

67799-3

3/5/2004

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U.S. ENVIRONMENTAL PROTECTION AGENCY  
Office of Pesticide Programs  
Registration Division (7505C)  
Aerial Rios Building  
1200 Pennsylvania Ave., N.W.  
Washington, D.C. 20460

EPA Reg. Number:

67799-3

Date of Issuance:

MAR 5 2004

Term of Issuance:

Conditional

Name of Pesticide Product:

Sea Fresh 150

NOTICE OF PESTICIDE:

Registration  
 Reregistration  
(under FIFRA, as amended)

Name and Address of Registrant (include ZIP Code):

SEACO TECHNOLOGIES, Inc.  
P.O. Box 80205  
Bakersfield, CA 93380

**Note:** Changes in labeling differing in substance from that accepted in connection with this registration must be submitted to and accepted by the Registration Division prior to use of the label in commerce. In any correspondence on this product always refer to the above EPA registration number.

On the basis of information furnished by the registrant, the above named pesticide is hereby registered/reregistered under the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA).

Registration is in no way to be construed as an endorsement or recommendation of this product by the Agency. In order to protect health and the environment, the Administrator, on his motion, may at any time suspend or cancel the registration of a pesticide in accordance with the Act. The acceptance of any name in connection with the registration of a product under this Act is not to be construed as giving the registrant a right to exclusive use of the name or to its use if it has been covered by others.

This product is conditionally registered in accordance with FIFRA Section 3(c) (7) (A) provided that you:

1. Submit and/or cite all data required for registration of your product under FIFRA Section 3(c) (5) when the Agency requires all registrants of similar products to submit such data; and submit acceptable responses required for reregistration of your product under FIFRA Section 4.
2. Make the following label changes before you release the product for shipment:
  - a. Revise the EPA Registration Number to read, "EPA Reg. No. 67799-3."
  - b. Revise the statement on page 5: "Entering the fumigation area while the levels of sulfur dioxide exceed 2 ppm is not recommended" to "Entering the fumigation area while the levels of sulfur dioxide exceed 2 ppm is not permitted without the required PPE."
  - c. On page 8, under the heading "Truck, Van and Railcar Fumigation Areas" add the requirement: "Trucks, and vans fumigated with sulfur dioxide must be held for 24 hours before releasing for shipment. Transporting containers or vehicles under fumigation over public roads is prohibited."
3. Submit one copy of the revised final printed label before releasing the product for shipment.
4. If the conditions enumerated above are not complied with, the registration will be subject to cancellation in accordance with FIFRA Section 6(e). Your release for shipment of the product constitutes acceptance of these conditions. A stamped copy of the label is enclosed for your records.

Signature of Approving Official:

Date:

MAR 5 2004

Cynthia Giles-Parker  
Product Manager (22)  
Fungicide Branch

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# SEA♣FRESH 150

## INSTRUCTIONS BOOKLET

SULFUR DIOXIDE  
LIQUEFIED  
GAS UNDER PRESSURE

EPA REG. NO  
EPA EST. NO 67799

ACCEPTED  
with COMMENTS  
In EPA Letter Dated:  
MAR 5 2004

Under the Federal Insecticide,  
Fungicide, and Rodenticide Act,  
as amended, for the pesticide  
registered under EPA Reg. No.

67799-3

**DANGER**  
**PELIGRO**

# POISON



Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle

### KEEP OUT OF REACH OF CHILDREN

Active Ingredient:	
SULFUR DIOXIDE	100.00%
Total	100.00%

SEACO TECHNOLOGIES, INC  
P. O. BOX 80205  
BAKERSFIELD, CA 93380  
661 326-1522

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## PRECAUTIONARY STATEMENTS

Hazard to Humans

**DANGER**

**SULFUR DIOXIDE (SEA FRESH 150) is a hazardous liquid under pressure and is to be used and dispersed only by individuals trained by Seaco Technologies, Inc. This product is intended to be used only by Seaco personnel or under supervision and instruction of Seaco Technologies, Inc. It is recommended that a minimum of two persons be present at all times from introduction of the fumigant through the aeration period. Read this entire booklet prior to use.**

**NOTICE TO USER:** It is a violation of Federal Law to use this product in a manner inconsistent with its labeling. This labeling must be in possession of the user at the time of the pesticide application. Before moving or using, handlers must be trained how to appropriately use respirators that conform to OSHA requirements (described in 29 CFR Part 1910.134) and how to appropriately handle and use sulfur dioxide. This product, including dispensing equipment, must be handled and used in accordance with the practices specified by all applicable product labeling.

**Sulfur Dioxide (Sea Fresh 150) is a hazardous liquid and vapor under pressure. Inhalation may be fatal or cause serious acute illness.** Do not breathe vapor. It is an irritant to eyes, nose and throat even at low levels. Do not get liquid or excessive vapor on skin, in eyes or on clothing. If tearing or upper respiratory tract irritation occurs, leave the fumigation area immediately. Persons with a history of respiratory problems should not be exposed to sulfur dioxide. Medical examinations of potential applicators or persons expected to be regularly exposed to sulfur dioxide should be conducted prior to employment and again at 1 to 2 year intervals. Use only in well ventilated areas.

**STORAGE AND DISPOSAL: DO NOT CONTAMINATE FOOD OR FEED BY STORAGE OR DISPOSAL.** Store upright outside or in a well ventilated area indoors at normal room temperatures. Do not store in direct sunlight or expose to temperatures in excess of 130 F. Do not store near flammable material, heat source, inlet areas of venting or air conditioning units or in a subsurface area. Do not drop the cylinders. Do not remove the valve protection bonnet and safety cap until immediately before use. Cylinders must be stored in a secure manner under lock and key and the storage area must be properly marked as a pesticide storage area. Do not use rope slings, hooks, tongs, or similar devices to unload cylinders. Transport cylinders using hand truck, fork truck or other device to which the cylinder can be firmly attached.

**Pesticide Disposal:** If these wastes cannot be disposed of by use according to the label instructions, contact your State Pesticide or Environmental Control Agency or the Hazardous Waste representative at the nearest EPA Regional Office for guidance.

**Container Disposal:** Sulfur dioxide cylinders are designed for reuse and must be returned to the supplier. Cylinders to be returned should be properly identified with DOT tag or weather resistant label attached near the outlet valve and returned according to the prescribed instructions and practices of the supplier. Do not use cylinders for any other purpose.

**WARRENTY & DISCLAIMER:** Seaco Technologies, Inc. warrants that this material conforms to the chemical description on the label and is reasonably fit for the purposes referred to in the Directions For Use, subject to the risks referred to therein. SEACO TECHNOLOGIES, INC. MAKES NO OTHER EXPRESS OR IMPLIED WARRENTY OF FITNESS OR MERCHANTABILITY OR ANY OTHER EXPRESS OR IMPLIED WARRENTY. In no case shall Seaco Technologies, Inc. or seller be liable for consequential, special or indirect damages resulting from the use or handling of this product including, but not limited to, loss of profits, business reputation, or customers, labor cost, or other expenses incurred in repackaging, sort or reprocessing.

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## FIRST AID

**IN EVERY INSTANCE OF OVEREXPOSURE, GET IMMEDIATE MEDICAL ATTENTION.**

### IF INHALED:

Remove exposed person to fresh air immediately and away from contaminated area. If breathing has stopped, administer artificial respiration immediately. Do not attempt to give anything by mouth to an unconscious person. Trained personnel should administer oxygen as quickly as possible.

If breathing has not stopped, arrange exposed person in a sitting position with head and body elevated to a 45 to 60% angle. Trained personnel should administer oxygen as quickly as possible. Get Medical Attention Immediately.

### IF INGESTED (SWALLOWED):

If person is unconscious, do not attempt to give anything by mouth. If person is conscious, give one to two glasses of milk or water as quickly as is possible. DO NOT induce vomiting! Get immediate medical attention.

### IF IN EYES

Hold eyelids open while flushing with large amounts of water in a steady stream for at least 15 minutes (for 30 minutes if medical attention cannot be immediate). All areas of the eye and lid should be flushed. Do not apply any ointments, liquids or medications of any kind. Get immediate medical attention.

Contact lenses should not be worn when working with sulfur dioxide.

### PROTECTIVE CLOTHING:

Wear protective clothing, gloves, and boots at all times when handling this pesticide product. If using braided hose, an approved full-face mask is necessary when checking connections or making gas applications.

If unbraided hose is being used, protective clothing, gloves and boots impervious to sulfur dioxide, goggles and a NIOSH/MSHA approved respirator are to be worn when checking connections and making all gas applications. Contact lenses should not be worn while working with sulfur dioxide.

### RESPIRATORY PROTECTION:

Sulfur Dioxide concentrations of 2.0 ppm or less as measured by a pump and functioning detector tubes require no respiratory protection. Examples of pump and detector tubes would include Draeger handpumps with recommended detector tubes and Sensidyne or Kitagawa syringe type samplers with recommended detector. Manufacturers correct use of any measuring device should be followed to ensure safety.

### RESPIRATORY PROTECTION AT HIGHER CONCENTRATION LEVELS:

If the 2.0 ppm level of concentration is exceeded at any time, any and all personnel working in the fumigation area must wear a NIOSH/MSHA approved full face respirator. TIME OF EXPOSURE SHOULD BE KEPT TO A MINIMUM. Overloading of sulfur dioxide in unmeasured concentrations is possible, therefore exposure, even with an approved mask should be kept brief and only at short periods of time. A NIOSH/MSHA approved self-contained breathing mask (SCBA) or combination air supplied SCBA respirator should be available at all times in case of an emergency and is essential to any levels above 20ppm. Even brief exposures to 100 ppm can result in death.

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## DIRECTIONS FOR USE

### STORAGE, HANDLING AND DISPOSAL

#### SULFUR DIOXIDE (SEA FRESH 150) CYLINDERS SHOULD BE STORED:

1. IN A SECURED AREA LABELED AS A CATEGORY I PESTICIDE STORAGE AREA.
2. In an UPRIGHT POSITION
3. Secured to prevent accidental tipping or knocking together.
4. Out of direct sunlight.
5. Away from the general public.
6. Away from water sources.
7. Away from food.
8. Away from feed.
9. Away from sources of heat.
10. Away from flammable or combustible materials.
11. Away from inlets for air conditioning or heating units.
12. At or above ground rather than subsurface.
13. With bonnet and safety caps tightly secured at all times.

#### HANDLING OF CYLINDERS

Sulfur Dioxide (Sea Fresh 150) cylinders should be handled in a careful manner at all times to prevent dropping or shock. They should be moved carefully to prevent exterior abrasion and never slid along the ground. Slings, hooks and tongs should not be used in moving cylinders.

Empty cylinders are designed to be refilled and reused by AUTHORIZED DEALERS ONLY. When empty, close valve by turning to the right until tight, replace safety bonnet and return to Seaco Technologies, Inc. Authority to return and shipping instructions can be arranged by contacting Seaco Technologies, Inc. DO NOT USE CYLINDERS FOR ANY OTHER PURPOSE.

#### SPILL AND LEAK PROCEDURES

Immediately move unprotected personnel upwind. If the Sulfur Dioxide (Sea Fresh 150) container/cylinder is leaking, try to position it in an upright position so that gas, rather than liquid leaks. Using full protective equipment, apply emergency-sealing device if possible. Cover leak area with tarp or plastic sheet to limit spread of Sulfur Dioxide. NEVER IMMERSE A LEAKING CONTAINER IN WATER.

Sulfur Dioxide (Sea Fresh 150) can be deactivated with dilute solutions of soda ash, caustic soda, hydrated lime or sodium bicarbonate. Maintain alkaline pH during neutralization. Alkaline solutions must be oxidized before disposal due to their oxygen demand.

Dispose of any waste material at an approved waste disposal facility and in accordance with all applicable regulations. Do not dispose of waste materials in normal garbage or sewer system.

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## PLACARDING INSTRUCTIONS

### FUMIGATED WAREHOUSE AREAS:

Before fumigation, all entrances to the fumigation area must be posted with signs that include the following information:

DANGER / PELIGRO

Area Under Fumigation

DO NOT ENTER / NO ENTRE

Date and Time of Fumigation

Name of Fumigant Used

Name, Address and Telephone Number of the Applicator

The words DANGER / PELIGRO need to be written in at least 2" letters for optimum visibility

If a treated commodity is moved to another location without aeration, the new site must be placarded until the air around the commodity is tested and determined to be below the threshold concentration of 2.0 ppm.

Entering the fumigation area while levels of sulfur dioxide exceed 2.0 ppm is not recommended. Please refer to RESPIRATORY PROTECTION AT HIGHER CONCENTRATION LEVELS in First Aid Section.

**AERATION & RE-ENTRY TO FUMIGATED WAREHOUSE:** After fumigation, treated areas must be aerated until the level of sulfur dioxide is below 2.0 ppm. This is determined by using a direct detection device (for example, a Gastec-Sensidyne Dosimeter Tube or for immediate readings, a Draeger hand pump and recommended detector tube or Kitagawa or Sensidyne syringe with recommended detection device). Do not allow anyone into the fumigation area until sulfur dioxide levels are measured below 2.0 ppm. Posted placards can be removed after SeaFresh 150 concentrations fall below the 2.0 ppm level in the treated area. It is important to note that any level more than 20 ppm is above capacity of rated gas masks and only self contained breathing devices can be used and only with proper training and instruction in its use. Even very brief exposure to 100 ppm is extremely hazardous to life and health.

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## PLACARDING INSTRUCTIONS (CONTINUED)

### TRUCK, VAN & RAILCAR FUMIGATION AREAS:

All truck, van, and railcars that are being used for fumigation must be placarded. The following should be included:

DANGER/PELIGRO

*Need to be written in at least 2" letters for optimum visibility.*

TRAILER FUMIGATED WITH SULFUR DIOXIDE.

DO NOT ENTER – NO ENTRE

DATE & TIME OF FUMIGATION

In addition, a manifest must accompany each load. The Applicator must show on the manifest, which accompanies the load of produce, that the trailer, van or railcar has been fumigated with Sulfur Dioxide. The statement must include the following:

DANGER / PELIGRO

TRAILER FUMIGATED WITH SULFUR DIOXIDE

Date and Time of Fumigation

The words, DANGER/PELIGRO, NEED TO BE WRITTEN IN AT LEAST 2" LETTERS for optimum visibility.

**AERATION & RE-ENTRY TO FUMIGATED TRAILERS, VANS & RAILCARS:** If re-entry to a fumigated trailer or railcar is necessary after fumigation, treated areas must be aerated until the level of sulfur dioxide is below 2.0 ppm. This is determined by using a direct detection device (for example, a Gastec-Sensidyne Dosimeter Tube or for immediate readings, a Draeger hand pump and recommended detector tube or Kitagawa or Sensidyne syringe with recommended detection device). Do not allow anyone into the fumigation area until sulfur dioxide levels are measured below 2.0 ppm. Posted placards can be removed after Sulfur Dioxide (SeaFresh 150) concentrations fall below the 2.0 ppm level in the treated area. It is important to note that any level more than 20 ppm is above capacity of rated gas masks and only self contained breathing devices can be used and only with proper training and instruction in its use. Even very brief exposure to 100 ppm is extremely hazardous to life and health.

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## DIRECTIONS FOR USE (CONT)

### WAREHOUSE STORAGE & FUMIGATION:

Timing is crucial to ensure optimum results. The fumigation of grapes using Sulfur Dioxide should occur as soon after harvest as is possible.

Fruit that will be held for extended periods of time should be fumigated with Sulfur Dioxide on the same day as harvesting, within a 12-hour period and then followed with subsequent fumigation at 7-day intervals.

Fruit that is being shipped to markets soon after harvest should be fumigated before initial transportation. Fruit held for shorter periods of time in preparation for shipping can be fumigated in transit if it has been fumigated no more than three times.

Seeded varieties of grapes may be fumigated every 7 to 10 days up to a total of 20 times. Seedless varieties may be fumigated using 7 to 10 day intervals up to 15 times and the Thompson Seedless grape should not be fumigated more than a total of 12 times total using 7 to 10 day intervals.

### FOR POST HARVEST USE ON GRAPES HELD IN COLD STORAGE:

Sulfur Dioxide (SEA FRESH 150) fumigation of grapes held in cold storage will suppress the spread of gray mold disease caused by Botrytis Cinerea. For optimum results:

1. Care should be given to avoid bruising of fruit, crushing of berries or excess bunch shatter.
2. Do not allow liquid Sulfur Dioxide (Sea Fresh 150) to come in direct contact with fruit as bleaching will occur.
3. Apply only in closed stationary spaces such as fumigation, pre-cooling or cold storage rooms or transportation vehicles such as trucks, trailers, vans and railcars.
4. Commence fumigation in the following order:
  - a. Position palletized fruit in accordance with industry recommendations and those suggested in these directions in enclosed area. Packed boxes should be oriented to ensure that openings are aligned with openings of other packed boxes to promote optimum air flow. See Storage Room Fumigation, Traditional & Utilization Methods.
  - b. Using recommended industry standards; determine quantity of sulfur dioxide needed for each particular application.
  - c. Turn on fans, using an adequate number to ensure volatilization of all the sulfur dioxide and to permit a uniform concentration of fumigant throughout the closed area. Air volume is recommended to be at least 0.5 times the volume of the fumigated space during each minute of gassing.



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- d. Firmly close all vents and ports into and out of the storage area prior to attaching Sulfur Dioxide (Sea Fresh 150) to hose system.
- e. Attach Sulfur Dioxide (Sea Fresh 150) container/cylinder into the house hose system making certain hoses are directed into open, unrestricted areas.
- f. Ensure that safety placards are in place in accordance with the instructions under PLACARDING OF FUMIGATED WAREHOUSE AREAS.
- g. Vaporize Sulfur Dioxide (Sea Fresh 150) by opening valve all the way to the left and only after ensuring that all connections are tightly closed. Leave the valve open until the container is empty. Treatment should last 20 to 30 minutes and starts from the minute gas is initially admitted into the room.
- h. End fumigation period at the end of 30 minutes, or sooner, by venting or scrubbing the fumigated air from the enclosed area. This should be accomplished immediately following gassing to avoid excess residue. This will require sufficient air movement or replacement of air in the room at the rate of 0.1 to 0.3 of the cubic volume of the room per minute for an approximate 30 minute period. Fans should be periodically checked to ensure this rate of air movement. Water scrubbing systems must have sufficient surface to remove the Sulfur Dioxide (Sea Fresh 150) at the same rate as that of direct venting.
- i. Close valve on empty cylinder by turning to the right or clockwise direction prior to disconnecting hose lines. Replace protection bonnet and return empty cylinder to Seaco Technologies, Inc.
- j. End fumigation period at the end of 30 minutes, or sooner, by venting or scrubbing the fumigated air from the enclosed area. This should be accomplished in a 20 to 30 minute period. This will require sufficient air movement or replacement of air in the room at the rate of 0.1 to 0.3 of the cubic volume of the room per minute.
- k. Close valve on empty cylinder by turning to the right or clockwise direction prior to disconnecting hose lines.

These recommendations, as well as, temperature control will provide for best results. To use less than the recommended amounts of Sulfur Dioxide (Sea Fresh 150) may result in reduced efficacy.

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## HIGH FREQUENCY - LOW DOSAGE TREATMENT

It is essential if using this method, that examination of fruit should be made at least once a week to determine if there is any evidence of mold growth. This inspection should be repeated for the duration of the storage time. For optimum results, follow directions given in FOR POST HARVEST USE OF GRAPES HELD IN COLD STORAGE with the following departures:

1. Initial fumigation should be  $\frac{3}{4}$  to 1% of the gas concentration based on the measured volume of the cold storage room. This initial fumigation should occur within a 12-hour period after harvest. Treatment should continue until a room concentration level is determined by measurement to be less than 2.0-ppm. Vigorous air movement is required during the fumigation process and for a 30 minute time period following the fumigation. No venting is required for this process.
2. Follow-up fumigation should proceed at the rate of 200 to 400 ppm gas concentration based on the measured volume of the cold storage room and at a frequency of three times per week (for example 2 days, 2 days and 3 days.)
3. A pre-weighed cylinder of Sulfur Dioxide (Sea Fresh 150) will be supplied by Seaco Technologies, Inc. or their agent that has been filled for a predetermined measured room. The filling weight of the cylinder will be determined by the room size.
4. Connect the appropriate cylinder to a gassing system, which has been inspected and approved by Seaco Technologies, Inc or their agents. Open the valve completely to the right. Leave the valve open until the cylinder is empty.
5. Close valve on empty cylinder by turning all the way to the left. Remove the cylinder from the gassing system. Replace protection bonnet and return empty cylinder to Seaco Technologies, Inc. or their agents.

**AERATION & RE-ENTRY TO FUMIGATED WAREHOUSE:** After fumigation, treated areas must be aerated until the level of sulfur dioxide is below 2.0 ppm. This is determined by using a direct detection device (for example, a Gastec-Sensidyne Dosimeter Tube or for immediate readings, a Draeger hand pump and recommended detector tube or Kitagawa or Sensidyne syringe with recommended detection device). Do not allow anyone into the fumigation area until sulfur dioxide levels are measured below 2.0 ppm. Posted placards can be removed after Sulfur Dioxide (Sea Fresh 150) concentrations fall below the 2.0 ppm level in the treated area. It is important to note that any level more than 20 ppm is above capacity of rated gas masks and only self contained breathing devices can be used and only with proper training and instruction in its use. Even very brief exposure to 100 ppm is extremely hazardous to life and health.

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## **SUGGESTIONS FOR LOADING GRAPES FOR TRANSIT**

A 48-foot-long trailer can accommodate wood or corrugated boxes stacked on 48 X 40-inch pallets to reach the 45,000 lb. shipping weight. Pallets should be pin-wheel loaded in order to maximize flow of air and minimize temperatures rising during transit. A 53-foot-long trailer would be needed in order to accommodate a full load of the 12 X 20" foam boxes. A load of all wood boxes should be loaded with their 40" side across the trailer from side to side. They can be side shifted against opposite trailer walls to prevent contact between boxes and trailer sides. All wood boxes will reach a maximum trailer weight prior to the trailer becoming full.

## **FUMIGATION OF TRAILERS**

An approved hose kit should be installed in the trailer through the drain line at the end of the trailer and under the pallets. Detailed instructions for installing the hose kit are included in the container case for the kit. Close the trailer doors and insure placards are in place. Connect the Sea Fresh 150 container, which has been pre-weighed, to the hose end. Turn the cylinder upside down and open the valve for approximately 2 minutes or until empty. After the cylinder is emptied, close the valve completely and disconnect from the hose end. Return empty cylinders to Seaco Technologies, Inc.

Trailers fumigated with Sulfur Dioxide (Sea Fresh 150) must be held for twenty-four (24) hours before being released for shipment. See AERATION & RE-ENTRY TO FUMIGATED TRAILERS, VANS & RAILCARS below.

## **FUMIGATION OF RAILCARS**

An approved hose kit should be installed in the trailer through the drain line under the pallets that support the fruit. Detailed instructions for installing the hose kit are included in the container case for the kit. Close all doors/openings and ensure that the placards are in place. Connect the Sulfur Dioxide (Sea Fresh 150) cylinder, which has been pre-weighed, to the hose end by turning the cylinder upside down and open the valve for approximately 2 minutes or until empty. After the cylinder is emptied, close the valve completely and disconnect from the hose end. Return empty cylinders to Seaco Technologies, Inc.

## **AERATION & RE-ENTRY TO FUMIGATED TRAILERS, VANS & RAILCARS:**

If re-entry to a fumigated trailer or railcar is necessary after fumigation, treated areas must be aerated until the level of sulfur dioxide is below 2.0 ppm. This is determined by using a direct detection device (for example, a Gastec-Sensidyne Dosimeter Tube or for immediate readings, a Draeger hand pump and recommended detector tube or Kitagawa or Sensidyne syringe with recommended detection device). Do not allow anyone into the fumigation area until sulfur dioxide levels are measured below 2.0 ppm. Posted placards can be removed after Sulfur Dioxide (SeaFresh 150) concentrations fall below the 2.0 ppm level in the treated area. It is important to note that any level more than 20 ppm is above capacity of rated gas masks and only self contained breathing devices can be used and only with proper training and instruction in its use. Even very brief exposure to 100 ppm is extremely hazardous to life and health.

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## MEASURING AND MONITORING LEVELS OF SEA FRESH 150

The concentration of Sulfur Dioxide (Sea Fresh 150) and the time of contact on the fruit are multiplied to achieve the CT (concentration X time). The concentration is measured in ppm (parts per million) and is multiplied by the amount of time of contact with the fruit.

Levels of Sulfur Dioxide (Sea Fresh 150) up to 250 ppm-hour should be measured by dosimeter tube placed within boxes of fruit. Typically, these tubes should be placed in fruit contained in the hardest to fumigate areas of a given room. This would include center boxes as well as areas of reduced airflow. Dosimeter type tubes should be placed immediately prior to fumigation and read upon completion of fumigation. Higher concentration levels within the storage rooms should be measured using pump-type samplers. Infrared style analyzers should not be used on a regular basis due to difficulty in accurate calibrations. The maximum allowable level of sulfur dioxide in initial fumigation is 10,000 ppm. The maximum allowable level of sulfur dioxide in storage fumigation is 5,000 ppm.

Quantities of Sulfur Dioxide (Sea Fresh 150) need to be monitored in each storage facility as follows:

Dosimeter Tubes should be placed in the center boxes on the pallets. Boxes should be monitored from at least three lanes of pallets at both the up and down wind ends of lanes along with high and low levels of elevation.

Frequently inspect the grapes taken from pallets that receive the highest and also the lowest concentrations of Sea Fresh 150. (Ordinarily these boxes would be closest to the air in-take and air returns). Frequently inspect the fruit in the center most boxes and in areas where airflow is compromised for any decay.

Monitor Sulfur Dioxide (Sea Fresh 150) residues in fruit starting as early as possible in the storage facility. Highest percentages of residue will typically occur nearest the upwind end of the pallet rows and in outside top corner boxes. Any residues higher than 3ppm should be immediately reported to the supervisor.

## INITIAL FUMIGATION - TRADITIONAL METHODS

Circulating-air fumigation or forced-air fumigation can be used in combination with initial cooling or as a completely separate operation. The amount of sulfur dioxide needed can be determined using the following formula:

$$\text{Pounds Sulfur Dioxide} = \frac{A \times V \times C}{10,000,000}$$

A = 1.67 at 70°F and 1.82 at 32°F

V = Room Volume (cubic feet)

C = Sulfur Dioxide concentration (ppm)

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Concentration levels may also be determined by the percentage of sulfur dioxide in the given room. One percent sulfur dioxide is equivalent to 10,000 ppm (0.5 percent sulfur dioxide is equal to 5,000 ppm).

Maximum sulfur dioxide concentration level is 10,000 ppm for any initial fumigation. Dosimeter tubes placed in boxes must be used to determine proper penetration percentages.

Care should be given to ensure air speeds of at least 140 feet per minute if using circulating-air techniques to optimize maximum penetration of sulfur dioxide to the center placed pallets. In addition, proper aligning of liner vents and box vents are crucial to the success of the fumigation. In some instances, fruit wrapped in plastic bags and/or paper wrapping may reduce the penetration of sulfur dioxide.

Forced-air fumigation utilizes airflow systems much like forced-air cooling. The open areas between pallet rows should be covered with reinforced tarps to create a tunnel effect. Fans are needed to pull the air through the tunnel, allowing the room air in which sulfur dioxide has been added to penetrate the boxes. Typically, the excess sulfur dioxide is expelled from the room after thirty minutes.

It is important to note: Newly constructed facilities may not release any sulfur dioxide into the outside atmosphere. Existing facilities, as of the time of this writing, are not under the same restrictions. Where venting is regulated, water-scrubbing equipment is typically used in which the sulfur dioxide laden air is forced through a water spray or pad assembly process. Ten pounds of sulfur dioxide can be absorbed by 1400 gallons of water if the water is at 32°F. Warmer water temperatures are less effective. This water cannot be reused and must be disposed of in accordance with local, state and federal regulations. In some instances, sodium or potassium hydroxide is used in the scrubbing water to increase it's ability to absorb the sulfur dioxide with the same waste water rules applying to it's disposal.

#### **INITIAL FUMIGATION – TOTAL UTILIZATION METHODS**

This method of fumigation can be used ONLY in conjunction with pre-cooling of the fruit. The actual fumigation is done simultaneously with the pre-cooling allowing complete absorption as the sulfur dioxide stays in contact with the fruit for extended periods of time. The storage rooms are prepared in the same manner as for forced-air fumigation and any related considerations apply.

An advantage of this method of fumigation is less sulfur dioxide is used to achieve more consistent levels of in-box CT levels in excess of 100 ppm-hours for all packaging types. An additional advantage would be concentration levels of 2 ppm or less at the end of the fumigation period necessitating less scrubbing of the sulfur dioxide. If concentration levels, at the end of the fumigation period do happen to exceed 2 ppm, less sulfur dioxide can be used or an extension of the fumigation period may be necessary.

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The factors for determining the amount of sulfur dioxide necessary to provide adequate decay control in initial fumigation may be calculated using the following formula:

Box Type	Sulfur Dioxide Factor (lbs./10,000 boxes)	
EPS	1.5	(or 3.0 if penetration is poor)(boxes @ 25lbs. gross)
TKV	3.7	(or 6.3 if penetration is poor)(boxes @ 25lbs. gross)

*EPS (Expanded Polystyrene Boxes)*  
*TKV (Technical Kraft Veneer Boxes)*

Lower factors are recorded for Polystyrene boxes since they do not absorb sulfur dioxide as readily as other materials such as wood or fiberboard.

Examples of sulfur dioxide needed for an initial forced air fumigation using utilization methods for a room storing 10,000 boxes of fruit is as follows:

% of max. box storage capacity	sulfur dioxide required (depending on measured penetration)	
	EPS boxes	TKV boxes
20	.8 – 1.5	1.9 – 3.2
40	.8 – 1.5	1.9 – 3.2
50	.8 – 1.5	1.9 – 3.2
60	.9 – 1.8	2.2 – 3.8
80	1.2 – 2.4	3.0 – 5.0
100	1.5 – 3.0	3.7 – 6.3

Since rooms vary, each fumigation room needs to be calibrated to determine the appropriate quantity of sulfur dioxide needed to achieve a CT of 100 ppm-hours in packed boxes. Sulfur Dioxide levels should never be lower than that of a half full storage room.

#### STORAGE ROOM FUMIGATION USING TRADITIONAL METHODS

The maximum concentration of sulfur dioxide permitted in storage rooms is 5,000 ppm. Methods for fumigating are similar to that described in initial fumigation using traditional methods allowing for the lower 5,000 ppm. Optimally, a room is fumigated every seven days to control Botrytis on grapes held in storage and temperatures are maintained at 31°F.

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### STORAGE ROOM FUMIGATION USING UTILIZATION METHODS

Methods for storage room fumigation are similar to the initial fumigation utilization method except that the air is not forced past the pallet rows, but rather flows freely down the lanes. Typically, pallets are stacked two to three high with not less than four and no more than six inches separating the lanes. Methods for fumigating storage rooms are similar to that described in initial fumigation using utilization methods; however, sulfur dioxide levels are greater due to poorer penetration. The level of sulfur dioxide should never be less than that required for a half full room. Fumigation should be repeated at seven day intervals and temperatures maintained at 31°F.

The factors for determining the amount of sulfur dioxide necessary to provide adequate decay control in storage fumigation may be calculated using the following formula:

Box Type	Sulfur Dioxide Factor (lbs./10,000 boxes)	
EPS	3.0	(or 7.5 if penetration is poor)(boxes @ 25lbs. gross)
TKV	6.3	(or 14.0 if penetration is poor)(boxes @ 25lbs. gross)

Lower factors are recorded for Polystyrene boxes since they do not absorb sulfur dioxide as readily as other materials such as wood or fiberboard.

Examples of sulfur dioxide needed for forced air fumigation using utilization methods for a room storing 30,000 boxes of fruit is as follows:

% of max. box storage capacity	sulfur dioxide required (depending on measured penetration)	
	EPS boxes	TKV boxes
20	4.5 - 11.3	9.5 - 21.0
40	4.5 - 11.3	9.5 - 21.0
50	4.5 - 11.3	9.5 - 21.0
60	5.4 - 13.5	11.3 - 25.2
80	7.2 - 18.0	15.1 - 33.6
100	9.0 - 22.5	18.9 - 42.0

Since rooms vary, each fumigation room needs to be calibrated to determine the appropriate quantity of sulfur dioxide needed to achieve a CT of 100 ppm-hours in packed boxes. Sulfur Dioxide levels should never be lower than that of a half full storage room.

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## STORAGE AND DISPOSAL

### DO NOT CONTAMINATE FOOD OR FEED BY STORAGE OR DISPOSAL

**Pesticide Storage:** Store upright outside or in a well ventilated area indoors at normal room temperatures. Do not store in direct sunlight or expose to temperatures in excess of 130 F. Do not store near flammable material, heat source, inlet areas of venting or air conditioning units or in a subsurface area. Do not drop the cylinders. Do not remove the valve protection bonnet and safety cap until immediately before use. Cylinders must be stored in a secure manner under lock and key and the storage area must be properly marked as a pesticide storage area. Do not use rope slings, hooks, tongs, or similar devices to unload cylinders. Transport cylinders using hand truck, fork truck or other device to which the cylinder can be firmly attached.

**Pesticide Disposal:** If these wastes cannot be disposed of by use according to the label instructions, contact your State Pesticide or Environmental Control Agency or the Hazardous Waste representative at the nearest EPA Regional Office for guidance.

**Container Disposal:** Sulfur dioxide cylinders are designed for reuse and must be returned to the supplier. Cylinders to be returned should be properly identified with DOT tag or weather resistant label attached near the outlet valve and returned according to the prescribed instructions and practices of the supplier. Do not use cylinders for any other purpose.

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