toxicity indicated in the available data. No chronic data are required based on, 1) the available acute toxicity data indicating that sulfur is practically nontoxic, and 2) the fact that sulfur in nature is ubiquitous and chronic exposure is common.

Available open literature will also be used to evaluate the potential direct effects of sulfur to the aquatic and terrestrial receptors identified in this section. This includes toxicity data on the technical grade active ingredient, and when available, formulated products.

At this time, a full and complete ECOTOX search has not been performed, but will be conducted prior to issuance of any Data Call-in. The open literature studies will be identified through EPA's ECOTOX database (http://cfpub.epa.gov/ecotox/), which employs a literature search engine for locating chemical toxicity data for aquatic life, terrestrial plants, and wildlife. The evaluation of data can also provide insight into the direct and indirect effects of sulfur on biotic communities from loss of species that are sensitive to the chemical and from changes in structure and functional characteristics of the affected communities.

Table II.3 provides a summary of the taxonomic groups and the surrogate species tested to help understand potential acute ecological effects of pesticides to these non-target taxonomic groups. In addition, the table provides a preliminary overview of the potential acute toxicity of sulfur by providing the acute toxicity classifications.

Table II.3. Test Species Evaluated for Assessing Potential Ecological Effects of Sulfur and the Associated Acute Toxicity Classification

Taxonomic Group	Example(s) of Surrogate Species	Acute Toxicity Classification
Birds[1]	Mallard (*Anas platyrhynchos*) Bobwhite (*Colinus virginianus*)	Practically non-toxic
Mammals	Laboratory rat (*Rattus norvegicus*)	Practically non-toxic
Insects	Honey bee (*Apis mellifera L.*)	Practically non-toxic
Freshwater fish[2]	Bluegill sunfish (*Lepomis macrochirus*) Rainbow trout (*Oncorhynchus mykiss*)	Practically non-toxic
Freshwater invertebrates	Water flea (*Daphnia magna*)	Practically non-toxic
Estuarine/marine fish	Sheepshead minnow *(Cyprinodon variegatues)*	Data waived
Estuarine/marine invertebrates	Mysid shrimp *(Americamysis bahia)* Eastern oyster (*Crassostrea virginica)*	Practically non-toxic
Terrestrial plants[3]	Monocots – corn (*Zea mays*) Dicots – soybean (*Glycine max*)	Data waived
Aquatic plants and algae	Duckweed (*Lemna gibba*) Green algae (*Selenastrum capricornutum*)	Data waived

[1] Birds represent surrogates for terrestrial-phase amphibians and reptiles.
[2] Freshwater fish may be surrogates for aquatic-phase amphibians.
[3] Four species of two families of monocots, of which one is corn; six species of at least four dicot families, of which one is soybeans.

Incident Reports

There were a total of three terrestrial plant incidents in the United States found in the Ecological Incident Information System (EIIS). In one incident, there was reported damage to 127 acres of citrus treated directly with sulfur. The symptoms were described as "miscellaneous". It is unknown as to whether the application was made according to label guidelines. Also, no chemical analysis was conducted. The certainty index for this

incident was probable. The second incident report indicated damage to 44 acres of a grape vineyard treated directly with sulfur and trifloxysrobin. The symptoms noted were spotting and speckling. The application rate and method were not reported for sulfur but were reported for trifloxystrobin. The certainty index for this incident was possible for sulfur and probable for trifloxystrobin. Available terrestrial plant data for trifloxystrobin result in an EC_{25} greater than the highest concentration tested; therefore an assessment of risks is not possible. However, another strobilurin fungicide is highly toxic to terrestrial plants. In the third reported incident a tank mixture of sulfur, fenarimol, and oxyfluorfen applied to 20-acre plot of grapes may have caused burnt leaves and berries. The certainty index for sulfur and fenarimol was unlikely and was probable for oxyfluorfen. The plant damage was more likely caused by the herbicide oxyfluorfen rather than to the fenorimol and sulfur fungicides. No incidents of contamination of surface, ground and drinking water have been reported to the Agency.

2. Ecosystems Potentially at Risk

The ecosystems at risk are often extensive in scope, and as a result it may not be possible to identify specific ecosystems during the development of a baseline risk assessment. However, in general terms, terrestrial ecosystems potentially at risk due to the use of sulfur, could include the treated field and areas immediately adjacent to the treated field that may receive drift or runoff. Areas adjacent to the treated field could include cultivated fields, fencerows and hedgerows, meadows, fallow fields or grasslands, woodlands, riparian habitats and other uncultivated areas. As mentioned earlier, sulfur may be used on multiple crops.

Aquatic ecosystems potentially at risk due to the use of sulfur include water bodies adjacent to, or down stream from, the treated field and might include impounded bodies such as ponds, lakes and reservoirs, or flowing waterways such as streams or rivers. For uses in coastal areas, aquatic habitat also includes marine ecosystems, including estuaries. Sulfur is insoluble in water; therefore, its use is not expected to result in exposure to aquatic ecosystems.

D. Assessment Endpoints

Assessment endpoints are defined as "explicit expressions of the actual environmental value that is to be protected." Defining an assessment endpoint involves two steps: 1) identifying the valued attributes of the environment that are considered to be at risk; and 2) operationally defining the assessment endpoint in terms of an ecological entity (*i.e.*, a community of fish and aquatic invertebrates) and its attributes (*i.e.*, survival and reproduction). Therefore, selection of the assessment endpoints is based on valued entities (*i.e.*, ecological receptors), the ecosystems potentially at risk, the migration pathways of pesticides, and the routes by which ecological receptors are exposed to pesticide-related contamination. The selection of clearly defined assessment endpoints is important because they provide direction and boundaries in the risk assessment for addressing risk management issues of concern. Changes to assessment endpoints are typically estimated from the available toxicity studies, which are used as the measures of

effects to characterize potential ecological risks associated with exposure to pesticides, such as sulfur.

To estimate exposure concentrations, the ecological risk assessment considers a single application at the maximum application rate to fields that have vulnerable soils. The most sensitive toxicity endpoints are used from surrogate test species to estimate treatment-related direct effects on acute mortality and chronic reproductive, growth and survival assessment endpoints. Toxicity tests are intended to determine effects of pesticide exposure on birds, mammals, fish, terrestrial and aquatic invertebrates, and plants. These tests include short-term acute, sub-acute, and reproduction studies and are typically arranged in a hierarchical or tiered system that progresses from basic laboratory tests to applied field studies. The toxicity studies are used to evaluate the potential of a pesticide to cause adverse effects, to determine whether further testing is required, and to determine the need for precautionary label statements to minimize the potential adverse effects to non-target animals and plants.

The submitted ecological toxicity data indicate that sulfur is practically nontoxic on an acute toxicity basis and all other ecological toxicity data were waived. An open literature search will be conducted to determine any additional relevant endpoints.

E. Conceptual Model

For a pesticide to pose an ecological risk, it must reach ecological receptors in biologically significant concentrations. An exposure pathway is the means by which a pesticide moves in the environment from a source to an ecological receptor. For an ecological pathway to be complete, it must have a source, a release mechanism, an environmental transport medium, a point of exposure for ecological receptors, and a feasible route of exposure.

A conceptual model provides a written description and visual representation of the predicted relationships between sulfur, potential routes of exposure, and the predicted effects for the assessment endpoint. A conceptual model consists of two major components: risk hypothesis and a conceptual diagram (EPA, 1998).

1. Risk Hypothesis

For sulfur, the following ecological risk hypothesis is being employed for this baseline risk assessment:

> *Given the large annual sulfur usage and the high application rates, sulfur when used in accordance with the label, may result in potential adverse effects upon survival of non-target terrestrial organisms.*

2. Conceptual Diagram

The conceptual site model is a generic graphic depiction of the risk hypothesis, and assumes that as an fungicide/ insecticide with a multi-site contact activity (disrupts

electron transport along the cytochromes) mode of action, sulfur, which has outdoor uses, is capable of affecting terrestrial and aquatic animals provided that environmental concentrations are sufficiently elevated as a result of proposed label uses. Through a preliminary iterative process of examining available data, the conceptual model (i.e., the representation of the risk hypothesis) has been refined to reflect the likely exposure pathways and the organisms that are most relevant and applicable to this assessment (Figure II.2). It includes the potential pesticide or stressor (sulfur), the sources and/ or transport pathways, exposure media, exposure points, biological receptor types, and attributes changes.

In the specific case of sulfur, the source and mechanism of release of the chemical may be applied by chemigation, soil band treatment (ground sprayer, aircraft), soil treatment (soil incorporation treatment), low volume spray concentrate (low volume ground concentrate), high volume spray or dilute (high volume ground sprayer), or dust (ground or aircraft) to an agricultural or ornamental plants field. Surface runoff from the areas of application is assumed to depend on factors such as topography, irrigation, and rainfall events; however, due to the fact that sulfur is insoluble in water, this compound is expected to runoff in large rain events (it is insoluble in water), possibly as eroded insoluble particles, depending on the application rate.

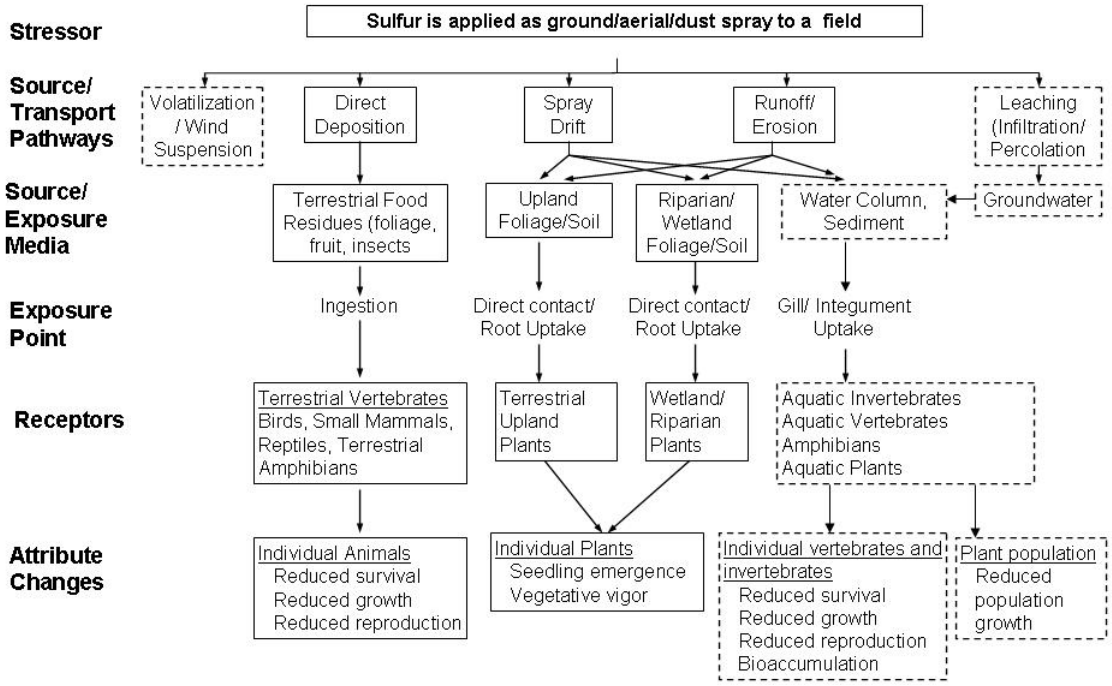
Additional transport mechanisms include spray drift and wind erosion (*e.g,* when applied aerially), which may potentially transport contaminants to the surrounding sites. In addition, direct deposition may result in contamination of food items that may be consumed by terrestrial organisms. Sulfur is believed to be relatively reactive in soils with high bacteria population, where it is oxidized to a sulfate; therefore, long-term exposure of non-target organisms to sulfur is uncertain.

For aquatic receptors, the major point of exposure is through direct contact with the water column, sediment, and pore water (gill/ integument) contaminated with spray drift (from spray and aerial applications) and/ or runoff (which appears to be a minor route) from treated areas. Indirect effects to aquatic organisms (especially fish) can also occur through impact to various food chains. However, due to the fact that sulfur is insoluble in water, minimal exposure is expected. Sulfur exposure to terrestrial animals could occur through ingestion of contaminated food items such as grass, foliage, and small insects. Exposure to plants may occur mostly through direct contact, since root uptake is unlikely (due to low or no solubility of sulfur). On the other hand, root uptake of sulfate, the major derivative of sulfur, is beneficial to plants (this form of sulfur constitutes a needed nutrient to the plants).

Based on a review of the available data, it is hypothesized that terrestrial receptors may potentially be at risk from sulfur exposure. This is based on potential exposure due to the large application rates (ex. 122.5 lb a.i./A). The exposure to aquatic organisms is lower or minimal because sulfur is insoluble. The representative terrestrial receptors are certain mammals, birds and plants. The attribute changes used to assess risk for terrestrial receptors depend on the type of test (*e.g.*, reduced survival, growth, or reproduction). Although a full evaluation of risk to aquatic and terrestrial animals and plants was not possible due to the lack of a whole toxicity data set, based on the data available, it is not

expected that sulfur will be of any toxic concern. Sulfur appears to be relatively non-toxic.

Figure II.2. Ecological Conceptual Exposure Model for Screening-Level Risk Assessment of Sulfur Applied to Agricultural or Ornamentals Fields



F. Analysis Plan Options

1. Conclusions from Previous Risk Assessments

In 1991, a Reregistration Eligibility Document (RED) was issued for sulfur. At the time, it was concluded that since sulfur is a ubiquitous element in the environment and an essential nutrient for some organisms, it appears to pose a small hazard to non-target organisms. This is supported by data that shows low order of toxicity to various species tested. There was a concern that, upon oxidation, elemental sulfur forms sulfuric acid, which may acidify soil and water. At the time, it was recommended that lime, *i.e.* calcium carbonate, was applied, to neutralize the acidity produced by the sulfur. It was also concluded that elemental sulfur should not pose a problem to the environment because it rapidly incorporates into the natural sulfur cycle.

2. Preliminary Identification of Data Gaps

All environmental fate data requirements for sulfur are waived based on the availability of public information. The following notes were mostly taken from the 1991 RED.

Elemental sulfur, applied as pesticide or soil amendment, will become incorporated into the natural sulfur cycle. The fate of sulfur is dependent on environmental redox conditions. Under aerobic conditions, elemental sulfur is oxidized to SO_4^{2-} via microbial metabolism. The dissipation of SO_4^{2-} is dependent on leaching and soil organic matter immobilization. Under anaerobic conditions, elemental sulfur is reduced to S^{2-} via microbial metabolism. The subsequent fate of S^{2-} is dependent on metal sulfide precipitation or volatilization of H_2S. Therefore, elemental sulfur should not pose an environmental problem because it dissipates rapidly into the natural environment.

The major environmental concern with elemental sulfur is that upon oxidation it forms sulfuric acid, which can acidify soil or water ecosystems. In soil management systems, elemental sulfur is a common soil amendment used to acidify calcareous soil and increase the sulfur fertility; it is expected to have a similar effect when used as a pesticide. In soil and water management systems, the application of lime, *i.e.* $CaCO_3$, is recommended to neutralize the acidity generated via sulfur oxidation.

Elemental sulfur dissipation requires, as a first step, usually, the sulfur oxidation, which depends to a high degree on the particle size distribution of the elemental sulfur; small particles will oxidize faster than larger particles. When sulfur is finely ground, and mixed with soil, it is oxidized to sulfate by soil microorganisms. Oxidation also depends on the microfloral population in soil, characteristics of the sulfur source, and the soil redox potential.

The total sulfur content in mineral soil, is approximately 700 µg/g. A large fraction of the soil sulfur is bound in soil organic matter (*e.g.* 95%); otherwise, the sulfur is in inorganic forms. The sulfur associated with soil organic matter can be roughly separated into humic acid bound sulfur (C-S bonding) and HI reducible S (sulfate esters and sulfamates). The cycling of organic sulfur components is dependent on mineralization via microbial exoenzyme (sulfohydrolases) or biological oxidation (respiration). Hence, in non-saline soil, organic matter cycling controls the sulfur chemistry.

The inorganic sulfur cycle is dependent on redox conditions. Sulfur can exist in nine different oxidation states, which range from S^{2-} to S^{6+}. In nature, the predominate sulfur species are sulfate (SO_4^{2-}) and sulfide (S^{2-}, HS^- and H_2S). The fate of elemental sulfur in aerobic environments is dependent upon oxidation to SO_4^{2-} via a microbially-mediated process. Elemental sulfur oxidation occurs when the redox potential exceeds a pe+pH of 4. The oxidation of sulfur leads to formation of sulfuric acid, which may decrease the pH of some soils and shallow water bodies. Elemental sulfur, in fact, is used as a soil amendment to supplement sulfur fertility.

The dissipation of sulfate is dependent upon leaching and inorganic matter immobilization. In acid and near-neutral soils, sulfate can precipitate as gypsum ($CaSO_4 \cdot 2H_2O$) when the soil solution SO_4^{2-} activity exceeds $10^{-2.5}$ M; however, in calcareous soil, gypsum precipitation requires a much higher soil solution SO_4^{2-} activity. Gypsum can be a persistent mineral in soils formed under semiarid to arid climatic conditions; otherwise, it is not expected to persist as a secondary soil mineral. Sulfate

can also be adsorbed to aluminum oxides and silicate clays by ligand binding (replacement of hydroxyl). These soil retention mechanisms, *e.g.*, precipitation and adsorption, cannot prevent SO_4^{2-} leaching. *Since sulfate is a ubiquitous species, it should not pose any environmental risk to ground or surface water pollution. In addition, microbes and plants can assimilate SO_4^{2-} with subsequent immobilization into organic compounds (cysteine, cystine, and methionine).*

No additional ecological effects data are required for sulfur. Sulfur is not soluble in water and the available data indicate low order toxicity to the four aquatic species tested. In addition to the fact that sulfur is ubiquitous in nature and chronic exposure is common, the available ecotoxicity data on terrestrial organisms indicate that sulfur is practically nontoxic on an acute basis. However, an open literature search will be completed to determine any additional relevant endpoints for non-target taxa.

Status of Data Requirements

Ecological Effects

The available ecotoxicity data on seven species suggest a low order of toxicity for sulfur. No additional data are required; however, an open literature search will be completed to determine any relevant endpoints for non-target taxa. If data are available, an evaluation will be made as to whether or not the data are adequate for use in a risk assessment. The Agency uses the ECOTOX database as its mechanism for searching the open literature. ECOTOX integrates three previously independent databases - AQUIRE, PHYTOTOX, and TERRETOX - into a system which includes toxicity data derived predominately from the peer-reviewed literature, for aquatic life, terrestrial plants, and terrestrial wildlife, respectively. At this point in time, a full and complete ECOTOX search has not been performed, but will be done prior to issuance of any Data Call-In.

Environmental Fate

All environmental fate data requirements for sulfur have been waived based on the availability of public information.

3. Measures of Effects and Exposure

The preliminary assessment of sulfur indicates that there is low risk associated with the use of sulfur. There is no evidence to suggest a hazard to the environment or to non-target organisms when this pesticide is used according to the label.

For a chemical, a number of measures of exposure are used, which are the measures of stressor existence and movement in the environment and their contact or co-occurrence with the assessment endpoint. Measures of exposure are potentially estimated using models. Aquatic exposure usually consists of aquatic EECs derived using a water-body that is vulnerable and representative of static ponds and first order waterways. Terrestrial exposure is usually estimated using a model that assumes a direct application to a variety of avian, mammal and reptilian food items. Exposure to terrestrial plants is usually

estimated using a model that assumes sulfur drifts or moves with runoff to adjacent habitats. Models require quantitative measurements for endpoints to evaluate the effects of the chemicals on the various species. In the absence of standard environmental fate studies, these measures of exposure could not be modeled.

Table II.4 provides a summary of the assessment endpoints previously identified as survival, growth and reproduction along with the measure of effects and exposure.

Table II.4. Measures of Ecological Effects and Exposure for Sulfur

Assessment Endpoint		Surrogate Species and Measures of Ecological Effect[1]	Measures of Exposure
Birds[2]	Survival	Bobwhite acute oral LD_{50} (data waived) Bobwhite and mallard subacute dietary LC_{50} (Bobwhite quail LC_{50} >5620 ppm)	Maximum residues on food items (foliar)
	Reproduction and growth	Bobwhite and mallard chronic reproduction NOAEC and LOAEC (data waived)	
Mammals	Survival	Laboratory rat acute oral LD_{50} LD_{50} = >5g/kg	
	Reproduction and growth	Laboratory rat oral reproduction chronic NOAEC and LOAEC (data waived)	
Freshwater fish[3]	Survival	Rainbow trout and bluegill sunfish acute LC_{50} (LC_{50} >180 ppm for rainbow trout and bluegill sunfish)	Peak EEC[4]
	Reproduction and growth	Fathead minnow chronic (early life-stage) NOAEC and LOAEC (data waived)	60-day average EEC[4]
Freshwater invertebrates	Survival	Water flea (and other freshwater invertebrates) acute $EC_{50.}$ (Daphnia $EC_{50.}$ >5,000)	Peak EEC[4]
	Reproduction and growth	Water flea chronic (life cycle) LOAEC (data waived)	21-day average EEC[4]
Estuarine/marine fish	Survival	Sheepshead minnow acute LC_{50} (data waived)	Peak EEC[4]
	Reproduction and growth	Sheepshead minnow chronic (early life-stage) NOAEC and LOAEC (data waived)	60-day average EEC[4]
Estuarine/marine invertebrates	Survival	Eastern oyster acute EC_{50} and mysid acute LC_{50} (Mysid shrimp LC_{50}	Peak EEC[4]

Assessment Endpoint		Surrogate Species and Measures of Ecological Effect[1]	Measures of Exposure
		736 ppm)	
	Reproduction and growth	Mysid chronic NOAEC and LOAEC (data waived)	21-day average EEC[4]
Terrestrial plants[5]	Survival and growth	Monocot and dicot seedling emergence and vegetative vigor EC_{25}, EC_{05}, and NOAEC values (data waived)	Estimates of runoff and spray drift to non-target areas
Insects	Survival (not quantitatively assessed)	Honeybee acute contact LD_{50} (data waived)	Maximum application rate
Aquatic plants and algae	Survival and growth	Algal and vascular plant (i.e., duckweed) EC_{50} and NOAEC values for growth rate and biomass measurements (data waived)	Peak EEC

[1] If species listed in this table represent most commonly encountered species from registrant-submitted studies, risk assessment guidance indicates most sensitive species tested within taxonomic group are to be used for baseline risk assessments.
[2] Birds represent surrogates for amphibians (terrestrial phase) and reptiles.
[3] Freshwater fish may be surrogates for amphibians (aquatic phase).
[4] One in 10-year return frequency.
[5] Four species of two families of monocots - one is corn, six species of at least four dicot families, of which one is soybeans. LD_{50} = Lethal dose to 50% of the test population; NOAEC = No observed adverse effect concentration; LOAEC = Lowest observed adverse effect concentration; LC_{50} = Lethal concentration to 50% of the test population; EC_{50}/EC_{25} = Effect concentration to 50%/25% of the test population.

4. Endangered Species Considerations

Pesticide ecological risk assessments for registration review will address Endangered Species Act, Section 7 (a)(2) obligations. The data available on terrestrial species (mammalian, avian, honey bee) and aquatic species (rainbow trout, bluegill sunfish, daphnia, and mysid shrimp) indicate that sulfur is acutely nontoxic to these species. Sulfur use is not expected to pose an aquatic risk based on the results of available data on aquatic organisms and the insolubility of the compound. The use of sulfur is not expected to pose terrestrial risk based on available toxicity data results and the fact that sulfur in nature is ubiquitous therefore chronic exposure is common. An open literature search will be conducted to determine any survival, growth or reproductive endpoints.

Path Forward

The planned ecological risk assessment will evaluate the lines of evidence and make a determination of potential effects to endangered species. If the planned ecological risk assessment indicates that sulfur may affect, either directly or indirectly, listed species or affect critical habitat, the Agency will take steps to refine the assessment to determine whether this pesticide's uses are likely to adversely affect, or are not likely to adversely affect the species. In the case of critical habitat, the Agency will assess whether use of the pesticide may destroy or adversely modify any principle constituent elements for the critical habitat.

If the Agency's assessment results in a determination that the pesticide may affect but is not likely to adversely affect a listed species or designated critical habitat, the Agency will request concurrence by the US Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) (Services) on that determination. If the Services do not concur, the Agency will enter into Formal Consultation with them under the Endangered Species Act. If the Agency's assessment results in a determination that the pesticide is likely to adversely affect a listed species or designated critical habitat, the Agency will initiate Formal Consultation with the Services. Formal Consultation concludes with issuance of a Biological Opinion to the Agency. The Agency may seek to change the terms of registration to address unacceptable risks to a listed species should EPA determine such risks exist.

Other Information Needs

Information is requested for confirmation on the following label information:

1. use or potential use distribution (e.g., acreage and geographical distribution of relevant crops)
2. use history
3. median and 90th percentile reported use rates (lbs a.i./acre) from usage data – national, state, and county
4. application timing (date of first application and application intervals) by crop – national, state, and county
5. sub-county crop location data
6. usage/use information for non-agricultural uses (for example residential)
7. directly acquired county-level usage data (not derived from state level data)
    a. maximum reported use rate (lb a.i./A) from usage data – county
    b. percent crop treated – county
    c. median and 90th percentile number of applications – county
    d. total pounds per year – county
    e. the year the pesticide was last used in the county/sub-county area
    f. the years in which the pesticide was applied in the county/sub-county area
8. typical interval (days)
9. state or local use restrictions
10. ecological incidents not already reported to the Agency
11. monitoring data

The analysis plan will be revisited and may be revised depending upon the data available in the open literature and the information submitted by the public in response to the opening of the Registration Review docket.

Summary

- Sulfur is a fungicide/ insecticide with a multi-site contact activity mode of action (disrupts electron transport along the cytochromes).
- Sulfur accounts for 15% of the inner core of the earth and 0.052% of its crust. It is insoluble in water (HSDB).
- When sulfur is mixed with soil, it is oxidized to sulfate by soil microorganisms. Oxidation depends on the microfloral population in soil, characteristics of the sulfur source (particle size distribution), and environmental conditions in the soil.
- Since sulfate is a ubiquitous species, it should not pose any environmental risk to ground or surface water pollution. In addition, microbes and plants can assimilate SO_4^{2-} (sulfate) with subsequent immobilization into organic compounds.
- The Agency's Ecological Incident Information System (EIIS) does not contain any reports of damage or adverse effects to non-target organisms attributed to the use of sulfur.
- The fate data were waived for sulfur based on the availability of public information.
- Available ecotoxicity data suggest low toxicity to non-target aquatic and terrestrial organisms. All other ecotoxicity data requirements have been waived based on; 1) results of available data, 2) insoluble nature of sulfur in water; and 3) the fact that sulfur in nature is ubiquitous and chronic exposure is common.
- An open literature search will be completed to determine any relevant endpoints for non-target taxa.

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URLs:

http://www.fotosearch.com/photos-images/sulfur.html

Table I-1. Sulfur Table of Environmental Fate Data Requirements				
Guide-line #	**Data Requirement**	**Study ID**	**Study Classification**	**Are Additional Data Needed for Risk Assessment?**
161-1	Hydrolysis	No data	Waived[1]	no
161-2	Photolysis in Water	No data	Waived[1]	no
161-3	Photodegradation on Soil	No data	Waived[1]	no
161-4	Photodegradation in Air	No data	Waived[1]	no
162-1	Aerobic Soil Metabolism	No data	Waived[1]	no
162-2	Anaerobic Soil Metabolism	No data	Waived[1]	no
162-3	Anaerobic Aquatic Metabolism	No data	Waived[1]	no
162-4	Aerobic Aquatic Metabolism	No data	Waived[1]	no
163-1	Leaching-Adsorption/ Desorption	No data	Waived[1]	no
163-2	Laboratory Volatility	No data	Waived[1]	no
163-3	Field Volatility	No data	Waived[1]	no
164-1	Terrestrial Field Dissipation	No data	Waived[1]	no
164-2	Aquatic Field Dissipation	No data	Not required[2]	no
164-3	Forestry Dissipation	No data	Not required[2]	no
165-4	Accumulation in Fish	No data	Waived[1]	no

1. The environmental fate data requirements were waived based on the availability of public information on this chemical. It is likely that sulfur would eventually react in the soil environments in the presence of soil microflora to form sulfate and enter the environment cycle.

2. Data are not required because sulfur does not have aquatic uses.

Table I-2. Ecological Effects Data Requirements for Sulfur					
Guideline #	**Data Requirement**	**Formulation**	**Are Additional Data Needed for Risk Assessment?**	**MRID or Acc. Number**	**Study Classification**
71-1	Avian Acute Oral Toxicity	NA	No	No data submitted	N/A
71-2	Avian Subacute Dietary Toxicity	95% wettable powder formulation	No	GS0031-003	Satisfied
71-4	Avian Reproduction Toxicity	NA	No	No data submitted	N/A
72-1	Freshwater Fish LC_{50}	99.5% dust formulation	No	GS0031-0004, GS0031-0005	Satisfied
72-2	Freshwater Invertebrate Acute LC_{50}	90%	No	GS00031-0002	Satisfied
72-3(a)	Estuarine/Marine Fish LC_{50}	NA	No	No data submitted	N/A
72-3(b)	Estuarine/Marine Invertebrate (Mollusk)	NA	No	No data submitted	N/A
72-3(c)	Estuarine/Marine Invertebrate (Mysid)	90%	No		Satisfied
72-3 (d)	Estuarine/Marine Crustacean	NA	No	No data submitted	N/A
72-4 (a)	Freshwater Fish Early Life-Stage	NA	No	No data submitted	N/A

Table I-2. Ecological Effects Data Requirements for Sulfur					
Guideline #	**Data Requirement**	**Formulation**	**Are Additional Data Needed for Risk Assessment?**	**MRID or Acc. Number**	**Study Classification**
72-4	Aquatic Invertebrate Life-Cycle (Freshwater) Chronic Toxicity	NA	No	No data submitted	N/A
72-4	Aquatic Invertebrate Life-Cycle (Marine) Chronic Toxicity	NA	No	No data submitted	N/A
72-5	Freshwater Fish Full Life-Cycle (marine)	NA	No	No data submitted	N/A
72-7	Aquatic Field Study	NA	No	No data submitted	N/A
141-1	Acute Honeybee Contact Toxicity Test	98%	No	05012143	Satisfied
141-2	Residues on Foliage Honeybee Toxicity Test	92%	No	05017101	Satisfied
141-4	Subacute Honeybee Feeding Toxicity Test	NA	No	No data submitted	

NA=Not Available; N/A=Not Applicable

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
PREVENTION, PESTICIDES AND
TOXIC SUBSTANCES

PC Code	016001, 016601, 076103, 076104, 129083
Case No.	0031, 4019, 4052
DP Barcode	DP: 346318, 342928

MEMORANDUM

DATE: March 17, 2008

SUBJECT: Problem Formulation for Ecological Risk Assessment, for Carbon Dioxide and Gas Fumigant Producing Cartridges: Carbon, Sawdust, Sodium Nitrate, Potassium Nitrate and Sulfur

FROM: José Luis Meléndez, Chemist
Jean Holmes, DVM, Risk Assessment Process Leader
Environmental Risk Branch V
Environmental Fate and Effects Division (7507P)

THROUGH: Mah T. Shamim, Ph.D., Chief 03/18/08
Environmental Risk Branch V
Environmental Fate and Effects Division (7507P)

TO: Veronique LaCapra, Chemical Review Manager
Jude Andreasen, Chemical Review Manager
Eric Miederhoff, Chemical Review Manager
Reregistration Branch II
Special Review and Reregistration Division

Please find attached the ecological risk assessment problem formulation for carbon dioxide and gas fumigant producing cartridges: carbon, sawdust, sodium nitrate, potassium nitrate and sulfur.

Problem Formulation, For Ecological Risk Assessment, For Carbon Dioxide, and Gas Fumigant Producing Cartridges: Sawdust, Sodium Nitrate, Potassium Nitrate and Sulfur

Case Number 4019, 4052, 0031

Environmental Fate and Effects Division
Office of Pesticide Programs
U.S. Environmental Protection Agency

Table of Contents

Problem Formulation

The purpose of this problem formulation is to provide the foundation for the ecological risk assessment being conducted for carbon, sawdust, sodium nitrate, potassium nitrate and sulfur when used in fumigant gas producing cartridge products. It also includes carbon dioxide which has indoor fumigant uses. It does not include sulfur uses other than the gas cartridge use. It also does not include the active ingredient nitrite because there are no nitrite products registered at this time. As such, it articulates the purpose and objectives of the risk assessment, evaluates the nature of the problem, and provides a plan for analyzing the data and characterizing the risk (EPA, 1998).

A. Nature of Regulatory Action

This report summarizes the Environmental Fate and Effects Division's Problem Formulation for the Registration Review of; 1) carbon, carbon dioxide, and sawdust (Case Number 4019); 2) sodium and potassium nitrate (Case Number 4052); and 3) the cartridge use of sulfur (Case Number 0031). In 1991, the USEPA issued Reregistration Eligibility documents for carbon and carbon dioxide, sodium nitrate and potassium nitrate, and sulfur which serves as the basis for this assessment. At the time, sawdust was not included in the document. It was concluded that, for these chemicals, application of the cartridges to burrows (subsurface) precludes exposure to avian and aquatic organisms. However, organisms that live in burrows, including endangered species, may be impacted. The label as of the date of issuance of the RED documents included provisions to protect those species. For carbon dioxide, which only has indoor uses, the Agency concluded that exposure to non-target organisms was unlikely.

B. Stressor Source and Distribution

1. Nature of the Chemical Stressor

Carbon, sodium and potassium nitrates, sawdust, and sulfur are used in pyrotechnic fumigant gas producing cartridge products. After the cartridges are ignited they produce toxic gases that cause asphyxiation of the pests. These toxic gases, not the active ingredients, are the stressors for these products. Not all the gasses have been identified, however, for one product (Large Gas Cartridge, EPA Reg. No. 56228-21) over forty combustion products were identified, including carbon monoxide, carbon dioxide and nitrogen. For example, the following is a possible reaction (Savarie, *et.al.* 1980).

$$4C + 2NaNO_3 \rightarrow 3CO + Na_2CO_3 + N_2$$

The gases displace the oxygen in the burrows, creating an un-breathable atmosphere, causing asphyxiation of the target organisms.

Carbon dioxide (CAS No. 124-38-9; PC Code 016601) is an insecticide gas used as an indoor fumigant. For this use, carbon dioxide is the stressor. Carbon dioxide is "poured" indoors as a fumigant in such places like sealed trucks, trailers, sealed railroad cars, food handling establishments and ships. The area to be fumigated is sealed, and the atmosphere is filled at a minimum of 60% carbon dioxide for up to 4-5 days, causing the

pests to die of asphyxiation. Table II.1 provides some basic characteristics of carbon dioxide.

Table II.1. Nature of the Chemical Stressor	
Common name	***Carbon Dioxide***
Chemical name	*Carbon Dioxide*
Pesticide type	*Insecticide, Rodenticide*
Chemical class	*NA*
CAS number	*124-38-9*
Empirical formula	CO_2
Molecular mass (g/mol)	*44.01*
Vapor pressure	$4.83x10^4$ *mm Hg @ 25 deg C*
Henry's Law Constant (atm-m^3/mol)	*NA*
Solubility in water (g/L)	*0.145 g/100 mL at 25°C*
Log K_{ow}	*NA*
PK_a/PK_b	*NA*
Physical state	*Colorless odorless gas*
Melting point (°C)	*-56.6 at 5.2 atm*
Boiling point (°C)	*-78.5*
Density/Specific gravity (Air=1)	*1.527*
pH of saturated carbon dioxide solution	*3.7 at 1 atm to 3.2 at 23.4 atm*
Solubilities	*Miscible with hydrocarbons and most organic liquids*

Carbon dioxide is in the atmosphere; analyses of air in the temperate zones of the earth show 0.027-0.036% (v/v) of carbon dioxide (HSDB). Carbon dioxide is considered an inert ingredient without toxicological significance to non-target organisms in the environment.

2. Overview of Pesticide Usage

Table II.2 provides a summary of data regarding gas cartridge products containing sawdust, carbon, sodium nitrate, potassium nitrate, and sulfur as well as the carbon dioxide products. The table shows the labeled target organisms and the use sites. It is noted that sawdust and carbon products are co-formulated either with sodium or potassium nitrate and in various formulations with sulfur. The products consist of cartridges that are lit and inserted into the pests' burrows, where they are sealed. When the cartridges ignite, they produce toxic gasses which cause asphyxiation of the target pests (rodents and some larger mammals). These cartridges are to be used outdoors only (refer to use sites in Table II.2).

Carbon dioxide, used as a fumigant, is used to control a number of insects in enclosed indoor areas. These areas may contain grains or other agricultural commodities (food or feed crops, stored), as indicated in the table. Carbon dioxide may also be used in residential settings.

Table II.2. **All Products Containing Carbon, Carbon Dioxide or Sawdust** **plus Sodium or Potassium Nitrate and Sulfur**		
Product Name, **Reg No.**	**Active Ingredients %**	**Target Species;** **Use Areas**
SMOKE'em 4-463	Potassium nitrate 46.2% Sulfur 34.8% Sawdust 8.7%	Woodchucks, ground squirrels; Open fields, non-crop areas
Dexol Gopher Degasser 192-49	Potassium nitrate 45.0% Sulfur 45.0% Carbon 8.0%	Gophers, ground squirrels; Lawns, golf courses, gardens, rangeland
Revenge Rodent Smoke Bomb 9086-4	Potassium nitrate 38.8% Sulfur 39.4% Carbon 12.5%	Gophers, moles, woodchucks, rats, skunks, ground squirrels; Lawns, golf courses, non-crop areas, rangeland, meadows, reforested areas, open fields, parks
The Giant Destroyer 10551-1	Sodium nitrate 46.2% Sulfur 34.8% Carbon 8.7%	Gophers, moles, woodchucks, rats, skunks, ground squirrels; Lawns, golf courses, non-crop areas, rangeland, meadows, reforested areas, open fields
Large Gas Cartridge 56228-21	Sodium nitrate 53.0% Carbon (Charcoal) 28.0%	Coyotes, red foxes, striped skunks; In dens only in rangeland, crop and non-crop areas
Gas Cartridge 56228-2	Sodium nitrate 53.0% Carbon (Charcoal) 28.0%	Woodchucks, yellow bellied marmots, ground squirrels, black tailed prairie dogs, white tailed prairie dogs, Gunnison prairie dogs; Open fields, non-crop areas, rangeland, reforested areas, lawns, golf courses
Carbon dioxide 10330-20	Carbon dioxide 99.8%	Beetles, Psocoptera, moths; Storage, trucks, trailers, sealed railroad cars and ships. The following may be treated-raw and processed agricultural products such as corn, barley, oats, rice, sorghum, wheat, rye, cocoa and coffee beans, flour, cereal, dry beans, peas, pasta products, dry milk, nuts, dried fruits, tobacco products, spices and herbs, etc.
Carbon dioxide 38719-5	Carbon dioxide 99.95%	Silos, trucks, trailers, sealed railroad, cars, and ships, food handling establishments, processing and storage facilities and residential structures. The following raw agricultural commodities may be treated: wheat, oats, rice, barley, corn, processed food

There is no information on the typical usage (number of applications, "rate" or interval between applications) for carbon, carbon dioxide or sawdust. The state of California does report usage of these pesticides and some useful data may be extrapolated (refer to tables named Carbon Usage, Carbon Dioxide Usage and Sawdust Usage below). It is noted that the total usage of carbon decreased by almost one half from 2003 to 2004 in California and did not increase in 2005. Major decrease in use was in vertebrate control, followed by landscape maintenance. Another important use of carbon appeared to be rights of way. Data available for sawdust shows that less than 2 lb of the product were used in California in 2003 and 2004, and only 0.143 lb (total) were used in 2005. The carbon dioxide usage is higher than the one for carbon or sawdust. In California, the chemical total pounds range from 132,000 lb (in 2005) to 202,000 lb (in 2004). Major uses appear to be almond, dried fruit, grapes, pistachio, tomatoes and walnuts. With respect to fumigation of structures, food processing plants and structural pest control appeared to be the important categories, and a category named "fumigation, only."

For sulfur, the California (CADPR) use information data indicate that there is an increasing trend on the use for "vertebrate control" in a period of three years, from 453 lb in 2003 to 4418 lb in 2005.

- There is also no information on the typical usage (number of applications, "rate" or interval between applications) for sodium nitrate and potassium nitrate. The Screening Level Usage Analysis (SLUA) was verified for these chemicals. The SLUA provides the average annual pounds of pesticide applied for each agricultural crop (*i.e.* for the states surveyed, not for the entire U.S.). According to the SLUA for sodium nitrate, it appears that crops of major use for the chemical are almonds, kiwifruit, nectarines, olives, pistachios and prunes & plums. In each case, <500 lb of active ingredient were used in California. However, it is indicated that ≥95% of the U.S. acres that have this gas cartridge use are in California. For potassium nitrate, the SLUA lists almonds, nectarines, pistachios and prunes & plums as the crops of interest, but <500 lb active ingredient were utilized in California. As in the previous case, it is indicated that ≥95% of the U.S. acres that have potassium nitrate gas cartridge use are in California.

Carbon Usage

Publicly available data from the California Department of Pesticide Regulation was used to produce the following table outlining the pounds of carbon used in California over the three most recent years available (2003-2005).

Crop/Area	2003 Lbs. Applied	2004 Lbs Applied	2005 Lbs. Applied
ALMOND	40	29	17
CHERRY		4	1
GRAPE			30
KIWI	0.1		
LANDSCAPE MAINTENANCE	283	145	110
LEMON	1		

NURSERY OUTDOOR TRANSPLANTS	2	3	
NURSERY GREENHOUSE TRANSPLANTS			2
NECTARINE			3
OAT (FORAGE - FODDER)		2	
PEAR	0.1	2	
PISTACHIO	28		18
RANGELAND		3	
REGULATORY PEST CONTROL	9	16	42
RESEARCH COMMODITY	0.01	0.03	
RIGHTS OF WAY	376	488	570
STRUCTURAL PEST CONTROL	3	1	2
UNCULTIVATED AG	9		
VERTEBRATE CONTROL	1,296	345	224
WALNUT	4	11	37
Chemical Total	**2,051**	**1,047**	**1,056**

Prepared by: Jenna Carter 7/31/07
Source: Cal DPR data - http://www.cdpr.ca.gov/docs/pur/purmain.htm

Carbon Dioxide Usage

Publicly available data from the California Department of Pesticide Regulation was used to produce the following table outlining the pounds of carbon dioxide used in California over the three most recent years available (2003-2005).

Site	2003 Pounds Applied	2004 Pounds Applied	2005 Pounds Applied
ALMOND	10,779	15,762	45,003
COMMODITY FUMIGATION	24,348	9,290	28,655
CORN, HUMAN CONSUMPTION		88	7
CORN (FORAGE - FODDER)	1,071		
DRIED FRUIT	7,988	6,877	3,785
FIG	152	613	157
FOOD PROCRESSING PLANT	1,533	29,985	
FUMIGATION, OTHER	111,635	32,409	22,623
GRAPE	7,350	13,651	18,330
GRAPE, WINE	1,066	119	
LANDSCAPE MAINTENANCE		294	83
NUTS			923
PEAS			43
PISTACHIO	4,565	4,945	5,255
PUBLIC HEALTH			300
RICE		125	
RICE, WILD	8	22	39
RIGHTS OF WAY	698	41	

STORAGE AREA/BOX	183	267	411
STRUCTURAL PEST CONTROL	461	15,107	1,114
TOMATO	921	1,441	1,254
TOMATO, PROCESSING	421	1,127	902
UNKNOWN [1]	74	62,969	122
WALNUT	500	7,313	3,134
Chemical Total	**173,757**	**202,446**	**132,139**

[1] Site not specified in source data

Prepared by: Jenna Carter 6/29/07

Source: Cal DPR data - http://www.cdpr.ca.gov/docs/pur/purmain.htm

Sawdust Usage

Publicly available data from the California Department of Pesticide Regulation was used to produce the following table outlining the pounds of sawdust used in California over the three most recent years available (2003-2005).

Crop/Site	2003 Lbs. Applied	2004 Lbs. Applied	2005 Lbs. Applied
CHERRY			0.11
LANDSCAPE MAINTENANCE	0.4956	0.88	0.011
STRUCTURAL PEST CONTROL	0.12		
VERTEBRATE CONTROL	0.5412	0.5368	0.022
Chemical Total	**1.1568**	**1.4168**	**0.143**

Prepared by: Jenna Carter 8/01/07

Source: Cal DPR data - http://www.cdpr.ca.gov/docs/pur/purmain.htm

C. Receptors

1. Aquatic and Terrestrial Effects

The receptor is the biological entity that is exposed to the stressor (EPA, 1998). Various types of receptors may inhabit burrows, where carbon, sawdust, sulfur, sodium nitrate, and potassium nitrate are applied in the form of explosive cartridges. These include rodents and other small mammals. The areas to be fumigated are to be located outdoors only. In addition, several forms of life may be exposed to carbon dioxide, when it is applied to enclosed areas, such as ships, railroads, cars and storage facilities (may include insects, mites and rodents); however, these are usually considered the target pests, beetles, moths and other insects.

Consistent with the process described in the Overview Document (EPA, 2004), risk assessments use a surrogate species approach in its evaluation of pesticides such as carbon, carbon dioxide, sulfur, sodium nitrate, potassium nitrate and sawdust.

Toxicological data generated from surrogate test species, which are intended to be representative of broad taxonomic groups, are used to extrapolate to potential effects on a variety of species (receptors) included under these taxonomic groupings. For the gas cartridge use of carbon, carbon dioxide, sawdust, sulfur, sodium nitrate and potassium nitrate all data requirements for ecological studies have been waived.

As indicated previously, the pest species are not exposed to the active ingredients in gas cartridges, but rather to the products of the pyrolysis. The cartridge application is subsurface into burrows, and exposure to aquatic organisms and most avian species is not anticipated. However, any organism living in or inhabiting burrows may be exposed and, thus, impacted and killed by the cartridges. There is a potential direct impact to non-target species and endangered species. To address the potential risks to non-target organisms, the Agency will review product efficacy data to ensure that labeling instructions are explicit concerning actions users must take before applying the product.

The potential direct effect of carbon dioxide on endangered species is minimal since it is utilized in enclosed structures, such as silos, trailers, food handling establishments, processing, storage facilities and residential structures.

Incident Reports

The Agency's Ecological Incident Information System (EIIS) does not contain any reports of damage or adverse effects to non-target organisms attributed to the use of carbon, sawdust, sulfur, sodium nitrate or potassium nitrate gas cartridge uses or carbon dioxide indoor fumigant uses. No incidents of contamination of surface, ground and drinking water have been reported to the Agency. A lack of reported incidents does not necessarily mean that such incidents have not occurred.

2. Ecosystems Potentially at Risk

The ecosystems at risk are often extensive in scope, and as a result it may not be possible to identify specific ecosystems during the development of a baseline risk assessment. However, in general terms, terrestrial ecosystems potentially at risk could include the treated field and areas immediately adjacent to the treated field that may receive drift or runoff (note that these are not routes of dissipation for the carbon, sawdust, sodium nitrate, potassium nitrate, and sulfur gas cartridge use or the indoor carbon dioxide fumigant use). The gas cartridges may be used in sealed burrows in such areas as open fields, non-crop areas, rangeland, reforested areas, lawns and golf courses; however, this will result in limited exposure. Areas adjacent to the treated field could include cultivated fields, fencerows and hedgerows, meadows, fallow fields or grasslands, woodlands, riparian habitats and other uncultivated areas. Carbon dioxide is used in enclosed areas; therefore, there are no extensive terrestrial ecosystems at risk.

Aquatic ecosystems potentially at risk include water bodies adjacent to, or down stream from, the treated field and might include impounded bodies such as ponds, lakes and reservoirs, or flowing waterways such as streams or rivers. For uses in coastal areas,

aquatic habitat also includes marine ecosystems, including estuaries. The use of carbon dioxide is not expected to result in exposure to aquatic ecosystems because it is used in enclosed areas and the sealed burrow application of carbon, sawdust, sodium nitrate, potassium nitrate, and sulfur gas cartridge is also not expected to result in exposure to aquatic ecosystems. No extensive exposure is anticipated if used according to the label.

D. Assessment Endpoints

Assessment endpoints are defined as "explicit expressions of the actual environmental value that is to be protected." Defining an assessment endpoint involves two steps: 1) identifying the valued attributes of the environment that are considered to be at risk; and 2) operationally defining the assessment endpoint in terms of an ecological entity (*i.e.*, a community of fish and aquatic invertebrates) and its attributes (*i.e.*, survival and reproduction). Therefore, selection of the assessment endpoints is based on valued entities (*i.e.*, ecological receptors), the ecosystems potentially at risk, the migration pathways of pesticides, and the routes by which ecological receptors are exposed to pesticide-related contamination. The selection of clearly defined assessment endpoints is important because they provide direction and boundaries in the risk assessment for addressing risk management issues of concern. Changes to assessment endpoints are typically estimated from the available toxicity studies, which are used as the measures of effects to characterize potential ecological risks associated with exposure to pesticides, such as carbon, carbon dioxide, sodium nitrate, potassium nitrate, sulfur and sawdust.

To estimate exposure concentrations, the ecological risk assessment considers a single application at the maximum application rate to fields that have vulnerable soils. The most sensitive toxicity endpoints are used from surrogate test species to estimate treatment-related direct effects on acute mortality and chronic reproductive, growth and survival assessment endpoints. Toxicity tests are intended to determine effects of pesticide exposure on birds, mammals, fish, terrestrial and aquatic invertebrates, and plants. These tests include short-term acute, sub-acute, and reproduction studies and are typically arranged in a hierarchical or tiered system that progresses from basic laboratory tests to applied field studies. The toxicity studies are used to evaluate the potential of a pesticide to cause adverse effects, to determine whether further testing is required, and to determine the need for precautionary label statements to minimize the potential adverse effects to non-target animals and plants.

Registrant submitted ecological toxicity data were waived for carbon, carbon dioxide, sodium nitrate, potassium nitrate, sulfur and sawdust based on the gas cartridge uses and the indoor fumigant uses. No additional data is required to determine relevant endpoints. The registrant has submitted ecological toxicity data for sulfur to support the non-gas cartridge uses.

E. Conceptual Model

For a pesticide to pose an ecological risk, it must reach ecological receptors in biologically significant concentrations. An exposure pathway is the means by which a

pesticide moves in the environment from a source to an ecological receptor. For an ecological pathway to be complete, it must have a source, a release mechanism, an environmental transport medium, a point of exposure for ecological receptors, and a feasible route of exposure.

A conceptual model provides a written description and visual representation of the predicted relationships between carbon, sulfur, sodium nitrate, potassium nitrate, carbon dioxide and/or sawdust, potential routes of exposure, and the predicted effects for the assessment endpoint. A conceptual model consists of two major components: risk hypothesis and a conceptual diagram (EPA, 1998).

1. Risk Hypothesis

For carbon, sawdust, sulfur, sodium nitrate, potassium nitrate and carbon dioxide, the following ecological risk hypotheses are being employed for this baseline risk assessment:

> *Carbon, sawdust, sodium nitrate, potassium nitrate, sulfur and sawdust by-products from gas cartridge use, when used in accordance with the label, result in potential adverse effects upon the survival of non-target terrestrial organisms.*
>
> *Carbon dioxide, when used in accordance with the label, does not result in potential adverse effects to non-target terrestrial and aquatic organisms.*

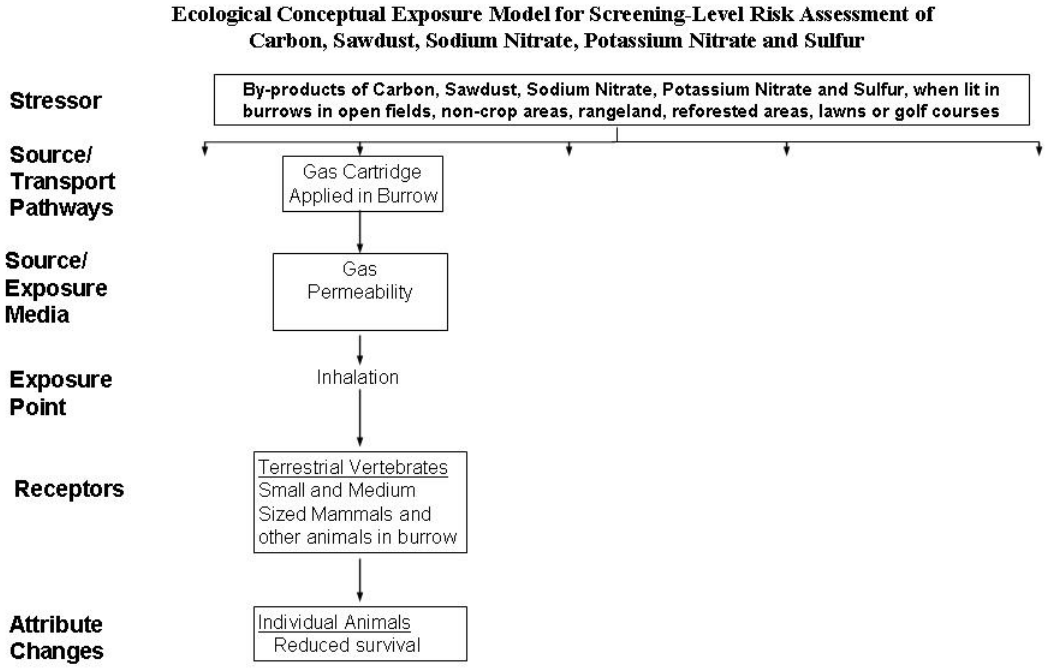
2. Conceptual Diagram

The conceptual site model is a generic graphic depiction of the risk hypothesis, and assumes that as rodenticides/ predacides with a inhalation toxic mode of action, carbon, sulfur, sodium nitrate, potassium nitrate and sawdust by-products are capable of affecting terrestrial (and less likely aquatic) animals provided that environmental concentrations are sufficiently elevated as a result of proposed label uses. However, through a preliminary iterative process of examining available data, the conceptual model (i.e., the risk hypothesis) has been refined to reflect the likely exposure pathways and the organisms that are most relevant and applicable to this assessment (Figure II.1). It includes the potential stressor (reaction by-products from the gas cartridge use, *e.g.* carbon monoxide, carbon dioxide and nitrogen), the source and/or transport pathways, exposure media, exposure point, biological receptor types, and attributes changes.

The stressor resulting from application of gas cartridges applied to sealed burrows in open fields, rangelands, lawns, golf courses, non-crop areas or reforested areas are gases that are formed after the explosion of the cartridges, including carbon monoxide. The exposure media/ source is gas permeability, that is, carbon monoxide and other gases that may be inhaled by terrestrial animals that inhabit burrows, resulting in death by asphyxiation (the attribute change is reduced survival). Since the instructions of these cartridges indicate that the burrows are to be sealed quickly after the cartridge is activated and inserted in burrow, the gases are to remain for an extended period inside the burrow,

and the exposure to non-target animals is expected to be minimal, except for animals living in burrows.

Figure II.1. Conceptual Diagram for Carbon, Sawdust, Sodium Nitrate, Potassium Nitrate and Sulfur Risk to Terrestrial Animals



F. Analysis Plan

1. Conclusions from Previous Risk Assessments

In 1991, Re-registration Eligibility Documents for carbon and carbon dioxide, potassium nitrate and sodium nitrate, and for sulfur were issued and covered various products containing these chemicals. The general conclusion is that there are no unreasonable effects to the environment due to the use of these active ingredients. The use of carbon, potassium nitrate, sodium nitrate, and sulfur could result in potential impact to certain endangered species, while carbon dioxide is an indoor use only fumigant with limited exposure potential.

2. Preliminary Identification of Data Gaps and Analysis Plan-Need uses

All the environmental fate and ecological effects data requirements are waived for carbon, carbon dioxide, sulfur, sodium nitrate, potassium nitrate and sawdust for the gas cartridge uses. The waivers were based on the ecological effects assessment of carbon, sulfur, sodium nitrate, potassium nitrate and sawdust, the fact that some of these chemicals are widespread and/or the physical and chemical properties are understood. Carbon dioxide has only indoor uses. For indoor uses, usually, only hydrolysis is required; however, since carbon dioxide is a gas at room temperature, the data requirement is also waived.

All the ecological effects data requirements are waived for gas cartridge uses of carbon, carbon dioxide, sawdust, sulfur, sodium nitrate and potassium nitrate. The cartridges are applied to burrows, subsurface, which precludes substantive exposure to avian and aquatic organisms or terrestrial organisms that do not live in burrows. However, organisms that live in burrows may be at risk. A review of gas cartridge efficacy data will be conducted to ensure there is appropriate labeling language regarding timing of application and observation of signs indicating the presence or absence of target and non-target organisms.

Status of Data Requirements

Ecological Effects

All ecological effects data requirements for carbon, carbon dioxide, sulfur, sodium nitrate, potassium nitrate and sawdust have been waived for the gas cartridge use. Efficacy data on the gas cartridges will be evaluated.

Environmental Fate

All environmental fate data requirements for carbon, carbon dioxide, sulfur, sodium nitrate, potassium nitrate and sawdust have been waived.

3. Measures of Effects and Exposure

Ecological effects data are waived. The preliminary assessment of carbon, carbon dioxide, sulfur, sodium nitrate, potassium nitrate, and sawdust indicates that they are chemically un-reactive in the environment. There is no evidence to suggest a hazard to the environment when these pesticides are used according to the label. However, any non-target organism inhabiting a burrow in which the gas cartridges are applied would potentially be adversely affected.

For a chemical, a number of measures of exposure are used, which are the measures of stressor existence and movement in the environment and their contact or co-occurrence with the assessment endpoint. Measures of exposure are potentially estimated using models. Aquatic exposure usually consists of aquatic EECs based on a total residue approach and derived using a water-body that is vulnerable and representative of static

ponds and first order waterways. Terrestrial exposure is usually estimated using a model that assumes a direct application to a variety of avian, mammal and reptilian food items. Exposure to terrestrial plants is usually estimated using a model that assumes that a chemical drifts or moves with runoff to adjacent habitats. Models require quantitative measurements for endpoints to evaluate the effects of the chemicals on the various species. In the absence of fate data, these measures of exposure could not be modeled.

Table II.5 provides a summary of the assessment endpoints previously identified as survival, growth and reproduction along with the measure of effects and exposure. No registrant submitted data to support the gas cartridge or indoor fumigant use are available for the measures of effects.

Table II.5. Measures of Ecological Effects and Exposure for Carbon, Carbon Dioxide, Sulfur, Sodium Nitrate, Potassium Nitrate, and Sawdust

		Surrogate Species and Measures of Ecological Effect[1]	Measures of Exposure
Birds[2]	Survival	Bobwhite acute oral LD_{50} Bobwhite and mallard subacute dietary LC_{50} (data waived)	Maximum residues on food items (foliar)
	Reproduction and growth	Bobwhite and mallard chronic reproduction NOAEC and LOAEC (data waived)	
Mammals	Survival	Laboratory rat acute oral LD_{50} (data waived)	
	Reproduction and growth	Laboratory rat oral reproduction chronic NOAEC and LOAEC (data waived)	
Freshwater fish[3]	Survival	Rainbow trout and bluegill sunfish acute LC_{50} (data waived)	Peak EEC[4]
	Reproduction and growth	Fathead minnow chronic (early life-stage) NOAEC and LOAEC (data waived)	60-day average EEC[4]
Freshwater invertebrates	Survival	Water flea (and other freshwater invertebrates) acute EC_{50} (data waived)	Peak EEC[4]
	Reproduction and growth	Water flea chronic (life cycle) LOAEC (data waived)	21-day average EEC[4]
Estuarine/marine fish	Survival	Sheepshead minnow acute LC_{50} (data waived)	Peak EEC[4]
	Reproduction and growth	Sheepshead minnow chronic (early life-stage) NOAEC and LOAEC (data waived)	60-day average EEC[4]
Estuarine/marine invertebrates	Survival	Eastern oyster acute EC_{50} and mysid acute LC_{50} (data waived)	Peak EEC[4]

		Surrogate Species and Measures of Ecological Effect[1]	Measures of Exposure
	Reproduction and growth	Mysid chronic NOAEC and LOAEC (data waived)	21-day average EEC[4]
Terrestrial plants[5]	Survival and growth	Monocot and dicot seedling emergence and vegetative vigor $EC_{25,}$ EC_{05}, and NOAEC values (data waived)	Estimates of runoff and spray drift to non-target areas
Insects	Survival (not quantitatively assessed)	Honeybee acute contact LD_{50} (data waived)	Maximum application rate
Aquatic plants and algae	Survival and growth	Algal and vascular plant (i.e., duckweed) EC_{50} and NOAEC values for growth rate and biomass measurements (data waived)	Peak EEC

[1] If species listed in this table represent most commonly encountered species from registrant-submitted studies, risk assessment guidance indicates most sensitive species tested within taxonomic group are to be used for baseline risk assessments.
[2] Birds represent surrogates for amphibians (terrestrial phase) and reptiles.
[3] Freshwater fish may be surrogates for amphibians (aquatic phase).
[4] One in 10-year return frequency.
[5] Four species of two families of monocots - one is corn, six species of at least four dicot families, of which one is soybeans. LD_{50} = Lethal dose to 50% of the test population; NOAEC = No observed adverse effect concentration; LOAEC = Lowest observed adverse effect concentration; LC_{50} = Lethal concentration to 50% of the test population; EC_{50}/EC_{25} = Effect concentration to 50%/25% of the test population.

4. Endangered Species Considerations

Pesticide ecological risk assessments for registration review will address Endangered Species Act, Section 7 (a)(2) obligations. Data requirements were waived for carbon, carbon dioxide, sulfur, sodium nitrate, potassium nitrate, and sawdust for the gas cartridge use; therefore no RQs can be calculated to assess the risk to endangered species. At this time, no incident reports are available that indicate risk to endangered species.

All the labels for carbon, sulfur, sodium nitrate, potassium nitrate, and sawdust gas cartridge products have an "Endangered Species Considerations" section, in which it is specified that the product should not be used in the presence of specified endangered species. Additional specifications, such as time of the year during which the product should or should not be used, temperature, etc. may appear in some labels.

Path Forward

The Agency realizes that when the gas cartridges are used, any organism in a properly treated burrow will likely be killed and is concerned about potential impact to populations of non-target and endangered species. Due to the potential risk to non-target organisms, the Agency will review product efficacy data. This information will be used to ensure that label instructions are explicit concerning actions users must take before applying the products. It may require more extensive labeling regarding timing of application and observation of signs indicating the presence or absence of target and non-target organisms.

The planned ecological risk assessment will evaluate the lines-of-evidence and make a determination of potential effects to endangered species. If the planned ecological risk assessment indicates that carbon, carbon dioxide, sulfur, sodium nitrate, potassium nitrate and sawdust may affect, either directly or indirectly, listed species or affect critical habitat, the Agency will take steps to refine the assessment to determine whether this pesticide's uses are likely to adversely affect, or are not likely to adversely affect the species. In the case of critical habitat, the Agency will assess whether use of the pesticide may destroy or adversely modify any principle constituent elements for the critical habitat.

If the Agency's assessment results in a determination that the pesticide may affect but is not likely to adversely affect a listed species or designated critical habitat, the Agency will request concurrence by the USFWS and NMFS (Services) on that determination. If the Services do not concur, the Agency will enter into Formal Consultation with them under the Endangered Species Act. If the Agency's assessment results in a determination that the pesticide is likely to adversely affect a listed species or designated critical habitat, the Agency will initiate Formal Consultation with the Services. Formal Consultation concludes with issuance of a Biological Opinion to the Agency. The Agency may seek to change the terms of registration to address unacceptable risks to a listed species should EPA determine such risks exist.

Other Information Needs

Information is requested for confirmation on the following label information:

1. confirmation on the following label information
    g. maximum application rates
    h. frequency of application, application intervals, and maximum number of applications per season
    i. geographic limitations on use
2. use or potential use distribution (e.g., acreage and geographical distribution of relevant crops)
3. use history
4. median and 90th percentile reported use rates (lbs ai/acre) from usage data – national, state, and county

5. application timing (date of first application and application intervals) by crop – national, state, and county
6. sub-county crop location data
7. usage/use information for non-agricultural uses (e.g., forestry, residential, rights-of-way)
8. directly acquired county-level usage data (not derived from state level data)
    j. maximum reported use rate (lbs ai/acre) from usage data – county
    k. percent crop treated – county
    l. median and 90th percentile number of applications – county
    m. total pounds per year – county
    n. the year the pesticide was last used in the county/sub-county area
    o. the years in which the pesticide was applied in the county/sub-county area
9. typical interval (days)
10. state or local use restrictions
11. ecological incidents not already reported to the Agency
12. monitoring data

The analysis plan will be revisited and may be revised depending upon the information submitted by the public in response to the opening of the Registration Review docket. is not expected to be a risk issue to humans based currently registered use patterns.

Summary

- Carbon dioxide is a naturally occurring substance; analyses of air in the temperate zones of the earth show 0.027-0.036% (v/v) of carbon dioxide (HSDB). Carbon, sawdust, sulfur, potassium nitrate, sodium nitrate, and carbon dioxide are considered ingredients without toxicological significance to non-target organisms in the environment.
- The state of California reports usage of carbon, carbon dioxide and sawdust and useful data may be extrapolated. The total usage of carbon decreased by almost one half from 2003 to 2004 and did not increase in 2005. Major decrease in use was in vertebrate control, followed by landscape maintenance. Data available for sawdust shows that only 0.143 lb (total) were used in 2005. In California, the carbon dioxide total pounds range from 132,000 lb (in 2005) to 202,000 lb (in 2004). Major uses appear to be almond, dried fruit, grapes, pistachio, tomatoes and walnuts.
- The California (CADPR) use information data for sulfur indicate that there is an increasing trend on the use for "vertebrate control" in a period of three years, from 453 lb in 2003 to 4418 lb in 2005.
- According to the SLUA for sodium nitrate, it appears that crops of major use for the chemical are almonds, kiwifruit, nectarines, olives, pistachios and prunes & plums. In each case, <500 lb of active ingredient were used in California. However, it is indicated that ≥95% of the U.S. acres are in California. For potassium nitrate, the SLUA lists almonds, nectarines, pistachios and prunes & plums as the crops of interest, but <500 lb active ingredient were utilized in California. As in the previous case, it is indicated that ≥95% of the U.S. acres are in California.
- All the environmental fate data requirements are waived for carbon, carbon dioxide, sulfur, sodium nitrate, potassium nitrate and sawdust. The fate data are waived based on the ecological effects assessment of the chemicals, and the fact that some of these chemicals are widespread or natural chemicals and the physical and chemical properties

of the chemicals are understood. Carbon dioxide has only indoor uses. Usually, only hydrolysis is required; however, since carbon dioxide is a gas at room temperature, the data requirement is also waived.

- All the ecological effects data requirements are waived for carbon, carbon dioxide, sulfur, sodium nitrate, potassium nitrate and sawdust for the gas cartridge use. The ecological requirements for carbon, sulfur, sodium nitrate, potassium nitrate and sawdust are waived based on the lack of exposure to most non-target organisms and the fact that any non-target organism inhabiting a properly treated burrow with the gas cartridges would be killed. Furthermore, carbon dioxide, a naturally occurring gas, is used indoors only. No exposure to non-target organisms is anticipated.
- Efficacy data will be reviewed for the gas cartridge uses to determine if label language needs to be revised.
- The Agency's Ecological Incident Information System (EIIS) does not contain any reports of damage or adverse effects to non-target organisms attributed to the use of carbon, carbon dioxide, sulfur, sodium nitrate, potassium nitrate or sawdust.

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Table 1. Carbon, Carbon Dioxide, Sawdust, Sodium Nitrate, Potassium Nitrate and Sulfur Table of Environmental Fate Data Requirements for Gas Cartridge and Indoor Fumigant Use

Guide-line #	Data Requirement	Study ID	Study Classification	Are Additional Data Needed for Risk Assessment?
161-1	Hydrolysis	No data	Waived[1]	no
161-2	Photolysis in Water	No data	Waived[1]	no
161-3	Photodegradation on Soil	No data	Waived[1]	no
161-4	Photodegradation in Air	No data	Waived[1]	no
162-1	Aerobic Soil Metabolism	No data	Waived[1]	no
162-2	Anaerobic Soil Metabolism	No data	Waived[1]	no
162-3	Anaerobic Aquatic Metabolism	No data	Waived[1]	no
162-4	Aerobic Aquatic Metabolism	No data	Waived[1]	no
163-1	Leaching-Adsorption/ Desorption	No data	Waived[1]	no
163-2	Laboratory Volatility	No data	Waived[1]	no
163-3	Field Volatility	No data	Waived[1]	no
164-1	Terrestrial Field Dissipation	No data	Waived[1]	no
164-2	Aquatic Field Dissipation	No data	Not required[2]	no
164-3	Forestry Dissipation	No data	Not required[2]	no
165-4	Accumulation in Fish	No data	Waived[1]	no

1. Data requirements were waived for carbon, sawdust, sodium nitrate and potassium nitrate based on the limited exposure that is expected to non-target organisms when used according to label specifications. These pesticides are applied in cartridges in sealed burrows. Carbon dioxide data requirements were also waived based on no exposure due to indoor only uses. Carbon, sawdust and carbon dioxide are considered inert ingredients without toxicological significance to non-target organisms in the environment.

2. Data are not required because carbon, sawdust, sodium nitrate, potassium nitrate and sulfur do not have aquatic uses; carbon dioxide only has indoor uses.

Table I-2. Ecological Effects Data Requirements for Carbon, Carbon Dioxide, Sawdust, Sodium Nitrate, Potassium Nitrate and Sulfur for Gas Cartridge and Indoor Fumigant Use

Guideline #	Data Requirement	Formulation	Are Additional Data Needed for Risk Assessment?	MRID or Acc. Number	Study Classification
71-1	Avian Acute Oral Toxicity	NA	No	No data submitted	N/A
71-2	Avian Subacute Dietary Toxicity	NA	No	No data submitted	N/A
71-4	Avian Reproduction Toxicity	NA	No	No data submitted	N/A
72-1	Freshwater Fish LC_{50}	NA	No	No data submitted	N/A
72-2	Freshwater Invertebrate Acute LC_{50}	NA	No	No data submitted	N/A
72-3(a)	Estuarine/Marine Fish LC_{50}	NA	No	No data submitted	N/A
72-3(b)	Estuarine/Marine Invertebrate (Mollusk)	NA	No	No data submitted	N/A
72-3(c)	Estuarine/Marine Invertebrate (Mysid)	NA	No	No data submitted	N/A
72-3 (d)	Estuarine/Marine Crustacean	NA	No	No data submitted	N/A
72-4 (a)	Freshwater Fish Early Life-Stage	NA	No	No data submitted	N/A

Table I-2. Ecological Effects Data Requirements for Carbon, Carbon Dioxide, Sawdust, Sodium Nitrate, Potassium Nitrate and Sulfur for Gas Cartridge and Indoor Fumigant Use					
Guideline #	**Data Requirement**	**Formulation**	**Are Additional Data Needed for Risk Assessment?**	**MRID or Acc. Number**	**Study Classification**
72-4	Aquatic Invertebrate Life-Cycle (Freshwater) Chronic Toxicity	NA	No	No data submitted	N/A
72-4	Aquatic Invertebrate Life-Cycle (Marine) Chronic Toxicity	NA	No	No data submitted	N/A
72-5	Freshwater Fish Full Life-Cycle (marine)	NA	No	No data submitted	N/A
72-7	Aquatic Field Study	NA	No	No data submitted	N/A
141-1	Acute Honeybee Contact Toxicity Test	NA	No	No data submitted	N/A
141-2	Residues on Foliage Honeybee Toxicity Test	NA	No	No data submitted	N/A
141-4	Subacute Honeybee Feeding Toxicity Test	NA	No	No data submitted	N/A

NA=Not Available; N/A=Not Applicable

IV. Human Health Effects Scoping Document

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
PREVENTION, PESTICIDES AND
TOXIC SUBSTANCES

MEMORANDUM

Date: January 17, 2008

SUBJECT: Sulfur (PC code 077501). Human Health Risk Scoping Document in Support of Registration Review. DP Barcode 346937.

FROM: Yan Donovan, Risk Assessor
Health Effects Division (7509P)
Office of Pesticide Programs

THRU: Ray Kent, Branch Chief
Susan Hummel, Senior Scientist
Reregistration Action Branch 4
Health Effects Division (7509P)
Office of Pesticide Programs

TO: Veronique LaCapra
Chemical Review Manager
Special Review and Reregistration Division (7508P)
Office of Pesticide Programs

Executive Summary

Health Effects Division's (HED) sulfur scoping team has completed the human health risk assessment status update for sulfur as part of the Registration Review process. Sulfur is an insecticide/miticide/fungicide which is currently registered for use on a variety of field crops, fruits, vegetables, ornamentals, lawns, and golf courses. The most recent and comprehensive risk assessment for sulfur was conducted in 1990 associated with the reregistration of sulfur. Based on the natural occurrence of sulfur in food and in the environment, it was determined that "sulfur is recognized as safe for use as a pesticide and, is exempted from tolerances...". Therefore, no dietary, residential, or aggregate risk assessment was conducted. No subchronic or chronic toxicity studies are available. Acute toxicity is low. Acute oral toxicity is category IV, while acute dermal and inhalation are category III. Sulfur is an eye and skin irritant (Category III). It is not a skin sensitizer. In response to California incident data, a qualitative occupational risk assessment was conducted previously which recommended that a 24-hour re-entry interval be established for foliar applications, and that workers wear personal protective equipment such as coveralls, chemical-resistant gloves, and goggles during mixing/loading and application. Sulfur was also assessed as a member of the "weathered materials" inert ingredients by the Inert Ingredient Focus Group in 2002 and classified as

List 4A. The exemption from the requirement of a tolerance for sulfur was reassessed at that time.

HED's scoping team concludes that no new dietary or aggregate risk assessment is needed for the Registration Review of sulfur. However, due to the large number of reported incidents associated with sulfur product uses, especially incidents related to respiratory problems, a refined incident report is needed to analyze the relationship between the nature of incidents and the types of products used. A new ORE assessment is needed for the Registration Review of sulfur. Depending on the outcome of the refined incident report, a subchronic inhalation study may be required to assess risk to handlers, and additional PPE such as respirators may be needed for some sulfur product labels.

Introduction

HED has evaluated the status of the human health assessments for sulfur to determine whether sufficient data are available and whether a new human health risk assessment is needed to support Registration Review. HED has considered the most recent risk assessments for sulfur, HED database, OPPIN database, and Google online search during the process of this scoping. For a complete listing of the references, see Section **Reference** at the end of this memo.

Elemental sulfur is an insecticide/miticide/fungicide which is currently registered for use on a variety of field crops, fruits, vegetables, ornamentals, lawns, and golf courses. It is formulated into dusts (20-99.8% ai), wettable powders, and flowable concentrates. Sulfur is also mixed with other pesticides/compounds and formulated into liquids or powders. There are several registered products where sulfur is mixed with potassium nitrate and carbon. These sulfur, potassium nitrate and carbon mixtures are designed to undergo chemical reactions and produce toxic fumes after ignition. Although no toxicity data are available on the fume by products, HED believes that worker and bystander exposure scenarios are not likely to exist based on the use patterns (underground uses) and current label precautions. This scoping document is for sulfur active ingredient only.

Hazard Identification/Toxicology

No subchronic or chronic toxicity studies are available for elemental sulfur. Acute oral toxicity is category IV, while acute dermal and inhalation are category III. Sulfur is an eye and skin irritant (Category III). It is not a skin sensitizer.

Conclusions: The HED registration review scoping team determined that since sulfur is exempted from the requirement of tolerances on food commodities due to its natural occurrence in food and its abundance in the environment, and that any sulfur absorbed into the body is metabolized to harmless products, risk to human health from dietary exposure is likely to be minimal. However, inhalation risks to workers and home owners during mixing, loading, and applying have not been assessed before. Depending on the out come of the refined incident report, a subchronic inhalation study may be required for the Registration Review of sulfur to assess risk to handlers.

Exposures

It was determined previously that "sulfur is recognized as safe for use as a pesticide and, is exempted from tolerances. Information from Canada indicates that the use of sulfur on raw agricultural commodities and food or feed items in that country is exempt from the requirements of tolerance and that the use of sulfur according to good agricultural practices is recognized as safe…" (HED memo of 09/10/1990, L. Kutney), therefore, no dietary assessment was conducted.

Conclusions: The HED registration review scoping team concurs with the previous decision that no tolerance is needed for sulfur, due to its natural occurrence in food and its abundance in the environment. In addition, sulfur is practically insoluble in water, so bioavailability of the element from food and water to human is not expected to be great. Small amounts of sulfur in the intestinal tract will be converted to sulfide, which will be excreted as sulfate. In humans, normal sulfur excretion as sulfate is 0.6-1.4 g sulfur/day and normal blood serum contains 0.8-1.4 mg/100 mL sulfur as sulfate (Agency memo of 02/04/1976, M. H. Rogoff). No dietary assessment is needed. However, depending on the out come of the refined incident report, inhalation data to assess risk to handlers may be needed.

Aggregate

No aggregate risk assessment has been conducted previously.

Conclusions: HED's scoping team concurs with the previous decision that an aggregate risk assessment is not needed for Registration Review of sulfur.

Incident Report

The active ingredient responsible for the largest numbers of acute occupational pesticide related illnesses in the 1998-1999 Sensor data, was sulfur (78 cases, MRID 46654303 in reference #8). Most were farm workers performing routine work activities that did not involve pesticide application. A separate incident report being prepared by HED indicates that there are incidents associated with the use of products containing elemental sulfur as the sole active ingredient.

Conclusions: HED's scoping team concludes that a refined incident report is needed to analyze the relationship between the nature of incidents involving elemental sulfur and the types of product used, so that appropriate protective/precaution statements can be added to the labels of those products that caused high number of incidents, and at the same time, allow the Agency to determine if additional data are required to assess risks to handlers.

Occupational Exposure and Risk

A partial, qualitative occupational risk assessment was conducted previously which recommended that a 24-hour re-entry interval for foliar applications be established and that workers should wear personal protective equipment such as coveralls, chemical-resistant gloves, and goggles during mixing/loading and application based on California incident data (HED memo of 07/20/1990, P. Perreault).

Conclusions: HED's scoping team concludes that all label requirements previously recommended have been adequately incorporated into the most current sulfur product labels. However, the previously conducted qualitative partial occupational risk assessment is no longer adequate. A new occupational risk assessment is needed for the Registration Review of sulfur. Depending on the out come of the refined incident report, a subchronic inhalation study may be required to assess risk to workers. Additional PPE such as respirators may be needed for some sulfur product labels based on the outcome of the upcoming analysis of the incident data.

Conclusions/Future Actions Needed

- A new ORE assessment is needed for the Registration Review of sulfur.
- Inhalation endpoint selection may be needed.

Data Requirements

- A subchronic inhalation study may be required to assess risk to handlers.
- Additional PPE such as respirators may be needed for some sulfur product labels based on the outcome of the upcoming analysis of the incident data.

References

1) Bibliography for Sulfur (OPPIN database);
2) Agency memo of 01/31/2002, K. Boyle, "Meeting of the IIFC Decision Memo";
3) HED memo of 09/10/1990, L. Kutney, TXR Nos. 008104, CASwell # 812, "FY 1990 Reregistration of Sulfur; Toxicology, Product and Residue Chemistry, Reentry and Nondietary Exposure Issues";
4) HED memo of 07/25/1990, W. Greear, "Toxicology Summary for the FY'90 Reregistration Decision on Sulfur";
5) HED memo of 07/20/1990, P. Perreault, "Assessment of Reentry/Non-Dietary Exposure Data Requirements for Sulfur and Recommendations for the Reregistration Decision Document";
6) Agency memo of 02/04/1976, M. H. Rogoff, "Waiver of Data- Elemental Sulfur";
7) HED memo of 01/13/1982, C. Trichilo, "Sulfur registration Standard".
8) MRID 46654303 Calvert, G.; Plate, D.; Das, R.; et. al. (2004) Acute occupational pesticide-related illness in the US, 1998-1999: Surveillance findings from the SENSOR-Pesticides Program. American Journal of Industrial Medicine 45: 14-23.

V. GLOSSARY OF TERMS AND ABBREVIATIONS

ai	Active Ingredient
ACGIH	American Conference of Governmental Industrial Hygienists
aPAD	Acute Population Adjusted Dose
AR	Anticipated Residue
CFR	Code of Federal Regulations
cPAD	Chronic Population Adjusted Dose
CSF	Confidential Statement of Formula
DCI	Data Call-In
DFR	Dislodgeable Foliar Residue
DWLOC	Drinking Water Level of Comparison.
EC_{50}	50% Effect Concentration
ECOTOX	An EPA database for locating chemical toxicity data for aquatic life, terrestrial plants and wildlife
EDWC	Estimated Drinking Water Concentration
EEC	Estimated Environmental Concentration
EFSA	European Food Safety Authority
EPA	Environmental Protection Agency
EUP	End-Use Product
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FQPA	Food Quality Protection Act
FOB	Functional Observation Battery
FWP	Final Work Plan
GENEEC	Tier I Surface Water Computer Model
GLN	Guideline Number
HIARC	Hazard Identification Assessment Review Committee
IR	Index Reservoir
LC_{50}	Median Lethal Concentration. A statistically derived concentration of a substance that can be expected to cause death in 50% of test animals. It is usually expressed as the weight of substance per weight or volume of water, air or feed, e.g., mg/l, mg/kg or ppm.
LD_{50}	Median Lethal Dose. A statistically derived single dose that can be expected to cause death in 50% of the test animals when administered by the route indicated (oral, dermal, inhalation). It is expressed as a weight of substance per unit weight of animal, e.g., mg/kg.
LOC	Level of Concern
LOAEL	Lowest Observed Adverse Effect Level
LOEC	Lowest Observed Effect Concentration
mg/kg/day	Milligram Per Kilogram Per Day
mg/L	Milligrams Per Liter

MOE	Margin of Exposure
MRID	Master Record Identification (number). EPA's system of recording and tracking studies submitted.
MRL	Maximum Residue Level
MUP	Manufacturing-Use Product
NA	Not Applicable
NPDES	National Pollutant Discharge Elimination System
NR	Not Required
NOAEC	No Observed Adverse Effect Concentration
NOAEL	No Observed Adverse Effect Level
NOEC	No Observed Effect Concentration
OPP	EPA Office of Pesticide Programs
OPPTS	EPA Office of Prevention, Pesticides and Toxic Substances
OSHA	Occupational Safety and Health Administration
PAD	Population Adjusted Dose
PCA	Percent Crop Area
PDP	USDA Pesticide Data Program
PHED	Pesticide Handler's Exposure Data
ppb	Parts Per Billion
PPE	Personal Protective Equipment
ppm	Parts Per Million
PRZM/EXAMS	Tier II Surface Water Computer Model
PWP	Preliminary Work Plan
Q_1*	The Carcinogenic Potential of a Compound, Quantified by the EPA's Cancer Risk Model
REI	Restricted Entry Interval
RfD	Reference Dose
RQ	Risk Quotient
SAP	Science Advisory Panel
SF	Safety Factor
SLN	Special Local Need (Registrations under Section 24(c) of FIFRA)
TGAI	Technical Grade Active Ingredient
TLV	Threshold Limit Value
TREX	Terrestrial Residue EXposure model
TWA	Time Weighted Average
USDA	United States Department of Agriculture
UF	Uncertainty Factor
WPS	Worker Protection Standard

Appendix 4
Safety Data Sheet

SECTION 1: IDENTIFICATION

Trade Name & Synonyms **Agricultural Sulfur, Yellow Jacket Wettable Sulfur**

EPA Reg # 6325-13

Chemical Name Sulfur

CAS Number 7704-34-9

Family Name Element – Sulfur

Chemical Formula S_8

Recommended Use As a spray and dust for the control of fungus, mold, mites and etc.. ***Carefully read the entire product label prior to use*.**

Restrictions on Use Keep away from heat sources, sparks, or open flames.

Manufacturer/Supplier

Sales and Technical Services
Georgia Gulf Sulfur Corporation
P. O. Box 1165
Valdosta, Georgia 31603
Tel: (229) 244-0000
Fax: (229) 245-1664
http://www.georgiagulfsulfur.com/msds.htm

Shipping and Receiving
Georgia Gulf Sulfur Corporation
1300 Spring Creek Road
Bainbridge, Georgia, USA 39817
Tel: (229) 246-4552
Fax: (229) 246-3245
GPS Coordinates: 30° 54' 06" N
84° 36' 30" W

Emergency Assistance
CHEMTREC
Tel: (800) 424-9300 within the USA
Tel: 001-703-527-3887 outside the USA

SECTION 2: HAZARDS IDENTIFICATION

GHS Classifications

Skin irritant, Category 1
Eye irritant, Category 1
Flammability, Category 1

KEY
4 = Severe
3 = Serious
2 = Moderate
1 = Slight
0 = Minimal

GHS Label Elements

WARNING

Irritant (Eye and Skin) Flammable Solid

SECTION 2: HAZARDS IDENTIFICATION (CONT)

Hazard Statement	H228: Flammable solid. H290: May be corrosive to metals. H303: May be harmful if swallowed. H316: May cause mild skin irritation. H320: May cause eye irritation. H335: May cause respiratory irritation.
Prevention Statement	P210: Keep away from heat/sparks/open flames/hot surfaces. No smoking. P220: Keep away from oxidizing agents. P424: Use non-sparking tools when available. P243: Take precautionary measures against static discharge. P261: Avoid breathing dust/fume/gas/mist/vapors/spray. P264: Wash hands thoroughly after handling and before eating. P284: In case of inadequate ventilation, wear respiratory protection.
Response Statement	P362: Take off contaminated clothing. P363: Wash contaminated clothing before reuse. P370+P378: In case of a fire, use water fog, spray, or regular foam to extinguish. Do not use a direct water stream. P381: Eliminate all ignition sources.
Storage Statement	P402: Store in a dry place. P403: Store in a well-ventilated place. P404: Store in a closed container.

SECTION 3: COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Characterization

Sulfur percentage ranges due to formulation confidentiality.

Mixture

Product	Percentage Contained	CAS Number
Sulfur	> 90.0%	7704-34-9
Hydrated aluminum silicate	< 8.0%	1332-58-7
Dispersant	< 1.0%	Surfactant blend proprietary
Synthetic precipitated silica	< 1.0%	7631-86-9
Magnesium carbonate	< 1.0%	7760-50-1
Decarboxylated resin	< 0.5%	8050-18-8

Hazardous Ingredient None

SECTION 4: FIRST AID MEASURES

Description of First Aid Measures

Skin Wash skin thoroughly with mild soap and water. Wash exposed clothing separately before reuse.

Eye Immediately flush eyes with plenty of water for 15 minutes, while holding upper and lower lid apart to insure rinsing of entire eye surface and lids. Do not use boric acid to rinse with. FOR SEVERE IRRITATION, SEEK MEDICAL ATTENTION, preferably an ophthalmologist.

Inhalation Move victim to fresh air. Watch for signs of an allergic reaction. Use a bronchodilator inhaler if directed by asthma patient. Keep victim warm and quiet. If not breathing, give artificial respiration. If heart has stopped beating, start cardiopulmonary resuscitation (CPR). SEEK MEDICAL ATTENTION.

SECTION 4: FIRST AID MEASURES (CONT)

Ingestion

Give one tablespoon of *Syrup of Ipecac* to induce vomiting. If vomiting does occur, give fluids again. If vomiting has not occurred in twenty minutes, the same dose of *Syrup of Ipecac* may be repeated one additional time. Alternatively, vomiting may be induced by touching the back of the throat with a finger. Do not give anything by mouth to an unconscious or convulsing person. SEEK MEDICAL ATTENTION.

Most Important Symptoms and Effects (Long-Term and Acute)

Refer to *Section 11: Toxicological Information*

Indication of any Immediate Medical Attention or Special Treatment Needed

Individuals with known allergies to sulfide drugs may also have allergic reactions to elemental sulfur.

SECTION 5: FIREFIGHTING MEASURES

Suitable Extinguishing Media

Water fog, spray, or regular foam. Do not use a direct water stream.

Unsuitable Extinguishing Media

Do not use solid streams of water, which could create sulfur dust clouds and cause an explosion or could move burning sulfur to adjacent areas.

Exposure Hazards

Prevent human exposure to smoke, fumes, or products of combustion (sulfur oxide gases). Evacuate nonessential personnel from the fire area. If large fire, evacuate people downwind from fire. Consider evacuation for ½ mile in all directions.

Advice for Firefighters

Firemen exposed to contaminated smoke should be immediately relieved and checked for symptoms of exposure of toxic gases. This should not be mistaken for heat exhaustion or smoke inhalation. SEEK MEDICAL ATTENTION IMMEDIATELY.

Protective Equipment

Wear full-faced, self-contained breathing apparatus and full protective clothing.

Fire and Explosion Hazards

Fire will rekindle until mass is cooled below 310°F (154°C). Cool surrounding areas with water fog to prevent re-igniting. Sulfur dust is HIGHLY FLAMMABLE. If suspended in air, it will ignite by friction, static electricity, heat, sparks, or flames. Sulfur dust clouds may explode.

Combustion Products

Sulfur oxide gases.

SECTION 6: ACCIDENTAL RELEASE MEASURES

Personal Precautions

Minor spills such as torn or ruptured containers should be repaired or patched with tape if possible. Place spilled material in a disposable container. Avoid getting dust in eyes.

Protective Equipment

Maintain adequate ventilation. Wear a dust mask when dust is present or a respirator if smoke is present. Wear safety glasses.

Emergency Procedures

As an immediate precautionary measure isolate spills or leak areas. Eliminate all sources of ignition, such as flares, sparks, or flames, in the immediate area. No smoking. Ventilate closed spaces before entering.

Environmental Precautions

Do not allow runoff to enter lakes or waterways.

SECTION 6: ACCIDENTAL RELEASE MEASURES (CONT)

Containment/Cleanup Measures Gently sweep or shovel up spilled material using a natural fiber broom and/or aluminum shovel to prevent sparking, to avoid creating a dust cloud. Place sweepings in an appropriate chemical waste container for reclaiming or disposal in an approved facility. Wash spill site after clean-up is complete.

SECTION 7: STORAGE AND HANDLING

Precautions for Safe Handling **All handling and conveying equipment should be properly grounded and bonded.** Be careful not to create dust. Avoid any conditions that might tend to create a dust explosion. Maintain good housekeeping practices to minimize dust build-up and dispersion. Eliminate sources of ignition. Keep away from heat, sparks, and flames. Use nonferrous tools, when available, to reduce sparking. Gently sweep or shovel up spilled materials using a natural fiber broom and/or aluminum shovel to prevent sparking. Maintain adequate ventilation in all areas.

Conditions for Safe Storage, Including any Incompatibilities:

Containers should be stored in a cool, dry, well-ventilated area. Keep container tightly closed. Store away from flammable materials, sources of heat, flames, and sparks. Separate from chlorates, nitrates, and other oxidizing agents. Exercise due caution to prevent damage to or leakage from container.

Incompatible Materials Keep away from flammable materials, sources of heat, flame, sparks, chlorates, nitrates and other oxidizing agents.

SECTION 8: EXPOSURE CONTROLS/ PERSONAL PROTECTION

Engineering Measures/Control Maintain adequate ventilation in all areas. No flares or flames in area. Be careful not to create dust. Eliminate sources of ignition.

Personal Protective Equipment Pictograms

Respiratory Wear dust masks and use NIOSH/MSHA approved dust respirator if airborne concentrations exceed exposure limits.

Eyes/Face Wear suitable, protective safety glasses to prevent eye irritation from dust.

Hands Wash hands thoroughly after handling and before eating or smoking.

Skin/Body Wear suitable, protective clothing to prevent skin irritation from dust. Wash skin thoroughly after handling and before eating or smoking. Wash contaminated clothing separately before reuse.

Environmental Exposure Controls Follow best practice for site management and disposal of waste. Avoid release to the environment.

General Industrial Hygiene Considerations Protective equipment should be used in any situation that may result in hazardous exposure. Maintain good housekeeping practices to minimize dust build-up and dispersion. Eliminate sources of ignition. Use nonferrous tools to reduce sparking. Sweep or shovel up spilled material using a natural fiber broom and/or aluminum shovel to prevent sparking. Maintain adequate ventilation in all areas.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Solid
Appearance	Yellow colored lumps, crystals, powder, or formed shape
Formula	S_8 (Rhombic or monoclinic)
Odor	Odorless, or faint odor of rotten eggs
Odor Threshold	No data available
pH	No data available
Boiling Point	832° F (444° C)
Melting/Freezing Point	118-120°C (244-248°F)
Flash Point	207°C (405°F) Closed Cup
Evaporation Rate	No data available
Flammability	May form combustible dust concentrations in air
Flammable/Explosion Limits	Upper: 6.38% (v) Lower: 0.17% (v)
Vapor Pressure	8 mmHg at 246°C (475°F) 1 mmHg at 183.8°C (362.8°F)
Vapor Density	No data available
Purity	90.0% Min. Wettable; 98.0% Min. Dusting
Auto-Ignition Temperature	240°C (464°F)
Decomposition Temperature	Does not decompose
Viscosity	Not applicable
Specific Gravity	2.07 @ 70° F
Solubility in Water	Insoluble
Bulk Density	Lumps: 75-115 lbs. /ft^3 Powder: 33-80 lbs. /ft^3

SECTION 10: STABILITY AND REACTIVITY

Chemical Stability	Stable
Conditions to Avoid	Keep from heat sources, sparks, and open flames.
Incompatible Materials	Oxidizing agents, copper, copper alloys, steel, chlorates, nitrates.
Possibility of Hazardous Reactions	Oxidizing agents may react violently.
Hazardous Decomposition Products	Oxides of sulfur gases produced by burning sulfur.
Hazardous Polymerization	Will not occur.

SECTION 11: TOXICOLOGICAL INFORMATION

Likely Routes of Exposure Inhalation, ingestion, skin contact, and eye contact.

Signs and Symptoms of Overexposure Nose or throat irritation, coughing, chest discomfort, asthma, difficulty breathing, skin irritation, nausea, vomiting, stinging eye irritation, and hives.

Exposure Limits No exposure limits have been established.

Acute Symptoms and Effects

Inhalation Prolonged inhalation may cause irritation of respiratory tract. Breathing of dust may aggravate asthma and other pulmonary diseases.

Eye Contact Sulfur dust is an eye irritant.

Skin Contact No adverse effects. Skin irritation may be aggravated in persons with existing skin lesions.

Ingestion Ingested sulfur is converted to sulfides in the gastrointestinal tract (GI), and ingestion of 10 to 20 grams has caused irritation of the GI tract and renal injury. Swallowing large amounts may cause nausea and vomiting.

SECTION 11: TOXICOLOGICAL INFORMATION (CONT)

Long-Term Effects None known to humans

Toxicity

	LD_{50}	Oral: >5050 mg/kg (rats)
		Dermal: >2020 mg/kg (rats)
	LC_{50}	Inhalation @ 90%: >5.49-mg/L air concentration (rats)
	Skin	Slightly irritating (rabbits)
	Eye	Minimal irritation in non-washed eyes (rabbits)

Sensitization	Reproductive Effects	Developmental Effects	Endocrine Disruptor
Not Established	Not Established	Not Established	Not Established

Carcinogenicity	Teratogenicity	Mutagenicity
This product does not contain any ingredient designated by NTP, IARC, or OSHA as a probable human carcinogen.		

SECTION 12: ECOLOGICAL INFORMATION

Toxicity

Toxicity to Fish	**LC_{50}**	*Oncorhynchus mykiss* (rainbow trout) -> 180 mg/l -96h
	LC_{50}	Other fish- 866 mg/l -96h
Toxicity to Daphnia and Other Aquatic Invertebrates	**EC_{50}**	Daphnia magna (Water flea) -> 5,000 mg/l -48h

Ecotoxicity No data available
Mobility No data available
Degradation No data available
Bioaccumulation No data available
Results of PBT and vPvB Assessment PBT/vPvB assessment not available as chemical safety assessment not required/not conducted.

SECTION 13: DISPOSAL CONSIDERATIONS

Waste Treatment Methods

Product Waste Dispose of content and/or container in accordance with local, regional, national and/or international regulations.

Packaging Waste Dispose of content and/or container in accordance with local, regional, national and/or international regulations.

SECTION 14: TRANSPORTATION INFORMATION

Solid sulfur is not regulated if transported in non-bulk packaging (less than 400 kg per package), or if formed to a specific shape, such as prills, granules, pellets, pastilles, or flakes (49 CFR 172.102, Special Provision 30).

US and Canadian Shipments

Bulk containers (packaging) of powdered sulfur of more than 400 kg (880 lbs.) per package

	14.1 UN Number	14.2 UN Proper Shipping Name	14.3 Transport Hazard Classes	14.4 Packaging Group	14.5 Environmental Hazards
DOT (Domestic)	NA1350	Sulfur (Sulphur)	9 (Misc. Hazardous Materials)	III	No data available
DOT (International)	UN1350	Sulphur (Sulfur)	4	III	No data available
TDG	UN 1350	Sulfur	4.1	III	No data available

SECTION 14: TRANSPORTATION INFORMATION (CONT)

Other than US and Canadian Shipments

All shipments of powdered sulfur

IMO/IMDG	UN1350	Sulphur (Sulfur)	4.1 (Flammable solid)	III	No data available
IATA/ICAO	UN 1350	Sulfur	4.1	III	No data available

This product is not a Marine Pollutant as defined in *40 CFR Part 172.*

Pictograms for Hazard Classes

Powdered sulfur packaging over 400 kg (880 lbs.) only

Special Precautions for User None specified

SECTION 15: REGULATORY INFORMATION

This chemical is a pesticide product registered by the Environmental Protection Agency and is subject to certain labeling requirements under federal pesticide law. These requirements differ from the classification criteria and hazard information required for safety data sheets and for workplace labels of non-pesticide chemicals.
Following is the hazard information as required on the pesticide label:

CAUTION Harmful if absorbed through skin. Causes moderate eye irritation. Avoid contact with skin, eyes or clothing. Wash thoroughly with soap and water after handling.

PERSONAL PROTECTIVE EQUIPMENT Some materials that are chemical-resistant to this product are listed below. If you want more options, follow the instructions for Category A n an EPA chemical-resistance category selection chart.
Applicators and other handlers other than mixers and loaders must wear long-sleeved shirt and long pants, plus socks and protective eyewear.
Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washable exist, use detergent and hot water. Keep and wash PPE separately from other laundry

ENGINEERING CONTROLS STATEMENT When handlers use closed systems, enclosed cabs or aircraft in a manner that meets the requirements listed in the Worker Protection Standard (WPS) for agricultural pesticides [40 CFR 170.240(d)(4-6)], the handler PPE requirements may be reduced or modified as specified in the WPS.

TSCA This product is listed on the TSCA Inventory at CAS Registry Number 7704-34-9.

CERCLA *Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)*

- If this product is accidentally spilled, it is not subject to any special reporting. We recommend that you contact state and local authorities to determine if there are other local reporting requirements.

SARA TITLE III *Superfund Amendments and Reauthorization Act, Title III*

- Sections 311/312: None. Section 313: None. Section 302: None.

SECTION 15: REGULATORY INFORMATION (CONT)

RCRA *Resource Conservation and Recovery Act*

- Not subject to reporting because sulfur is not identified as a hazardous waste.

SECTION 16: OTHER INFORMATION

Last Revision Date 05/01/2015 **Preparation Date** 05/01/2015

Additional Information For additional information, contact your technical sales representative. For additional health and safety information, call Georgia Gulf Sulfur Corporation at 229-244-0000.

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