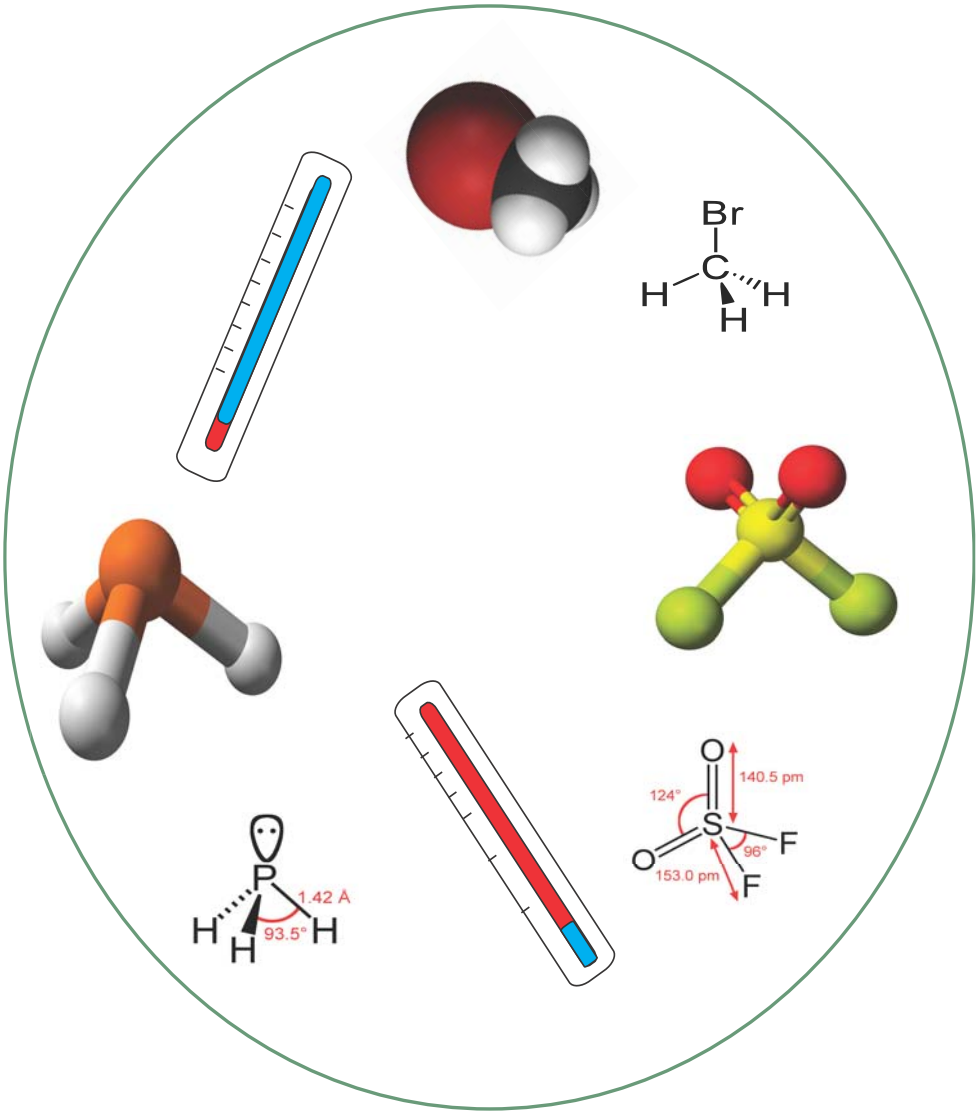
United States Department of Agriculture

Animal and Plant Health Inspection Service

Plant Protection and Quarantine

Treatment Manual



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Treatment Manual

Contents

Contents
1-1-i
Figures
1-1-v
Tables
1-1-ix
Introduction
Chemical Treatments
Overview *2-1-1*
Fumigants *2-2-1*
Fumigants • Methyl Bromide *2-3-1*
Fumigants • Methyl Bromide • Tarpaulin Fumigation *2-4-1*
Fumigants • Methyl Bromide • Chamber Fumigation *2-5-1*
Fumigants • Methyl Bromide • Ship Fumigation *2-6-1*
Fumigants • Methyl Bromide • Structure Fumigation *2-7-1*
Fumigants • Methyl Bromide • Special Procedures for Container Fumigations Without a Tarpaulin *2-8-1*
Fumigants • Sulfuryl Fluoride *2-9-1*
Fumigants, Phosphine *2-10-1*
Aerosols and Micronized Dusts *2-11-1*
Dips *2-12-1*
Dusts *2-13-1*
Sprays *2-14-1*
Nonchemical Treatments
Overview *3-1-1*
Heat *3-2-1*
Heat, Hot Water Immersion Treatment *3-3-1*
Heat • Steam Treatments *3-4-1*
Heat • Vapor Heat and Forced Hot Air Treatment *3-5-1*
Heat • Forced Hot Air • Niger Seed *3-6-1*
Cold Treatment (CT) *3-7-1*
Irradiation *3-8-1*
Residue Monitoring
Overview *4-1-1*
Instructions for Collecting, Packaging, and Shipping Residue Monitoring Samples *4-2-1*
Treatment Schedules
Index to Schedules *5-1-1*
T100 - Schedules for Fruit, Nuts, and Vegetables *5-2-1*

T200 - Schedules for Propagative Plant Material *5-3-1*
T300 - Schedules for Miscellaneous Plant Products *5-4-1*
T400 - Schedules for Miscellaneous Products *5-5-1*
T500 - Schedules for Plant Pests or Pathogens *5-6-1*
T600-Controlled Atmosphere Temperature Treatment System *5-7-1*
Domestic Treatments
5-8-1
Certifying Facilities
Overview *6-1-1*
Certifying Facilities
Certification of Vacuum Fumigation Chambers *6-2-1*
Certifying Atmospheric Fumigation Chambers *6-3-1*
Certification of Cold Treatment *6-4-1*
Certification of Hot Water Immersion Facilities *6-5-1*
Certification of Niger seed Treatment Facilities *6-6-1*
Certification of Forced Hot Air and Vapor Heat Treatment Facilities *6-7-1*
Certifying Irradiation Treatment Facilities *6-8-1*
Certifying Facilities for the Heat Treatment of Firewood *6-9-1*
Emergency Aid and Safety
Fumigation Exposure *7-1-1*
Pesticide Exposure *7-2-1*
Guidelines for Managing Pesticide Spills *7-3-1*
Hazard Communication and Material Safety Data Sheets *7-4-1*
Equipment
Glossary
Appendix A
Forms *A-A-1*
Appendix B
Coast Guard Regulations *B-B-1*
Appendix C
Maintenance: Supporting and Updating Manuals *C-C-1*
Appendix D
Conversion Tables *D-D-1*
Appendix E
Directory of Treatment Facilities *E-1-1*
Appendix F
List of Integral Containers Approved for Intransit Cold Treatment *F-1-1*
Appendix G
List of Vessels Equipped for Intransit Cold Treatment *G-1-1*
Appendix H
Reference Guide to Commercial Suppliers of Treatment and Related Safety Equipment *H-1-1*
Comment Sheet
CS-1-1
Index

Figures

Figure 2-3-1 Section 18 Exemptions *2-3-3*
Figure 2-4-1 Container Arrangement in Two Rows *2-4-9*
Figure 2-4-2 Container Arrangement in Two Rows *2-4-9*
Figure 2-4-3 Gas Lead Position (Side View) *2-4-12*
Figure 2-4-4 Typical Stack Arrangement with Fans, Leads, Introduction Line, Padding, and Sand Snakes *2-4-14*
Figure 2-10-1 NIOSH-Recommended Respiratory Protection *2-10-8*
Figure 2-10-2 Amount of Phosphine Liberated by Various Products *2-10-9*
Figure 2-10-3 Diagram of ECO2FUME® Gas Cylinder *2-10-10*
Figure 2-10-4 Diagram of One Type of Dispensing Equipment *2-10-12*
Figure 2-10-5 Diagram of One Type of Blending Equipment *2-10-16*
Figure 2-10-6 Diagram of VAPORPH3OS® and Forced Air Blending Equipment *2-10-18*
Figure 2-10-7 Commodity temperature and exposure period *2-10-32*
Figure 2-10-8 Side view of a recirculation system *2-10-34*
Figure 2-10-9 Three-dimensional view of a recirculation system *2-10-35*
Figure 3-7-1 Proper Placement of Pulp Sensor within Larger Fruit *3-7-7*
Figure 3-7-2 Proper Placement of Pulp Sensor within Smaller Fruit *3-7-8*
Figure 3-7-3 Fruit stack with middle row temperature probe placement *3-7-10*
Figure 3-7-4 40 foot Refrigerated Container with 18 Pallets of Fruit (not drawn to scale) *3-7-11*
Figure 3-7-5 Proper placement of cardboard between the last pallet row of fruit and the back doors of the container *3-7-12*
Figure 3-7-6 Number of Sensors in a Warehouse *3-7-21*
Figure 5-2-1 Commodities Ineligible for Quick Freeze Treatment *5-2-85*
Figure 5-5-1 Example of International Plant Protection Convention Marking *5-5-20*
Figure 6-4-1 Number of Temperature Sensors per compartment *6-4-6*
Figure 6-4-2 Example of a Completed Application for USDA Vessel Approval, page 1 of 3 *6-4-9*
Figure 6-4-3 Example of a Completed Application for USDA Vessel Approval, page 2 of 3 *6-4-10*
Figure 6-4-4 Example of a Completed Application for USDA Vessel Approval, page 3 of 3 *6-4-11*

Figure 6-4-5 Example of a Completed Application for USDA Container Certification, page 1 of 2 *6-4-13*
Figure 6-4-6 Example of a Completed Application for USDA Container Certification, page 2 of 2 *6-4-14*
Figure 6-4-7 Number of Temperature Sensors *6-4-16*
Figure 6-4-8 Example of a Completed Application for USDA Warehouse Approval, page 1 of 3 *6-4-19*
Figure 6-4-9 Example of a Completed Application for USDA Warehouse Approval, page 2 of 3 *6-4-20*
Figure 6-4-10 Example of a Completed Application for USDA Warehouse Approval, page 3 of 3 *6-4-21*
Figure 6-5-1 Hypothetical Certification Results: Treatment Tank with Multiple Set Points *6-5-3*
Figure 7-3-1 Abbreviated Spill Plan, Personal Reference Card (Wallet-size) *7-3-2*
Figure 7-3-2 Emergency Contacts for Pesticide Spills *7-3-3*
Figure 7-3-3 Poison Control Center *7-3-4*
Figure 7-3-4 Medical Emergency Facility *7-3-4*
Figure 7-3-5 Federal Aviation Administration (FFA) Office *7-3-6*
Figure 7-3-6 Community-Right-To-Know or Emergency Planning Coordinator (Fire Marshall) *7-3-7*
Figure 7-3-7 Fish and Game Department *7-3-7*
Figure 7-3-8 Regional Veterinary Services (VS) Office *7-3-7*
Figure 7-3-9 Regional Safety and Health Coordinator *7-3-8*
Figure 7-3-10 Local Police *7-3-8*
Figure 7-3-11 Local Hazardous Waste Official *7-3-9*
Figure 7-4-1 Appendix E—Guidelines for Employer Compliance *7-4-2*
Figure 8-1-1 Fumiscopes® *8-1-2*
Figure 8-1-2 GowMac® *8-1-3*
Figure 8-1-3 Spectros Methyl Bromide Monitor *8-1-9*
Figure 8-1-4 Methyl Bromide Volatilizer Coil *8-1-25*
Figure 8-1-5 Tubing Specifications *8-1-26*
Figure 8-1-6 Auxiliary Pump *8-1-29*
Figure 8-1-7 Example of Pressure Measurement in an Open-arm Manometer *8-1-30*
Figure 8-1-8 Example of U Tube Manometer *8-1-32*
Figure A-1 APHIS Form 205-R, Instructions and Worksheet for Calibrating Portable Temperature Sensors *A-A-3*
Figure A-2 APHIS Form 206-R, Test of the Accuracy of the Permanent RTD Sensors Installed in Hot Water Tanks *A-A-4*

Figure A-3 APHIS Form 207-R, Sensor Location Diagram Fruit Weights and Pulp Temperatures *A-A-5*
Figure A-4 Calibration of Temperature Probes (Cold Treatment) *A-A-7*
Figure A-5 Location of Temperature Sensors in Containerized Cargo (Cold Treatment) *A-A-8*
Figure A-6 Example of PPQ Form 429, Fumigation Record (Front) *A-A-9*
Figure A-7 Example of PPQ Form 429, Fumigation Record (Back) *A-A-10*
Figure A-8 Example of PPQ Form 519, Compliance Agreement *A-A-13*
Figure A-9 Example of PPQ Form 523, Emergency Action Notification *A-A-16*
Figure A-10 Example of PPQ Form 449-R, Temperature Recording Calibration Report *A-A-27*
Figure A-11 PPQ Form 203, Foreign Site Certificate of Inspection and/or Treatment *A-A-29*
Figure A-12 PPQ Form 556, In Transit Cold Treatment Clearance Report *A-A-32*
Figure H-1 DC Scientific Glass - Approved Thermometers *H-1-64*
Figure H-2 Fisher Scientific - Approved Thermometers *H-1-64*
Figure H-3 VWR - Approved Thermometers *H-1-65*
Figure H-4 Cole Parmer - Approved Thermometers *H-1-65*

Tables

Table 2-4-1 Determine Reporting Requirements *2-4-3*

Table 2-4-2 Number of Thermocouples *2-4-5*

Table 2-4-3 Determine the Temperature for the Proper Dosage Rate *2-4-15*

Table 2-4-4 Determine the Need to Add Gas and Adjust Exposure *2-4-23*

Table 2-4-5 Determine the Extended Exposure Period *2-4-25*

Table 2-4-6 Determine Gas Concentration Values and Corrections for Fruits and Vegetables at the 30-Minute Reading of T101-a-1 or Equivalent Schedules *2-4-27*

Table 2-4-7 Determine Gas Concentration Values and Corrections for Fruits and Vegetables at the 2-Hour Reading of T101-a-1 or Equivalent Schedules *2-4-28*

Table 2-4-8 Determine Gas Concentration Values and Corrections for Oak Log Fumigations Using Schedule T312-a *2-4-30*

Table 2-4-9 Determine Gas Concentration Values and Corrections for Oak Log Fumigations using Schedule T312-a-Alternative *2-4-33*

Table 2-4-10 Determine Responsibility for Aerating the Commodity *2-4-35*

Table 2-4-11 Determine the Aeration Procedure *2-4-37*

Table 2-4-12 Determine When to Release the Commodity *2-4-38*

Table 2-4-13 Determine When to Release the Commodity for Outdoor Fumigations *2-4-40*

Table 2-4-14 Determine When to Release the Commodity for Indoor Fumigations *2-4-40*

Table 2-4-15 Determine Number of Fans *2-4-41*

Table 2-4-16 Determine When to Release the Commodity *2-4-42*

Table 2-4-17 Determine when to Release the Commodity *2-4-43*

Table 2-4-18 Determine When to Release the Commodity for Indoor Fumigations *2-4-44*

Table 2-4-19 Determine when to Release the Commodity *2-4-45*

Table 2-4-20 Determine when to Release the Commodity *2-4-46*

Table 2-5-1 Determine Whether to Use Commodity or Air Temperature for Determining Dosage Rate *2-5-3*

Table 2-5-2 Determine the Responsibility for Monitoring the Aeration *2-5-4*

Table 2-5-3 Determine the Aeration Procedure *2-5-4*

Table 2-5-4 Determine When to Release the Commodity *2-5-5*

Table 2-5-5 Determine When to Release the Commodity *2-5-6*

Table 2-5-6 Determine When to Release the Commodity *2-5-7*

Table 2-6-1 Determine Pre-fumigation Procedures *2-6-7*

Table 2-6-2 Determine Time for Extended Exposure *2-6-12*

Table 2-6-3 Determine the Responsibility for Monitoring the Aeration *2-6-12*

Table 2-7-1 Determine the Number of Sampling Tubes *2-7-9*

Table 2-7-2 Determine the Responsibility for Monitoring the Aeration *2-7-15*

Table 2-9-1 Effect of Hose Inside Diameter on Rate of Gas Introduction through a 25-Foot Hose (approximates, depending on cylinder pressure) *2-9-4*

Table 2-9-2 Effect of Hose Length on Rate of Gas Introduction through a inch Inside Diameter Hose *2-9-4*

Table 2-10-1 Fan Capacity Based on Volume of Hold *2-10-33*

Table 2-10-2 Phosphine Residue Tolerances *2-10-36*

Table 3-4-1 Pressure Temperature Relationships *3-4-2*

Table 3-5-1 Example of a Treatment Schedule *3-5-4*

Table 3-8-1 Pest-Specific Minimum absorbed dose (Gy) *3-8-4*

Table 5-2-1 Determine Dip Time Based on Origin of Fruit *5-2-57*

Table 5-2-2 Determine Dip Time Based on Origin of Fruit *5-2-57*

Table 5-2-3 Determine Dip Time Based on Origin of Fruit *5-2-58*

Table 5-2-4 Pest-Specific Minimum absorbed dose (Gy) *5-2-66*

Table 5-2-5 Origin and Approved Commodity List for 150 Gy *5-2-68*

Table 5-2-6 Origin and Approved Commodity List for 400 Gy *5-2-69*

Table 5-2-7 Origin and Approved Commodity List for 300 Gy *5-2-69*

Table 5-4-1 Determine Gas Concentration Values and Corrections for Oak Log Fumigations using Schedule T312-a *5-4-32*

Table 5-4-2 Determine Gas Concentration Values and Corrections for Oak Log Fumigations using schedule T312-a-Alternative *5-4-35*

Table 5-4-3 Amount of Phosphine Liberated by various Products. Calculate amount of product needed by using the amount of phosphine released as shown in the right column. *5-4-39*

Table 5-5-1 Pesticide Treatment for Pinus radiata and Eucalyptus Wood Chips *5-5-21*

Table 5-5-2 Airbus Industries *5-5-31*

Table 5-5-3 Antonov *5-5-32*

Table 5-5-4 ATR *5-5-32*

Table 5-5-5 BAC (British Aircraft Corp) *5-5-32*

Table 5-5-6 BAC (Aerospatiale) *5-5-33*

Table 5-5-7 Boeing *5-5-33*

Table 5-5-8 Canadair *5-5-34*

Table 5-5-9 Casa *5-5-35*

Table 5-5-10 Cessna *5-5-35*

Table 5-5-11 Convair *5-5-35*

Table 5-5-12 de Havilland *5-5-36*

Table 5-5-13 Dornier *5-5-36*

Table 5-5-14 Embraer *5-5-37*

Table 5-5-15 Fairchild *5-5-37*

Table 5-5-16 Fokker *5-5-37*

Table 5-5-17 Lockheed *5-5-37*

Table 5-5-18 McDonnel-Douglas *5-5-38*

Table 5-5-19 SAAB *5-5-40*

Table 5-5-20 Shorts *5-5-40*

Table 5-5-21 Sidely *5-5-40*

Table 5-5-22 Tupolev *5-5-41*

Table 5-5-23 Vickers *5-5-41*

Table 5-5-24 Military Aircraft *5-5-41*

Table 5-5-25 Amount of Phosphine Liberated by Various Products *5-5-48*

Table 5-7-1 Summary of CATTS treatments *5-7-5*

Table 5-8-1 Emulsifiable Chlorpyrifos Dosage for Balled or Containerized Plants *5-8-7*

Table 5-8-2 Insecticides and Dosages for Drenching Plants in Containers *5-8-7*

Table 5-8-4 Certification period for Plants in Containers *5-8-8*

Table 5-8-3 Bifenthrin calculations based on Bulk Density *5-8-8*

Table 5-8-5 Emulsifiable Chlorpyrifos Dosage for Balled Plants *5-8-9*

Table 5-8-6 Potting Media Bulk Density *5-8-9*

Table 5-8-7 Application Rates for Incorporation of Granular Insecticides into Potting Media *5-8-11*

Table 5-8-8 Chlorpyrifos Dosage for Grass Sod *5-8-12*

Table 6-2-1 Vacuum Chamber Classification Table *6-2-3*

Table 6-2-2 Chamber Checklist *6-2-6*

Table 6-3-1 Chamber Checklist *6-3-7*

Table 7-1-1 Fumigant Monitoring Devices and Sources of Exposure *7-1-6*

Table 8-1-1 Threshold Limit Values of Fumigants *8-1-13*

Table A-1 Instructions for Completing PPQ Form 519, Compliance Agreement *A-A-14*

Table A-2 Instructions for Initiating an EAN *A-A-18*

Table A-3 Determine Paperwork to Be Presented upon Arrival of a Precleared Commodity *A-A-30*

Table A-4 Distribution of PPQ Form 203, Foreign Site Certificate of Inspection and/or Treatment *A-A-31*

Table D-1 Conversion Tables *D-D-1*

1 Introduction

Treatment Manual

Contents

Purpose **1-1-1**
Restrictions **1-1-1**
Scope **1-1-2**
Users **1-1-2**
Related Documents **1-1-3**
Application **1-1-3**
How to Use This Manual **1-1-3**
Reporting Problems **1-1-4**
Conventions **1-1-4**

Purpose

The procedures and treatment schedules listed in this manual are administratively authorized for use in Plant Protection and Quarantine (PPQ). The treatment of listed commodities prevents the movement of agricultural pests into or within the United States. An officer may determine that other commodities require treatment to prevent similar pest movement.

Important

Do not treat unlisted commodities until consulting and receiving approval from the Center for Plant Health Science & Technology (CPHST) in Raleigh, North Carolina.

Approval from CPHST **must** be obtained each time a treatment schedule is used that is **not** an approved schedule from this manual.

Restrictions

Treatment recommendations listed in this manual are based on uses authorized under provisions of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), as amended. Directions appearing on the label, Section 18 Emergency Exemptions, and manual instructions must be followed. Nevertheless, some treatments may damage commodities.

PPQ personnel may **not** make any warranty or representations, expressed or implied, concerning the use of these pesticides.

The occasional use of registered trade names in this manual does **not** imply an endorsement of those products or of the manufacturers by the U.S. Department of Agriculture, Animal and Plant Health Inspection Service (USDA, APHIS).

Scope

This manual covers all treatments for import, export, and those domestic plant pests which are of quarantine significance. This manual is broadly divided into ten sections:

- Chemical Treatments
- Nonchemical Treatments
- Residue Monitoring
- Treatment Schedules
- Certifying Facilities
- Emergency Aid and Safety
- Equipment
- Glossary
- Appendixes
- Index

Each section is tabbed and contains a Table of Contents, an Overview, and where appropriate, a Methods and Procedures section. The Overview is a broad, general description of what is covered in the section. Methods and Procedures cover the “how to” of that particular activity as well as procedural and reference material for performing tasks associated with each activity.

The Appendixes contain information directly associated with treatment activities, but are placed in the back so they do **not** interfere with the flow of procedural instructions.

Users

This manual is used primarily by PPQ officers, Headquarters personnel, and State cooperators involved in conducting treatments. The secondary users of this manual are other government agencies, fumigators, pest control operators, foreign governments, and other interested parties.

Related Documents

The following documents are related to the treatment manual:

- Pesticide labels and labelling
- Material Safety Data Sheet (MSDS)
- APHIS Safety and Health manual
- Federal Insecticide, Fungicide, Rodenticide Act as amended
- Plant Import manuals (Propagative and Nonpropagative)
- Code of Federal Regulations (CFR)
  - Title 7 (Agriculture)
  - Title 46 (Shipping) Chapter 1, Part 147—Interim Regulations for Shipboard Fumigation
- Occupational Safety and Health Administration (OSHA) treatment manual

Application

This manual serves both as a field manual for employees conducting treatments and as a reference for PPQ officers, program managers, and staff officers. Under APHIS policy, only certified pesticide applicators may conduct or monitor treatments. This manual will also serve as a reference for researching the types of treatments available for imports and to answer questions from importers, industry, and foreign countries.

How to Use This Manual

Review the content of this manual to get a feel for the scope of material covered. Glance through the section that you will be using and familiarize yourself with the organization of information. Major headings such as Chemical Treatments and subheadings such as Fumigants will be tabbed. Each section is divided by tabs so when you want to find information on taking residue samples, you would turn to the tab labeled “Residue Monitoring” and check the Table of Contents for the page number.

Use the Table of Contents which follows each tab to quickly find information. If the Table of Contents is **not** specific enough, then turn to the Index to find the topic and page number.

Reporting Problems

If you want to suggest an improvement or identify a problem with the content of this manual, complete and mail the “Comment Sheet” at the back of this manual. If the problem is urgent, email josie.cooley@aphis.usda.gov or call (240) 529-0358. If you disagree with the guidelines or policies contained in this manual, contact Quarantine Policy, Analysis and Support (QPAS) through channels.

Conventions

The following are terms that are widely recognized and used throughout this manual:

DANGER	Indicates that people can easily be hurt or killed
WARNING	Indicates that people could possibly be hurt or killed
CAUTION	Indicates that people could possibly be endangered and slightly hurt
NOTICE	Indicates a possibly dangerous situation, goods might be damaged
Important	Indicates helpful information

EXAMPLE: indicates additional information that helps to clarify the content in the manual

Treatment schedules which are FIFRA Section 18 Exemptions (such as the sample below) are followed by an “Important” note to help you determine the current exemption status.

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At: 0.5 hrs	2 hrs	3 hrs	3.5 hrs
90 °F or above	2 lbs	26	19	19	—
80-89 °F	2.5 lbs	32	24	24	—
70-79 °F	3 lbs	38	29	24	—
60-69 °F	3 lbs	38	29	—	24

Important

Do not use this treatment schedule if its FIFRA Section 18 Exemption has expired. For the current exemption status, call your local State Plant Health Director (SPHD).

2

Treatment Manual

Chemical Treatments

Overview

Contents

Overview **2-1-1**
Fumigants **2-2-1**
Aerosols and Micronized Dusts **2-11-1**
Dips **2-12-1**
Dusts **2-13-1**
Sprays **2-14-1**

Introduction

The Chemical Treatments section of this manual is organized by chemicals tabbed as follows:

- Fumigants
- Aerosols and Micronized Dust

Use the Contents in this section to quickly find the information you need. The subjects listed in the Contents are also marked on the tabs in this manual. If the Contents is **not** specific enough, then turn to the Index to find the topic and its page number.

2

Treatment Manual

Chemical Treatments

Fumigants

Contents

Fumigants • Methyl Bromide **2-3-1**
Fumigants • Sulfuryl Fluoride **2-9-1**
Fumigants, Phosphine **2-10-1**

Introduction

Fumigation is the act of releasing and dispersing a toxic chemical so it reaches the target organism in a gaseous state. Chemicals applied as aerosols, smokes, mists, and fogs are suspensions of particulate matter in air and are not fumigants.

The ideal fumigant would have the following characteristics:

- Highly toxic to the target pest
- Nontoxic to plants and vertebrates (including humans)
- Easily and cheaply generated
- Harmless to foods and commodities
- Inexpensive
- Nonexplosive
- Nonflammable
- Insoluble in water
- Nonpersistent
- Easily diffuses and rapidly penetrates commodity
- Stable in the gaseous state (will not condense to a liquid)
- Easily detected by human senses

Unfortunately, no one fumigant has all the above properties, but those used by APHIS and PPQ have many of these characteristics.

The toxicity of a fumigant depends on the respiration rate of the target organism. Generally, the lower the temperature, the lower the respiration rate of the organism which tends to make the pest less susceptible. Fumigation at lower temperatures requires a higher dosage rate for a longer exposure period than fumigation at higher temperatures.

Fumigants vary greatly in their mode of action. Some kill rapidly while others kill slowly. In sublethal dosages, some fumigants may have a paralyzing effect on the pest while others will not allow the pest to recover. Some fumigants have no effect on commodities while others are detrimental even at low concentrations. Commodities vary in their sorption of fumigants and in the effort required to aerate the commodities after fumigation.

Due to the reduction in number of labeled fumigants, there is seldom a choice in selecting fumigants. When there is a choice, factors such as the commodity to be treated, pest and stages present, type of structure, and cost should be considered in selecting a fumigant.

The only authorized fumigants are the following:

- Methyl bromide (MB)
- Sulfuryl fluoride (SF) (Vikane)
- Phosphine (PH) (There are two chemicals used for phosphine, AP—aluminum phosphide and MP—magnesium phosphide)

Much of the information on fumigants is based on MB with modification as needed for the other fumigants.

Monitoring of Quarantine Treatments

Monitoring of program fumigations is performed to ensure that effective fumigant concentration levels are maintained throughout the treatment to prevent the introduction of quarantine pests. Quarantine fumigations employing restricted use pesticides require careful monitoring to assure efficacy and personal safety, to maintain pesticide residues within acceptable limits, and to preserve commodity quality. These requirements are included in the fumigant label, and it is a violation of Federal law to use fumigants and pesticides in a manner inconsistent with its labeling.

Nonperishable Commodities in Temporary Enclosures

PPQ officers will provide onsite monitoring from introduction of the fumigant through completion of the 2 hour gas concentration readings. Half hour and 2 hour readings are required for these treatments. These readings and general

observations permit the officer to determine how a particular treatment is progressing and to make necessary corrections to the enclosure or fumigant concentration level.

Perishable Commodities in Temporary Enclosures

The monitoring officer will remain on the site through the entire fumigation of perishable commodities. Continuous monitoring allows the officer to alert the pest control operator at any time to implement necessary corrective measures. Due to the nature of the commodity and the length of treatment, onsite monitoring of yam and chestnut fumigations may be interrupted after the 2 hour reading when efficacy and safety considerations warrant.

These instructions do not prevent the officer from leaving the immediate fumigation site for brief periods when it is necessary and safe to do so. The pest control operator must be notified of the PPQ officer's intended absence. These absences would ordinarily be limited to 20 minutes and do not constitute a break in service. These practices are in place in many locations and will require only minor modifications in other areas.

Fumigation Guidelines

The following fumigation guidelines are in common usage throughout this manual:

- Dosage rate is based on 1,000 cubic feet of enclosure space, whether chamber, tarpaulin, van, freight car, ship hold, etc. Dosage should be calculated from the volume of the tarped fumigation enclosure.
- Dosages are listed by weight in the Treatment Schedules. If liquid measures are needed, convert from weight to volume by using the conversion figures.
- Ounces per 1,000 cubic feet (oz/1000 ft^3) is equal to milligrams per liter (mg/liter) and is equal to grams per cubic meter (g/m^3).
- Volume of commodity being treated should **not** exceed two-thirds of enclosure volume unless otherwise specified in a schedule.
- Specified vacuum should be held throughout the exposure period.

- Blowers or fans should be operated as follows:
  - for propagative material (T200-series schedules), the entire period of exposure, whether NAP or vacuum
  - under tarpaulin (and vacuum fumigation for other than propagative material), fans should operate for 30 minutes after gas introduction, or until an APHIS-approved gas detection device indicates uniform gas distribution
  - for all bulk material, forced recirculation is required, check for uniform gas distribution by taking gas readings at four or five locations including at least three from the commodity

Important

Phosphine fumigations do **not** require fans.

- In this section, all NAP treatments that refer to chamber fumigations should be conducted in USDA-approved chambers. (Refer to ***Certification of Vacuum Fumigation Chambers*** on **page 6-2-1** or ***Certifying Atmospheric Fumigation Chambers*** on **page 6-3-1**).
- Methyl bromide treatment schedules are indicated as “MB.” MB generally refers to any methyl bromide label. Specific MB label restrictions are noted in this manual for the “Q” label. Always check the label of the fumigant to be sure the commodity is listed on the label. Commodities that are not listed on the fumigant’s label are not authorized for fumigation with the manufacturer’s gas.

Physical Properties of Fumigants

Fumigant	Chemical Formula	Boiling Point	Specific Gravity[1]	Flammability Limits in Air
Methyl Bromide	CH_3Br	3.6 °C 40.1 °F	3.27	Normally nonflammable. Flame propagation at 13.5 to 14.5 percent by volume only in the presence of an intense source of ignition.
Phosphine	PH_3	–87.4 °C –126 °F	1.214	1.79 percent by volume
Sulfuryl fluoride	SO_2F_2	–55.2 °C –67 °F	2.88	Nonflammable

1 Air = 1, anything greater is heavier than air.

Fumigant	Odor	Effects on Metals	General
Methyl Bromide	No odor at low concentration. Strong musty or sweet at high concentrations.	Reacts with aluminum, may damage electronic equipment	Discharged from cylinders, 1.5 lb cans
Phosphine	Garlic-like or carbide due to impurities	Copper, brass, gold and silver severely damaged; electronic equipment damaged. Other metals slightly affected in high humidity.	Evolved from aluminum phosphide or magnesium phosphide preparations
Sulfuryl fluoride	None	Non-corrosive	Discharged from cylinders

2

Treatment Manual

Chemical Treatments

Fumigants • Methyl Bromide

Contents

Properties and Use **2-3-1**
"Q Labels" and Section 18 Exemption Treatment Schedules **2-3-2**
Leak Detection and Gas Analysis **2-3-5**
Effects of Temperature and Humidity **2-3-5**
Penetration and Aeration of Boxes and Packages **2-3-5**
Plastic Wrappings and Impermeable Papers **2-3-5**
Kraft Paper and Corrugated Cartons **2-3-6**
Wooden Boxes **2-3-6**
Sorption **2-3-6**
Residual Effect **2-3-7**

Properties and Use

Methyl bromide (MB) (CH_3Br) is a colorless, odorless, nonflammable fumigant. MB boils at 38.5 °F and has a very low solubility in water. As a gas, MB is three times heavier than air. As a liquid at 32 °F, 1 pound of MB is equivalent to 262 ml. For ease in transportation and handling, MB is compressed and stored in metal cylinders as a liquid.

MB is an effective fumigant for treating a wide variety of plant pests associated with a wide variety of commodities. MB is the most frequently used fumigant in quarantine fumigations. MB may also be used to devitalize plant material. MB is effective in treating the following pests:

- Insects (all life stages)
- Mites and ticks (all life stages)
- Nematodes (including cysts)
- Snails and slugs
- Fungi (such as oak wilt fungus)

MB is effective over a wide range of temperatures (40 °F and above). In general, living plant material tolerates the dosage rate specified, although the degree of tolerance varies with species, variety, stage of growth, and condition of the plant material. MB accelerates the decomposition of plants in poor condition.

Since MB is three times heavier than air, it diffuses outward and downward readily, but requires fans to ensure upward movement and equal gas distribution. Fan circulation also enhances penetration of MB into the commodity. A volatilizer is used to heat the liquid MB in order to speed up its conversion to a gas. Once the gas is evenly distributed, it maintains that condition for the duration of the treatment unless an outside event such as excessive leakage occurs.

"Q Labels" and Section 18 Exemption Treatment Schedules

Methyl bromide fumigants, except those with "Q" labels, may be subject to requirements of the FIFRA Section 18 Quarantine Exemption. When commodities intended for food or feed are fumigated with methyl bromide under the FIFRA Section 18 Quarantine Exemption, one additional EPA *requirement* must be met: PPQ must monitor aeration by sampling the gas concentration to determine when a commodity may be released.

The EPA defines a Federal quarantine exemption (40 CFR 166.2(b)) as "A quarantine exemption may be authorized in an emergency condition to control the introduction or spread of any pest new to or not theretofore known to be widely prevalent or distributed within and throughout the United States and its territories."

Therefore, the Federal Quarantine Section 18 Crisis Exemption cannot be used on **domestic** commodities destined for **export**. If the commodity of concern is NOT on any methyl bromide label, the State must apply (to EPA) for a state specific exemption or a special local need in order to fumigate.

In this manual, fumigation schedules under the FIFRA Section 18 Quarantine Exemption are followed by an "Important" note to help you determine the current exemption status. For example:

Important

Do **not** use this treatment schedule if its FIFRA Section 18 Exemption has expired. For the current exemption status, call your local State Plant Health Director (SPHD).

CAUTION

Always use the label of the fumigant to determine if the commodity can be treated. Fumigation schedules in this publication are intended to clarify and expand commercial labels for methyl bromide. The EPA only authorizes fumigation for commodities that are listed on the label of the gas being used for the fumigation. Also, to comply with State requirements, a fumigant must be registered in the State where it is being used. If you are uncertain that a fumigant is registered in a state where the fumigation is being performed, contact a major port in that state or the Center for Plant Health Science Technology (CPHST).

The following Table is a list of commodities covered by the FIFRA Section 18 exemption. This list will expire on March 03, 2010.

Figure 2-3-1 Section 18 Exemptions

Commodity	Minimum Temperature (F)	Maximum Dosage Range (lb/1000 ft^3)	Exposure Period (hours)
Avocado	70	4	4
Banana and Plantain	40	4	2
Blackberry and raspberry	40	4	2
Cucurbit seeds, edible, shelled/unshelled	40	9	12
Cucurbit vegetables **not** on the Q-label (except gherkins)	40	4	2
Dasheen (root and tuber)	40	4	4
Gherkin (cucurbit)	50	3	2
Herbs and spices, fresh	40	4	2
Ivy gourd	40	4	2
Kiwi	40	4	4
Leafy Vegetables **not** on the Q-label (including Brassica)	40	4	2
Longan	60	4	2
Lychee fruit	40	4	2
Mint, dried	40	3	24
Mint, fresh	40	4	2
Opuntia	40	4	3.5
Plumcot/Pluot	40	4	2
Pointed gourd	40	4	2
Rambutan	60	4	2
Root and tubers **not** on the Q-label (except Dasheen)	60	3	3.5
Edible Podded Legume Vegetables	40	4	2

The Animal and Plant Health Inspection Service (APHIS) uses a premium 100 percent methyl bromide fumigant that is only intended for quarantine and regulatory use. This methyl bromide fumigant is provided by several companies and generally referred to as a "Q label". It is labeled for many uses which were previously covered by FIFRA Section 18 Exemptions. Additional features of the "Q label" include the following:

- Use of additional fumigant to maintain the required concentration is allowed.
- The commodity must be allowed to aerate for at least one hour before completely removing the tarp. However, the aeration procedures described in this manual require a longer period than required on the label, and must be followed. Be sure that the fumigator is placed under a compliance agreement, and that he follows the aeration procedures outlined in this manual.

Although there is some overlap in the "Q label" and other methyl bromide labels, substitution of the products may result in non-compliance. Use the Treatment Manual to determine when a "Q" labeled fumigant must be used:

- When the treatment schedule is marked MB, any methyl bromide fumigant may be used for the fumigation if the commodity is on the fumigant label.

Important

When the treatment schedule is marked MB ("Q" label only), the fumigation is restricted to methyl bromide "Q" labels. This restriction is based on the "Q" label replacement of FIFRA Section 18 exemptions.

- A few schedules restrict the use of a label based on temperature range. In this case, the specific temperature range is marked and noted ("Q" label only).

Always read and follow the "Q label" label and use directions. The "Q- label" allows fumigation of certain commodities and pests at sites and rates that are not allowed under other labels. The label is purposely flexible to handle unforeseen emergencies and other special situations formerly covered by FIFRA Section 18 label exemptions.

Although the use of "Q label" fumigants eliminates the requirements for residue and aeration monitoring, the "Q label" requires fumigations using the product be conducted under the monitoring of a state or federal agency. Monitoring does not necessarily require the actual presence of a regulatory agent during the entire fumigation, but does mean that the monitoring agent be able to certify that the fumigant was done in compliance with the label and other requirements.

To show that the fumigation using the "Q" label was monitored by a regulatory agent, the fumigator should record the name, title, telephone number and mailing address of the monitoring regulatory agent(s) on the restricted use pesticide application records, even if the same information is recorded on other documents (e.g., phytosanitary certificate).

Leak Detection and Gas Analysis

Use an APHIS-approved gas detection device to measure gas concentration levels in tarpaulins and chambers. Use an APHIS-approved leak detection device primarily to check for leaks around tarpaulins, chambers, application equipment, and as a safety device around the fumigation site. For a partial list of manufacturers of detection devices, refer to **Reference Guide to Commercial Suppliers of Treatment and Related Safety Equipment**. Colorimetric tubes, which are supplied by the fumigator, are used to measure gas concentration levels during aeration.

Effects of Temperature and Humidity

MB is effective at the same temperatures plants are generally handled (usually 40 °F and above). In general, increases in temperature give a corresponding increase in the effectiveness of MB. All treatment schedule temperatures are listed with the corresponding dosage rate. Follow the dosage rates listed. A Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) Section 3 registration (the labeled rate of MB provided), or a Section 18 Exemption must be in effect at the time of treatment.

For live plant material which is actively growing or with leaves, maintain a high percentage of humidity (above 75 percent) in the chamber by placing wet sphagnum or excelsior in the chamber or by wetting the chamber walls and floor. Protect actively growing or delicate plants from the direct air flow of fans. Do **not** add any moisture to the chamber when fumigating seeds. Too much moisture on the material to be fumigated may prevent the fumigant from reaching some of the pests.

Penetration and Aeration of Boxes and Packages

Plastic Wrappings and Impermeable Papers

Plastic wrappings such as cellophane, films, and shrink wrap, and papers that are waxed, laminated, or waterproofed are not readily permeable and must be perforated, removed, or opened before fumigation. If wrappings are perforated to facilitate fumigation, holes should be at least 3/16-inch in diameter every 3

square inches or 1/4-inch in diameter every 4 square inches over the entire surface of the wrapping. Also acceptable are plastic wraps containing numerous pinholes (at least 49 per square inch). These holes enhance permeability through the plastic fruit trays, which are frequently used for transport of fruit.

Important

Inform prospective importers that the wrappings on their shipments may have to be perforated to PPQ specifications, removed, or opened if PPQ requires fumigation. If wrappings on shipments are designed to satisfy PPQ requirements for fumigation readily, importers could save time and money. Shippers should send a complete bag/wrap sample to CPHST for inspection and approval.

USDA-APHIS-PPQ-CPHST
Treatment Quality Assurance Unit
1730 Varsity Drive, Suite 400
Raleigh, NC 27606
919-855-7450

Kraft Paper and Corrugated Cartons

Kraft paper is permeable to MB and does not need to be removed prior to fumigation. Corrugated cartons are also permeable to MB and unless impermeable liners are present, aeration will be satisfactory, although it will be slower in closed boxes.

Wooden Boxes

Although MB penetrates wooden boxes, aeration of tight boxes may be slow, particularly if sorptive packing materials are present. To aid in aeration, have the lids removed and boxes placed on their sides prior to fumigation. If removing lids is not practical, then increase the aeration time.

Sorption

Sorption is the process of chemically or physically binding free MB on or within the fumigated commodity. Sorption makes the fumigant unavailable to kill the plant pest. There are three types of sorption—absorption, adsorption, and chemisorption. Sorption rate is high at first, then gradually reduces to a slow rate. Sorption increases the time required for aeration.

Commodities known or believed to be highly sorptive should not be fumigated in chambers unless concentration readings can be taken to ensure the required minimum concentration is met. Additional readings may be necessary in order to properly monitor gas concentration sorptive commodities in chambers.

For tarpaulin fumigation, additional gas readings are necessary to monitor concentration of gas to determine the rate of sorption. The following is a partial list of commodities known to be highly sorptive:

- Burlap bales
- Carpet backing
- Cinnamon quills
- Cocoa mats
- Cotton
- Flour and finely milled products
- Gall nuts
- Hardboard (Masonite™)
- Incense
- Myrobalan
- Pistachio nuts
- Polyamide waste
- Polystyrene foam (Styrofoam)
- Potato starch
- Rubber (crepe or crude)
- Vermiculite
- Wood products (unfinished)
- Wool (raw, except pulled)

Contact CPHST if you are concerned about the sorptive properties of other commodities.

Residual Effect

MB may adversely affect the shelf life of fresh fruits and vegetables, the viability of dormant and actively growing plants, and the germination of seed. Although MB may adversely affect some commodities, it is a necessary risk in order to control pests. Some dosage rates are near the maximum tolerance of the commodity, so care must be exercised in choosing the proper treatment schedule and applying the treatment.

MB may also adversely affect nonplant products. In general, articles with a high sulfur content may develop "off-odors” on contact with MB. In some commodities the odors are difficult or impossible to remove by aeration. If possible or practical, remove from the area to be fumigated any items that are likely to develop an undesirable odor.

Ordinarily, the following items should **not** be fumigated:

- Any commodity **not** listed on the label or lacking a FIFRA Section 18 Exemption
- Any commodity lacking a treatment schedule
- Automobiles
- Baking powder
- Blueprints
- Bone meal
- Butter, lard, or fats, unless in airtight containers
- Charcoal (highly sorptive)
- Cinder blocks or mixed concrete and cinder blocks
- Electronic equipment
- Feather pillows
- Felt
- Furs
- High-protein flours (soybean, whole wheat, peanut)
- Horsehair articles
- Leather goods
- Machinery with milled surfaces
- Magazines and newspapers (made of wood pulp)
- Magnesium articles (subject to corrosion)
- Paper with high rag or sulfur content
- Photographic chemicals and prints (**not** camera film or X-rays)
- Natural rubber goods, particularly sponge rubber, foam rubber, and reclaimed rubber including pillows, mattresses, rubber stamps, and upholstered furniture
- Rug pads
- Silver polishing papers

- Woolens (especially angora), soft yarns, and sweaters; viscose rayon fabrics
- Yak rugs

2

Treatment Manual

Chemical Treatments

Fumigants • Methyl Bromide • Tarpaulin Fumigation

Contents

Methods and Procedures **2-4-1**
Materials Needed **2-4-1**
PPQ Official Provides **2-4-1**
Fumigator Provides **2-4-2**
Preparing to Fumigate **2-4-3**
Conducting the Fumigation **2-4-20**
Aerating the Enclosure **2-4-35**
Responsibility for Aerating the Commodity **2-4-35**
Materials Needed **2-4-36**
Securing the Area **2-4-36**
Wearing Respiratory Protection **2-4-37**
Aerating Nonsorptive, Containerized Cargo—Indoors and Outdoors **2-4-37**
Aerating Nonsorptive, Noncontainerized Cargo—Indoors and Outdoors **2-4-39**
Aeration Procedures for Fresh Fruits, Vegetables, and Cut Flowers—Indoors or Outdoors **2-4-41**
Aerating Sorptive, Noncontainerized Cargo—Indoors and Outdoors **2-4-42**
Aerating Sorptive Commodities in Containers—Indoors and Outdoors **2-4-44**

Methods and Procedures

The procedures covered in this section provide PPQ officials and commercial fumigators with the methods, responsibilities, and precautions for tarpaulin fumigation.

Materials Needed

PPQ Official Provides

- Calculator (optional)
- Colorimetric tubes (Draeger/Kitagawa)
- Desiccant (Drierite®)
- Forms (PPQ Form 429 and APHIS Form 2061 if necessary)

- APHIS-approved leak detection device
- Self-contained breathing apparatus (SCBA) or supplied air respirator to be used by PPQ official
- Tape measure (as back-up for fumigator)
- APHIS-approved gas detection device[1], [2]
- Thermometer (as back-up for fumigator)

Fumigator Provides

- Auxiliary pump for purging long gas sample tubes
- Carbon dioxide filter (Ascarite®)
- Colorimetric tubes (Draeger/Kitagawa)
- Desiccant (Drierite®)
- Electrical wiring (grounded, permanent type), three prong extension cords
- Exhaust blower and ducts
- Fans (circulation, exhaust, and introduction)
- Framework and supports
- Gas introduction line
- Gas sampling tubes (leads)
- Heat supply
- Insecticides and spray equipment
- Loose sand
- Measuring Tape
- Methyl bromide
- Padding
- Sand or water snakes or adhesive sealer
- Scales or dispensers[3]
- Self-contained breathing apparatus (SCBA) or supplied air respirator
- Tape

1 If fumigating oak logs or lumber for export, the unit must be capable of reading 400 oz.
2 Gas detection device must be calibrated annually. Contact the Center for Plant Health Science & Technology (CPHST) (919-855-7450) in Raleigh, North Carolina, for calibration information.
3 All scales must be calibrated by the State, a company that is certified to conduct scale calibrations, or by the fumigator under the supervision of PPQ. The source and date of calibration must be posted in a visible location on or with the scale at all times. The scale must be calibrated a minimum of every six months.

- Tape measure
- Tarpaulin and supports
- Temperature recorder
- APHIS-approved gas detection device[4 5]
- Thermocouples (maximum number of 12)
- Thermometer
- Volatilizer
- Warning signs

Preparing to Fumigate

Step 1—Selecting a Treatment Schedule

Select a treatment schedule to effectively eliminate the plant pest without damaging the commodity being fumigated.

Turn to the Treatment Schedule Index and look up the available treatment schedule(s) by commodity (example—apples, pears, or citrus) or by pest (e.g., Mediterranean fruit fly). Some commodities may have several treatment schedules. Refer to ***Residual Effect*** on **page 2-3-7** for a list of those commodities which may be damaged by MB. Each treatment schedule lists the target pest or pest group (e.g., *Ceratitis capitata*, surface feeders, wood borers...), commodity, or both pest and commodity. If there is no schedule, the commodity may **not** be fumigated. Refer to ***Figure 2-3-1*** on **page 2-3-3** to determine if a schedule is available under a FIFRA Section 18 Exemption. If a treatment is required, go to **Table 2-4-1**.

Table 2-4-1 Determine Reporting Requirements

If a treatment is required:	Then:
As a result of a pest interception	GO to Step 2
As a condition of entry	GO to Step 3

Step 2—Issuing a PPQ Form 523 (Emergency Action Notification)

When an intercepted pest is identified and confirmed by a PPQ Area Identifier as requiring action, issue a PPQ Form 523 (Emergency Action Notification - EAN) to the owner, broker, or representative. Be sure to list all treatment options when completing the PPQ Form 523. Follow instructions in Appendix A for completing and distributing the PPQ Form 523.

4 If fumigating oak logs or lumber for export, the unit must be capable of reading 400 oz.
5 Gas detection device must be calibrated annually. Contact the Center for Plant Health Science & Technology (CPHST) (919-855-7450) in Raleigh, North Carolina, for calibration information.

Step 3—Determining Section 18 Exemptions and Sampling Requirements

After selecting the treatment schedule, you will be able to determine which treatment schedules are FIFRA Section 18 Exemptions. The schedule will be followed by an "IMPORTANT" note to help you determine the current exemption status. Some treatment schedules are only FIFRA Section 18 Exemptions at specific temperature ranges. Check the treatment schedule and temperature to determine if the fumigation will be a FIFRA Section 18 Exemption.

Residue monitoring by taking samples of the commodity prior to the start of the fumigation and after aeration is no longer required.

Step 4—Selecting a Fumigation Site

Consider the following factors in selecting a fumigation site:

- Well-ventilated, sheltered area
- Ability to heat area (in colder areas)
- Impervious surface
- Nonwork area that can be effectively marked and safeguarded or isolated
- Electrical power supply
- Water supply
- Well-lighted area
- Aeration requirements

Well-Ventilated, Sheltered Area

Select sites that are well-ventilated and in a sheltered area. A well-ventilated site is required for exhausting gas before and when the tarpaulin is removed from the stack. Most piers and warehouses have high ceilings and a number of windows/doors which can be used for ventilation. Some gas will escape from the tarpaulin even in the best conditions. Avoid areas where strong drafts are likely to occur.

In warehouses, an exhaust system must be provided to exhaust MB to the outside of the building. Ensure that the exhausted gas does not reenter the building nor endanger people working outdoors.

When treatments are conducted in a particular location on a regular basis, a permanent site should be designated. At such sites, the fan used to remove the fumigant from the enclosure during aeration must be connected to a permanent stack extending above the roof level.

If fumigations are conducted outside, select a site that is semi-sheltered such as the leeward side of a warehouse, pier, or building that offers some protection from severe winds. Severe winds are defined as sustained winds or gusts of 30 m.p.h. or higher for any time period. Do not conduct outdoor fumigations if there is a forecast from the National Weather Service of severe winds and/or thunderstorms at the beginning of or for the entire length of the fumigation.

Ability to Heat Area

When cooler temperatures (below 40 °F) are expected, the site must be heated to maintain commodity temperatures above 40 °F. Take the ambient temperature 12 inches above the floor. For treatments lasting 6 hours or longer, temperatures must be maintained at or above the starting treatment temperature for the entire duration of the treatment. Additionally, the temperature of the enclosure must be monitored using temperature thermocouples and a temperature recorder. The thermocouples must be evenly placed throughout the enclosure or container. The placement of the thermocouples will vary depending on the item fumigated and the configuration of the fumigation site. Contact CPHST for instructions regarding exact placement of the thermocouples. Use **Table 2-4-2** to determine the number of thermocouples needed based on size of the enclosure:

Size of Enclosure	Number of Thermocouples
Up to 10,000 ft^3	3
10,001 - 25,000 ft^3	6
25,001 - 55,000 ft^3	9
Larger than 55,000	12

Table 2-4-2 Number of Thermocouples

NOTICE

Do **not** use flame or exposed electrical element heaters under the tarpaulin during treatment because MB may cause the formation of hydrogen bromide. Hydrogen bromide (hydrobromic acid) is a highly corrosive chemical which can cause damage to the heater and to surrounding materials including the commodity. Hot air or radiator type heaters can be used for heating under tarpaulins. When using space heaters to heat warehouses, there must be adequate ventilation.

Impervious Surface

Select an asphalt, concrete, or tight wooden surface—**not** soil, gravel, or other porous material. If you must fumigate on a porous surface, cover the surface with plastic tarpaulins. For large fumigations, covering the surface is **not** usually practical because pallets must be rearranged and heavy equipment used to move the commodity. On docks, wharfs, and piers, check for cracks, holes, and manhole covers which will allow the MB to escape through the floor. Have all cracks, holes, and manhole covers sealed.

Nonwork Area

Select a secure area where traffic and people are restricted from entering and which is isolated from people working. You want a nonwork area to help prevent accidents such as a forklift piercing a tarpaulin and for other safety reasons. Consider either the entire structure area or an area which extends 30

feet from the tarpaulin and is separated by a physical barrier such as ropes, barricades, or walls as the fumigation area. If a wall of gas-impervious material is less than 30 feet from the tarpaulin, the wall may serve as the edge of the secured area. Some states, for example California, require a 100 foot buffer zone. Place placards clearly in sight of all who come near. Placards must meet label requirements regarding specific warnings, information, and language. Placards generally include the name of the fumigant, the fumigation date, time, and the name of the company conducting the fumigation. Restrict access to the fumigation area to the fumigator's employees and PPQ employees monitoring the treatment. Use rope or marker tape to limit access within 30 feet of the enclosure. Do **not** allow motor vehicles (includes forklifts) to operate within 30 feet of the enclosure during the fumigation and aeration periods. The area outside the 30-foot perimeter is usually regarded as a safe distance from the tarpaulin. Gas concentrations exceeding 5.0 ppm (TLV for MB) are seldom recorded by gas monitoring, except during aeration. PPQ officials that work within the 30-foot perimeter must wear (and use) respiratory protection (SCBA), unless the gas levels are safe to breath and validated as safe by gas monitoring. The 30-foot perimeter is **not** specifically mentioned on the MB label, but is required for PPQ officials. When space is tight, it is permissible to overlap two adjoining 30-foot perimeters. However, there must be sufficient space for a person wearing SCBA to walk between the tarpaulins.

Electrical Power Supply

An adequate electrical source must be available to run the circulation fans and the gas detection device. A separate line should be available for the gas detection device. Electrical outlets must be ground and conveniently located in relation to the fumigation area. Generators may be used as a power source *only* under emergency conditions.

Water Supply

A water supply is necessary for safety purposes. Water is necessary for washing off MB if the liquid form is spilled on someone. Water is also used to fill the volatilizer. If no permanent water is present on site, the fumigator must provide a portable, 5-gallon supply of clean water.

Well-Lighted Areas

The area should have adequate lighting for safety purposes and for ease in reading gas concentration, thermometers, and for determining whether a tarpaulin has holes or tears.

Aeration Requirements

Assuming that you've already restricted access and secured the fumigation area, you now must restrict access to the area where the exhaust duct extends beyond the enclosure. Before you start a fumigation, make sure the exhaust duct is located in a safe place.

During the first 10 minutes of aeration, there should be no people within 200 feet down wind of the exhaust duct outlet. If the exhaust duct is **not** used, then the requirement for a 200 foot down-wind buffer zone does **not** necessarily

apply. However, personnel in the immediate area should be aware that a release of fumigant gas is about to take place and given the option of wearing SCBA if they choose to continue working in the area. If it is impossible to restrict people from the area of aeration during regular work hours, consider aeration during another time of the day. When securing the duct outlet area, consider the direction of the wind. Face the duct outlet toward an open area, and away from people. Point the duct outlet upward to aid in dispersing the exhausted gas.

After the first 10 minutes of aeration, if an exhaust duct is **not** used, then a perimeter of 30 feet or more from the stack is usually regarded as a safe distance for personnel. However, for personal safety, gas levels should occasionally be monitored at greater distances, especially downwind. Experience provides the best guide.

Step 5—Arranging the Stack

Break Bulk Cargo

Have the cargo arranged in a square or rectangular shape, if possible, to make it easy to cover and to calculate the volume of the stack. An even shaped stack is easy to tarp. The height of the stack should be uniform so dosage can be calculated accurately. For loose cargo, the tarpaulin should be 2 feet above the load and one foot from the sides and ends. Unless specified in the treatment schedule, cargo should **not** exceed two-thirds of the volume of the area to be fumigated. The maximum size for an enclosure is 25,000 ft^3. Contact the Center for Plant Health Science & Technology (CPHST) in Raleigh, North Carolina, to get approval for any enclosures larger than 25,000 ft^3. For very large enclosures, it may be necessary to:

- Install extra circulation fans
- Add more sampling leads
- Introduce the fumigant at several sites, using multiple volatilizer
- Run the circulation fans longer than just the first 30 minutes, if the difference between the highest and lowest gas concentration readings exceeds 4 ounces

Once CPHST has approved the site and enclosure, it does **not** require additional approvals for subsequent fumigations. The commodity should be on pallets to permit air movement along the floor and between the cargo. Allow an inch or more of space between pallets. By arranging the stack evenly and with space between pallets or cartons, the fumigant will be effectively distributed and dosage calculation should be easier and more accurate. Dosages are easier to calculate when the dimensions are uniform.

When the fumigation involves multiple stacks, allow 10 feet of space between each uncovered stack. After the stack is tarped, there should be approximately 5 feet between enclosures.

Containerized Cargo

Place no more than eight containers that are 20 to 40 feet in length under a single tarpaulin. APHIS recommends that containers **not** be stacked. Stacking may create too great a safety risk to the person placing the tarp, fans, and gas monitoring leads. If fumigating multiple containers in a single row, have all the rear doors opening on the same side. If multiple containers are placed in two rows, then have all the doors opening on a center aisle toward each other (see ***Figure 2-4-1*** on **page 2-4-9**). The aisle must be at least 3 feet wide. The aisle must be at least 3 feet wide. All doors should be completely open, if possible.

However, APHIS will allow fumigation of containerized cargo with one door open on each container using a configuration such as the one shown in ***Figure 2-4-2*** on **page 2-4-9**, or in a single row of eight containers. Gas should be introduced at both ends of this long row configuration, either at the same time or half at one end and half at the other end. In any case, the single open door on each container must be kept from closing during the fumigation, either taped or blocked open.

CAUTION

APHIS recommends that perishable commodities be fumigated outside their containers. Because it is difficult to aerate the container, the commodity may be damaged by the fumigant if left in the container. Therefore, it is best to remove perishable commodities from their containers before fumigation. When a commodity is removed from the container, spray the emptied container with Malathion as a precaution against leaving the container contaminated with live pests. Pests such as hitchhikers may not remain with the commodity.

However, because of the cost of devanning the commodity most importers choose to have their commodity fumigated inside the container.

Due to safety considerations, containers to be fumigated should **not** be stacked. Also, to conserve methyl bromide use, CPHST recommends that containers be removed from their chassis prior to fumigation. (If this is not done, then the space beneath the container must be calculated as part of the total volume being fumigated.

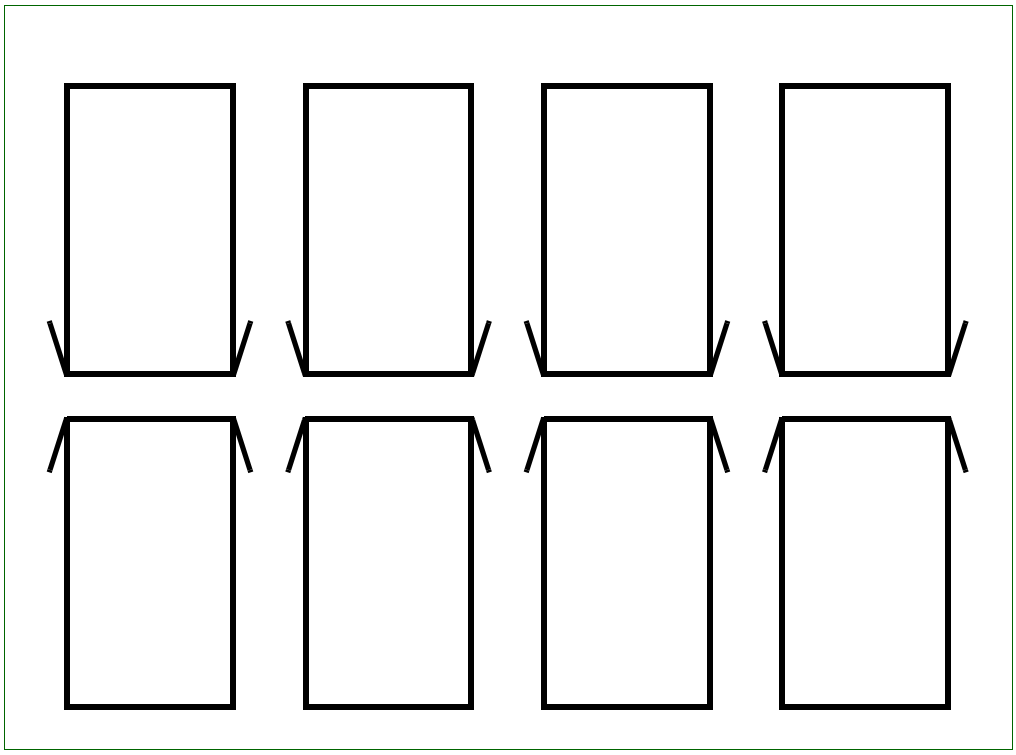

Figure 2-4-1 Container Arrangement in Two Rows

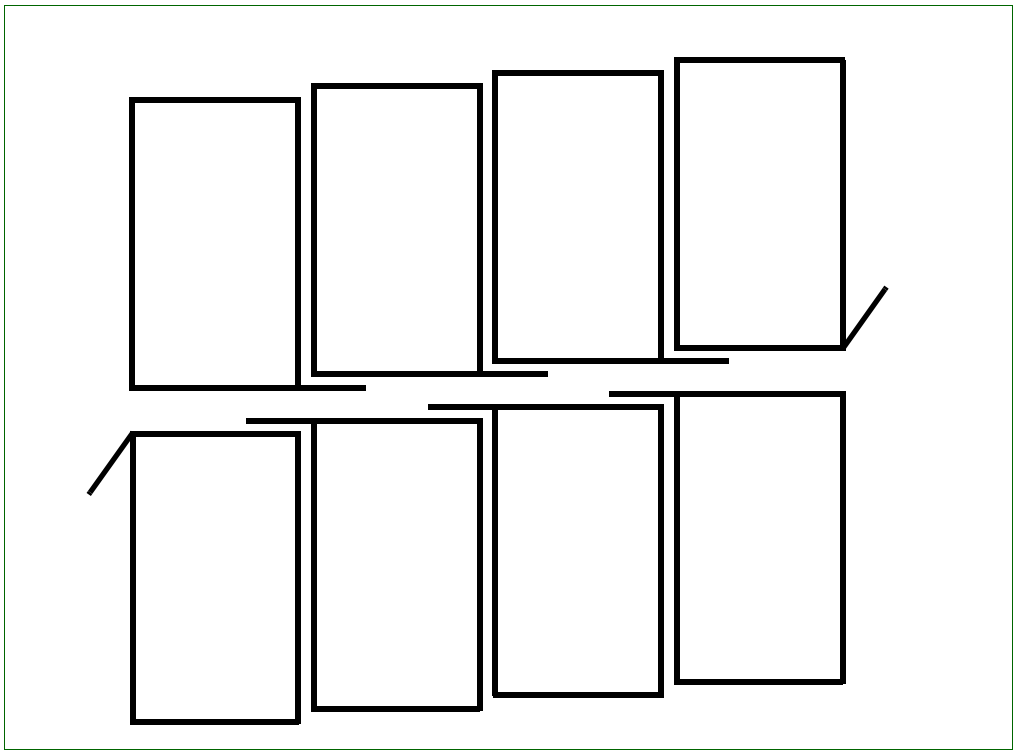

Figure 2-4-2 Container Arrangement in Two Rows

If fumigating multiple containers in a single row, the rear doors should all open on the same side of the stack. If containers are parked parallel to one another and close together, it is permissible to open only the door on the right side of each container, overlapping and taped to the closed left door of the container adjacent to it. In such circumstances, however, one must have a fan positioned high, blowing into the open door of each container, to assure uniform fumigant distribution. If containers are not parked closely together, all doors must be completely open.

Containers should ordinarily not be loaded beyond 80 percent of their capacity. Bulk commodities must be placed in boxes or containers on pallets. The pallets must be loaded in the container so that there is at least two inches of space under the commodity and between each pallet. A space of 20 percent (18 inches) should be provided above the commodity. This facilitates uniform gas distribution and allows a crawl space for placing the gas monitoring leads and fans. (Some restacking of cargo may be necessary to meet this requirement.) If the container is tarped, no additional head space is required between the roof of the container and the tarp, unless the pest is found on the outside of the container.

Gas Penetration and Distribution

MB will penetrate most cargo easily. When fumigating finely milled products (such as flour, cottonseed meal, and baled commodities), provide space every 5 feet in any direction. Penetration is enhanced by the availability of free MB.

Some of the more common types of impermeable materials are cellophane, plastic, wax coated materials, laminated, and waterproofed papers. Tight wooden packing cases are also relatively gas tight. Impermeable materials will allow some gas to penetrate, but make it difficult to aerate and evacuate the gas. Remove, perforate, or open all impermeable materials.

For impermeable wrappers or containers, open the entire top or side and place the package with the open portion on the side.

Step 6—Arranging and Operating Fans

Break Bulk Cargo

Use fans which have the capacity to move a volume in cubic feet per minute equivalent to the total volume of the enclosure. For a 5,000 ft^3 enclosure, use two axial-type (blade) fans of approximately 2,500 cfm. Place one fan on the floor at the rear of the stack facing the front and the other fan at the top front (where the gas is introduced) facing the rear. For enclosures from 5,000 to 7,500 ft^3, add a third fan near the upper middle facing the rear. For enclosures from 7,501 to 10,000 ft^3, add a fourth fan on the floor near the middle facing the front. Enclosures from 10,001 to 25,000 ft^3 may require up to seven fans to provide adequate gas circulation. Enclosures larger than 25,000 ft^3 require approval from the Center for Plant Health Science & Technology (CPHST) in Raleigh, North Carolina.

Turn on all fans to make sure they work. Operate fans during gas introduction and for 30 minutes after the gas is introduced. If after taking gas concentration readings the fumigant is **not** evenly distributed, run the fans until the gas is evenly distributed as indicated by concentration readings (within 4 oz. of each other). Operate fans when adding gas, but only long enough to get even gas distribution.

Containerized Cargo

Use an appropriate number of fans which have the capacity to move the equivalent cubic feet per minute of the total volume of the enclosure. In addition, place one additional fan of at least 2,500 cfm at the top of the load (near door) of each container facing the opposite end of the container.

Place air introduction ducts, for aeration, into the far ends of each container. Also, place exhaust ducts on the ground in front of the end doors of the containers. Place the end of the ducts near the edge of the tarpaulin so they can be pulled under the tarpaulin when aeration begins.

Step 7—Placing the Gas Introduction Lines

MB is converted from a liquid into a gas by a volatilizer. The line that runs from the MB cylinder into the volatilizer must be 3000 PSI hydraulic high pressure hose with a 3/8 inch interior diameter (ID) or larger. From the volatilizer, MB gas is introduced into the structure by means of a gas introduction line. The gas introduction line must be a minimum of 350 PSI with a 1/2 inch ID or larger.

Break Bulk Cargo

Place the gas introduction line directly above the upper front fan. Attach the line to the top of the fan to prevent movement of the hose. An unsecured introduction line could tear the tarpaulin, move the line, or direct it out of the airflow. The fan should be firmly attached to the cargo or have a base that prevents it from toppling (not a pedestal type). Place a piece of impermeable sheeting (example—plastic or rubberized canvas) over the commodity below and to the front of each gas supply line. The sheet will prevent any liquid MB from coming in contact with the cargo.

Containerized Cargo

The number and placement of gas introduction lines will depend upon the number and arrangement of containers to be fumigated.

For single containers, place the introduction line directly above the fan near the rear door of the container.

For multiple containers, place the introduction line near the door end of the containers, but aimed across the open doors rather than directly into one container.

If you are fumigating four or more containers under one tarpaulin, then use two gas introduction lines.

Step 8—Placing the Gas Sampling Tubes

Break Bulk Cargo

Place a minimum of three gas sampling tubes for fumigations up to 10,000 ft^3. Position the gas sampling tubes in the following locations (see **Figure 2-4-3**):

- Front low—front of the load, 3 inches above the floor
- Middle center—center of the load, midway from bottom to top of load
- Rear high—rear of the load, at the extreme top of the load

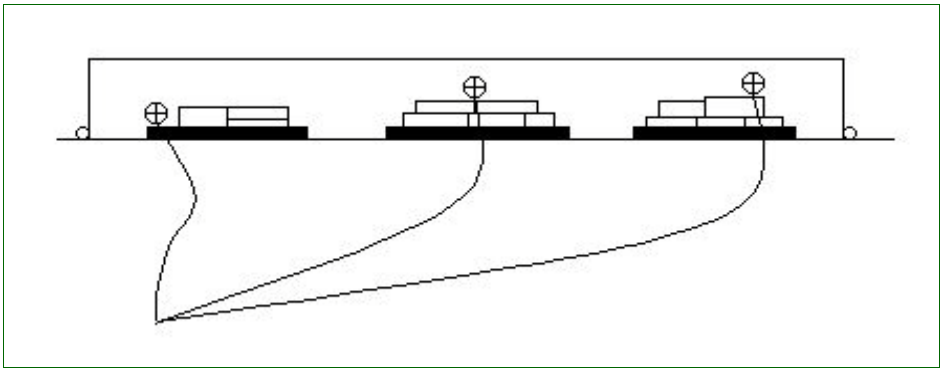

Figure 2-4-3 Gas Lead Position (Side View)

For fumigations from 10,001 to 25,000 ft^3, use six gas sampling tubes. Position the gas sampling tubes in the following locations:

- Front low—front of the load, 3 inches above the floor
- Upper front quarter section
- Middle center—center of the stack, midway from bottom to top
- Upper rear quarter section
- Lower rear quarter section
- Rear high—rear of the stack, at the extreme top

Contact the Center for Plant Health Science & Technology (CPHST) in Raleigh, North Carolina, for approval of fumigations larger than 25,000 ft^3, for instructions for number of gas sampling tubes, and for other technical information.

Important

For khapra beetle cargo containing baled, packaged, finely milled, or closely packed commodities, place two additional gas sampling tubes in the center of the bags, packages, or bales. Before placing gas sampling tubes in commodities, place burlap over the end of the tube and secure the burlap to the tube with tape.

Containerized Cargo

For multiple containers (either 20 or 40 feet in length) under the same tarpaulin, use at least three tubes per container. Also, for single containers, use at least three tubes, and for khapra beetle infestations, use two additional tubes. Position the gas sampling tubes as follows:

- Front low—near the floor at the door end of the container
- Rear high—rear of the load at the high end opposite the fan
- Middle center—mid way from front to back, at mid depth

If treating commodities for khapra beetle, you will need the following additional gas sampling tubes:

- High (in the commodity)
- Low (in the commodity)

Cover the end of the gas sampling tube with burlap taped to the tube before insertion into the commodity.

Break Bulk and Containerized Cargo

Use gas sampling tubes of sufficient length to extend from the sampling position inside the enclosure to at least 30 feet beyond the tarpaulin. Have all the gas sampling tubes meet in one area for ease and safety in taking gas concentration readings. Do **not** splice gas sampling tubes. Before starting the fumigation, check for gas sampling tube blockage or pinching by connecting each tube to the gas detection device for a short time. If the tube is blocked, the flow to the device will drop sharply. Replace any defective gas sampling tubes.

Fix all gas sampling tubes securely in place under the tarpaulin and label each one at the end where the gas concentration readings will be taken. By labeling each gas sampling tube, you will be able to record concentration readings easily.

Step 9—Padding Corners

Look for corners and sharp angles which could tear the tarpaulin. Never use commodity to support the tarpaulin. If the sharp angles or corners cannot be eliminated, they must be covered with burlap or other suitable padding (e.g., old tires or cloth) (see ***Figure 2-4-4*** on **page 2-4-14**).

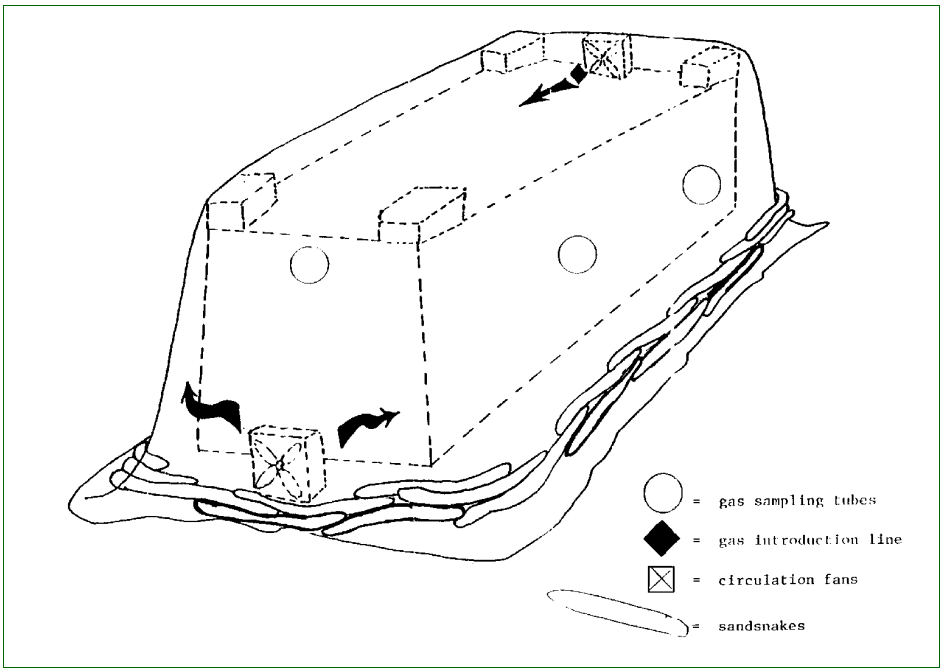

Figure 2-4-4 Typical Stack Arrangement with Fans, Leads, Introduction Line, Padding, and Sand Snakes

Step 10—Measuring the Temperatures

Important

Regardless of the commodity, never fumigate at temperatures below 40 °F.

Temperature recordings should be rounded to the nearest tenth of a degree (C ° or F °)

Determine the temperature to use in selecting the proper dosage rate:

- For pulpy fruits, pulpy vegetables, or logs use only the commodity temperature.
- For all other commodities use ***Table 2-4-3*** on **page 2-4-15** to determine the temperature for the proper dosage rate.

To take the temperature readings, use a bimetallic, mercury, or digital long-stem thermometer that has been calibrated. Use ***Table 2-4-3*** on **page 2-4-15** to determine which temperature to use when selecting the proper dosage rate for commodities other than fresh fruits, vegetables, or logs.

Table 2-4-3 Determine the Temperature for the Proper Dosage Rate

If the air temperature is:	And:	Then, for commodities other than pulpy fruits, pulpy vegetables, or logs and lumber:
Higher than the commodity temperature	→	Use the single lowest commodity temperature for determining the dosage rate (Do **not** use the average commodity temperature).
Lower than the commodity temperature	By 9 degrees or less	
	By 10 degrees or more	Use the average of the single lowest air and commodity temperatures for determining the dosage rate (Never initiate a fumigation if any commodity temperature reads lower than 40 °F.)

EXAMPLE: You are about to fumigate guar gum and the commodity temperature is 82 °F and the air temperature is 69 °F. Average the air and commodity temperatures to determine the dosage rate because the air is 13 degrees lower than the commodity temperature. The average of the two temperatures is 75.5 °F. Use 75 °F to determine the dosage rate.

If the commodity is fruits, pulpy vegetables, or logs, see the specific procedures that follow.

Pulpy Fruits and Pulpy Vegetables

For pulpy fruit and pulpy vegetables, insert the thermometer into the pulp. Peppers are also included in the category of pulpy vegetables. For commodities which have been refrigerated, probe the fruit that have the lowest pulp temperature. Again, fumigate only when the fruit pulp is at 40 °F or higher.

Important

Fresh fruits and vegetables that require fumigation treatment as a condition of entry, must meet the minimum temperature requirement of 40 °F (4.4 °C), at the time of discharge. This may require the gradual warming of the shipment over the later course of the voyage to ensure that the commodity achieves the proper minimum temperature of 40 °F (4.4 °C).

This process will facilitate whether or not the fumigation treatment of the cargo takes place on the same day of arrival.

However, if the commodity has no pulp (for example, peas, beans, grains, herbs, spices, etc.), take the temperature of the air space immediately surrounding the commodity as well as the commodity temperature. With these temperatures, use **Table 2-4-3** to determine the correct temperature for use when selecting the proper dosage rate.

Logs and Lumber

Select several representative locations within the stack at the ends of the logs or pieces of lumber and drill holes in them to accommodate a thermometer. After drilling, wait at least 10 minutes to allow the wood around the holes to

cool. Insert the thermometer into the holes drilled. Record the temperature from each hole, and average the readings. All readings (not just the average) must be above 40 °F.

Take temperature readings in each hold. Base the dosage calculation on the lowest reading obtained. (Do **not** average temperatures.) All readings must be above 40 °F to initiate the fumigation. If not, you must postpone it.

Record the temperatures in Block 22 of the PPQ Form 429.

If using the electronic 429 database, record the temperatures in the space and commodity fields in the Treatment form.

Important

When the commodity and air temperature drastically differ, moisture may condense inside the gas sampling tubes or inside the gas detection device and cause inaccurate gas concentration readings. Check the gas sampling tubes frequently for possible puddling of condensed water, and drain it off, as needed, before taking a reading. Also, check the Drierite frequently, and change it as soon as it becomes saturated with water [turns pink], to obtain true gas concentration readings. Never fumigate commodities that are frozen.

Step 11—Covering the Stack

After covering the stack, check the tarpaulin for rips, tears, and holes. Look at the spots that have been taped, and verify they are properly sealed. Have the fumigator repair all holes.

The tarpaulin should be made of a material such as vinyl, polyethylene plastic, or coated nylon. 4 mil vinyl or polyethylene plastic tarpaulins are only approved for one usage; 6 mil vinyl or polyethylene plastic tarpaulins may be used up to four times with the PPQ official's approval for each usage; 10 to 12 mil rubber or plastic coated nylon tarpaulins may be approved for multiple use with the PPQ official's approval for each usage.

The fumigator should cover all corners and sharp ends with burlap or other padding to prevent the tarpaulin from ripping. Have the fumigator pull the tarpaulin over the stack, being careful not to catch or tear the tarpaulin. Make sure there is sufficient structural support to raise the tarpaulin 2 feet above and 1 foot beyond the sides of the commodity.

The tarpaulin must be large enough to provide a floor overlap of at least 18 inches around all sides of the stack. Carefully lay the tarpaulin out to prevent excess folds or wrinkles along the floor, especially around corners.

Important

Sealed containers and vans cannot be considered as "fumigation chambers," and therefore **must be covered by a tarpaulin**, unless they can pass the pressure-leakage test.

Step 12—Sealing the Tarpaulin

Sealing may be accomplished with loose, wet sand, sand snakes, water snakes, adhesives, or a combination. If there is danger of crushing or crimping the gas sampling or introduction tubes, use the loose, wet sand. If using snakes, use two rows of snakes along the sides and three rows on the corners. The snakes should overlap each other by approximately 1 foot. The goal in sealing the tarpaulin is to get the tarpaulin to lie flat against the floor to prevent gas from leaking out. When wind is not a factor, plastic tape may be used for sealing the tarp. The tape must be at least 2 inches in width, and applied (only to a smooth surface) with the aid of high-tack spray adhesive.

Seal corners by laying two sand snakes around the corner and working the tarpaulin until it is flat. Place a third snake on top of the two other snakes to provide additional weight to force the tarpaulin against the floor. Loose, wet sand can be used in the area where the gas introduction line, electrical cords, and gas sampling tubes extend from under the tarpaulin.

Step 13—Measuring the Volume

Using a 100-foot tape measure, carefully measure the length, width, and height of the enclosure. *Never* estimate the measurements. An error in measurement of as little as 12 inches can result in miscalculation of the dosage by as much as 15 percent. When measuring, round off to the nearest quarter foot (example—3 inches =.25 feet). In the case of fumigations of edible commodities, an error can result in an unacceptable level of residue on the commodity. If the sides of the enclosure slope outward from top to bottom, measure both the top and bottom and average the two to determine the dimension. Enclosure height should always be uniform and not require adjustment.

Formula for determining volume:

Length × width × height = volume in cubic feet

EXAMPLE: A stack with measurements H=10′6″, L=42′3″, and W=10′9″ 10.50 × 42.25 × 10.75 = 4,768.9 ft^3 round to 4,769 ft^3

Record volume in Block 26 of the PPQ Form 429.

If using the electronic 429 database, record the length, width and height in the corresponding fields under the “AMT of Gas Introduced” heading on the Treatment form. The total volume of the enclosure will be calculated.

Step 14—Calculating the Dosage

Calculate dosage by doing the following:

1. Refer to the treatment schedule for the correct dosage rate (lbs./1,000 ft^3) based on temperature (°F) (Step 10).
2. Multiply by the dosage (lbs./1,000 ft^3) rate by the volume (ft^3) to get the dosage in pounds.
3. Rules for rounding. Round to nearest 1/4 pound.

Formula for calculating dosage:

$$\text{dosage (lbs.)} = \text{volume}(ft^3) \times \text{dosage rate (lbs./1,000 } ft^3)$$

$$= \frac{\text{volume}(ft^3) \times \text{dosage rate (lbs.)}}{1{,}000\ ft^3}$$

If using the electronic 429 database, enter the dosage rate in the “dosage” field and the total amount of gas required for the fumigation will be displayed in the “GAS REQUIRED” field.

EXAMPLE: You need to determine the dosage for a stack with a volume of 3,000 ft^3. For 72 °F (air and commodity temperatures), the treatment schedule lists the dosage rate at 2 pounds MB/1,000 ft^3. Determine dosage by doing the following:

$$\text{1. Volume} = 3{,}000\ ft^3$$

$$\text{2. Dosage rate} = 2 \text{ lbs. MB}/1{,}000\ ft^3$$

$$\text{3. Dosage (lbs.)} = \text{volume } (ft^3) \times \text{dosage rate (lbs./1,000 } ft^3)$$

$$= 3{,}000\ ft^3 \times 2 \text{ lbs. MB}/1{,}000\ ft^3$$

$$= \frac{3{,}000\ ft^3 \times 2 \text{ lbs. MB}}{1{,}000\ ft^3}$$

$$= 6 \text{ lbs. MB}$$

Step 15—Making a Final Check

Just prior to introducing the gas, do the following:

- Turn on all fans and APHIS-approved gas detection devices to make sure they work.
- Warm up gas detection devices at least 30 minutes before zeroing in.
- Start volatilizer and heat water to 200 °F or above. A minimum temperature of 150 °F is required at all times during the introduction process.
- Place fumigant cylinder with gas introduction line on scale and take initial weight reading. Make sure the gas introduction line is attached to the cylinder. After obtaining the correct weight, subtract the dosage to be introduced into the enclosure. After you have introduced the proper amount of gas, the scale will be balanced.
- Check that tarpaulin is placarded and the area is secured. Only people working on the fumigation may be in the area.

- Check tarpaulin to make sure it is free from rips and tears.
- Check that all gas sampling tubes are labeled and are **not** crimped or crushed. Inspect tubes visually, or use an electric or Mityvac hand pump to check tubes. Either a fumiscope or vacuum pump may be used to test leads for unrestricted flow.

Important

When conducting fumigations with methyl bromide, sulfuryl fluoride or phosphine, erroneous readings may occur if the monitoring leads become blocked or crimped. It would be impossible to install a new monitoring lead during a fumigation treatment. Therefore, to avoid an unsuccessful fumigation, you should test monitoring leads before the treatment begins.

Use the following procedure to detect blocked monitoring leads with the use of a Mityvac hand-held pump (for supplier, see ***Vacuum Pump*** on **page H-1-72**):

1. Prior to fumigant introduction, connect the Mityvac hand-held vacuum pump to a monitoring lead.
2. Squeeze the handle on the Mityvac unit. If the lead is blocked, a vacuum will be indicated on the vacuum gauge of the Mityvac unit. (The handle should be squeezed two or three times for monitoring leads longer than 25 feet. The Mityvac hand-held pump has the capacity to attain and hold 25 inches of Hg vacuum and a minimum of 7 psig pressure.)
3. Disconnect the Mityvac hand-held pump from the monitoring lead, and repeat this procedure for each monitoring lead. (Connect monitoring leads to the gas analyzer prior to fumigant introduction.)

- Check that there is enough gas in the cylinder and if necessary, that other cylinders are available.
- Check the gas introduction line connections to make sure they are tight and free of leaks (wearing the SCBA).
- Check all safety equipment, especially SCBA, is available and in working order.
- If using a T/C. install Drierite® tube on gas sample line attached to the T/C unit and check to make sure granules are blue, if pink—replace Drierite®. If humidity is high, additional Drierite® tubes or frequent changes may be necessary
- If using a T/C, install Ascarite® tube in line with the Drierite® tube if fumigating living plant and plant products, including fruits and vegetables, timber, flowers, and seed.

Important

Other gas detection devices may not require the use of Drierite® or Ascarite®.

Conducting the Fumigation

Step 1—Introducing the Gas

CAUTION

The acceptable air concentration level for methyl bromide (MB) is 5 ppm. A respirator (approved SCBA or MSHA/NIDSH) is required if the MB concentration level in the air is greater than 5 ppm at any time. You and the fumigator must use your SCBA while introducing the gas, checking for leaks, and when taking aeration readings.

Turn on all fans before introducing the gas. When using large cylinders of MB, have the fumigator open the cylinder valve slightly, then close the valve. With an APHIS-approved leak detection device, check all connections on the gas introduction line for leaks. If leaks are found, advise the fumigator to tighten the connections and repeat the test. If no leaks are found, then open the valve to the point where 3 to 4 pounds of MB are being introduced per minute. The water temperature in the volatilizer should never go below 150 °F at any time during gas introduction. The water in the volatilizer may include an antifreeze and should be handled with the appropriate safeguards.

CAUTION

Don't touch the introduction line with your bare hands—you could get burned! Close the cylinder valve once the proper dosage has been introduced.

The fumigation time begins once all the gas has been introduced. Record the time gas introduction was started and completed in Block 32 on the PPQ Form 429.

If using the electronic 429 database, record the fumigation date, gas introduction start and finish time in the corresponding fields under the "GAS INTRODUCTION" heading on the Treatment form.

Run the fans for 30 minutes to achieve even gas distribution. Take the initial concentration reading 30 minutes after all the gas has been introduced.

Important

Do **not** begin counting fumigation time until all the gas has been introduced and valve on the MB tank is closed.

Step 2—Testing for Leaks

Wear the SCBA while checking for leaks. Use an APHIS-approved leak detection device to test for leaks before the 30 minute reading or anytime when the concentration level is unknown or above 5 ppm. Test around the perimeter of the tarpaulin on the floor, corners, and especially where electric cords, gas sampling tubes, or gas introduction lines are present. When you detect leaks,

have them sealed using more sand or sand snakes for floor leaks and tape for sealing small holes in the tarpaulin. Use loose, wet sand to reduce leakage from electric cords, gas sampling tubes, gas introduction lines, or uneven flooring.

Important

If an employee encounters unsafe conditions (such as holes in the tarpaulin or a breach in safety protocol) and the condition(s) cannot be corrected in a timely manner, the employee may CANCEL the fumigation. Consult with a PPQ Supervisor prior to cancellation.

If you detect excessive leakage (concentration readings of 50 percent or less of the minimum concentration) in a tarpaulin which cannot be corrected in a practical way, do **not** attempt to correct the problem by adding more gas. Quickly evacuate the remaining gas from the enclosure, eliminate the problem, and construct a new enclosure. Aerate as usual following procedures on **page 2-4-35**. Restart the fumigation in the new enclosure.

CAUTION

Commodities used for food or feed may not be re-treated. If commodities fall into this category, the only options are the following:

- Return to the country of origin
- Reexported to another country if they will accept the shipment
- Destroy by incineration

Step 3—Taking Concentration Readings

Important

Before taking a reading, always purge sampling lines with a mechanical or hand pump. If using a T/C unit, connect it to the sampling lead, adjust the gas flow rate to 1.0, and wait until the meter registering “ounces per thousand cubic feet” stabilizes before taking a reading. (This may take a minute or more, depending upon the length of the tubing and whether or not an auxiliary pump is used.).

Take concentration readings with an APHIS-approved gas detection device to determine the gas concentration and distribution within the enclosure. If used, check desiccant tubes before each reading and change Drierite® if its color is pink.

Important

Living plant and plant products generate carbon dioxide gas, which interferes with the MB reading from the T/C. In order to remove CO_2, install an Ascarite® tube in line with the Drierite® tube if fumigating living plant and plant products, including fruits and vegetables, timber, flowers, and seed.

Depending upon the length of exposure period, take concentration readings at the following times[6]:

6 If fumigating oak logs or lumber for export, see “Special Procedures for Adding Gas to Oak Logs and Lumber.”

- 30 minutes
- 2 hours
- 4 hours
- 6 hours
- 12 hours
- 24 hours
- 36 hours
- 48 hours
- 72 hours
- Any final concentration reading

CAUTION

Avoid using hand-held two-way radios near the T/C unit. Using two-way radios near the T/C unit will interfere with an accurate concentration reading.

Thirty-Minute Reading

The 30-minute reading shows the initial concentration and distribution of gas. The 30-minute reading can indicate leakage, sorption, incorrect dosage calculation, or error in fumigant introduction—all of which require immediate attention. Concentration readings should **not** differ more than 4 ounces among the leads.

Two-Hour Reading

In comparison with the 30-minute reading, the 2-hour reading also will indicate if the tarpaulin is leaking or the commodity is sorbing gas. Readings more than 15 percent lower than the 30-minute reading will require close monitoring and possible corrective action.

EXAMPLE: Your dosage for the fumigation was 4 pounds (64 ounces). The 30 minute reading was 50 ounces (3.125 pounds). The 2-hour reading is 42 ounces (2.625 pounds). The 2-hour reading is more than 15 percent less than the 30 minute reading and would indicate that either a leak or sorption problem may exist. You would need to monitor the fumigation closely until the concentration level stabilizes.

Final Reading

The final reading is required for all tarpaulin fumigations in order to determine if the fumigation has been successfully completed. You may start the final reading before the finishing time of the treatment so that aeration commences at the finishing time. Starting the final reading before finishing time is especially critical when fumigating perishables.

Additional Readings

Decide the need to take additional readings based on the following:

- Rate of gas concentration decrease

- Any condition which could change the gas concentration such as severe winds, or rain.

When concentration readings differ by more than 4 ounces, run the fans to equalize the gas and record readings on the APHIS 429. Generally, at the 1/2 hour reading, gas should be evenly distributed, and you should not have to restart the fans unless you added gas. If readings continue to differ by more than 4 ounces, continue running the fans until the gas is evenly distributed.

If unpredicted severe winds occur, additional readings must be taken. Any sharp or unusual decreases of the readings in relation to previous readings is a clue to take corrective action and supplementary readings. Take additional readings every 30 minutes until problems are rectified.

Sorptive commodities may also require additional concentration readings.

Step 4—Determining the Need to Add Gas and Adjust Exposure

Use the following table to determine when to add gas or extend the exposure period:

Table 2-4-4 Determine the Need to Add Gas and Adjust Exposure

If the lowest gas reading is:	And the schedule is:	Then:
Below the required minimum concentration	T101-a-1* or equivalent	SEE ***Table 2-4-6*** on **page 2-4-27** for corrections at 0.5 hour, or ***Table 2-4-7*** on **page 2-4-28** for corrections at 2 hours
	Other than T101-a-1 or equivalent	See ***Adding Gas to Commodities that are Fumigated Using Treatment Schedules other than T101-a-1 or Equivalent (may include perishables)*** on **page 2-4-24**
At or above required minimum concentration	T101-a-1* or equivalent	SEE ***Table 2-4-6*** on **page 2-4-27** for corrections at 0.5 hour, or ***Table 2-4-7*** on **page 2-4-28** for corrections at 2 hours
	Other than T101-a-1	No action necessary

Important

* T101-a-1 or equivalent treatment schedules are those schedules that are **not** greater than 2 hours long (exposure time), and the dosage rate is **not** greater than 4 lbs. per 1000 ft^3, anywhere on the schedule.

Special Procedures for Adding Gas and Extending Exposure Period[7]

Adding Gas to Commodities that are Fumigated Using Treatment Schedules other than T101-a-1 or Equivalent (may include perishables)

Important

T101-a-1 or equivalent treatment schedules are those schedules that are **not** greater than 2 hours long (exposure time), and the dosage rate is **not** greater than 4lbs per 1000ft^3.

Adding Gas Calculation

NOTICE

To avoid injuring the commodity, add fumigant using the following formula:

1.6 × number of oz. below minimum × volume in ft^3/1,000 ft^3 = oz. of gas to add or oz. of gas to add/16 oz/lbs. = pounds (lbs.) of gas to add.

When adding gas, these procedures must be followed:

1. Heat water in volatilizer.
2. Turn on fans.
3. Take weight of the cylinder.
4. With SCBA on, open valve on cylinder and introduce the gas.
5. Close valve when the weight of the cylinder indicates that the needed amount of gas has been added.
6. Record quantity of fumigant added in Block 34 and the additional fan time in Block 30 of the PPQ Form 429.
7. If using the electronic 429, record the amount of additional gas listed in the Treatment Manual in the “Additional Gas Recommended” field and the actual amount of additional gas added in the “ACTUAL ADDITIONAL GAS” field. Record the additional fan time in the “TIME FANS OPERATED” field in the Treatment form.

Note the time the fumigator started introducing additional gas and the time the fumigator finished introducing gas and record in Block 40 (Remarks) of the PPQ Form 429 or in the “Remarks” form in the electronic 429 database. Run the fans for 30 minutes. Turn off fans, then take a concentration reading. If all readings are above minimum concentration levels, then proceed as usual with the remaining scheduled concentration readings.

7 The MB label does allow the extension of exposure time due to low gas readings for non-food commodities.

Excessive leakage in any one tarpaulin enclosure, which cannot be eliminated in a practical way, must **not** be corrected by the addition of MB. (Excessive leakage has occurred when concentration readings are less than or equal to 50 percent of minimum concentration reading). Quickly evacuate remaining gas from such an enclosure, eliminate the problem, and construct a new enclosure. Start a new treatment in the new enclosure.

CAUTION

Commodities used for food or feed may **not** be re-treated. If commodities fall into this category, the only options are the following:

- Return to the country of origin
- Reexport to another country if they will accept the shipment
- Destroy by incineration

Extending the Exposure Period for Commodities that are Fumigated Using Treatment Schedules other than T101-a-1 or Equivalent (may include perishables)

Use the following table to determine how long to extend the exposure period.

Table 2-4-5 Determine the Extended Exposure Period

If the exposure time is:	And any individual reading is below minimum by:[1]	Then extend exposure:
Less than 12 hours	10 oz. or less	10 percent of the time lapse since the last acceptable reading
	11 oz. or more	30 minutes
12 hours or more	10 oz. or less	10 percent of the time lapse since the last acceptable reading
	11 oz. or more	2 hours or 10 percent of time lapse since last acceptable reading, whichever is greater

1 If any individual reading is 50 percent or more below the minimum concentration reading, then abort the treatment. For example, if the minimum reading is 38 ounces then the reading 50 percent below the minimum is 19 ounces [38 ounces – (38 ounces ×.50) = 19 ounces]. For oak logs (T312-a, T312-a-alternative), refer to ***Special Procedures for Adding Gas to Oak Logs Using T312-a or T312-a-Alternative* on page 2-4-29** for specific instructions.

Adding Gas to Fruits, Vegetables, or Perishable Commodities Using Schedule T101-a-1 or Equivalent

Use these instructions only for fruits and vegetables being fumigated under treatment schedule T101-a-1 or equivalent.

CAUTION

Fresh fruits and vegetables are sensitive to MB so you should double check volume calculations and dosage measurements to avoid accidental overdoses. If any 30-minute readings are 50 percent or more above the minimum concentration, it indicates a miscalculation of the dosage. Include a brief report on the PPQ Form 429 stating possible reasons for the overdose. Exposure periods are decreased for fumigations where concentration readings are much higher than required. See tables on the following pages to determine when to reduce exposure periods.

Use ***Table 2-4-6*** on **page 2-4-27** and ***Table 2-4-7*** on **page 2-4-28** for fresh fruits and vegetables to determine if you need to add gas or extend or decrease the exposure time.

Important

DO **NOT** average the concentration readings before using the tables. Base your decision on whether to add gas from the LOWEST gas concentration of any individual gas reading.

Select the proper table based on the time of the gas reading (30 minutes or 2 hours).

Important

These tables apply **only** to those T101 schedules lasting 2 hours or less at a dosage rate of 4 lbs./1000 ft^3 or less. They do **not** apply to schedules of longer duration.

Adding Gas Calculation

NOTICE

To avoid injuring the commodity, add fumigant using the following formula:

1.6 × number of oz. below minimum × volume in ft.3/1,000 ft.3 = oz. of gas to add or oz. of gas to add/16 oz/lbs. = pounds (lbs.) of gas to add.

When adding gas, these procedures must be followed:

1. Heat water in volatilizer.
2. Turn on fans.
3. Take weight of the cylinder.
4. With SCBA on, open valve on cylinder and introduce the gas.
5. Close valve when the weight of the cylinder indicates that the needed amount of gas has been added.
6. Record quantity of fumigant added in Block 34 and additional fan time in Block 30 of the PPQ Form 429.

7. If using the electronic 429, record the amount of additional gas listed in the Treatment Manual in the "Additional Gas Recommended" field and the actual amount of additional gas added in the "ACTUAL ADDITIONAL GAS" field. Record the additional fan time in the "TIME FANS OPERATED" field in the Treatment form.

Note the time the fumigator started introducing additional gas and the time the fumigator finished introducing gas and record in Block 40 (Remarks) of the PPQ Form 429 or in the "Remarks" form in the electronic 429 database. Run the fans until there is even gas distribution throughout the stack. Turn off fans, then take a concentration reading 30 minutes after the gas has been introduced. If all readings are above minimum concentration levels, then proceed as usual with the remaining scheduled concentration readings.

Table 2-4-6 Determine Gas Concentration Values and Corrections for Fruits and Vegetables at the 30-Minute Reading of T101-a-1 or Equivalent Schedules

If the schedule is:	And the minimum concentration reading (oz.) in schedule is:	And the lowest concentration reading (oz.) is:	Then:
40-49 °F 4 lbs for 2 hrs	48	65 or greater[1]	REDUCE exposure by 15 minutes
		64-48	TAKE 2 hour reading as scheduled
		Lower than 48	1. ADD gas, and 2. EXTEND exposure 15 minutes
50-59 °F 3 lbs for 2 hrs	38	52 or greater[1]	REDUCE exposure by 15 minutes
		51-38	TAKE 2 hour reading as scheduled
		Lower than 38	1. ADD gas, and 2. EXTEND exposure 15 minutes
60-69 °F 2.5 lbs for 2 hrs	32	48 or greater[1]	REDUCE exposure by 15 minutes
		47-32	TAKE 2 hour reading as scheduled
		Lower than 32	1. ADD gas, and 2. EXTEND exposure 15 minutes
70-79 °F 2 lbs for 2 hrs	26	37 or greater[1]	REDUCE exposure by 15 minutes
		36-26	TAKE 2 hour reading as scheduled
		Lower than 26	1. ADD gas, and 2. EXTEND exposure 15 minutes
80-89 °F 1.5 lbs for 2 hrs	19	27 or greater[1]	REDUCE exposure by 15 minutes
		26-19	TAKE 2 hour reading as scheduled
		Lower than 19	1. ADD gas, and 2. EXTEND exposure 15 minutes

1 If concentration reading is more than 50 percent above the minimum concentration reading, it indicates a problem. An immediate check should be made to determine the cause and to correct it.

Table 2-4-7 Determine Gas Concentration Values and Corrections for Fruits and Vegetables at the 2-Hour Reading of T101-a-1 or Equivalent Schedules

If the schedule is:	And the lowest concentration reading at 2 hours is:	Then do not add gas, but:
40-49 °F 4 lbs for 2 hours	38 and above	AERATE commodity
	37-28	EXTEND exposure by 15 minutes
	27-25	EXTEND exposure by 30 minutes
	Lower than 25	ABORT
50-59 °F 3 lbs for 2 hrs	29 and above	AERATE commodity
	28-24	EXTEND exposure by 15 minutes
	23-21	EXTEND exposure by 30 minutes
	Lower than 21	ABORT
60-69 °F 2.5 lbs for 2 hrs	24 and above	AERATE commodity
	23-21	EXTEND exposure by 15 minutes
	20-18	EXTEND exposure by 30 minutes
	Lower than 18	ABORT
70-79 °F 2 lbs for 2 hrs	19 and above	AERATE commodity
	18-16	EXTEND exposure by 15 minutes
	15-13	EXTEND exposure by 30 minutes
	Lower than 13	ABORT
80-89 °F 1.5 lbs for 2 hrs	14 and above	AERATE commodity)
	13-12	EXTEND exposure by 15 minutes
	11-10	EXTEND exposure by 30 minutes
	Lower than 10	ABORT

Special Procedures for Adding Gas to Oak Logs Using T312-a or T312-a-Alternative

There are two alternative treatments for the MB fumigation of Oak logs. Refer to **Table 2-4-8** and **Table 2-4-9** for actions to take during the fumigation of Oak Logs using T312-a or T312-a-Alternative.

Use the following formula to calculate the amount of gas to add to the enclosure:

1.6 × (number of oz. below the required minimum) × (volume in ft^3)/1,000 ft^3 = oz. of gas to add. To convert ounces to pounds, use the formula:

$$\frac{\text{oz. of gas to add}}{16\frac{\text{oz.}}{\text{lbs.}}} = \text{pounds (lbs.) of gas to add}$$

After adding gas, run the fans for 30 minutes and take additional gas concentration readings.

Refer to **Table 2-4-8** if using T312-a and **Table 2-4-9** if using T312-a-Alternative to determine how much additional time must be added to the fumigation to compensate for the low gas concentrations.

EXAMPLE: The treatment schedule is T312-a-Alternative. The size of the enclosure is 2400 ft^3. The required reading at 48 hours must be a minimum of 140 ounces. The actual lowest reading is 132 ounces. Calculate the amount of gas to add to the enclosure using the formula:
1.6 x (the number of ounces below 140) x (volume in ft^3)/1000 ft^3
ANSWER:
140-132=8
1.6 x 8 x 2400=30,720/1000 = 30.72 ounces of gas to add
30.72/16 = 1.92 pounds of gas to add

Determine the amount of time to add by referring to **Table 2-4-9**. In this example, 1 hour will be added to the total fumigation time.
Take the regularly scheduled reading at 72 hours (the minimum should be 100 ounces.)
Take another reading at 73 hours (the minimum should be 100 ounces.)
If the minimum is not 100 ounces, add more gas and time according to **Table 2-4-9**.

Instructions for Adding Gas and Time to Schedule T312-a

Do **not** combine schedules T312-a and T312-a-Alternative. The treatment must be aborted if any individual gas concentration readings are 50 percent or more below the minimum required concentration.

Table 2-4-8 Determine Gas Concentration Values and Corrections for Oak Log Fumigations Using Schedule T312-a

If the Reading is Taken At:	And the lowest individual concentration reading is:	Then:
0.5 hour	121-239	1. ADD gas, and 2. EXTEND exposure by 0.5 hour
	0-120	ABORT
2 hours	160-239	1. ADD gas, and 2. EXTEND exposure by 0.5 hour
	121-159	1. ADD gas, and 2. EXTEND exposure by 1.0 hour
	0-120	ABORT
12 hours	190-199	1. ADD gas, and 2. EXTEND exposure by 0.5 hour
	180-189	1. ADD gas, and 2. EXTEND exposure by 1.0 hour
	170-179	1. ADD gas, and 2. EXTEND exposure by 1.5 hours
	160-169	1. ADD gas, and 2. EXTEND exposure by 2.0 hours
	150-159	1. ADD gas, and 2. EXTEND exposure by 2.5 hours
	140-149	1. ADD gas, and 2. EXTEND exposure by 3.0 hours
	130-139	1. ADD gas, and 2. EXTEND exposure by 3.5 hours
	120-129	1. ADD gas, and 2. EXTEND exposure by 4.0 hours
	110-119	1. ADD gas, and 2. EXTEND exposure by 4.5 hours
	101-109	1. ADD gas, and 2. EXTEND exposure by 5.0 hours
	0-100	ABORT

Table 2-4-8 Determine Gas Concentration Values and Corrections for Oak Log Fumigations Using Schedule T312-a (continued)

If the Reading is Taken At:	And the lowest individual concentration reading is:	Then:
24 hours	120-239	1. Add gas to bring the total concentration to 240 ounces. 2. DO **NOT** ADD TIME.
	110-119	1. ADD gas, and 2. EXTEND exposure by 1.0 hour
	100-109	1. ADD gas, and 2. EXTEND exposure by 2.0 hours
	90-99	1. ADD gas, and 2. EXTEND exposure by 3.0 hours
	80-89	1. ADD gas, and 2. EXTEND exposure by 4.0 hours
	70-79	1. ADD gas, and 2. EXTEND exposure by 5.0 hours
	61-69	1. ADD gas, and 2. EXTEND exposure by 6.0 hours
	0-60	ABORT
36 hours	150-159	1. ADD gas, and 2. EXTEND exposure by 1.0 hour
	140-149	1. ADD gas, and 2. EXTEND exposure by 1.5 hours
	130-139	1. ADD gas, and 2. EXTEND exposure by 2.5 hours
	120-129	1. ADD gas, and 2. EXTEND exposure by 3.0 hours
	110-119	1. ADD gas, and 2. EXTEND exposure by 4.0 hours
	100-109	1. ADD gas, and 2. EXTEND exposure by 4.5 hours
	90-99	1. ADD gas, and 2. EXTEND exposure by 5.5 hours
	81-89	1. ADD gas, and 2. EXTEND exposure by 6.0 hours
	0-80	ABORT

Table 2-4-8 Determine Gas Concentration Values and Corrections for Oak Log Fumigations Using Schedule T312-a (continued)

If the Reading is Taken At:	And the lowest individual concentration reading is:	Then:
48 hours	110-119	1. ADD gas, and 2. EXTEND exposure by 1.0 hour
	100-109	1. ADD gas, and 2. EXTEND exposure by 2.0 hours
	90-99	1. ADD gas, and 2. EXTEND exposure by 3.0 hours
	80-89	1. ADD gas, and 2. EXTEND exposure by 4.0 hours
	70-79	1. ADD gas, and 2. EXTEND exposure by 5.0 hours
	61-69	1. ADD gas, and 2. EXTEND exposure by 6.0 hours
	0-60	ABORT
72 hours	70-79	1. ADD gas, and 2. EXTEND exposure by 3.0 hours
	60-69	1. ADD gas, and 2. EXTEND exposure by 6.0 hours
	50-59	1. ADD gas, and 2. EXTEND exposure by 9.0 hours
	41-49	1. ADD gas, and 2. EXTEND exposure by 12.0 hours
	0-40	ABORT

Important

If additional time has been added to the treatment, the 72 hour reading AND the extended time reading MUST be taken. If the minimum of 80 ounces is **not** met, time and gas MUST be added according to this Table.

Instructions for Adding Gas and Time to Schedule T312-a-Alternative

Do **not** combine schedules T312-a and T312-a-Alternative.

Table 2-4-9 Determine Gas Concentration Values and Corrections for Oak Log Fumigations using Schedule T312-a-Alternative

If the Reading is Taken At:	And any individual concentration reading is:	Then:
0.5 hours	121-239	1. ADD gas, and 2. DO **NOT** EXTEND exposure.
	0-120	ABORT
2 hours	160-239	1. ADD gas, and 2. DO **NOT** EXTEND exposure
	121-159	1. ADD gas, and 2. EXTEND exposure by 1.0 hour
	0-120	ABORT
24 hours	140-239	1. Add gas to bring the total concentration to 240 ounces. 2. DO **NOT** ADD TIME.
	130-139	1. ADD gas, and 2. EXTEND exposure by 1.0 hour
	120-129	1. ADD gas, and 2. EXTEND exposure by 2.5 hours
	110-119	1. ADD gas, and 2. EXTEND exposure by 4.0 hours
	100-109	1. ADD gas, and 2. EXTEND exposure by 5.5 hours
	90-99	1. ADD gas, and 2. EXTEND exposure by 7.0 hours
	80-89	1. ADD gas, and 2. EXTEND exposure by 8.5 hours
	71-79	1. ADD gas, and 2. EXTEND exposure by 10.0 hours
	0-70	ABORT

Table 2-4-9 Determine Gas Concentration Values and Corrections for Oak Log Fumigations using Schedule T312-a-Alternative (continued)

If the Reading is Taken At:	And any individual concentration reading is:	Then:
48 hours	130-139	1. ADD gas, and 2. EXTEND exposure by 1.0 hour
	120-129	1. ADD gas, and 2. EXTEND exposure by 2.5 hours
	110-119	1. ADD gas, and 2. EXTEND exposure by 4.5 hours
	100-109	1. ADD gas, and 2. EXTEND exposure by 6.0 hours
	90-99	1. ADD gas, and 2. EXTEND exposure by 8.5 hours
	80-89	1. ADD gas, and 2. EXTEND exposure by 9.5 hours
	71-79	1. ADD gas, and 2. EXTEND exposure by 11 hours
	0-70	ABORT
72 hours	90-99	1. ADD gas, and 2. EXTEND exposure by 1.5 hours
	80-89	1. ADD gas, and 2. EXTEND exposure by 4.0 hours
	70-79	1. ADD gas, and 2. EXTEND exposure by 7.5 hours
	60-69	1. ADD gas, and 2. EXTEND exposure by 8.5 hours
	51-59	1. ADD gas, and 2. EXTEND exposure by 11.0 hours
	0-50	ABORT

Important

If additional time has been added to the treatment, the 72 hour reading AND the extended time reading MUST be taken. If the minimum of 100 ounces is **not** met, time and gas MUST be added according to this Table.

Step 5—Exhausting the Gas

Exhaust the gas at the completion of the exposure period. If the treatment schedule is a FIFRA Section 18 Exemption, then the PPQ official must monitor the aeration of the commodity. Detector tube readings and the time interval from the aeration must be recorded in the corresponding fields in the "DETECTOR READINGS" form.

Aerating the Enclosure

Aeration procedures are designed to provide safe working conditions during the aeration period and to assure that commodities are safe for handling, storage, and transportation. A fumigant must be aerated in accordance with Environmental Protection Agency (EPA) label requirements, the Occupational Safety and Health Administration (OSHA), and the PPQ Treatment Manual.

When treatments are conducted in a particular location on a regular basis, a permanent site should be designated. At such sites, the fan used to remove the fumigant from the enclosure during aeration must be connected to a permanent stack extending above the roof level.

Aeration of fumigated structures and ships are covered within those particular sections.

Responsibility for Aerating the Commodity

The label requires that at least two people trained in the use of the fumigant must be present at all times during gas introduction, treatment, and aeration. The PPQ official, however, is **not** required to be continuously present at the fumigation site throughout the aeration process unless specified by the label or by State or local regulations.

If the fumigation is performed under a Section 18 Exemption, then a PPQ official must be present at the initiation of aeration and to verify the final aeration readings.

Table 2-4-10 Determine Responsibility for Aerating the Commodity

If the Treatment Schedule is:	Then:
A FIFRA Section 18 Exemption	1. PPQ must MONITOR the aeration of the enclosure, and 2. USE **Table 2-4-11 on page-2-4-37** to determine which aeration procedure to follow
A labeled Treatment Schedule	1. RELEASE the fumigation to the fumigator to aerate according to label instructions and the conditions of the compliance agreement. 2. RELEASE the commodity.

Materials Needed

The following materials will be needed to aerate the enclosure:

- SCBA[8]
- Colorimetric tubes (Draeger or Kitagawa for example)
- Exhaust fan[9]
- Exhaust duct[9]
- Danger signs and materials for limiting access to area (barricades, rope)[7]
- PPQ Form 429[8]

The following procedures apply to the aeration of all tarpaulin fumigations.

Securing the Area

Assuming that you have already restricted access and secured the fumigation area, you now must restrict access to the area where the exhaust duct extends on the ground beyond the enclosure.

During the first 10 minutes of aeration, it is recommended that no one be within 200 feet of the exhaust duct outlet.

If this buffer zone is regulated by the State or municipality where the fumigation takes place, local regulations must be followed.

If it is impossible to restrict people from the area of aeration during regular work hours, consider aeration during another time of the day. When securing the duct outlet area, consider the direction of the wind. Face the duct outlet toward an open area, and away from people. Point the duct outlet upward to aid in dispersing the exhausted gas.

Advise the fumigator to use a physical barrier such as ropes, barricades, or walls to secure the area.

Placard the secure area near the exhaust outlet with the appropriate DANGER/PELIGRO signs. Make sure the placards meet the appropriate fumigant label or labeling requirements. The skull and crossbones should be present as well as "AREA UNDER FUMIGATION, DO **NOT** ENTER/**NO** ENTRE"; date of the fumigation; name of the fumigant used; and the name, address, and telephone number of the fumigator. Unless you authorize their use, do **not** allow motorized vehicles to operate within the secure area.

8 Materials required for both PPQ and the commercial fumigator.
9 Materials to be furnished by the commercial fumigator.

Wearing Respiratory Protection

The fumigator and the PPQ official monitoring the aeration must wear approved respiratory protection (SCBA, air supplied respirator, or a combination unit) when:

- Installing the exhaust system
- Opening the tarpaulin for aeration
- Removing the tarpaulin if measured levels of fumigant are above 5 ppm
- Anytime during the aeration process when a risk of exposure to concentrations above 5 ppm exists. This includes any time the concentration is unknown.

Refer to the following table to determine which Aeration Procedure to use when monitoring aeration.

Table 2-4-11 Determine the Aeration Procedure

If:	And:	And:	Then:
Nonsorptive	Containerized	→	GO to **page 2-4-37**
	Noncontainerized	Fresh fruits and vegetables, and cut flowers	GO to **page 2-4-41**
		Other than fresh fruits and vegetables, and cut flowers	GO to **page 2-4-39**
Sorptive, including yams and chestnuts (See **page 2-3-6** for list of sorptive commodities)	Containerized	→	GO to **page 2-4-44**
	Noncontainerized	→	GO to **page 2-4-42**

Aerating Nonsorptive, Containerized Cargo—Indoors and Outdoors

Step 1—Installing Exhaust System

Advise the fumigator to:

1. Install an exhaust fan (minimum of 5,200 cfm capacity) to a 16 inch, or greater, diameter duct located at the floor near rear doors of the container.
2. Install an air introduction duct system consisting of a 3,750 cfm, or greater, fan attached to a 12 inch, or larger, duct which reaches two-thirds of the length of the container at the top of the load. Have the ducts installed prior to the start of the fumigation. For indoor fumigation,

extend the exhaust duct at least 30 feet beyond the building or through a vertical stack extending through the roof. For outdoor fumigations, extend the exhaust duct at least 30 feet beyond the container.

Important

(1) Volume of enclosure (in cubic feet) divided by the sum of cubic feet per minute (cfm) of the exhaust fan(s) or exhaust blower equals the number of minutes required per complete gas volume exchange. (2) Sixty minutes divided by the number of minutes per gas volume exchange equals the number of complete gas exchanges per hour. The result should be in the range of 4 to 15. The faster the rate of aeration the better, particularly for perishable commodities. If the exhaust flow is connected to a methyl bromide recovery system, this device must **not** impede the flow rate to less than 4 volumes per hour.

Step 2—Aerating the Commodity

Advise the fumigator to:

1. Connect the exhaust duct to the exhaust fan.
2. Start the exhaust fan(s) and lift the end of the tarpaulin opposite the end at which the exhaust fan and duct are located.
3. Aerate for **3 hours.**
4. Stop the aeration fans.
5. Use a colorimetric tube to take a concentration reading in the airspace around and, when feasible, within the carton or box**.** Exceptions may include compressed cotton and other very difficult to probe commodities. Obtain prior approval from CHPST for exceptions to this rule.

For FIFRA Section 18 exemptions, record the concentration reading (in ppm), date, and time in Block 39 of PPQ Form 429. If using the electronic 429 database, record the date, time and detector reading (in ppm) in the “Detector Readings” form.

Then use **Table 2-4-12** to determine when to release the commodity.

Table 2-4-12 Determine When to Release the Commodity

If the gas concentration level is:	Then:
5 ppm or less	RELEASE the commodity
6 ppm or more	1. CONTINUE aeration until the concentration is 5 ppm or less, then 2. RELEASE the commodity

Aerating Nonsorptive, Noncontainerized Cargo—Indoors and Outdoors

Step 1—Installing the Exhaust System

Important

This step is optional for outdoor fumigations, but must be done for indoor fumigations.

Advise the fumigator to:

1. Install an exhaust duct (minimally one 3,500 cfm capacity fan connected to an exhaust duct). An exhaust duct is optional for outdoor fumigations.
2. Extend the exhaust duct outlet to an outside area where there is adequate ventilation and at least 30 feet away from the building or through a vertical exhaust stack extending through the roof.

Important

(1) Volume of enclosure (in cubic feet) divided by the sum of cubic feet per minute (cfm) of the exhaust fan(s) or exhaust blower equals the number of minutes required per complete gas volume exchange. (2) Sixty minutes divided by the number of minutes per gas volume exchange equals the number of complete gas exchanges per hour. The result should be in the range of 4 to 15. The faster the rate of aeration the better, particularly for perishable commodities. If the exhaust flow is connected to a methyl bromide recovery system, this device must **not** impede the flow rate to less than 4 volumes per hour.

Step 2—Aerating the Commodity

Advise the fumigator to:

1. Start the exhaust fan.
2. Lift the end of the tarpaulin opposite the end with the exhaust fan and duct (if used).
3. Aerate the enclosure for **2 hours.**

Outdoor Fumigations

Advise the fumigator to:

1. Stop the fans.
2. Remove the tarpaulin.
3. Take concentration readings with colorimetric tubes in the airspace around and, when feasible, inside the box or cartons.

For FIFRA Section 18 exemptions, record the concentration reading (in ppm), date, and time in Block 39 of PPQ Form 429. If using the electronic 429 database, record the date, time and detector reading (in ppm) in the "Detector Readings" form. If using the electronic 429, record the time and detector reading (in ppm) in the "Detector Readings" form.

Then use **Table 2-4-13** to determine when to release the commodity.

Table 2-4-13 Determine When to Release the Commodity for Outdoor Fumigations

If the gas concentration level is:	Then:
5 ppm or less	RELEASE the commodity
6 ppm or more	1. CONTINUE aeration and take concentration readings until the level is 5 ppm or less, then 2. RELEASE the commodity

Indoor Fumigations

Advise the fumigator to:

1. Stop the fans.
2. Take concentration readings with colorimetric tubes in the airspace around and, when feasible, in the carton or box.

For FIFRA Section 18 exemptions, record the concentration reading (in ppm), date, and time in Block 39 of PPQ Form 429. If using the electronic 429, record the time and detector reading (in ppm) in the "Detector Readings" form.

Then use **Table 2-4-14** to determine when to release the commodity.

Table 2-4-14 Determine When to Release the Commodity for Indoor Fumigations

If the gas concentration level is:	Then:
5 ppm or less	1. ADVISE fumigator to REMOVE the tarpaulin, and 2. RELEASE the commodity
6 ppm to 99 ppm	1. ADVISE fumigator to REMOVE the tarpaulin, and 2. CONTINUE aeration until the concentration is 5 ppm or less, then 3. RELEASE the commodity
100 ppm or above	1. CONTINUE aeration and take concentration readings until the concentration level is below 100 ppm, then remove the tarpaulin, and 2. CONTINUE aeration until concentration is 5 ppm or less, then 3. RELEASE the commodity

Aeration Procedures for Fresh Fruits, Vegetables, and Cut Flowers—Indoors or Outdoors

Important

Do **not** use these procedures for fresh chestnuts or yams. (see procedures for sorptive commodities on **page 2-4-45**)

Step 1—Installing Exhaust System

Use **Table 2-4-15** to determine which size fan to use.

Table 2-4-15 Determine Number of Fans

If the enclosure is:	Then:
Up to 1000 cu ft	USE one fan, 67-350 cfm
1001-15,000 cu ft	USE one or 2 fans. The volume of the enclosure divided by the sum of the cfm of the fans should equal a figure of 15 or less. Connect fan(s) to 3-ft diameter exhaust duct(s) 3 ft in diameter.
15,001-25,000 cu ft	USE two fans, each 1,000 to 5,000 cfm. The volume of the enclosure divided by the sum of the cfm of the fans should equal a figure of 15 or less. Connect fan(s) to exhaust duct(s) 3 ft in diameter.
More than 25,000 cu ft	CONTACT the Center for Plant Health Science and Technology (CPHST) in Raleigh, North Carolina, for advice prior to conducting the first fumigation.

An alternate procedure to using exhaust fans and ducts is to aerate through a vertical stack.

Important

(1) Volume of enclosure (in cubic feet) divided by the sum of cubic feet per minute (cfm) of the exhaust fan(s) or exhaust blower equals the number of minutes required per complete gas volume exchange. (2) Sixty minutes divided by the number of minutes per gas volume exchange equals the number of complete gas exchanges per hour. The result should be in the range of 4 to 15. The faster the rate of aeration the better, particularly for perishable commodities. If the exhaust flow is connected to a methyl bromide recovery system, this device must **not** impede the flow rate to less than 4 volumes per hour.

Step 2—Aerating the Commodity

Advise the fumigator to:

1. Connect the exhaust duct to the exhaust fan.
2. Start the exhaust fan(s) and lift the end of the tarpaulin opposite the end at which the exhaust fan and duct are located.
3. Aerate for **2 hours.**

4. Remove the tarpaulin and allow **2 hours** for passive aeration.
5. Stop the fans and take concentration readings with colorimetric tubes in the airspace around and, when feasible, inside the cartons or boxes.

For FIFRA Section 18 exemptions, record the concentration reading (in ppm), date, and time in Block 39 of PPQ Form 429. If using the electronic 429, record the time and detector reading (in ppm) in the "Detector Readings" form.

Then use **Table 2-4-16** to determine when to release the commodity.

Table 2-4-16 Determine When to Release the Commodity

If the gas concentration level is:	Then:
5 ppm or less	RELEASE the commodity
6 ppm or more	1. CONTINUE aeration and take concentration readings until the level is 5ppm or less, then 2. RELEASE the commodity

Important

If using the electronic 429 database, follow the instructions for distribution in the "Help" section of the database. If using a paper copy of the form 429, give the original and one copy to your supervisor for review. The supervisor should keep the original for port files and send one copy to:

USDA, APHIS, PPQ, CPHST
Treatment Quality Assurance Unit
1730 Varsity Drive, Suite 400
Raleigh, NC 27606
919-855-7450

Aerating Sorptive, Noncontainerized Cargo—Indoors and Outdoors

Step 1—Installing the Exhaust System

Important

This step is optional for outdoor fumigations, but must be done for indoor fumigations.

Advise the fumigator to:

1. Install an exhaust duct (minimally one 3,500 cfm capacity fan connected to an exhaust duct).
2. Extend the exhaust duct outlet to an outside area where there is adequate ventilation and at least 30 feet away from the building or through a vertical exhaust stack extending through the roof.

Step 2—Aerating the Commodity

Outdoor Fumigations

Advise the fumigator to:

1. Lift both ends of the tarpaulin.
2. Start the circulation fans and exhaust fans (if available).
3. Aerate Oak logs and lumber a minimum of **48 hours**. If, after 48 hours, the concentration is 5 ppm or greater, continue aeration for 24 more hours. Continue this procedure until concentration readings are less than 5 ppm.
4. Run the fans for **4 hours** for commodities other than Oak logs and lumber.
5. Remove the tarpaulin.
6. Stop the fans and take concentration readings with colorimetric tubes in the airspace around and, when feasible, inside the cartons or boxes.

For FIFRA Section 18 exemptions, record the concentration reading (in ppm), date, and time in Block 39 of PPQ Form 429. If using the electronic 429 database, record the date, time and detector reading (in ppm) in the “Detector Readings” form.

Then use **Table 2-4-17** to determine when to release the commodity.

Table 2-4-17 Determine when to Release the Commodity

If the gas concentration level is:	Then:
5 ppm or less	RELEASE the commodity
6 ppm or more	1. CONTINUE aeration and take concentration readings until the level is 5ppm or less, then 2. RELEASE the commodity

Indoor Fumigations

Advise the fumigator to:

1. Complete the installation of the exhaust duct.
2. Start the circulation fans and exhaust fans.
3. Lift the end of the tarpaulin opposite the exhaust fan.
4. Aerate Oak logs and lumber a minimum of **48 hours**. If, after 48 hours, the concentration is 5 ppm or greater, continue aeration for 24 more hours. Continue this procedure until concentration readings are less than 5 ppm.
5. Run the fans for **4 hours** for commodities other than Oak logs and lumber.

6. Stop the fans and take concentration readings with colorimetric tubes in the airspace around and, when feasible, inside the carton or box.
7. Remove the tarpaulin.

For FIFRA Section 18 exemptions, record the concentration reading (in ppm), date, and time in Block 39 of PPQ Form 429. If using the electronic 429 database, record the date, time and detector reading (in ppm) in the "Detector Readings" form.

Then use **Table 2-4-18** to determine when to release the commodity. Take successive readings at intervals of **not** less than 2 hours.

Table 2-4-18 Determine When to Release the Commodity for Indoor Fumigations

If the gas concentration level is:	Then:
5 ppm or less	1. REMOVE the tarpaulin, and 2. RELEASE the commodity
6 ppm to 99 ppm	1. REMOVE the tarpaulin, and 2. CONTINUE aeration until the concentration is 5 ppm or less, then 3. RELEASE the commodity
100 ppm or above	1. CONTINUE aeration and take concentration readings until the concentration level is below 100 ppm, then remove the tarpaulin, and 2. CONTINUE aeration until concentration is 5 ppm or less, then 3. RELEASE the commodity

Aerating Sorptive Commodities in Containers—Indoors and Outdoors

Step 1—Installing the Exhaust System

Important

This step is **not** required for outdoor fumigations.

Advise the fumigator to:

1. Install an exhaust fan (minimum of 5,200 cfm capacity) to a 16 inch or greater diameter duct located at the floor near rear doors or the container.
2. Install an air introduction duct system consisting of a 3,750 cfm or greater fan attached to a 12 inch or greater duct which reaches two-thirds of the length of the container at the top of the load. Have the ducts

installed prior to the start of the fumigation. For indoor fumigations, extend the exhaust duct at least 30 feet beyond the building or through a vertical stack extending through the roof. For outdoor fumigations, extend the exhaust duct 30 feet beyond the container.

Step 2—Aerating the Commodity

Indoors

Advise the fumigator to:

1. Complete installation of exhaust duct and begin exhaust fan operation.
2. Lift both ends of the tarpaulin and begin exhaust fan operation. Do **not** remove the tarpaulin until the gas concentration level is below 100 ppm (see **Table 2-4-19**).
3. Start the circulation and air introduction fans. Require a minimum of **4 hours** aeration for all sorptive commodities. Sorptive commodities generally require 12 hours or longer to aerate, however, since sorptive commodities vary in their rates of desorption, aeration may be completed in less than 12 hours.
4. Aerate Oak logs and lumber a minimum of **48 hours**. If, after 48 hours, the concentration is 5 ppm or greater, continue aeration for 24 more hours. Continue this procedure until concentration readings are less than 5 ppm.
5. Stop the fans and take concentration readings with colorimetric tubes in the airspace around and, when feasible, inside the carton or box.

For FIFRA Section 18 exemptions, record the concentration reading (in ppm), date, and time in Block 39 of PPQ Form 429. If using the electronic 429 database, record the date, time and detector reading (in ppm) in the “Detector Readings” form.

Then use **Table 2-4-19** to determine when to release the commodity.

Table 2-4-19 Determine when to Release the Commodity

If the gas concentration level is:	Then:
5 ppm or less	1. ADVISE fumigator to REMOVE the tarpaulin, and 2. RELEASE the commodity
6 ppm to 99 ppm	1. HAVE fumigator REMOVE the tarpaulin, and 2. CONTINUE aeration until the concentration is 5 ppm or less, then 3. RELEASE the commodity
100 ppm or above	1. CONTINUE aeration and take concentration readings until the concentration level is below 100 ppm, then remove the tarpaulin, and 2. CONTINUE aeration until concentration is 5 ppm or less, then 3. RELEASE the commodity

Outdoors

Advise the fumigator to:

1. Complete installation of exhaust duct and begin exhaust fan.
2. Lift both ends of the tarpaulin that are furthest from exhaust fan.
3. Start the circulation and air introduction fans. Require a minimum of **4 hours** aeration for all sorptive commodities. Sorptive commodities generally require 12 hours or longer to aerate, however. since sorptive commodities vary in their rates of desorption, aeration may be completed in less than 12 hours.
4. Aerate Oak logs and lumber a minimum of **48 hours**. If, after 48 hours, the concentration is 5 ppm or greater, continue aeration for 24 more hours. Continue this procedure until concentration readings are less than 5 ppm.
5. Remove the tarpaulin after 4 hours aeration.
6. Stop the circulation fans and take concentration readings with colorimetric tubes in the airspace around and, when feasible, inside the cartons or boxes.

For FIFRA Section 18 exemptions, record the concentration reading (in ppm), date, and time in Block 39 of PPQ Form 429. If using the electronic 429 database, record the date, time and detector reading (in ppm) in the “Detector Readings” form.

Then use **Table 2-4-20** to determine when to release the commodity.

Table 2-4-20 Determine when to Release the Commodity

If the gas concentration level is:	Then:
5 ppm or less	RELEASE the commodity
6 ppm or more	1. CONTINUE aeration and take concentration readings until the level is 5ppm or less, then 2. RELEASE the commodity

2

Treatment Manual

Chemical Treatments

Fumigants • Methyl Bromide • Chamber Fumigation

Contents

Methods and Procedures **2-5-1**
Materials Needed **2-5-1**
Conducting the Fumigation **2-5-2**
Aerating the Chamber **2-5-4**
Normal Atmospheric Pressure Chamber—Aerating Noncontainerized Cargo **2-5-5**
Normal Atmospheric Pressure Chamber—Aerating Containerized and Noncontainerized Cargo **2-5-6**
Vacuum Fumigation Chambers—Aerating Containerized and Noncontainerized Cargo **2-5-7**

Methods and Procedures

Materials Needed

The procedures covered in this section provide commercial fumigators with the methods, responsibilities, and precautions for chamber fumigation.

- Colorimetric tubes (Draeger, Kitagawa, or equivalent)[1]
- APHIS-approved leak detection device[1]
- Methyl bromide
- Scale or graduated cylinder for volume (liquid measurements)
- SCBA or supplied air respirator[1]
- APHIS-approved gas detection device
- Thermometer[1]
- Volatilizer
- Warning signs

1 You will need to bring these items unless the chamber is operated by PPQ, in which case all materials are provided by PPQ.

The chamber operator is responsible for supplying the above materials as well as ensuring that the chamber is certified for conducting PPQ quarantine treatments.

Refer to ***Certification of Vacuum Fumigation Chambers* on page 6-2-1** and ***Certifying Atmospheric Fumigation Chambers* on page 6-3-1** for guidelines on chamber certification.

Conducting the Fumigation

Step 1—Selecting a Treatment Schedule

Select an appropriate treatment schedule to effectively eliminate the plant pest without damaging the commodity to be fumigated.

Turn to the treatment schedule Index and look up by commodity or by pest the treatment schedule(s) available. Treatment schedules which are approved for chambers will be listed as either “NAP” (normal atmospheric pressure) or as “vacuum.”

Step 2—Determining Section 18 Exemptions and Sampling Requirements

After selecting the treatment schedule, determine which treatment schedules are FIFRA Section 18 Exemptions. The schedule will be followed by an “IMPORTANT” note to help you determine the current exemption status. Some treatment schedules are only FIFRA Section 18 Exemptions at specific temperature ranges. Check the treatment schedule and temperature to determine if the fumigation will be a FIFRA Section 18 Exemption.

Residue monitoring by taking samples of the commodity prior to the start of the fumigation and after aeration is no longer required.

Step 3—Measuring the Temperature

Determine the temperature to use in selecting the proper dosage rate:

- For fruits, pulpy vegetables, or logs use only the commodity temperature.
- For all other commodities use both the commodity and air temperature.

To take the temperature readings, use a bimetallic, mercury, or digital long-stem thermometer that has been calibrated. Use ***Table 2-5-1*** on **page 2-5-3** to determine which temperature to use when selecting the proper dosage rate for commodities other than fresh fruits, vegetables, or logs. Record the temperatures in Block 22 of the PPQ Form 429.

If using the electronic 429 database, record the temperatures in the space and commodity fields in the Treatment form.

Important

Commodity and space temperatures must be 40 °F or above.

Table 2-5-1 Determine Whether to Use Commodity or Air Temperature for Determining Dosage Rate

If the air temperature is:	And:	Then, for commodities other than fresh fruits or vegetables or logs and lumber[1]:
Higher than the commodity temperature	→	Use the single lowest commodity temperature for determining the dosage rate (Do Not use the average commodity temperature).
Lower than the commodity temperature	By 9 degrees or less	
	By 10 degrees or more	Use the average of the air and commodity temperature for determining the dosage rate

1 Use commodity temperature for fresh fruits or vegetables or logs and lumber.

Step 4—Calculating the Dosage

In order to calculate dosage, you must have the following information:

- Treatment schedule
- Volume of the fumigation chamber (ft^3)
- Temperatures of commodity and air (°F)

Refer to the specific treatment schedule to determine the dosage rate (pounds/ft^3).

The formula for calculating dosage is:

$$\text{dosage(lbs.)} = \text{volume}(ft^3) \times \text{dosage rate(lbs./1,000 } ft^3) = \frac{\text{volume}(ft^3) \times \text{dosage rate(lbs.)}}{1{,}000\ ft^3}$$

EXAMPLE: Using a fumigation chamber which has a volume of 500 ft^3, you determine the temperature of the commodity and space is 72 °F. The treatment schedule requires 2 lbs. MB/1,000 ft^3 at 70 °F or above. To calculate dosage multiply the volume (500 ft^3) by the dosage rate (2 lbs. MB/1,000 ft^3). This equals 1.0 lbs. of MB needed for the dosage.

Step 5—Conducting the Fumigation

Since fumigation chambers vary by manufacturer and model, refer to the manufacturer's operating manual to determine how to use the chamber. However, in any case, circulation fans in a chamber should be kept running for 15 minutes following introduction of the gas.

Aerating the Chamber

Responsibility for aerating the chamber and releasing the commodity depends on whether the treatment schedule used was a labeled use or FIFRA Section 18 Exemption. Use the following table to determine responsibility for monitoring the aeration of the fumigation.

Table 2-5-2 Determine the Responsibility for Monitoring the Aeration

If the fumigation chamber is:	And the treatment schedule is:	Then:
Privately or State owned	A labeled treatment	RELEASE the fumigation to the fumigator to aerate and release the commodity
	A FIFRA Section 18 Exemption (noted in the treatment schedules)	1. PPQ must MONITOR the aeration, and 2. USE the following table to determine which aeration procedures to follow
PPQ owned	→	

Use the following table to determine which procedures to follow for aerating normal atmospheric pressure (NAP) and vacuum chambers.

Table 2-5-3 Determine the Aeration Procedure

If the chamber is:	And the cargo is:	Then:
NAP	Noncontainerized	Use the procedures on **page 2-5-5**
	Containerized	Use the procedures on **page 2-5-6**
Vacuum	→	Use the procedures on **page 2-5-6**

Each chamber must be equipped with at least one permanent, metal gas sampling tube to allow you to take colorimetric tube readings during the aeration. Any extensions of the gas sampling tube or flexible connectors must be made of Teflon™ tubing or metal. The gas sampling tube must extend outside the chamber to allow for colorimetric tube readings.

Normal Atmospheric Pressure Chamber—Aerating Noncontainerized Cargo

Step 1—Securing the Area

Assuming that you've already secured the fumigation area, allow only the chamber operator and the PPQ officer monitoring the fumigation into the secure area.

WARNING

Do ***not*** allow motorized vehicles to operate within the secure area.

Step 2—Aerating the Chamber

Run the exhaust long enough to obtain at least four complete changes of air (about 4 to 15 minutes per change of air or 1 hour).

Step 3—Taking Concentration Readings

Use a colorimetric tube to take a concentration readings in the airspace around and when feasible **within the carton or box.** Exceptions may include compressed cotton and other very difficult to probe commodities. Obtain prior approval from CHPST for exceptions to this rule.

For FIFRA Section 18 exemptions, record the concentration reading (in ppm), date, and time in Block 39 of PPQ Form 429. If using the electronic 429 database, record the date, time and detector reading (in ppm) in the "Detector Readings" form.

Use ***Table 2-5-4*** on **page 2-5-5** to determine when to release the commodity

Table 2-5-4 Determine When to Release the Commodity

If the gas concentration is:	Then:
5 ppm or less	RELEASE commodity
6 ppm or above	1. TAKE concentration readings, and 2. RELEASE commodity when the concentration level is 5 ppm or less

Normal Atmospheric Pressure Chamber—Aerating Containerized and Noncontainerized Cargo

Step 1—Securing the Area

Assuming that you've already secured the fumigation area, allow only the chamber operator and the PPQ officer monitoring the fumigation into the secure area.

WARNING

Do ***not*** allow motorized vehicles to operate within the secure area.

Step 2—Aerating the Chamber

Run the exhaust long enough to obtain at least four complete changes of air (about 4 to 15 minutes per change of air or 1 hour). If the containers have internal fans, run them unless they are operated by internal combustion engines. Remove container from the chamber at the conclusion of four complete changes of air to a secure outdoor area for passive aeration. Wear the SCBA while the container is being moved outdoors.

Step 3—Taking Concentration Readings

Use a colorimetric tube to take a concentration readings in the airspace around and when feasible **within the carton or box.** Exceptions may include compressed cotton and other very difficult to probe commodities. Obtain prior approval from CHPST for exceptions to this rule.

For FIFRA Section 18 exemptions, record the concentration reading (in ppm), date, and time in Block 39 of PPQ Form 429. If using the electronic 429 database, record the date, time and detector reading (in ppm) in the "Detector Readings" form.

Use the following table to determine when to release the commodity.

Table 2-5-5 Determine When to Release the Commodity

If the gas concentration is:	Then:
5 ppm or less	RELEASE commodity
6 ppm or above	1. CONTINUE passive aeration 2. TAKE concentration readings, and 3. RELEASE commodity when the concentration level is 5 ppm or less

Vacuum Fumigation Chambers—Aerating Containerized and Noncontainerized Cargo

Step 1—Securing the Area

Assuming that you've already secured the fumigation area, allow only the chamber operator and the PPQ officer monitoring the fumigation into the secure area.

WARNING

Do ***not*** allow motorized vehicles to operate within the secure area.

Step 2—Aerating the Chamber

Adjust any vacuum remaining at the end of the fumigation to zero by temporarily opening the air intake valve, then closing it. Draw a 15 inch vacuum and adjust it to zero. Repeat this process of drawing a 15 inch vacuum and releasing it four times or as many times as experience indicates is necessary.

Step 3—Taking Concentration Readings

Use a colorimetric tube to take a concentration readings in the airspace around and when feasible **within the carton or box.** Exceptions may include compressed cotton and other very difficult to probe commodities. Obtain prior approval from CHPST for exceptions to this rule.

For FIFRA Section 18 exemptions, record the concentration reading (in ppm), date, and time in Block 39 of PPQ Form 429. If using the electronic 429 database, record the date, time and detector reading (in ppm) in the "Detector Readings" form.

Use ***Table 2-5-6*** on **page 2-5-7** to determine when to release the commodity.

Table 2-5-6 Determine When to Release the Commodity

If the gas concentration is:	Then:
5 ppm or less	RELEASE commodity
6 ppm or above	1. Do two more vacuum washes 2. TAKE concentration readings, and 3. RELEASE commodity when the concentration level is 5 ppm or less

Important

Some vacuum chambers do not have sampling tubes. After four air washes, while wearing the SCBA, open chamber door and take colorimetric reading within the carton or box.

2

Treatment Manual

Chemical Treatments

Fumigants • Methyl Bromide • Ship Fumigation

Contents

Methods and Procedures **2-6-1**
Materials Needed **2-6-1**
PPQ Officer Provides **2-6-1**
Fumigator Provides **2-6-2**
Taking Safety Measures When Fumigating Ships **2-6-3**
Preparing to Fumigate **2-6-4**
Conducting the Fumigation **2-6-9**
Aerating the Hold or Storeroom **2-6-13**

Methods and Procedures

The procedures covered in this section provide commercial fumigators with the methods, responsibilities, and precautions for ship fumigation.

CAUTION

These procedures are used primarily for fumigation of ships that are infested with khapra beetle.

Generally, fumigation of commodities within the structure of a ship, such as cargo holds, cannot meet APHIS standards for fumigation, and these fumigations are **not** recommended by APHIS. However, on a case by case basis, commodities may be fumigated within the structure of a ship if approved. For approval, call the Center for Plant Health Science & Technology (CPHST) (tel: 919-855-7450)

In general, ship fumigations present problems not encountered in other types of fumigations. The large amount of gas required and the varying space configurations from ship to ship make it essential that experienced pest control operators and PPQ officers with extensive fumigation experience perform ship fumigations.

Materials Needed

PPQ Officer Provides

- PPQ Form 429
- Calculator (optional)

- Colorimetric tubes (Draeger/Kitagawa)
- Desiccant (Drierite®)
- APHIS-approved leak detection device
- SCBA or supplied air respirator
- Tape measure
- APHIS-approved gas detection device[1]
- Thermometer

Fumigator Provides

- Adhesive sealer, tape, and putty or other pliable material for sealing off holes around pipes
- Auxiliary pump for purging long gas sample tubes
- Carbon dioxide filter (Ascarite®)
- Colorimetric tubes (Draeger/Kitagawa)
- Electrical wiring (ground, permanent type), three prong extension cords
- Exhaust blower and ducts
- Fans (circulation, exhaust, and introduction)
- Framework and supports
- Gas sampling tubes (leads)
- Gas supply line
- Heat supply
- Insecticides and spray equipment
- Methyl bromide
- Padding
- Portable generator as backup unit to operate gas detection device, auxiliary pump, and lights
- Sand or water snakes
- Scales or dispensers
- SCBA or supplied air respirator
- Tape
- Tarpaulin and supports

1 The gas detection device must be calibrated annually. Contact the Center for Plant Health Science & Technology (CPHST) (919-855-7450) in Raleigh, North Carolina, for calibration information.

- APHIS-approved gas detection device
- Volatilizer
- Warning signs

PPQ officer and fumigator should be prepared to use auxiliary power if shore power is **not** available as most ships' power is 220 volts.

Taking Safety Measures When Fumigating Ships

The most important consideration when fumigating ships is the protection of human life. The commercial fumigator has the following safety responsibilities when fumigating ships:

- Observe all safety precautions while fumigating
- Prevent access of unauthorized personnel, including the ship's crew, to the fumigated area
- Conduct fumigation properly to result in an effective treatment
- Evacuate gas from ship and aerate when fumigation is completed
- Test, with a gas detector, all areas aboard ship to ensure freedom from MB before allowing crew members access to the ship

The commercial fumigator must abide by the following guidelines when fumigating ships:

- Have a representative present throughout the entire fumigation. The representative must be familiar with directions for using the fumigant, warnings, antidotes, etc., shown on the label, on the gas cylinder, and contained in the manufacturer's application manual.
- Have adequate first-aid equipment, SCBA, and other safety equipment available
- Have all areas of the ship tested with a gas detector prior to crew reentry. Pay particular attention to all fumigated areas, crew quarters, and the engine rooms
- Provide for immediate contact with the responsible ship's officer to provide information and access to areas of the ship which may be needed to assure a safe fumigation

Preparing to Fumigate

Step 1—Meeting With Ship's Captain and Agent

When planning a ship fumigation, meet with the ship's captain, agent, and the fumigation company representative to discuss the conditions of the fumigation. If cargo is present in an area about to be fumigated, determine if any materials might be adversely affected by the fumigant (see Methyl Bromide—Properties for a list of commodities adversely affected by MB). Notify the ship's agent of possible effects and if conditions permit, allow removal of the material from the hold for an alternate treatment.

Discuss plans for removing all crew from the ship. It is the responsibility of the commercial fumigator to comply with all label requirements, and with State, local, and U.S. Coast Guard regulations (see ***Coast Guard Regulations*** on **page B-B-1** in **Appendix B**) concerning shipboard fumigation.

Step 2—Selecting a Treatment Schedule

Refer to treatment schedule T402 (SHIPS) for the correct treatment. Select a treatment schedule based on the plant pest and commodity to be fumigated. Consider all the commodities present in the area to be fumigated when determining the best treatment available. In the case of khapra beetle fumigation, determine if finely milled products (example—flour) will be fumigated. If finely milled products are to be fumigated, give the captain the option to use the 12 hour schedule. Have the finely milled products destroyed either by incineration or by sterilization after the fumigation has been completed. If the captain elects **not** to remove and destroy the finely milled products, then use the 24 hour treatment schedule.

Treating Deck Areas

Areas which may be pest contaminated or suspected of being contaminated, such as the deck, hatch covers, drain channels, crevices around hatches, hallways, and similar areas that cannot be fumigated, should be treated with a 3 percent malathion emulsion spray (0.5 pint, 57 percent premium grade to a gallon of water). Spray at the rate of 2 gallons/1,000 sq. ft., or to the point of runoff.

CAUTION

Malathion emulsion sprays may break down asphalt surfaces. For asphalt surfaces, prepare a spray from a 25 percent wettable powder (1 pound to a gallon of water), rather than the emulsion.

Step 3—Determining Section 18 Exemptions and Sampling Requirements

After selecting the treatment schedule, you will be able to determine which treatment schedules are FIFRA Section 18 Exemptions. The schedule will be followed by an "IMPORTANT" note to help you determine the current exemption status. Some treatment schedules are only FIFRA Section 18 Exemptions at specific temperature ranges.

If food is fumigated, alert the captain that there may be higher than permitted residues.

Step 4—Preparing Areas to Be Fumigated

Storerooms

Open all bins, drawers, and cupboards. Stack all bagged commodities so gas can penetrate all sides of the commodity. Stacking bagged commodities on pallets will facilitate gas distribution and penetration.

Cargo Holds

Prepare to fumigate the entire hold regardless of the location of the infestation within the hold. If you want to fumigate a single deck (lower hold, lower 'tween deck, upper 'tween deck, etc.), you must get approval from your Regional Director. The decision to approve single deck fumigations should only be made after all sections of the hold have been inspected and there is no possibility of gas escaping to other parts of the hold.

In most cases, it is unnecessary to open or rearrange cargo containers within the hold. Occasionally, some rearrangement may be required to ensure uniform gas distribution. Have the hatch coverings between decks opened in such a manner as to permit adequate distribution and circulation of the gas.

Step 5—Arranging and Operating Fans

Storerooms

Storerooms normally require a minimum of two, 1,800 cfm fans. Place one fan at a low level and the other at a high level. Fans with capacity above 1,800 cfm create strong air currents which could result in gas leakage around the seals. If you're fumigating an area which includes the galley and adjoining storerooms, be sure to place the fans to evenly distribute gas. Make certain that fans can be turned on and off from an area outside the fumigation site.

Cargo Holds

Use the volume of the hold (ft^3) in determining how many fans you will need. The total cfm's of all the fans should approximate the volume of the hold. Use fans capable of 2,500 cfm or greater during gas introduction and for 30 minutes following the introduction. Placement of fans within holds depends on the presence or absence of cargo. Normally, place two fans in the lower hold at opposite ends facing across the hold. The number of fans can be reduced by using fans greater than 2,500 cfm. Fans should be labeled as to location and have the capability of being turned on and off individually in case of low readings in certain locations or pockets of gas.

Test all fans to ensure that they are in good operating condition. Operate fans during the gas introduction and for 30 minutes after introduction is completed.

Step 6—Placing Gas Sampling Tubes

Place gas sampling tubes in areas and commodities which will give representative samples within the fumigated area. Have all leads brought to one central point at least 30 feet upwind from the area being fumigated. Label all gas sampling tubes so they can be easily identified when you take concentration readings. Label each tube by identifying the level of the hold and whether the gas sampling tube is in a commodity or space.

Storerooms

Place a minimum of two gas sampling tubes in open space and at least one gas sampling tube within the commodity considered to be the most difficult for the fumigant to penetrate.

Cargo Holds

Within cargo holds, the exact location will depend primarily on the location of cargo within the hold. Place a minimum of two leads for each level of empty hold space. The average size hold of three levels is approximately 125,000 ft^3. Use one additional lead for every 50,000 ft^3 over 125,000 ft^3.

When cargo is present in the hold, place two additional gas sampling tubes in the commodity at each hold level. For mixed cargo, place additional gas sampling tubes in the cargo considered to be the most difficult for the fumigant to penetrate.

Step 7—Placing the Gas Introduction Lines

Storerooms, Galley, Quarters

Numerous gas introduction lines may be necessary in order to obtain even gas distribution throughout the fumigation area. Place the gas introduction line directly through an opening from the outside (example—a door or window) directly above a fan. Attach the introduction line securely to the top of the fan to prevent movement of the hose. An unsecured introduction line could move the line out of the airflow. Place a piece of nonpermeable sheeting (example—plastic or rubberized canvas) over the commodity in front of and below each gas supply line. The nonpermeable sheet will prevent any liquid MB from coming in contact with commodities and will prevent damage.

Cargo Holds

Numerous gas introduction lines may be necessary in order to obtain even gas distribution throughout the fumigation area. Place the gas introduction line directly into the air stream in front of one of the fans on the upper ’tween deck. Attach the introduction line securely to the top of the fan because gas passing through the line will cause the line to vibrate. An unsecured introduction line could be moved out of the airflow. Additional introduction lines can be used to hasten introduction and distribution of the gas. Place a piece of nonpermeable sheeting (example—plastic or rubberized canvas) over the commodity in front of and below each gas introduction line. The sheet will prevent any liquid MB from coming in contact with the cargo and prevent damage.

Step 8—Measuring the Temperature

Take temperature readings of the air (space) and of the commodity. Use a calibrated thermometer. Record the temperatures in Block 22 on the PPQ Form 429.

If using the electronic 429 database, record the temperatures in the space and commodity fields in the Treatment form.

If the temperature is below the minimum listed for the treatment schedule, then the hold or other space to be fumigated will need to be heated.

Table 2-6-1 Determine Pre-fumigation Procedures

If the temperature is:	Then:
At or above the minimum temperature listed for the treatment schedule	GO to Step 10 (Sealing Stores)
Below the minimum temperature listed for the treatment schedule	GO to Step 9 (Heating the Cargo Hold)

Step 9—Heating the Cargo Hold

If heating a hold is necessary, negotiate the method with the fumigator and get the concurrence of the Center for Plant Health Science & Technology (CPHST), in Raleigh, North Carolina.

Step 10—Sealing Stores

One of the most important steps in preparing for a ship fumigation is sealing all openings and areas which have the potential to leak gas. Consider the entire area to be fumigated as a natural atmospheric chamber and make the area as gastight as possible. The most important task is to locate all openings (e.g., drain pipes, bilge drain holes, or air ducts) and seal them.

Do **not** seal out or make gastight recessed areas, ducts, or similar apertures which may harbor an infestation. In some cases it is better to seal sources of leaks on the outside of the area to be fumigated. Use caulking compound or tape for sealing small spaces. For sealing larger areas, use polyethylene or similar material secured with tape or adhesive spray. Seal doors and other openings with either polyethylene or spray with vinylite plastic. When practical, seal air ventilation ducts on the outside of the space being fumigated so sealing tape can be removed when you get ready to evacuate the gas and begin aeration. Large openings such as hatch cover openings should be covered with polyethylene and securely taped. When necessary, lace rope across the tarpaulin to prevent billowing in high winds. Look for and seal off the following ship areas when preparing a ship for fumigation:

- Air vents

- All passageways, engine room, and other crew areas for electric pipeline or other duct work common with cargo holds
- Bilge and drainwell vents and drains to all cargo holds sometimes common with more than one hold or engine room bilges
- CO_2 piping to all cargo holds; degassing systems (older ships) which usually run from hold to hold
- Drains
- Dumb-waiter openings
- Emergency escape hatches from shaft alley and escape hatches from all holds
- Engine room—recirculation air systems controlled from and common with the engine room areas—especially on newer ships; check for drilled holes or other openings in fore and aft bulkheads of engine room spaces, all engine room vent systems, and housing or casing leading into spaces to be fumigated
- Galley intake and exhaust systems (may be common with the dry stores)
- Heating, air conditioning, and ventilation systems common with or to cargo holds, engine room, crew quarters, storerooms, or other spaces that use intake from the vent systems common with cargo holds
- Inner bottom and deep tank covers to ensure that they are closed prior to fumigating
- Pipes and other utility conduits through decks and bulkheads
- Speaking tubes and fire and smoke detector systems from fumigated areas
- Steam-smothering systems for connection between holds
- Vents in shaft alley and gear lockers to holds; breaks in bulkhead
- Wall plates

Step 11—Measuring Volume

Obtain the volume of the cargo holds from the chief mate, captain, or the ship's plan, which is usually posted outside the captain's office. If actual hold measurements are available, then figure the volume by multiplying the length, width, and height of the hold. If actual measurements are **not** available, then look on the ship's plan for the grain cube. Use the grain cube as the volume in lieu of actual hold dimensions. Consider all hold areas such as deep tanks, security lockers, and refrigerated spaces when calculating the volume of the area to be fumigated.

For dry stores, galleys, and crew quarters, measure the actual dimensions to calculate volume.

Step 12—Calculating Dosage

The formula for calculating dosage is:

$$\text{dosage(lbs.)} = \text{volume(ft}^3\text{)} \times \text{dosage rate(lbs./1,000 ft}^3\text{)}$$

$$= \frac{\text{volume(ft}^3\text{)} \times \text{dosage rate(lbs.)}}{\text{1,000 ft}^3}$$

EXAMPLE: Number 3 Hold is infested with khapra beetle. The volume is 80,000 ft^3, and the temperature is 65 °F. The treatment schedule lists the dosage rate as 6 lbs. MB/ 1,000 ft^3. To calculate the dosage multiply the volume (80,000 ft^3) by the dosage rate (6 lbs./1,000 ft^3). This equals 480 lbs. of MB needed for the dosage.

Step 13—Making a Final Check

Just before introducing the gas, you and the fumigator must do the following:

- Take gas concentration readings to determine if any contaminant gases are present
- Turn on all fans and gas detection device to make sure they work
- Start volatilizer and heat water to 200 °F or above
- Place fumigant cylinder with gas introduction line on scale and take initial weight reading. Make sure the gas introduction line is attached to the cylinder. After obtaining the correct weight, subtract the dosage to be introduced into the enclosure. When the entire dosage has been introduced, the scale will be balanced.
- Check to make sure the ship's gangway and areas to be fumigated are properly placarded and the area is secured. A guard should be present at the entrance to the gangway to restrict access to the ship. If the crew has been removed, walk through the quarters and other areas to make sure no one is aboard.
- Check all sealed areas to make sure they are securely taped and free from holes
- Check the gas introduction line connections to make sure they are tight
- Check to make sure all safety equipment is available and in working order

Conducting the Fumigation

Step 1—Introducing the Gas

CAUTION

PPQ Officers must wear the SCBA anytime they are within 30 feet of area being fumigated. You and the fumigator both must use SCBA while introducing the gas, checking for leaks, and when taking aeration readings.

Turn on all fans while introducing the gas. When using large cylinders of MB, have the fumigator slightly open the valve then close the valve. Using an APHIS-approved leak detection device, check all connections on the gas introduction line for leaks. If leaks are found, have the fumigator tighten the connections and repeat the test. If no leaks are found, have the fumigator open the valve to the point where 3 to 4 pounds of MB are being introduced per minute. The gas introduction line should always feel hot and the volatilizer must read at least 150 °F.

CAUTION

Do **not** touch the introduction line with your bare hands—you may get burned! Have the fumigator close the cylinder valve once the proper dosage has been introduced.

The fumigation time begins when all the gas has been introduced. Record the time gas introduction was started and completed in Block 32 on the PPQ Form 429.

If using the electronic 429 database, record the fumigation date, gas introduction start and finish time in the corresponding fields under the “GAS INTRODUCTION” heading on the Treatment form.

Run the fans for 30 minutes after all the gas has been introduced. Take the initial concentration reading 30 minutes after all the gas has been introduced.

When using cylinders, getting the final amounts of gas out of the cylinder may take a long time. Consider taking gas concentration readings 30 minutes after the gas is first introduced. If the gas distribution is even (all readings within 4 ounces of each other) and at an adequately high concentration, then you can turn off the fans. Running the fans longer may contribute to gas leakage. Allow the remainder of the gas to discharge at its slow rate with intermittent running of the fans for dispersal.

Step 2—Taking Concentration Readings

Take concentration readings with an APHIS-approved gas detection device to determine the gas concentration and distribution within the area being fumigated (galley, storeroom, or cargo holds). If using a T/C, check Drierite® tubes before each reading and change Drierite® if its color is pink. Depending upon the length of exposure period, take concentration readings at the following times after the introduction of the fumigant:

- 30 minutes
- 2 hours
- 4 hours
- 6 hours

- 12 hours
- 24 hours
- 48 hours
- 72 hours (for *Cochlicella*, *Helicella*, and *Monacha* spp.)

Consult the treatment schedule being used for the actual concentration readings. You may start the final concentration reading 30 minutes prior to the end of the exposure period.

Take additional readings when there is indication that the gas is **not** properly distributed or the minimum gas concentration is **not** being maintained. Record readings on PPQ Form 429.

Step 3—Testing for Leaks

Wearing the SCBA, use an APHIS-approved leak detection device to test for leaks after all the gas has been introduced. Test around the perimeter of the area being fumigated, especially where doors, windows, pipes, electric cords, gas sampling tubes, and gas introduction lines are present. If you detect leaks, be sure they are sealed with additional tape, adhesive, or by placing more polyethylene and adhesive over the leaking areas.

Step 4—Adding Gas and Extending Exposure

You may add gas at the following rate when concentration readings fall below the minimum:

1.6 × number of oz. below minimum × volume/1,000 = oz. of gas to add

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EXAMPLE: You are fumigating a ship's storeroom for khapra beetle and the minimum concentration for the 2-hour reading is listed at 50 oz., but your readings average 45 oz. The volume of the storeroom is 1,500 ft^3. Using the above formula, you would figure the following:

1.6 × 5 (oz. below min.) × 1,500/1,000
8 × 1.50 = 12 oz. gas to be added

Extending Exposure Period

Use ***Table 2-6-2*** on **page 2-6-12** to determine how long to extend the exposure period:

Table 2-6-2 Determine Time for Extended Exposure

If the exposure time is:	And the reading is below minimum by:	Then extend exposure:
Less than 12 hours	10 oz. or less	10 percent of the time lapse since the last reading
	11 oz. or more	30 minutes
12 hours or more	10 oz. or less	10 percent of the time lapse since the last reading
	11 oz. or more	2 hours or 10 percent of time lapse since last reading, whichever is greater

Step 5—Exhausting the Gas

Exhaust the gas at the completion of the exposure period. If the treatment schedule is a FIFRA Section 18 Exemption, then the PPQ Officer must monitor the aeration of the fumigated area. Use ***Table 2-6-3*** on **page 2-6-12** to determine who should monitor the aeration of the fumigated area:

Table 2-6-3 Determine the Responsibility for Monitoring the Aeration

If the treatment schedule is:	Then:
A FIFRA Section 18 Exemption	PPQ must MONITOR the aeration of the commodity. FOLLOW “Aerating the Hold or Storeroom” steps which follow.
A labeled treatment	RELEASE the fumigation to the fumigator and RELEASE the ship.

Removal of the fumigant from cargo holds is facilitated by using an outside blower to force fresh air through portable canvas, plastic, or similar ducts. Another method is to use compressed air hoses to force fresh air into the bottom of the hold. Use fans or blowers within the fumigated space to help aerate the hold. Use suction type fans with portable ducts to evacuate gas from storerooms to outside, downwind areas away from crew areas, preferably on the offshore side of the ship. Do **not** point the ducts upward, since dissipation onto the deck may occur. Use the ship’s aeration/ventilation equipment if possible. Make sure that use of ship’s equipment will **not** distribute the exhausted gas to other areas within the ship.

Aerating the Hold or Storeroom

Step 1—Securing the Area

Assuming that the fumigation access is restricted and the area is secured, restrict access to the area where the exhaust duct extends beyond the enclosure. During the first 10 minutes of aeration, there should be no one within 200 feet of the exhaust duct outlet. When securing the duct outlet area, consider the direction of the wind. Face the duct outlet toward an open area, and away from people. Point the duct outlet upward to aid in dispersing the exhausted gas.

Have the fumigator use a physical barrier such as ropes, barricades, or walls to secure the area.

Placard the secure area near the exhaust outlet with the appropriate DANGER/PELIGRO signs. Make sure the placards meet the appropriate fumigant label or labeling requirements. The skull and crossbones should be present as well as "AREA UNDER FUMIGATION, DO NOT ENTER/NO ENTRE"; date of the fumigation; name of the fumigant used; and the name, address, and telephone number of the fumigator.

Unless you authorize their use, do **not** allow motorized vehicles to operate within the secure area.

Step 2—Aerating the Area

Wearing the SCBA, advise the fumigator to open doors, hatches, tarpaulins, and areas to facilitate aeration. Start the exhaust system (minimum 3,500 cfm exhaust fan connected to an exhaust duct) and aerate the hold or storeroom.

Step 3—Taking Concentration Readings to Determine When to Release the Ship

Stop the aeration fans. While wearing SCBA, take a concentration reading with a colorimetric tube in the airspace within the storeroom or hold. If the concentration is above 5 ppm, but less than 100 ppm, continue aeration.

Record the date, concentration reading, and time on PPQ Form 429. If using the electronic 429 database, record the time and detector reading (in ppm) in the corresponding fields on the "Detector Readings" form.

2

Treatment Manual

Chemical Treatments

Fumigants • Methyl Bromide • Structure Fumigation

Contents

Methods and Procedures **2-7-1**
Materials Needed **2-7-1**
PPQ Officer Provides **2-7-1**
Fumigator Provides **2-7-2**
Taking Safety Measures When Fumigating Structures **2-7-3**
Preparing to Fumigate **2-7-3**
Conducting the Fumigation **2-7-12**
Aerating the Enclosure **2-7-15**

Methods and Procedures

The procedures in this section provide guidelines for the methods, responsibilities, and precautions for structure fumigation. These procedures relate to structure fumigation primarily for khapra beetle.

In general, structure fumigations present problems not encountered in other types of fumigations. The large amount of gas required and the fact that the structure configurations vary from structure to structure make it essential that experienced fumigators and PPQ officers with extensive fumigation experience perform structure fumigations.

Materials Needed

PPQ Officer Provides

- Calculator (optional)
- Colorimetric tubes (Draeger/Kitagawa)
- Desiccant (Drierite®)
- Forms (PPQ Form 429 and APHIS Form 2061 if necessary)
- APHIS-approved leak detection device
- SCBA or supplied air respirator
- Tape measure

- APHIS-approved gas detection device[1]
- Thermometer

Fumigator Provides

- Adhesive sealer, tape, and putty or other pliable material for sealing off holes around pipes
- Auxiliary pump for purging long gas sample tubes
- Carbon dioxide filter (Ascarite®)
- Colorimetric tubes (Draeger/Kitagawa)
- Device for adding nitrogen into MB cylinders
- Electrical wiring (ground, permanent type), three prong extension cords
- Exhaust blower and ducts
- Fans (circulation, exhaust, and introduction)
- Framework and supports
- Gas sampling tubes (leads)
- Gas supply line
- Heat supply
- Insecticides and spray equipment
- Methyl bromide
- Padding
- Portable generator as backup unit to operate gas detection device, auxiliary pump, and lights
- Sand or water snakes
- Scales or dispensers
- SCBA or supplied air respirator
- Tape
- Tarpaulin and supports
- APHIS-approved gas detection device
- Volatilizer
- Warning signs

1 The gas detection device must be calibrated annually. Contact the Center for Plant Health Science & Technology (CPHST) (919-855-7450) in Raleigh, North Carolina, for calibration information.

Taking Safety Measures When Fumigating Structures

The most important consideration when fumigating structures is the protection of human life. The commercial fumigator has the following safety responsibilities when fumigating structures:

- Observe all safety precautions while fumigating
- Prevent access of unauthorized personnel to the fumigated area
- Conduct fumigation properly to result in an effective treatment
- Evacuate gas from the structure and aerate when fumigation is completed
- Test, with a gas detector, the fumigated areas within the structure to ensure freedom from MB before allowing access to the fumigated areas

The commercial fumigator must abide by the following guidelines when fumigating structures:

- Have a representative present throughout the entire fumigation. The representative should be familiar with the directions for using the fumigant, warnings, antidotes, etc., shown on the label, on the gas cylinder, and contained in the manufacturer's application manual.
- Have adequate first-aid equipment, SCBA, and other safety equipment available
- Have all fumigated areas and any adjoining areas that were **not** fumigated tested with a gas detector prior to worker reentry
- Contact all necessary local and State authorities (fire, police, etc.)

Preparing to Fumigate

Step 1—Determining Type of Treatment Required

Consider the following factors in selecting a treatment for the structure:

- Type of commodities involved (e.g., grain, spices, or flour)
- Degree of infestation (light, moderate, heavy)
- Potential risk of spread from infestation
- Nature of the business—business shipping materials that could spread pest (e.g., a spice wholesaler or specialty foods distributor)
- Availability of food supply—is food available or is the find incidental
- Type of structure(s) infested

- Environmental conditions—warm, humid areas favor reproduction

In locations where reproduction occurs, or the potential for reproduction exists (warm temperature, humidity, and available food supply), seriously consider fumigation. Fumigation is not mandated every time an infestation is found.

In locations where reproduction is not occurring or the potential for reproduction does not exist (unfavorable temperature, low humidity, and no available food supply), consider using alternative treatments.

Make the final determination of which type of treatment to use with the concurrence of the following:

- PPQ line (Officer in Charge and Regional Director)
- PPQ staff (Riverdale/Raleigh (CPHST))
- Responsible State regulatory official

Options consist of the following:

- Complete Property Fumigation and Treatment (Category 1)
- Selective Property Fumigation and Treatment (Category 2)
- Interior Fumigation (Category 3)
- Alternate Treatment (Category 4)
- Selective Property Fumigation plus Alternative Treatments (Category 5)

The following is a detailed description of each of the above options:

Category 1—Complete Property Fumigation and Treatment

Fumigate all structures of similar usage on a single property. Place all structures under a gastight tarpaulin(s) and fumigate with MB.

Spray the area surrounding the structure(s) within the confines of the property at least twice with a registered malathion formulation. Make the last application after covering the structure(s) with the tarpaulin.

Free the surface area of all debris by raking or sweeping all debris toward the structure, include the debris under the cover.

Depending upon local conditions as determined by the PPQ Officer in Charge and the responsible State regulatory official, you may unconditionally release the structure after fumigation or hold the release until a series of inspections are conducted as outlined in Category 2.

Category 2—Selective Property Fumigation and Treatment

This treatment is similar to Category 1 except **not** all structures of related usage are fumigated and the fumigation is followed by at least three inspections of the entire property.

Notify the owner of the establishment in writing on the PPQ Form 523 (Emergency Action Notification) of the inspection requirement prior to fumigating any structures (see ***Appendix A*** on **page A-A-1**). To verify success of this treatment, conduct at least three inspections of the entire property within 1 year. In the Northeast and other cooler regions, inspections must extend through two summer seasons when khapra beetles are active. Allow at least 90 days to elapse between inspections. Make the last inspection within 30 days of the time the structure is to be released.

Category 3—Interior Fumigation

Treat all structures on the premises or only those structures known to be infested. Use interior fumigation when conditions make the use of complete fumigation impractical. Conduct three inspections of the property after the fumigation has been completed.

This method of fumigation is less desirable because khapra beetles may crawl into cracks, crevices, and other openings on both the interior and exterior of an infested structure. Seal all openings in the structure with masking tape, putty, polyethylene, or other materials from the outside of the structure. Make the structure as airtight as possible without sealing out any areas that may harbor khapra beetle.

Spray the area surrounding the structures or the structures within the confines of the property at least twice with a registered malathion formulation. Make the last application after sealing the structure prior to fumigation. Free the surface area of all debris by raking or sweeping all debris toward the building. Include the debris in the fumigated structure.

Notify the owner of the establishment in writing on the PPQ Form 523 (Emergency Action Notification) of the inspection requirement prior to fumigating any structures (see ***Appendix A*** on **page A-A-1**). To verify success of this treatment, conduct at least three inspections of the entire property within 1 year. In the Northeast and other cooler regions, inspections must extend through two summer seasons when khapra beetles are active. Allow at least 90 days to elapse between inspections. Make the last inspection within 30 days of the time the structure is to be released.

Category 4—Alternative Treatment

Use alternative treatments in infested properties where little or no regulatory hazard exists (little or no chance for the pest to escape and spread). Typically, such properties may include unused structures or buildings, facilities that do

not handle commodities or materials of regulatory significance, or facilities that by the nature or type of operation or for other reasons do **not** pose a regulatory hazard as a result of the commerce conducted there.

Alternative treatments include either a crack and crevice or broadcast application of a registered or exempt pesticide (including approved cleaning and sanitation prior to treatment) and may include one or more of the following procedures:

- Extensive trapping program utilizing adult and larval traps treated with both an attractant and an insecticide
- Insecticide-treated bait
- Intensive, repeated inspection program augmented by intensive larval and adult trapping
- Specified sanitation program

Apply one or more of the above treatments when the Port Director, Plant Health Programs in Riverdale, and the responsible State regulatory official believe treatment will result in eradication and no regulatory hazard.

Category 5—Selective Property Fumigation Plus Alternative Treatments

Fumigate selected structures with related usage on a single, infested property. Apply one or more alternative treatments to all structures which are on the property and are **not** fumigated.

Step 2—Issuing a PPQ Form 523 (Emergency Action Notification)

Once an infestation of khapra beetle is identified and confirmed by a PPQ area identifier, issue a PPQ Form 523 (Emergency Action Notification) to the owner of the premises, except when treatment is ordered under State or county regulations. Follow instructions in Appendix 1 for completing and distributing PPQ Form 523 (Emergency Action Notification).

Be sure to document the treatment selected plus any alternative treatments, inspections, and safeguards to be applied.

Step 3—Conducting Prefumigation Conference

Fumigating a structure presents problems **not** usually encountered in other types of fumigations. The quantity of fumigant, supplies, equipment needed, and the variations in building configurations make it essential that experienced commercial fumigators and PPQ officers conduct structure fumigations.

Arrange a meeting with the fumigator to discuss the conditions of the treatment. Discuss the following items:

- Accurate cubic capacity (volume) measurement of the enclosure
- Fumigation schedule to be used
- Adequate tarpaulin material—polyethylene or equivalent tarpaulin of 6 mil or greater thickness
- Electrical power source sufficient to operate circulation fans and gas detection device
- Gas sampling tubes—types and number
- Auxiliary air pump—to quickly draw samples through gas sampling tubes
- Pedestal-type fans for fumigant distribution and aeration
- Sufficient quantity of fumigant for initial dosage plus an additional amount of fumigant in case gas must be added
- Commodities involved and identification of materials that may be adversely affected by the fumigant (see ***Fumigants • Methyl Bromide*** on **page 2-3-1** for a list of commodities). Advise the property owner of any possible adverse effects. Articles or materials that may be damaged should be subjected to an alternate treatment if possible. Office furniture and equipment with foam rubber can be affected and should be removed. Computer equipment may have to be completely sealed with polyethylene and a positive pressure maintained within the sealed enclosure during the exposure period
- Provide a sheltered area for taking gas concentration readings. The area should be located a safe distance (30 feet or more) from the enclosure. All gas sampling tubes and the electrical source should be located within the sheltered area
- Structure and commodities aeration
- Final release—this is the responsibility of the fumigator unless the structure contains commodities requiring a Section 18 Exemption

In addition to the above, explain to the fumigator that it is the fumigator's responsibility to perform the fumigation in a manner which meets required treatment schedule, treatment procedures, and pest safeguards prescribed by the PPQ officer. The fumigator is also responsible for meeting all Federal, State, and local regulations. The fumigator must notify local fire, police, and health officials as required. The fumigator is also responsible for making arrangements for utility services such as electricity, telephone, and water.

Your responsibility is to determine that the prescribed procedures are followed, actually checking volume and dosage calculations, dosage applications, and that the required gas concentrations are maintained. When food commodities are involved, you must notify the local Food and Drug Administration (FDA) office so they can collect residue samples if they deem it necessary.

Step 4—Preparing Areas for Fumigation

In order to ensure uniform gas distribution and penetration, you may require commodities within the structure to be restacked. Place dense commodities such as flour and similar bagged commodities on pallets or other supports to improve gas circulation.

In the outside surrounding area, rake the surface area of all debris by raking the debris toward the structure.

Step 5—Arranging and Operating Fans

Use fans capable of 2,500 cfm or greater during gas introduction and for 30 minutes following gas introduction. Extend fan operation only if gas distribution is inadequate (concentration readings vary more than 4 oz.), or you need to add gas. If you must operate fans after the 30-minute reading, do so for the least amount of time required to get equal gas distribution.

Placing fans is largely determined by the configuration of the structure and the absence or presence of cargo, its nature, and quantity. Pedestal fans are preferred for large structures. Direct fan air movement upward to complement other fans and assure even gas distribution in every area of the enclosure. There is no definitive rule for determining the proper number of fans, but both you and the commercial fumigator must be satisfied that circulation will be adequate for both gas introduction and recirculation. Extremely tall buildings may require fans at several levels to ensure gas distribution to the top of the structure. Arrange the electrical source and extension cords of the fan system so the fans can be turned on and off individually from the outside of the enclosure.

Step 6—Placing Gas Sampling Tubes

Place gas sampling tubes in areas and commodities which will give representative samples of the gas concentration within the fumigated area. All gas sampling tubes must be 0.25 inch interior diameter polyethylene tubing.

The recommended number of sampling tubes is as follows:

Table 2-7-1 Determine the Number of Sampling Tubes

If the size of the enclosure is:	Then use:
500,000 ft^3 or less	Six sampling tubes for the first 100,000 ft^3, and Add one tube for each additional 50,000 ft^3
Greater than 500,000 ft^3	Fourteen sampling tubes for the first 500,000 ft^3, and Add one tube for each additional 200,000 ft^3

In addition to the number of sampling tubes described above, you must place sampling tubes within commodities stored in the structure. Place the sampling tube as near as practical to the center of the packaging (e.g., boxes, bags, or bins). Before placing the sampling tube in the commodity, wrap a piece of burlap over the end of the sampling tube and secure the burlap to the tube with tape.

Use a minimum of three tubes for the first 10,000 ft^3 of commodity. Use additional tubes to assure sampling of all types of tightly packed and difficult to penetrate commodities. Take care in placing sampling tubes to avoid clogging or pinching. Label each sampling tube with the location. Indicate if tube is in a commodity prior to fumigation and at the point where the concentration readings will be taken. For safety purposes, the gas sampling tubes should extend a minimum of 30 feet upwind from the enclosure. You should have extra tubing on hand to extend beyond 30 feet if necessary.

Step 7—Measuring the Temperature

Using a calibrated thermometer, take temperature readings of the air (space) and of the commodity. Record the temperatures in Block 22 on the PPQ Form 429.

If using the electronic 429 database, record the temperatures in the space and commodity fields in the Treatment form.

If the temperature is below the minimum listed for the treatment schedule, then you will have to heat the space to be fumigated or wait until the temperature rises to the level required by the schedule treatment.

Step 8—Sealing the Structure

Depending on the method of fumigation, interior fumigation or tarpaulin fumigation, the effort required in this step will vary greatly.

Tarpaulin Fumigation

Locate and seal all openings which have the potential to leak gas. Since the entire structure will be tarped, do **not** cover openings to the exterior of the structure such as doors, windows, and air vents. Look for and seal all openings which may lead outside the structure such as manhole covers, drain pipes, and

vent pipes. Seal these types of openings with polyethylene, tape, putty, or a combination of these materials. Do **not** seal out recessed areas, ducts, or similar areas which may harbor an infestation.

The structure or portion to be fumigated must be transformed into a gastight fumigation enclosure. This is accomplished by covering the entire structure with a 6 mil or greater, polyethylene tarpaulin. Tarpaulins may be joined together with mastic and tape or rolled and clamped together.

Have padding, such as burlap, placed on all corners of the structure and in any area where the tarpaulin may rub against rough or sharp edges of the structure.

Interior Fumigation

One of the most important steps in preparing for a structure interior fumigation is sealing all openings and areas which have the potential to leak gas. Consider the entire area to be fumigated as a natural atmospheric chamber and make the area as gastight as possible. The most important task is to locate all openings (e.g., drain pipes, or air ducts) and seal them.

Do **not** seal out or make gastight recessed areas, ducts, or similar apertures which may harbor infestations. In some cases, it is better to seal sources of leaks from the outside of the area to be fumigated. Use caulk compound or tape for sealing small spaces. For sealing larger areas, use polyethylene or similar material secured with tape or adhesive spray. Seal doors and other openings with either polyethylene or spray with vinylite plastic. When practical, seal air ventilation ducts on the outside of the space being fumigated so sealing tape can be removed when you get ready to evacuate the gas and begin aeration. Large openings should be covered with polyethylene and securely taped.

Step 9—Measuring Volume

For rectangular and square shaped buildings, multiply the length, width, and height. If the buildings are irregular, the volume of each unit can best be calculated separately and then added together.

Step 10—Calculating Dosage

The formula for calculating dosage is:

$$\text{dosage(lbs.)} = \text{volume(ft}^3\text{)} \times \text{dosage rate(lbs./1,000 ft}^3\text{)}$$

$$= \frac{\text{volume(ft}^3\text{)} \times \text{dosage rate(lbs.)}}{\text{1,000 ft}^3}$$

EXAMPLE: A structure infested with khapra beetle has a volume of 100,000 ft^3. The space and commodity temperature is 65 °F. The treatment schedule requires 6 lbs. MB/1,000 ft^3 at 65 °F. To calculate the dosage multiply the volume (100,000 ft) by the dosage rate (6 lbs. MB/1,000 ft). This equals 600 lbs. of MB needed for the dosage.

Step 11—Placing the Gas Introduction Line(s)

Introduce MB from the outside of the building with the introduction line going under the tarpaulin and directly into the airstream in front of a fan. Use the "hot gas" method of gas introduction by passing the fumigant through volatilizers after it leaves the cylinders. Depending upon the size of the structure being fumigated, you may want to have several gas introduction lines going into the structure to shorten the time required for gas introduction. Attach introduction lines to the top of the fans to prevent movement of the hose. Place a piece of nonpermeable sheeting (e.g., plastic or rubberized canvas) over the commodity in front of and below each gas introduction line. The sheet will prevent any liquid MB from coming in contact with the cargo and will prevent damage.

The other option of gas introduction is to release MB from inside the building. If this option is selected, cylinders should be placed by a team of two people and the location of each cylinder in the building should be mapped. The cylinders should be arranged so that fumigators can walk away from the released gas as they open each subsequent cylinder.

Because MB is heavier than air, it is advisable to increase slightly the amount of gas released on the top floor. Cylinders should be placed within a room for best distribution into all areas. Cylinders should be placed in an upright position and the shipping caps removed.

Because MB is heavier than air, it is advisable to attach standpipes (or curved pipes directed slightly upward) to the cylinder valves in order to reduce stratification at lower levels in the structure. If standpipes are used, they should be equipped with "T" fittings to direct the gas laterally and to prevent direct contact with the ceiling.

If the "inside release" option is used, provision must be made to have equipment in place to use the gas method of hot gas introduction to add fumigants as necessary to all areas of the structure.

You must be present during the introduction of the fumigant to ensure that the correct dosage is introduced into the enclosure.

Step 12—Making a Final Check

Just before introducing the gas, you and the fumigator must do the following:

- Make sure building is clear of all personnel and animals
- Make sure all areas requiring sealing are sealed
- Check the placement and identification of gas introduction lines and gas sampling tubes
- Turn on all fans and the gas detection device to make sure they work

- Check that the tarpaulin is placarded with warning signs on all sides of the building
- Take gas concentration readings to determine if any contaminant gases are present (contaminant gases may affect concentration readings)
- Check that all gas sampling tubes are labelled and not crimped or crushed by attaching to gas detection device and watch the air flow meter to ensure that air is getting through
- Check that there is enough gas for dosage and additional gas in case you need to add gas
- Start volatilizer and heat water to at least 200 °F or above
- Place fumigant cylinders with gas introduction line on scale and take initial weight reading. Make sure the gas introduction line is attached to the cylinder. After obtaining the correct weight, subtract the dosage to be introduced into the enclosure. When you have introduced the proper amount of gas, the scale will be balanced
- Check gas introduction line connections to make sure they are tight
- If using a T/C, install Drierite® tube on gas sampling lines of T/C unit making sure the Drierite® granules are blue in color and have not turned pink
- Make sure all safety equipment is present and in working order

Conducting the Fumigation

Step 1—Introducing the Gas

CAUTION

You and the fumigator must wear the SCBA whenever:

- Concentration exceeds 5 ppm
- The concentration level is unknown, as with spills, leaks, and other emergencies
- Introducing gas
- Checking for leaks
- Taking aeration readings

In addition, the PPQ Officer must wear SCBA when they are within 30 feet of the enclosure.

Turn on all fans before introducing the gas. When using large cylinders of MB, have the fumigator slightly open the cylinder valve then close the valve. Using an APHIS-approved leak detection device, check all connections on the gas introduction line for leaks. If leaks are found, have the fumigator tighten the

connections and repeat the test. Also, check all areas which are sealed. If you find a leak and it cannot be readily corrected, evacuate this partial dosage and reseal the area. If no leaks are found, then open the valve to the point where 3 to 4 pounds of MB are being introduced per minute. The gas introduction line should always be hot and the volatilizer should read at least 150 °F.

CAUTION

Do **not** touch the introduction line with your bare hands—you may get burned! Close the cylinder valve once the proper dosage has been introduced.

The fumigation time begins once all the gas has been introduced. Record the time gas introduction was started and completed in Block 32 on the PPQ Form 429.

If using the electronic 429 database, record the fumigation date, gas introduction start and finish time in the corresponding fields under the "GAS INTRODUCTION" heading in the Treatment form.

Run the fans for 30 minutes after all gas has been introduced. You will take the initial concentration reading 30 minutes after all the gas has been introduced.

When using large cylinders, getting the final amount of gas out of the cylinder may take a long time. Using a pressurized cylinder will shorten the time. Consider taking a gas concentration reading 30 minutes after the gas was first introduced. If the gas distribution is even (all readings within 4 oz. of each other) and at a sufficiently high concentration, then turn off the fans. Running the fans longer may contribute to gas leakage. Allow the remainder of the gas to discharge at its slow rate with intermittent running of the fans for dispersal.

Step 2—Testing for Leaks

Wear the SCBA while checking for leaks. Use an APHIS-approved leak detection device to test for leaks before the 30-minute reading. Test around the perimeter of the tarpaulin on the ground, corners, and especially where electric cords, gas sampling tubes, or gas introduction lines are present. If you detect leaks, be sure they are sealed by using more sand or water snakes for floor leaks and tape for small holes in the tarpaulin.

Step 3—Taking Concentration Readings

Take concentration readings with an APHIS-approved gas detection device to determine the gas concentration and distribution within the enclosure. If using a T/C, check Drierite® tubes before each reading and change Drierite® if its color is pink. Depending on the length of exposure period, take concentration readings at the following times after the introduction of the fumigant:

- 30 minutes

- 2 hours
- 4 hours
- 6 hours
- 12 hours
- 24 hours
- 36 hours
- 48 hours
- 72 hours

All times are after gas introduction is completed.

Use an auxiliary air pump when there are many gas sampling tubes or the gas sampling tubes are very long. The auxiliary air pump will lessen the time required to draw gas to the gas detection device.

You may start the final reading 30 minutes to 1 hour prior to completion of the exposure period. If final gas concentration levels meet minimum levels, start aeration immediately at the end of the exposure period.

Additional Readings

Adverse weather conditions may indicate the need for additional readings. Sorptive commodities and indications of a steady decline in gas concentration also indicate the need to take additional concentration readings.

Step 4—Adding Gas

For concentration readings below minimum levels, add gas at the following rate:

1.6 × number of oz. below × volume/1,000 = oz. of fumigant to add

Once you've determined that you need to add gas, follow the same procedures as introducing the gas (Step 1). That is—

1. Heat water in the volatilizer to at least 200 °F.
2. Turn on the fans.
3. Weigh the cylinder.
4. Use your SCBA.
5. Open valve on cylinder and introduce the gas.
6. Close valve when the weight of the cylinder indicates that the needed amount of gas has been added.
7. Record quantity of fumigant added in Block 34 on the PPQ Form 429.

8. If using the electronic 429, record the amount of additional gas added in the “Additional Gas Recommended” field and the additional fan time in the “TIME FANS OPERATED” field in the Treatment form.

Note the time you started introducing additional gas and the time you finished introducing gas and record in Block 40 (Remarks) on the PPQ Form 429 or in the “Remarks” form in the electronic 429 database. Run the fans until you get even gas distribution throughout the enclosure. Turn off the fans, then take a concentration reading 30 minutes after you complete introducing the gas. If all readings are above minimum concentration levels, then proceed as usual with the remainder of the concentration readings. If gas is **not** evenly distributed (readings **not** within 4 oz. of each other), then run fans until you get gas evenly distributed.

Step 5—Exhausting the Gas

Exhaust the gas at the completion of the exposure period. The aeration of the structure and the final release to the owner is the responsibility of the commercial fumigator unless under a Section 18 Exemption. Exhausting the fumigant is facilitated by partially removing the tarpaulin and the use of suction fans which are supplied with ducts leading from the enclosure to the outside. The fumigant should be evacuated to the outside, downwind areas of the enclosure. The fumigator must be certain that the removal of the covers and ventilation is done in a manner that minimizes the hazard from the released gas.

Aerating the Enclosure

Table 2-7-2 Determine the Responsibility for Monitoring the Aeration

If the treatment schedule is:	Then:
A FIFRA Section 18 Exemption	MONITOR the aeration of the commodity. FOLLOW “Aerating the Enclosure” steps which follow.
A labelled treatment	RELEASE the commodity and RELEASE the fumigation to the fumigator.

Step 1—Securing the Area

Assuming that you’ve already restricted access and secured the fumigation area, you now must restrict access to the area where the exhaust duct extends beyond the enclosure. During the first 10 minutes of aeration, there should be no people within 200 feet of the exhaust duct outlet. When securing the duct outlet area, consider the direction of the wind. Face the duct outlet toward an open area and away from people. Point the duct outlet upward to aid in dispersing the exhaust gas.

Have the fumigator use a physical barrier such as ropes, barricades, or walls to secure the area.

Placard the secure area near the exhaust outlet with the appropriate DANGER/ PELIGRO signs. Make sure the placards meet the appropriate fumigant label or labeling requirements. The skull and crossbones should be present as well as "AREA UNDER FUMIGATION, DO NOT ENTER/NO ENTRE"; date of the fumigation; name of the fumigant used; and the name, address, and telephone number of the fumigator.

Unless you authorize their use, do **not** allow motorized vehicles to operate within the secure area.

Step 2—Aerating the Structure

Wearing the SCBA, have the fumigator open slightly the opposite end of the enclosure to allow entry of fresh air. The fumigator may open doors, tarpaulins, and areas to facilitate aeration. Start the exhaust system (minimum 2,500 cfm exhaust fan connected to an exhaust duct) and aerate the structure.

Important

The PPQ officer is **not** required to be continuously onsite during the entire aeration unless specified by the label, Section 18 Exemption, or State or local regulations. The officer must verify the gas concentration levels before removal of the tarpaulin and final release of the structure.

Step 3—Taking Concentration Readings

Stop the aeration fans. Take a concentration reading with a colorimetric tube in the exhaust duct within the enclosure. If the concentration is above 5 ppm but less than 100 ppm (for MB), the fumigator may remove the tarpaulin while wearing the SCBA. Release the structure when the concentration is 5 ppm or less. Record the date, concentration reading, and time on PPQ Form 429. If using the electronic 429 database, record the time and detector reading (in ppm) in the corresponding "Detector Readings" form.

2

Treatment Manual

Chemical Treatments

Fumigants • Methyl Bromide • Special Procedures for Container Fumigations Without a Tarpaulin

Important

Effective February 25, 2008, tarpless container fumigations for quarantine purposes conducted under APHIS supervision are no longer authorized. This suspension remains in effect until further notice from the APHIS-PPQ Quarantine Policy and Analysis Support Staff (QPAS.) All container fumigations must be conducted under tarpaulin.

2

Treatment Manual

Chemical Treatments

Fumigants • Sulfuryl Fluoride

Contents

Properties and Use **2-9-1**
Leak Detection **2-9-2**
Tarpaulin Fumigation **2-9-2**
- Sealing **2-9-3**
- Circulation **2-9-3**
- Prevention of Condensation **2-9-3**
- Gas Sampling Lines **2-9-3**
- Gas Introduction **2-9-4**
- Dosage Rate **2-9-5**
- Measure Gas Concentrations **2-9-5**
- Replacing Lost Gas **2-9-5**
- Aeration **2-9-5**

Structural Fumigation **2-9-6**
Chamber Fumigation **2-9-6**
Shipboard Fumigation **2-9-6**
Safety and First Aid **2-9-7**
- Protective Clothing **2-9-7**
- If SF Is Inhaled **2-9-7**
- If Liquid SF Is Spilled on the Skin **2-9-7**
- If Liquid SF Is in the Eyes **2-9-7**

Consult the Vikane[1] Gas Fumigant label and Structural Fumigation Manual for more detailed instructions and additional supportive information.

Properties and Use

Sulfuryl fluoride (SF) is a compressed-gas fumigant which is used primarily against insects that attack wood. The following characteristics make this fumigant especially desirable:

- 2.88 times heavier than air
- High vapor pressure —13,442 mm Hg @ 770 °F
- Low solubility in water and low sorption by soil or commodity
- Odorless, colorless, and nonflammable

1 Trademark of Dow Agro Sciences

- Penetrates wood better than any other commercial fumigants, including methyl bromide
- Relatively nonreactive
- Very low loss through plastic tarpaulins

SF boils at minus 67 °F. SF is **not** registered for use on foodstuffs or on living plant material.

SF is effective at very low dosages on Drywood termites where control of the adult stage is the only concern (typically 0.5 to 1.0 lbs/1,000^2). Higher dosages are required for control of the egg stage of other insects (typically 3 to 5 lbs/ 1,000^2). Consult treatment schedules in this manual for specific dosages.

Leak Detection

Interscan (Model GF 1900) or Miran gas analyzers (these units are portable) may be used to detect SF in the range of 0 to 150 ppm respectively. Consult the Vikane Structural Fumigation Manual for further instructions. Colorimetric ("detector") tubes are **not** available for detecting SF gas leaks around tarpaulins, chambers, and application equipment.

Tarpaulin Fumigation

Important

Refer to the section for tarpaulin fumigation with methyl bromide for additional information on the following:

- selecting fumigation sites

- placing gas sampling lines

- sealing tarpaulins

- taking concentration readings

- securing fumigation areas

Important

Refer to the PPQ Treatment Manual section on ***Fumigants • Methyl Bromide • Tarpaulin Fumigation*** on **page 2-4-1** (and aeration), the Vikane label, and Vikane Structural Fumigation Manual for a detailed discussion of proper procedures.

Sealing

The commodity to be fumigated should be placed onto a relatively even and non-porous surface, such as concrete, asphalt, or macadam. Special attention should be given to the seal along the ground or floor. The inspector should have tape, sand, or water snakes properly positioned.

Circulation

Fans are necessary to distribute SF and to help prevent condensation. The number of fans depends upon the cubic volume of the enclosure being treated, and the arrangement of cargo. Axial fans of approximately 5,000 cfm have proven effective. Usually 2 fans are used, one on either end facing the lower center and upper center of the load. If the enclosure is over 35 feet long, additional fans should be used. It is usually **not** necessary to run fans longer than 15 minutes after the gas has been introduced.

Prevention of Condensation

In cool weather, moisture may condense under tarpaulins if the sun is shining directly on the load. Continuous air circulation can prevent this from occurring. Do **not** tarp or seal any item while it is wet.

Gas Sampling Lines

A thermal conductivity unit calibrated for Vikane must be available for readings. Sampling lines should be arranged so that gas samples are drawn from representative parts of the fumigation area and lead to a common point.

A minimum of 3 sampling lines should be placed in enclosures of up to 10,000 ft^3 at the following locations:

- Front of the load, 3 inches from the floor
- Center of the load, midway from the bottom to the top of the load
- Rear of the load, at the top.

When 10,000 to 15,000 ft^3 are being treated, 2 additional lines should be appropriately deployed.

Gas Introduction

Unlike methyl bromide, SF does **not** require the use of a volatilizer to speed up its conversion from a liquid to a gas. The gas introduction tube should be placed directly in the air flow of a fan away from the cargo. Also, place a drip cloth under the tube. The introduction rate is controlled by the introduction line length and diameter. A 1/8-inch-inside-diameter by 100-foot-long hose will allow a flow rate of approximately 2 pounds per minute while a 25-foot-long hose will allow approximately 4 pounds per minute.

Table 2-9-1 Effect of Hose Inside Diameter on Rate of Gas Introduction through a 25-Foot Hose (approximates, depending on cylinder pressure)

Inside Diameter (inches)	Vikane Per Minute (pounds)
1/8	4
1/4	20
1/2	45

Table 2-9-2 Effect of Hose Length on Rate of Gas Introduction through a 1/8 inch Inside Diameter Hose

Hose Length (in feet)	Pounds Vikane Per Minute
25 ft	4.0
50 ft	2.8
100 ft	2.0[1]

1 Where fumigant introduction rates lower than 2 lbs/min are needed, a longer hose can be used, e.g., 200 ft.

It is important **not** to overshoot the ability of the fan to rapidly disperse the cool air near the fumigant introduction site. Fan capacity should be at least 1,000 cfm for each lb of Vikane introduced per minute. In addition, a volatilizer (heat exchanger) may be used in fumigating containers or small chambers to prevent a “fog-out” (condensation) which could cause corrosion or damage to the contents. The last few pounds of fumigant will turn to gas within the cylinder before moving out, and the flow rate will be reduced. The cylinder and tubing will often become frosted. Be certain that no open flame or glowing hot surfaces above 400 °C are present since corrosive substances (mainly hydrofluoric acid) are formed when SF is exposed to such conditions. To avoid possible damage, do **not** apply the fumigant directly to any surface.

Dosage Rate

To control a particular pest, locate the proper fumigation schedule to be followed in the Treatment Manual. The three variables in these schedules are temperature, dosage, and exposure duration. Treatment is **not** recommended below 50 °F. Dosages are in pounds per 1,000 feet^3 of space. To determine the total amount of fumigant required by weight in pounds, divide the total volume of space by 1,000. Then multiply the resulting figure by the dosage rate schedule expressed in pounds (per 1,000 feet^3). The cylinder should be placed on a scale, and the flow of gas is controlled by the valve and introduction line until the desired cylinder end-weight is obtained. The valve should be turned fully open to fill the fumigant introduction hose with liquid SF. Initially, the valve should be opened slightly until flow has begun and then opened about one full turn which should give full flow through the 1/8″ fumigant introduction hose.

Measure Gas Concentrations

During the course of fumigation, minimum concentrations must be maintained according to the schedules used. Readings on the T/C unit (Fumiscope or Gow-Mac) if **not** calibrated for Vikane must be multiplied by a factor to obtain the actual ounces per 1,000 feet^3 present. Contact the Center for Plant Health Science & Technology (CPHST) in Raleigh, North Carolina, for calibration information. Be certain that the reading without the multiplied factor is also registered on PPQ Form 429, however. Do **not** use filters containing sodium hydroxide (Ascarite) with SF. Fresh desiccant (Drierite) should be used with the T/C unit. Desiccant should be changed at appropriate intervals to insure accurate readings.

Replacing Lost Gas

When it appears that additional SF will be needed, the inspector should use his best judgment to determine the amount of gas to add, according to the prevailing conditions of tarpaulin tightness or wind conditions. Usually, 1.6 oz of gas should be added for every ounce of deficiency in the minimum concentration required.

Aeration

For detailed guidelines, consult the “Aeration” discussion elsewhere in this manual, ***Fumigants • Methyl Bromide • Tarpaulin Fumigation*** on **page 2-4-1**, the Vikane Gas Fumigant label, and Structural Fumigation Manual. The threshold limit value for SF is 5 ppm (20 mg/cubic meter), the same as for MB. Since no colorimetric (“detector”) tubes are available for SF, a suitable instrument must be used, such as the Interscan GF 1900 or Miran (calibrated for SF).

Structural Fumigation

Refer to the section on MB structural fumigation (or aeration) in this manual, the Vikane label, and Vikane Structural Fumigation Manual for a detailed discussion of proper procedures.

When preparing a structure for fumigation with SF, the surrounding soil should be watered thoroughly at the base of trees, shrubs, and other ornamental plants around the perimeter of the structure to prevent loss of fumigant into the soil. Watering around the plants will protect the roots; however, plants and grass closer than 1 ft may die even if this precaution is taken.

Before placing the tarpaulin over the structure, be sure to remove items for which the use of SF is **not** registered. These include food, feed, drugs, and medicines. Extinguish all flames (including pilot lights), unplug all heating elements, and turn off all lights. Open all internal doors.

Chamber Fumigation

Refer to the section on MB chamber fumigation (and aeration) in this manual, the Vikane label, and Vikane Structural Fumigation Manual for a detailed discussion of proper procedures.

CAUTION

Trying to measure out a small quantity of SF in a graduated glass tube (sight gauge)—which is common practice with MB chamber fumigations—should never be attempted with SF because the cylinder pressure is much greater, and the glass gauge may explode and shatter.

The gas will generally be introduced through a volatilizer or heat exchanger in order to prevent a “fog-out” which could damage the contents. Introducing a very small amount of gas into a small chamber, however, is difficult to do with precise accuracy because the amount introduced must be calculated by weight loss from the cylinder. The scale used beneath the cylinder must be readable in ounces or grams, **not** just in pounds or kilograms.

Shipboard Fumigation

Refer to the section on MB ship fumigation (and aeration) in this manual, the Vikane label, and Vikane Structural Fumigation Manual for a detailed discussion of proper procedures. Surface ships (only those in port) must be fumigated at dock side, and **not** when the vessels are underway. Shipboard fumigation is also regulated by the U.S. Coast Guard (Department of Transportation). That regulation appears as 46CFR 147A.

Safety and First Aid

Read and understand all directions and safety precautions on Vikane label before applying. Additional information is presented in Vikane Structural Fumigation Manual. There is no known antidote for SF. Vikane is odorless. However, the chance of lethal exposure is not probable unless an individual actually enters the fumigation space. An SCBA must be worn by anyone in the fumigated areas when the level exceeds 5 ppm.

Protective Clothing

Wear goggles or full face shield for eye protection during introduction of the fumigant. Do **not** wear gloves or rubber boots. Do **not** reuse clothing or shoes that have become contaminated with liquid SF until thoroughly aerated and cleaned.

If SF Is Inhaled

An individual who has inhaled high concentrations of SF may exhibit the following symptoms:

- Difficulty breathing
- Dulled awareness
- Nausea
- Numbness in the extremities
- Slowed body movements
- Slowed or garbled speech

If any of the above symptoms appear, immediately do the following:

- Remove the victim to fresh air
- Put victim at complete rest
- Keep the victim warm and see that breathing is normal and unhampered; if breathing has stopped, give artificial respiration
- Do **not** give anything by mouth to an unconscious person
- Obtain medical assistance

If Liquid SF Is Spilled on the Skin

Immediately apply water to the contaminated area of clothing before removing. Wash contaminated skin thoroughly or shower.

If Liquid SF Is in the Eyes

Flush with plenty of water for at least 20 minutes, and get medical attention. Damage to the eye may result from cold or freezing temperatures.

2

Treatment Manual

Chemical Treatments

Fumigants, Phosphine

Contents

Properties and Use **2-10-1**
- Phosphine **2-10-3**
- Carbon Dioxide **2-10-4**

Leak Detection: Gas Analysis **2-10-4**

Safety **2-10-4**
- Applicator Requirements **2-10-4**
- Storage and Handling **2-10-5**
- First Aid Treatment **2-10-7**

Respiratory Protection **2-10-7**

MP, AP, ECO2FUME® and VAPORPH3OS® **2-10-9**
- Packaging **2-10-9**
- Dispensing ECO2FUME® Fumigant Gas **2-10-11**
- Blending VAPORPH3OS® Fumigant Gas **2-10-15**
- Dosage **2-10-18**
- Preparing to Fumigate Break Bulk Cargo **2-10-21**
- Preparing to Fumigate Containerized Cargo **2-10-28**
- Probing **2-10-30**
- Intransit Ship Board Fumigation **2-10-31**
- Intransit Fumigation of Wood Chips **2-10-31**
- Aeration Requirements **2-10-35**
- Disposal of AP and MP Residue **2-10-36**

Contacts **2-10-36**

Properties and Use

There are a number of phosphine formulations registered with the United States Environmental Protection Agency (EPA) to control a variety of insects currently infesting raw agricultural commodities, processed foods, animal feed, feed ingredients, and nonfood commodities, including tobacco. Aluminum phosphine (AP), magnesium phosphide (MP), $ECO_2FUME^{®}$ and $VAPORPH_3OS^{®}$ are phosphine formulations that are currently approved for use by the Plant Protection and Quarantine (PPQ). Always refer to the PPQ *Treatment Manual* to determine if there is an available treatment. There are commodities and pests listed on the labels that are **not** authorized for treatment by the United States Department of Agriculture (USDA), PPQ.

AP and MP are solid products and are available under various trade names (***Figure 2-10-2*** on **page 2-10-9**) as tablets, pellets, prepacs, bags, or plates. In the presence of moisture, phosphine (hydrogen phosphide, PH_3), a colorless gas, is emitted from the solid product

The flash point of PH is 212 °F. Direct contact with a liquid could cause spont aneous combustion. In case of fire, a CO_2 dry chemical fire extinguisher should be used. *Never use water to extinguish a PH-ignited fire.* PH has an odor somewhat like garlic, which enables the gas to serve as its own warning agent. However, under some conditions, the odor can be lost, even at high toxic concentrations.

$ECO_2FUME^{®}$ fumigant gas is a nonflammable, premixed mixture of phosphine and carbon dioxide. The phosphine is liquefied and mixed with carbon dioxide in high-pressure cylinders for shipment. Phosphine, the active ingredient, makes up 2 percent by weight (2.6 percent by volume) of the product. The carbon dioxide is used as a propellant and a flame inhibitor, making the product nonflammable in air. Do **not** store the fumigant near heat or open flame. Do **not** drop, puncture, or incinerate the cylinder.

Under pressure, $ECO_2FUME^{®}$ is a poisonous liquefied gas. The product is withdrawn from the cylinder as a liquid, but dispensed as a gas. When expanding from a liquid to a gas, ECO_2FUME's volume is multiplied by hundreds. Proper dispensing equipment (See ***Dispensing ECO2FUME® Fumigant Gas*** on **page 2-10-11**) is necessary to ensure a safe and effective fumigation; therefore, always contact the manufacturer concerning proper dispensing equipment for the fumigant. Fumigators should provide PPQ with all **Cytec®** equipment authorization documentation. The documentation should be on file and available for periodic audits by the USDA.

The rate at which phosphine is dispensed is **not** dependant on temperature or humidity, but on the dispensing equipment used. Unlike metal phosphide fumigants, the phosphine is **not** generated through a chemical reaction and its release is instantaneous. The choice of dispensing methods will depend on the type and duration of the fumigation planned.

$VAPORPH_3OS^{®}$ consists of 100 percent phosphine gas packaged in high-pressure gas cylinders. Unlike solid phosphide fumigants, the phosphine is **not** generated through a chemical reaction and its release is instantaneous. Phosphine is pyrophoric and will spontaneously ignite in air. Phosphine is dispensed as a gas from the cylinder and can be safely blended with carbon dioxide to less than 3 percent volume (30,000 ppm) or diluted with the surrounding air to 1 percent volume (10,000 ppm) to eliminate the flammability hazard. Contact the manufacturer for approved blending equipment necessary to ensure a safe and effective fumigation. Never store the cylinders where the temperature will exceed 125ºF. Fumigators should provide

PPQ with all **Cytec®** equipment authorization documentation. The documentation should be on file and available for periodic audits by the USDA.

Phosphine

Phosphine (PH) is highly toxic to humans and other animals. Avoid exposure to nontarget organisms. The current U.S. OSHA Permissible Exposure Limit (PEL) for phosphine is 0.3 ppm as an 8-hour time weighted average. The Short Term Exposure Limit (STEL) for phosphine is 1 ppm as a 15-minute time weighted average.

Phosphine is colorless and, at concentrations below the OSHA PEL, has the odor of decaying fish or garlic. Intermittent low concentration exposure may cause headaches, malaise, ringing of ears, fatigue, nausea, and chest pressure. Moderate exposure causes weakness, vomiting, and pain in the stomach and chest with difficult breathing. Phosphine gas reacts with moisture to form phosphoric acid, which causes pulmonary edema.

Phosphine may spontaneously ignite in air at levels above its lower flammability limit of 1.8 percent v/v (18,000 ppm). Do **not** exceed this concentration because, under these conditions, explosions can occur that could cause severe personal injury. Never allow the buildup of phosphine to exceed explosive concentrations.

Under high vacuum conditions, phosphine gas can cause an explosive hazard. **Do not apply either fumigant in vacuum chambers.**

Phosphine can react with certain metals and cause corrosion (especially at higher temperatures and lower relative humidity). **Gold, silver, copper, brass, and other copper alloys are susceptible to corrosion**.

CAUTION

Remove or protect the following items prior to fumigation:

- Batteries and battery chargers
- Brass sprinkler heads
- Communication devices
- Computers
- Electric motors
- Electronic or electrical equipment
- Fork lifts
- Smoke detectors
- Switching gears
- Temperature monitoring systems

Fans and blowers used with phosphine products should be manufactured from materials resistant to the fumigant. Aluminum or plastic wheels and housings are preferred. For phosphine fumigations, always contact the manufacturer for recommended fan and blower types.

Carbon Dioxide

In a liquefied state and when contact is made with exposed areas of the body, carbon dioxide can cause frostbite and freeze burns. Overexposure to carbon dioxide at low levels can cause headache, nausea, weakness, confusion, and labored breathing. Overexposure to higher concentrations can cause excitation, dizziness, euphoria, loss of consciousness, coma, and death.

The current U.S. OSHA PEL for carbon dioxide is 5,000 ppm as an 8-hour time weighted average.

Leak Detection: Gas Analysis

Phosphine levels can be detected using either colorimetric detector tubes or any approved electronic instrument such as the “Porta-Sens” detector. (See ***Equipment*** on **page 8-1-1** for instructions on how to use the Porta-Sens.) This equipment is used to determine both the high (fumigation concentration) and low (personnel safety) levels of PH. Do **not** use thermal conductivity (T/C) units (e.g., Gow-Mac or fumiscope) for PH.

Safety

Applicator Requirements

Before using $ECO_2FUME^{®}$ and $VAPORPH_3OS^{®}$, all users (fumigators) are required to attend the fumigant gas product stewardship course offered by **Cytec®** Industries. PPQ Officers are **not** required to attend the stewardship courses, but attendance is recommended.

It is a violation of federal law to use AP, MP, $ECO_2FUME^{®}$ and $VAPORPH_3OS^{®}$ fumigants in a manner inconsistent with their labeling. These fumigants are **Restricted Use Pesticides** that can only be used by certified applicators. Prior to using the fumigants, submit to PPQ all documentation concerning applicator certification and stewardship program completion by personnel working for the fumigation company. The documentation should be on file and available for periodic audits by the USDA.

A certified applicator must be physically present, responsible for, and maintain visual and/or voice contact with all fumigation workers during the application of the fumigants and during the initial opening of the fumigation structure for aeration.

Storage and Handling

Although PH is flammable and can ignite when exposed to excessive moisture, the commercial precautions of AP and MP are considered fire safe and explosion safe when used in accordance with the manufacturer's instruction. Place no more than 10 pellets of Phostoxin in a single envelope, which is supplied by the manufacturer. A Fumi-Cel plate should **not** contact another Fumi-Cel plate or the commodity.

Store containers of AP and MP in a cool, dry, locked, ventilated, protected area **not** subject to extremes of temperature. Never allow water to come in contact with AP or MP. The shelf life of unopened containers is virtually unlimited. When a tube or container is first opened, the odor of PH (garlic) and ammonia will be noticeable and a blue flame sometimes occurs. However, the quantity of free PH present within that container should **not** be considered dangerous.

When planning a storage area for $ECO_2FUME^{®}$ and $VAPORPH_3OS^{®}$ cylinders, consider the needs of the local authorities. Provide all emergency response personnel with Material Safety Data Sheets (MSDS) and detailed information regarding the quantities of product stored and the nature and location of the storage area.

Develop an Emergency Response Plan that defines procedures and outlines responsibilities in the event of an accident. Train all site personnel in the plan. Store all cylinders with the valve discharge cap securely in place.

In addition to instructions and precautions found on the label, be certain to:

- Study and follow the recommended application procedure
- Comply with all regulations
- Allow only properly trained personnel to conduct fumigations under the supervision of certified pesticide applicator(s)
- Ensure that first aid equipment, MSDS sheets, and fumigant labels are readily available at the fumigation site
- Placard the area to be fumigated and an area extending 30 feet from the fumigation enclosure—refer to the fumigation label for appropriate wording on all placards
- Always work in pairs, never alone—a minimum of two people must be present during the introduction, sampling, and aeration of the fumigant

- Never eat, drink, or smoke when handling PH products
- Remove placards when aeration is complete and concentrations are below the TLV
  - Only certified pesticide applicators or individuals under the direct supervision of the certified applicator should remove placards
- Do **not** apply either PH fumigant in vacuum chambers
- Wear leather or leather-faced cotton gloves when connecting or disconnecting ECO_2FUME and $VAPORPH_3OS$®cylinders from the dispensing or blending equipment
- Wear dry cloth gloves when handling AP or MP products
- Wear steel-toed shoes
- Always wear safety glasses when handling pressurized equipment
- Read and understand sections XI. STORAGE OF CYLINDERS and XII. TRANSPORT in the ECO_2FUME® and $VAPORPH_3OS$® Application Manual

First Aid Treatment

Mild inhalation exposure causes:

- Malaise
- Ringing of the ears
- Fatigue
- Nausea
- Pressure in chest

Moderate inhalation exposure causes:

- Weakness
- Vomiting
- Epigastric pain
- Chest pain
- Diarrhea
- Dyspnea (difficulty breathing)

Severe inhalation poisoning can occur within a few hours or up to several days—symptoms may be:

- Pulmonary edema (fluid in lungs)
- Dizziness
- Cyanosis (blue or purple skin color)
- Unconsciousness
- Death

Get the victim to fresh air, treat for shock, and call a physician.

Respiratory Protection

When applying AP, MP, $ECO_2FUME^{®}$ and $VAPORPH_3OS^{®}$, respiratory protection must be available at the site. An adequate number of NIOSH-approved self-contained breathing apparati (SCBA) with full face piece and operated in pressure-demand mode must be available.

The slow evolution of PH from the AP or MP enables the operator to dispense the tablets, pellets, packets, plates, or pre-pack ropes safely, usually without the need for wearing an SCBA.

However, wear SCBA during exposure to concentrations in excess of permitted limits (***Figure 2-10-1*** on **page 2-10-8**) or when concentrations are unknown. If the concentration of phosphine is unknown or known to exceed the STELs for phosphine and/or carbon dioxide, wear SCBA during troubleshooting for leaks. Use respiratory protection according to local regulations, including regular worker training in using respiratory protection equipment properly, medical clearance for respirator use, fit testing, inspection, maintenance, and cleaning and storage of respiratory protection equipment.

Figure 2-10-1 NIOSH-Recommended Respiratory Protection

Phosphine Gas (ppm)	Minimum Respiratory Protection
0.3 - 3.0	Supplied-air respirator
3.1 - 7.5	Supplied-air respirator operated in a continuous-flow mode
7.6 - 15	1. SCBA with full face piece OR 2. Supplied-air respirator with full face piece OR 3. Air-purifying full face piece respirator (gas mask) with chin style front or back-mounted canister
16 - 50	1. Supplied-air respirator with a full face piece and operated in pressure-demand mode OR 2. SCBA with a full face piece and operated in pressure-demand mode

MP, AP, $ECO_2FUME^{®}$ and $VAPORPH_3OS^{®}$

Packaging

AP and MP are packaged in a variety of ways, depending on the manufacturer. Use **Figure 2-10-2** to determine the amount of phosphine liberated by each product.

Figure 2-10-2 Amount of Phosphine Liberated by Various Products

Product	Type	Unit and weight in grams	Grams of phosphine
Degesch Fumi-Cel	MP	1 plate; 117.0	33.0
Degesch Fumi-Strip	MP	20 plates; 2340.0	660.0
Degesch Phostoxin	AP	1 tablet; 3.0	1.0
Degesch Phostoxin Tablet Prepac Rope	AP	1 prepac; 99.0 (strip or rope of 33 tablets)	33.0
Detia	AP	1 tablet; 3.0	1.0
Detia Rotox AP	AP	1 pellet; 0.6	0.2
Detia Gas EX-B	AP	1 bag or sachet; 34.0	11.4
Fumiphos tablets	AP	1 tablet; 3.0	1.0
Fumiphos pellets	AP	1 pellet; 0.6	0.2
Fumiphos bags	AP	1 bag; 34.0	11.0
Fumitoxin	AP	1 tablet; 3.0	1.0
Fumitoxin	AP	1 pellet; 0.6	0.2
Fumitoxin	AP	1 bag; 34.0	11.0
Gastoxin	AP	1 tablet; 3.0	1.0
Gastoxin	AP	1 pellet; 0.6	0.2
“L” Fume	AP AP	1 pellet; 0.5 1 pellet; 0.6	0.18 0.22
Phos-Kill	AP	1 tablet; 3.0	1.1
Phos-Kill	AP	1 pellet; 0.6	0.22
Phos-Kill	AP	1 bag; 34.0	12.0

$ECO_2FUME^®$ fumigant gas is packaged in a steel compressed gas cylinder designed, manufactured, maintained, and filled in compliance with regulations established by the United States Department of Transportation (DOT). (**Figure 2-10-3**) The product flows to the dispensing equipment through the cylinder outlet valve, which is equipped with a "dip tube." This tube extends to the bottom of the cylinder to facilitate the withdrawal of the liquefied gas mixture. As liquid is withdrawn from the cylinder, some of the product vaporizes to fill the remaining space in the cylinder. Through this vaporization, the cylinder pressure is maintained.

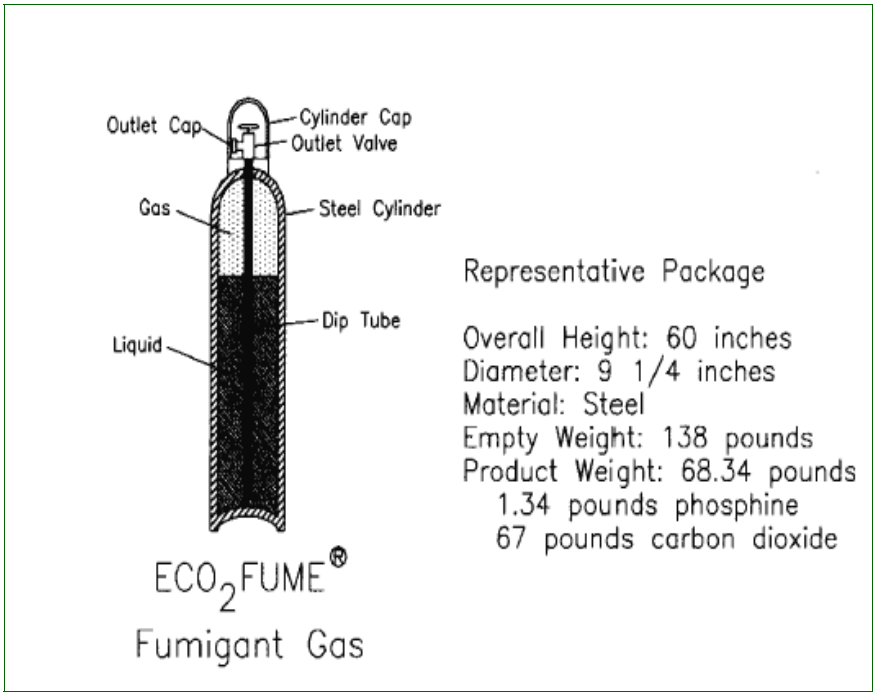

Figure 2-10-3 Diagram of $ECO_2FUME^®$ Gas Cylinder

The capacity of one $ECO_2FUME^®$ cylinder at 200 and 500 ppm is 78,000 and 31,100 ft^3 respectively. With the volume of $ECO_2FUME^®$ at 500 ft^3, the internal volume of the cylinder is 49 liters. The maximum cylinder pressure is 2,400 psig.

The Compressed Gas Association (CGA) established the valve outlet fitting as a CGA350. The valve outlet is protected by a threaded gas tight outlet cap, which must be secured whenever the cylinder is **not** in use. To dispense $ECO_2FUME^®$ fumigant gas at the time of fumigation, attach only **Cytec®**-provided (or approved) dispensing equipment to the cylinder valve outlet. Using any other dispensing equipment is prohibited.

Most compressed gas cylinder valves are equipped with a safety device that releases the cylinder contents due to fire exposure or over-pressurization. Because $ECO_2FUME^®$ and $VAPORPH_3OS^®$ fumigant gases are poisonous, Hazard Class A, the DOT regulations prohibit using such a device.

Each cylinder is supplied with a cylinder cap designed to protect the outlet valve. Secure this cap whenever a cylinder is **not** in use. It is unlawful to transport an $ECO_2FUME^®$ or $VAPORPH_3OS^®$ fumigant gas cylinder without the valve outlet cap and the cylinder cap securely in place.

$ECO_2FUME^®$ and $VAPORPH_3OS^®$ fumigant gas cylinders can only be refilled by authorized distributors. They can be filled countless times within a five-year period. Every five years, however, the cylinder is required, by law, to be tested by a qualified facility.

$VAPORPH_3OS^®$ is packaged in much the same way as $ECO_2FUME^®$ with two critical exceptions. First, $VAPORPH_3OS^®$ does **not** contain a dip tube, which means the fumigant is withdrawn from the cylinder directly through the outlet valve. Second, the capacity of one $VAPORPH_3OS^®$ cylinder at 200 and 500 ppm is 2.25M and 900,000 ft^3 respectively. With the volume of $VAPORPH_3OS^®$ at 500 ft^3, the internal volume of the cylinder is 49 liters. The maximum cylinder pressure is 2,400 psig. One $VAPORPH_3OS^®$ cylinder contains 18,000 grams of phosphine and is capable of fumigating 2.25M ft^3.

$ECO_2FUME^®$ cylinders are painted yellow with a dark green shoulder and cap. If you receive a cylinder of a different color or without a **Cytec®** $ECO_2FUME^®$ label, do not use the cylinder. Contact your distributor or **Cytec®** with the cylinder serial number.

$VAPORPH_3OS^®$ cylinders are painted silver with a red shoulder. If you receive a cylinder of a different color or without a $VAPORPH_3OS^®$ label, do not use the cylinder. Contact your distributor or CYTEC with the cylinder serial number.

Dispensing $ECO_2FUME^®$ Fumigant Gas

The following instructions are intended to provide general guidelines for typical $ECO_2FUME^®$ fumigation. There are a number of critical factors involved in the design of dispensing equipment. (See ***Figure 2-10-4*** on **page 2-10-12**) As such, dispensing equipment must meet both high-pressure standards and chemical compatibility requirements. Improper or inappropriate use of dispensing equipment can result in severe injury or death. Application

inconsistent with the labeling and Application Manual is a violation of federal law. Buyer assumes all risk should the product be used contrary to label or Application Manual instructions.

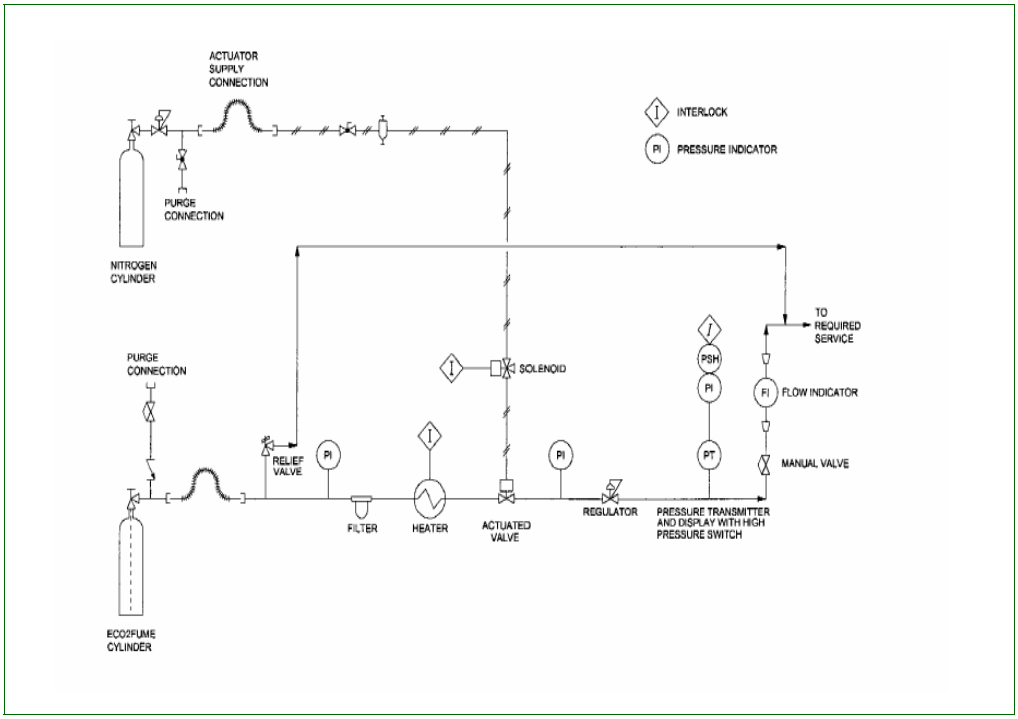

Figure 2-10-4 Diagram of One Type of Dispensing Equipment

Equipment Specification and Use

The equipment used to dispense $ECO_2FUME^{®}$ provides a means of containing the gas during the fumigation and controlling the release of the product into the desired space. While some dispensing equipment has been developed and used to date, it cannot be expected to cover all possible fumigation scenarios. The development of suitable dispensing equipment is an ongoing process based on the needs of the users and available technology.

The design of dispensing equipment must account for a number of technical issues including pressure rating, material compatibility, temperature limitations and operator safety. For this reason, use only appropriate equipment when dispensing $ECO_2FUME^{®}$. Only persons trained in the proper use of $ECO_2FUME^{®}$ and the dispensing equipment shall be permitted to use $ECO_2FUME^{®}$ for fumigation. Consult the instruction materials provided with the dispensing equipment for their proper use and maintenance.

Unapproved Dispensing Methods

It has been common practice, with other cylinderized fumigants, to place the cylinder in the space to be fumigated and the cylinder outlet valve opened to allow the fumigant to release. This is **not** an approved dispensing method and should **not** be used with $ECO_2FUME^{®}$.

Approved Dispensing Methods

The approved dispensing methods for $ECO_2FUME^®$ include using pressure-reducing regulators for slow release and selected piping components for quick release. The slow release of $ECO_2FUME^®$ is generally used for fumigating bulk storage facilities such as silos or bins, or for small fumigation chambers or spaces and for fumigating stacked materials under tarpaulins. The quick release method is used for space fumigation, or where the commodity to be treated is warehoused. The selection of the dispensing method will depend on the size of the fumigation, the time required, and facility limitations.

Two gas regulators, ambient and heated, have been developed for use with $ECO_2FUME^®$. Each of the regulators is designed to reduce the high cylinder pressure (less than 30 psig) and provide the heat necessary to vaporize the fumigant. Once reduced to this lower pressure, the fumigant can be distributed to the desired dispensing points using inexpensive and easy-to-use materials, such as plastic tubing. Flow indicators are used with regulated dispensers to measure and set the dispensing rate.

Ambient Heater Regulated Dispenser

The slower of the two dispensers relies on ambient heat to vaporize the fumigant and is limited to a dispensing rate of about one-half pound of $ECO_2FUME^®$ per hour.

Heated Regulated Dispenser

The heated regulator uses an external heating vaporizer to provide the energy required to vaporize the liquid fumigant at a much higher rate than the ambient heat regulator. This regulator is limited to a dispensing rate of about 24 pounds of $ECO_2FUME^®$ per hour. The equipment is designed for a service pressure up to 3,000 psig. From the cylinder, the liquid mixture flows down a flexible hose or pigtail through a filter and into a heater. The heater is thermostatically controlled and the temperature setting can be adjusted. Exiting the heater, $ECO_2FUME^®$ gas flows through an actuated valve that can be used for emergency shutdown purposes. $ECO_2FUME^®$ gas then flows through a gas regulator that drops the pressure to 30 psig. A diaphragm valve is used to control the gas flow at any desired value up to 100 liters/minute as indicated by the flow rotameter. The heater provides 1,000 watts of power that can vaporize a maximum of 100 ppm. Lower rotameter ranges are possible. $ECO_2FUME^®$ regulator assemblies, equipped with basic features, are available through authorized $ECO_2FUME^®$ distributors. Multiple regulators may be used together to achieve higher fumigant flows than available through a single regulator and custom equipment can be developed for specific types of applications.

Quick-Release Dispensing Equipment

When the fumigation space is very large, such as a mill, warehouse, or large fumigation chamber, using a number of cylinders is anticipated, a quick means of dispensing $ECO_2FUME^{®}$ is available. Specially selected components can be used to direct the cylinder discharge into the fumigation space, without the need to enter the space during the fumigation. Using this method, a single cylinder can be completely discharged in as little as 15 minutes. Unlike the regulated dispensing methods, the dispensing rate is **not** adjustable and generally, entire cylinders are emptied using this process. If partial cylinder contents are needed, the $ECO_2FUME^{®}$ cylinder can be placed on a weight scale and the amount of released fumigant can be measured. The quick release method must **not** be used for fumigation of small-sized stacked materials under tarpaulins, however, the quick dispensing method will be used for most applications. Three techniques of quick dispensing are presented in this section, with the major difference being the tubing size.

1. One technique uses high pressure tubing (stainless steel or hydraulic hose with a nylon core) connected directly to the cylinder valve. The tubing is then routed into the fumigation space. When the cylinder valve is opened the majority of the liquid will be dispensed in four to five minutes. The last few pounds below the cylinder internal dip pipe will require several additional minutes to vaporize and be dispensed. When the cylinder is empty of liquid, approximately 18 pounds of gas will remain in the cylinder. For larger fumigations, manifolds may be used with the cylinders to make the dispensing faster. Always leak test the dispensing piping and cylinder connection before opening the cylinder valve.
2. When a slower dispensing rate is desired, use smaller tubing (stainless steel or hydraulic hose with a nylon core). The fumigator must **not** throttle the cylinder valve to slow the dispensing rate; to do so will cause a high pressure drop through the valve. The pressure drop will result in cooling and dry ice formation. This solid dry ice formation will plug the dispensing pipe and possibly the cylinder valve. Attaching a short section of 1/8 inch tubing to the end of the 1/4 inch tubing will slow the dispensing rate to approximately 5 pounds/min. Use a calibrated scale to ensure the proper amount of product dispensed.
3. If a dispensing rate of less than 5 pounds/min is required, a small section of 1/16 inch tubing, 0.04 inch internal diameter (stainless steel or hydraulic hose with a nylon core) can be attached to the end of the 1/4 inch tubing to slow the dispensing rate to approximately 1.6 pounds/min. Use a scale to ensure the proper amount of product is dispensed. The tubing is also available in smaller internal diameters (I.D.) for reduced dispensing rates. When 1/8 inch tubing or 1/16 inch tubing is used a filter is recommended to prevent plugging of the smaller tubing.

Blending VAPORPH$_3$OS® Fumigant Gas

The following instructions are intended to provide general guidelines for typical fumigations. There are a number of critical factors involved in the design of blending equipment. As such, blending equipment must meet both high-pressure standards and chemical compatibility requirements. Improper or inappropriate use of blending equipment may result in severe injury or death. Application inconsistent with the labeling and Application Manual is a violation of federal law. Buyer assumes all risk should the product be used contrary to label or Application Manual instructions.

Equipment Specification and Use

The equipment used to blend VAPORPH$_3$OS® on site with carbon dioxide or surrounding air into a nonflammable gas mixture provides a means of containing the gas during the application and controlling the release of the product into the desired space. While some blending equipment has been developed and used to date, they cannot be expected to cover all possible fumigations scenarios. The development of suitable blending equipment is an ongoing process based on the needs of the users and available technology.

Blending equipment design must account for a number of technical issues, including pressure rating, material compatibility, temperature limitations and operator safety, and controlling the phosphine concentration between 2.0 and 2.9 percent volume for carbon dioxide blending and less than 10,000 ppm (1 percent volume) for dilution with air. For this reason, use only **Cytec®**-approved equipment in VAPORPH$_3$OS® blending. Only persons trained in the proper use of VAPORPH$_3$OS® and the dispensing equipment shall be permitted to use VAPORPH$_3$OS® for fumigation. These persons must also be licensed pesticide applicators.

Consult the instruction materials provided with the blending equipment or dilution equipment for their proper use and maintenance. FOSFOQUIM, the authorized manufacturer of the phosphine air blending equipment, will provide training and written instructions for the use and maintenance of its HDS equipment.

Unapproved Dispensing Methods

It has been common practice, with other cylinderized fumigants, to place the cylinder in the space to be fumigated and the cylinder outlet valve opened to allow the fumigant to release. This is **not** an approved dispensing method and should **not** be used with VAPORPH$_3$OS®. VAPORPH$_3$OS® phosphine fumigant is pyrophoric and will spontaneously ignite in air. VAPORPH$_3$OS® must be properly blended with carbon dioxide or diluted with air to eliminate the flammability hazard.

Blending Equipment for VAPORPH$_3$OS® and Carbon Dioxide

Phosphine gas (VAPORPH$_3$OS®) from high-pressure cylinders flows into the blender unit where it combines with carbon dioxide gas sourced from bulk storage, mobile bulk truck, semibulk, or cylinders. Various models of on-site blending equipment have been designed, built, and tested. All of the designs have incorporated engineering safeguards to ensure that the blended product is a nonflammable mixture.

One design uses a pressure regulator and flow control orifice on both the VAPORPH$_3$OS® and carbon dioxide gases to control the flow rate and to properly blend VAPORPH$_3$OS® with carbon dioxide. The size of each orifice is engineered for a specific fixed flow rate and, therefore, the blending rate cannot be adjusted. By controlling the pressure drop across the orifice plates, the phosphine concentration can be controlled around 2.5 percent v/v.

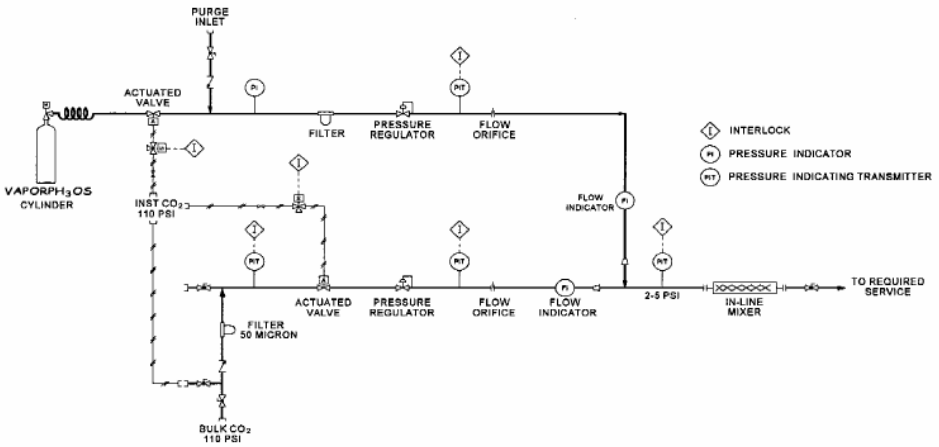

Figure 2-10-5 Diagram of One Type of Blending Equipment

A more sophisticated design uses mass meters, control valves, and the electronics to allow an adjustable blending rate while maintaining the proper blenc of phosphine concentration from going outside the range of 2.0 to 2.9 percent volume (1.6 to 2.2 percent weight.) The product from this equipment is equivalent to ECO$_2$FUME® fumigant gas. Blending equipment is intended for large facilities that have on-site carbon dioxide bulk storage and vaporizing equipment or facilities where it is feasible to bring in bulk carbon dioxide and vaporizing equipment for the fumigation. The blending equipment is designed for use only with carbon dioxide gas; therefore, a bulk supply of liquid carbon dioxide must be equipped with suitable vaporizing equipment. Contact **Cytec®** Industries Incorporated for blending equipment design specifications and recommendations. For smaller fumigation jobs, it is recommended that preblended ECO$_2$FUME® cylinders be used. VAPORPH$_3$OS® fumigant gas can

only be blended with registered carbon dioxide products. Never allow the buildup of phosphine to exceed explosive concentrations. When phosphine is blended with carbon dioxide, the LFL is raised to 3 percent v/v. The fumigator should always check with **Cytec®** for approved blending equipment. Fumigators should provide PPQ with all **Cytec®** equipment authorization documentation. The documentation should be on file and available for periodic audits by the USDA.

Blending Equipment for VAPORPH$_3$OS® and Forced Air

Phosphine gas (VAPORPH$_3$OS®) can spontaneously ignite in air if the concentration is greater than 1.8 percent (18,000 ppm). With specialized equipment, pure phosphine can be safely blended with a forced air stream to ensure the final concentration does **not** exceed 10,000 ppm (55 percent of the Lower Flammability Limit of 18,000 ppm). The equipment has incorporated engineering safeguards to ensure the flammable concentration is never exceeded.

Various models of phosphine/forced air blending equipment have been designed, built, and tested. The Horn Diluphos System (HDS) from FOSFOQUIM is approved by **Cytec®** and the **Treatment Quality Assurance Unit** to blend VAPORPH$_3$OS® with forced air (see section on HDS80 and HDS200 Blending Equipment). One design uses inert gas (nitrogen or carbon dioxide) to prepurge the phosphine lines and equipment. Once purged, phosphine flows through a pressure regulator and flow controller to the mixing point. Here, phosphine is safely blended into the forced air stream. The forced air can be supplied by various fans, blowers, or compressors. The air flow is measured and the phosphine flow will stop if the air flow is insufficient.

If the phosphine flow is stopped for any reason, post-purging of the phosphine lines and equipment is automatic.

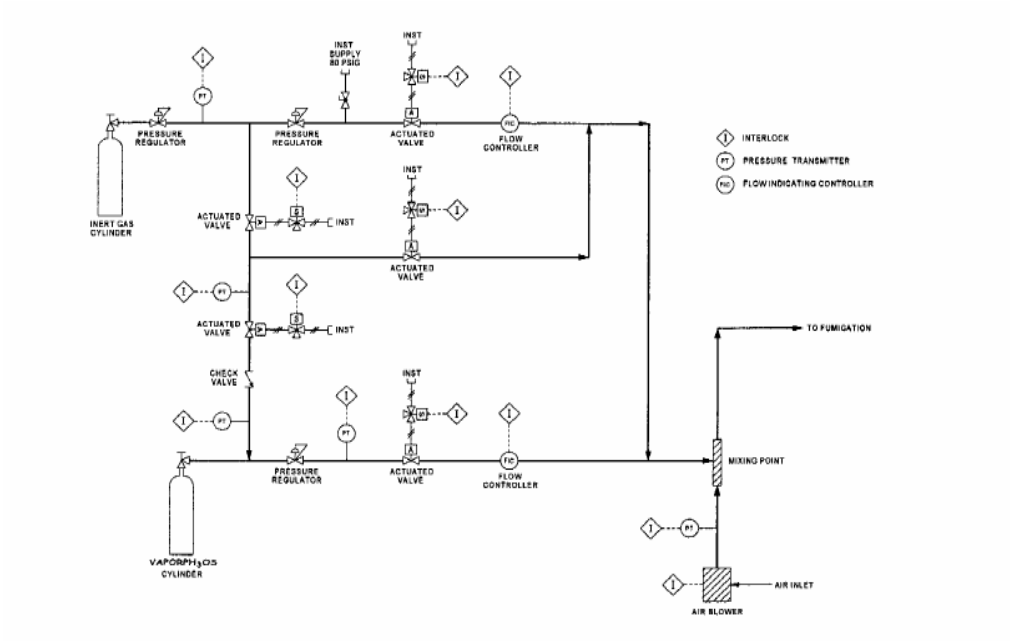

Figure 2-10-6 Diagram of VAPORPH$_3$OS® and Forced Air Blending Equipment

Dosage

The dosage rate for AP, MP, ECO$_2$FUME® and VAPORPH$_3$OS® is measured in grams per 1,000 cubic feet or grams per cubic meter and varies with the commodity, treatment temperature, and type of enclosure. The initial fumigant dose is determined by the volume of the space to be fumigated and the required phosphine dose rate needed to kill the target pest. ECO$_2$FUME®and VAPORPH$_3$OS® fumigant gas and carbon dioxide/forced air can be added if the desired target concentration changes due to a loss of the fumigant through leaks in the fumigation enclosure.

AP and MP

To calculate the number of tablets or pellets of AP or MP required for the fumigation:

Dosage Rate = the dosage rate from the treatment schedule (grams)
Volume of enclosure = Length * Width * Height (ft^3)
Grams of phosphine liberated = ***Figure 2-10-2*** on **page 2-10-9**

Step 1: Grams of PH$_3$ = (Dosage Rate* Volume of enclosure)/1,000 ft^3

Step 2: Number of Tablets or Pellets needed =
Grams of PH$_3$ / Grams of phosphine liberated

EXAMPLE: **T308-b-2.** Tobacco for Export in a warehouse requires 20 grams of phosphine per 1000 ft^3. The size of the warehouse is 100' * 75' * 50'. To determine the number of Fumiphos tablets and pellets to introduce, use the following procedure:

100 * 75 * 50 =375,000 ft^3
Step 1: (20 g * 375,000 ft^3)/1000 ft^3= 7500 g
Step 2:
Tablets: 7500/1.0 = 7500 tablets
Pellets: 7500/0.2 = 37,500 pellets

ECO_2FUME®

Method 1:

- **1 gram of phosphine (PH3) = 25 ppm PH3/1000 ft^3**

To calculate the total amount of ECO_2FUME® required for each treatment:

- **Target concentration in ppm** =
  (Dosage rate in grams from Treatment schedule* 25 ppm)
- **Grams of PH3 =**
  (Target concentration * Volume of enclosure)/25,000
- **Pounds of ECO_2FUME® =**
  (Target concentration * Volume)/226,800

EXAMPLE: ***T301-d-1-2*** on **page 5-4-5**. Cotton and cotton products infested with boll weevil requires 36 g of phosphine per 1000 ft^3. The volume of this enclosure is 10'*10'*10*. To determine the pounds of ECO_2FUME® gas to introduce, follow these steps.

Step 1: Convert grams of phosphine to ppm:
36g * 25 = 900 ppm/1000 ft^3
Step 2: Determine total volume of the enclosure
10*10*100 = 1000 ft^3
Step 3: Apply the formula to determine the amount of ECO_2FUME® to introduce (900 ppm * 1000 ft^3) / 226,800 = 3.97 pounds

Therefore, 3.97 pounds of ECO_2FUME® will be introduced into the structure.

Method 2:

- **1 pound of ECO_2FUME® = 9.07 grams PH3**
- Divide the dosage rate from the treatment schedule (in grams) by 9.07.

EXAMPLE:
Assuming the same treatment schedule as the previous example (***T301-d-1-2*** on **page 5-4-5**):

36 / 9.07 = 3.97 pounds

NOTE: When the amount of gas introduced is less than 68 pounds, use a calibrated scale to determine when the proper amount of gas has been introduced into the space.

VAPORPH$_3$OS®

To calculate the amount of VAPORPH$_3$OS® required for the fumigation:

- **1 pound of VAPORPH$_3$OS® = 454 grams PH3**

Target concentration = the desired phosphine concentration (ppm) from the treatment schedule

Step 1:
Grams of PH$_3$ = (Target concentration*Volume of enclosure) / 25,000

Blending with CO$_2$

Once the amount of phosphine has been determined, the appropriate amount of carbon dioxide must be calculated. It is recommended that twice the amount of carbon dioxide be available to ensure an adequate supply for the initial dose, the addition of gas, and equipment purging.

To calculate the amount of carbon dioxide required for the fumigation:

Step 2:
Pounds of CO$_2$ = (Grams of PH$_3$/454) * 105.3

EXAMPLE: ***T301-d-1-2*** on **page 5-4-5**. Cotton and cotton products infested with Boll weevil requires 36 g of phosphine per 1000 ft^3. The volume of the enclosure is 75,000 ft^3. To determine the amount of VAPORPH$_3$OS® gas to introduce, follow these steps:

Step 1: (36g * 75,000 ft^3) / 25,000 = 108 grams PH$_3$
Step 2: (108/454) * 105.3 = 25 pounds CO$_2$

Blending with Forced Air

When blending with forced air, only the amount of phosphine needs to be calculated. A closed circulation system is created if the air supply is sourced from inside the fumigation enclosure. This will prevent a positive pressure

from developing within the fumigation space. If recirculation is **not** used the perimeter of the fumigation site will need to be monitored because the air will be displaced from the fumigation space. The HDS 80 blending equipment used with forced air dispenses at 50g/min. If the minimum air flow is **not** maintained, the blending equipment will automatically shut down and phosphine will no longer be dispensed.

Adding $ECO_2FUME^®$ and $VAPORPH_3OS^®$ Gas to an Enclosure

Depending on the sealability of the type of space to be fumigated, it may be necessary to add additional gas to the structure in order to maintain the target concentration required by the treatment schedule.

To calculate the amount of $ECO_2FUME^®$/$VAPORPH_3OS^®$ to be added:

Grams of PH_3 = (Target Concentration - Actual Concentration) * Volume/ 25,000

The target and actual concentrations are measured in ppm and must be monitored with a device approved by CPHST, TQAU.

Preparing to Fumigate Break Bulk Cargo

Break bulk cargo has been unloaded from a ship hold, a container, or rail car. This cargo can be fumigated by covering the pallets, boxes, or raw cargo with an impervious tarpaulin.

Always check the PPQ *Treatment Manual* to determine if there is an approved treatment schedule using either AP, MP, $ECO_2FUME^®$ or $VAPORPH_3OS^®$ fumigant for the infested commodity. Treatment schedules typically list the commodity to fumigate with its associated pest(s). If the commodity in question does **not** have a treatment schedule, contact the **Treatment Quality Assurance Unit** to determine if there is an alternative treatment available.

Step 1: Site Selection

- Select sites that are well ventilated and in a sheltered area
  - Well-ventilated site is required for exhausting gas before and when the tarpaulin is removed from the stack
  - When applying $ECO_2FUME^®$ or $VAPORPH_3OS^®$, a sealed fumigation enclosure will typically see an increase of eight inches water pressure
  - It is advisable to have a vent area in one or more of the openings to the space to allow air to escape as $ECO_2FUME^®$ or $VAPORPH_3OS^®$ fumigant gas is applied
  - Seal the space after the target concentration is obtained

- Use portable or permanent fans to decrease the amount of time required for aeration
  - To ensure the exhausted gas does **not** reenter the building where the fumigation is being conducted nor endanger people working outdoors, monitor gas levels at the property lines and near inhabited structures adjacent to the fumigation site
- If fumigations are conducted outside, select a site that is semisheltered such as the leeward side of a warehouse, pier, or building that offers some protection from strong winds

Ability to Heat Area

- When cool temperatures (below 40ºF) are expected, heat the site to maintain commodity temperatures above 40ºF; take the ambient temperature 12 inches above the floor
- Because phosphoric acid will be produced if phosphine is burned, never use flame or exposed electrical element heaters during treatment
  - Contact the **Treatment Quality Assurance Unit** for appropriate heating sources

An Impervious Surface

- To fumigate on a porous surface, cover the surface with asphalt (tar) paper or plastic tarpaulins
  - For large fumigations, covering the surface is **not** usually practical because pallets must be rearranged and heavy equipment used to move the commodity
  - On docks, wharfs, and piers, check for cracks, holes, and manhole covers that will allow the phosphine gas to escape through the floor
  - Seal all cracks, holes, and manhole covers with plastic or asphalt paper

A Nonwork Area

- Select a secure nonwork area where traffic and people are restricted from entering
  - The fumigation area is considered either the entire structure area or an area that extends 30 feet from the tarpaulin and is separated by a physical barrier such as ropes, barricades, or walls
  - If a wall of gas-impervious material is less than 30 feet from the tarpaulin, the wall may serve as the edge of the secured area
  - Additional guidelines may be required by some states Department of Agriculture. Some states, California, for example, require a 100-foot buffer zone
- Place placards clearly in sight of all who come near
  - Placards must meet label requirements regarding specific warnings, information, and language
  - Placards generally include the name of the fumigant, the fumigation date, time, and the name of the company conducting the fumigation
  - Restrict access to the fumigation area to the fumigator's employees and PPQ employees monitoring the treatment
  - Use rope or marker tape to limit access within 30 feet of the enclosure
  - Do **not** allow motor vehicles (including forklifts) to operate within 30 feet of the enclosure during fumigation and aeration periods
  - The area outside the 30-foot perimeter is usually regarded as a safe distance from the tarpaulin
  - The 30-foot perimeter is **not** specifically mentioned on the AP, MP, $ECO_2FUME^{®}$ and $VAPORPH_3OS^{®}$ labels, but is required for safety to PPQ Officers

Important

Gas concentrations should never exceed 0.3 ppm phosphine and 5,000 ppm carbon dioxide in the safety zone (30 feet from the enclosure where officers are taking gas concentration readings).

Use colorimetric tubes or other approved devices to measure gas concentrations.

Electrical Power Supply

- An adequate electrical source must be available to run the dispensing equipment (ECO_2FUME® and $VAPORPH_3OS$® only)
  - A separate line should be available for the dispensing and blending units
  - Electrical outlets must be grounded and conveniently located in relation to the fumigation area
  - Except under emergency conditions, do **not** use generators as a power source

Water Supply

- A water supply is necessary for safety purposes; if no permanent water source is present on site, the fumigator must provide a portable, five-gallon supply of clean water

Well-Lighted Areas

- The area should have adequate lighting for safety purposes and for ease in reading the gas monitoring devices, thermometers, and for determining whether a tarpaulin has holes or tears

Step 2: Arranging the Stack

- Arrange the cargo in a square or rectangular shape, if possible, to make it easy to cover and to calculate the volume of the stack
  - An even-shaped stack is easier to tarp
  - The height of the stack should be uniform so dosage can be calculated accurately
  - By arranging the stack evenly and with space between pallets or cartons, the fumigant will be effectively distributed
- The maximum size for an enclosure is 25,000 ft^3
  - Contact the **Treatment Quality Assurance Unit** to get approval for any enclosures larger than 25,000 ft^3
  - For very large enclosures it may be necessary to add more sampling leads or introduce the fumigant at several sites
- When the fumigation involves multiple stacks, allow 10 feet of space between each uncovered stack; after the stack is tarped, there should be approximately five feet between enclosures

Step 3: Padding the Corners

Examine all areas that typically tear tarpaulins, e.g., corners and sharp angles. If the sharp angles or corners cannot be eliminated, they must be covered with burlap or other suitable padding (e.g., old tires or cloth).

Step 4: Covering the Stack

After covering the stack, check the tarpaulin for rips, tears, and holes. Look at the taped areas and verify they are properly sealed. Have the fumigator repair all holes.

The tarpaulin must be made of a tough material such as vinyl, polyethylene plastic, or coated nylon. The tarpaulins should be a minimum of 2-mil thickness, however, it is recommended to use 6 mil tarpaulins whenever possible.

The tarpaulin must be large enough to provide a floor overlap of at least 18 inches around all sides of the stack. Carefully lay the tarpaulin out to prevent excess folds or wrinkles along the floor, especially around corners.

Step 5: Sealing the Tarp

The goal in sealing the tarpaulin is to get it to lay flat against the floor to prevent gas from leaking out. Seal the tarpaulin with loose, wet sand, sand snakes, water snakes, adhesives, or a combination. If there is danger of crushing or crimping the gas sampling or introduction tubes, use the loose, wet sand. If using snakes, use two rows of snakes along the sides and three rows on the corners. The snakes should overlap each other by approximately one foot. Seal corners by laying two sand snakes around the corner and working the tarpaulin until it is flat. To force the tarpaulin against the floor, place a third snake on top of the two other snakes to provide additional weight. Loose, wet sand can be used in the area where the gas introduction line, electrical cords, and gas sampling tubes extend from under the tarpaulin.

Step 6: Introducing the Gas

Depending upon the type of AP or MP formulation used, the gas may be dispensed in a variety of methods. Follow the Application Procedures from the manufacturer's label for detailed instructions on gas introduction.

For $ECO_2FUME^{®}$ and $VAPORPH_3OS^{®}$, install the gas introduction line(s) at ground level on the floor or secured onto a pallet. These lines should **not** be located in or attached to commodity package and should be secured to eliminate the movement of the line(s). Direct the discharge toward the center of the space being treated and away from equipment if possible. For tarpaulin enclosures, control the dispensing rate of the gas. The tarpaulin can become damaged and sealing undone if the fumigant is dispensed at high speeds. For

small enclosures, a cylinder pressure less than 100 psig is recommended. A regulated dispenser with a pressure regulator and flow restricting nozzles are options to control the rate of the fumigant.

Place the fumigant cylinder with gas introduction line on a calibrated scale and take an initial weight reading. Ensure the gas introduction line is attached to the cylinder. After obtaining the correct weight, subtract the dosage to be introduced into the enclosure. After introducing the proper amount of gas, the scale will be balanced.

When no further fumigant is required to maintain target concentration levels, close all cylinder valves, depressurize the dispensing equipment, and disconnect all $ECO_2FUME^{®}$ or $VAPORPH_3OS^{®}$ cylinders. Replace the cylinder cap after the valve discharge cap is securely installed.

Step 7: Placing Gas Sampling Lines

Place a minimum of 3 gas sampling leads for fumigations up to 10,000 ft^3. Position the gas sampling tubes in the following locations:

- Front—low and front of the load, 3 inches above the floor
- Middle—center of the load (inside the box with the commodity), midway from bottom to top of load
- Rear—high and rear of the load, at the extreme top of the load

For fumigations from 10,001 to 25,000 ft^3, use 6 gas sampling leads. Position the gas sampling leads in the following locations:

- Front—low and front of the load, 3 inches above the floor
- Upper front quarter section (inside the box with the commodity)
- Middle—center of the stack (inside the box with the commodity), midway from bottom to top
- Upper rear quarter section
- Lower rear quarter section (inside the box with the commodity)
- Rear—high and rear of the stack, at the extreme top of the load

For approval of fumigations larger than 25,000 ft^3, contact the **Treatment Quality Assurance Unit** for instructions regarding the number of gas sampling leads, and for other technical information.

Before inserting into the commodity, cover the end of the gas sampling lines with burlap or wire gauze taped to the tube.

Use gas sampling lines of sufficient length to extend from the sampling position inside the enclosure to at least 30 feet beyond the tarpaulin. Connect all the gas sampling lines in one area for ease and safety in recording gas concentration readings. Do **not** splice gas sampling lines. Fix all gas sampling lines securely in place under the tarpaulin and label each one where the gas concentration readings will be recorded. By labeling each gas sampling line, concentration readings can be easily recorded.

Step 8: Testing For Leaks

To ensure they are within acceptable levels outside the fumigation area, monitor phosphine and carbon dioxide levels at the fumigation site and 30 feet from the fumigation enclosure. Phosphine and carbon dioxide levels can be detected using chemical-specific colorimetric tubes or electronic monitor's, e.g., Draeger and PortaSens detection kits. Do **not** use a Gow-Mac or Fumiscope to record gas readings.

The fumigator should leak test all connections and fittings before opening the cylinder valve. Instructions concerning cylinder leak detection can be found under the section "Poison Gas Hazards-Leak Detection and Repair" of the $ECO_2FUME^{®}$ and $VAPORPH_3OS^{®}$ fumigant Application Manuals.

Step 9: Monitoring Gas Concentrations

Take concentration readings within the enclosure using sampling lines connected to an APHIS-approved phosphine monitoring device. The fumigation does **not** begin until all of the gas has been introduced. Monitoring must take place 30 feet or more from the enclosure.

Phosphine and carbon dioxide levels can be detected using chemical-specific colorimetric tubes or approved electronic monitor's, e.g., Draeger and PortaSens detection kits. To determine if additional gas is needed, check gas concentration levels 30 minutes after the fumigant is added and periodically throughout the fumigation. Record gas concentration readings on PPQ Form 429 at the time intervals prescribed by the treatment schedule in the PPQ *Treatment Manual*.

The 30-minute reading shows the initial concentration and distribution of gas and can indicate leakage, incorrect dosage calculation, or error in fumigant introduction.

If the desired phosphine concentration is met before all of the gas is introduced, stop the addition of $ECO_2FUME^{®}$ or $VAPORPH_3OS^{®}$ and check all calculations. When fumigating with $ECO_2FUME^{®}$, 200 ppm of phosphine will release 7,700 ppm of carbon dioxide.

NOTICE

Erroneous readings can occur if the monitoring leads become blocked or crimped. It would be impossible to install a new monitoring lead during a fumigation treatment; therefore, always test monitoring leads before the treatment begins.

In order to detect blocked monitoring leads, follow the procedure below using a Mityvac hand-held pump (for supplier see Vacuum Pump, Appendix H).

- Prior to fumigant introduction, connect the Mityvac hand-held vacuum pump to a monitoring lead
- Squeeze the handle on the Mityvac unit. If the lead is blocked, a vacuum will be indicated on the vacuum gauge of the Mityvac unit. For monitoring leads longer than 25 feet, squeeze the handle two or three times. The Mityvac hand-held pump has the capacity to attain and hold 25 inches of Hg vacuum and a minimum of 7 psig pressure
- Disconnect the Mityvac hand-held pump from the monitoring lead, and repeat this procedure for each monitoring lead. Connect monitoring leads to the gas analyzer prior to fumigant introduction

Preparing to Fumigate Containerized Cargo

Containers require small amounts of phosphine, therefore, AP, MP, or $ECO_2FUME^{®}$ fumigant gas (**not** $VAPORPH_3OS^{®}$) is recommended for all container fumigations for which an approved treatment exists.

PPQ ***does allow*** the fumigation of nontarped containers provided the container can be completely sealed in order to prevent gas loss.

To fumigate containerized cargo, follow Steps 1through 9 in the previous section ***Preparing to Fumigate Break Bulk Cargo*** on **page 2-10-21**.

Additional Considerations for Fumigating Containerized Cargo

If fumigating a ***nontarped*** container:

- Close and secure one of the doors
  - Seal all openings and joints
  - If possible, caulk all joints and drape entire doorway with polyethylene sheeting, securing the edges to the inner walls, floor, and ceiling with duct tape
- Inspect the roof, floor, and walls for holes and cracks
  - Seal all openings with either duct tape or caulking compound
  - Containers require close inspection and a great deal of sealing to prevent fumigant leakage

- If possible, drape ***remaining*** doorway with polyethylene sheeting before the door is closed
  - Secure edges to door jambs and floor
  - Close door and secure
  - If doorway is draped with polyethylene, it may **not** be necessary to seal the door from the outside
  - If doorway is **not** draped, seal all cracks, openings, and joints with masking tape and caulking compound from the outside
- Placard all doors of the container with the appropriate warnings before fumigation begins

If fumigating a ***tarped*** container:

- If unable to completely seal the container, use a tarpaulin to cover the entire container
- Use a 4, 6, 10, or 12 mil vinyl, polyethylene plastic, or coated nylon tarpaulin
- After covering the container with a tarpaulin check for rips, tears, and holes
  - Examine all taped areas and verify they are properly sealed
  - Have the fumigator repair all holes
- The tarpaulin must be large enough to provide a floor overlap of at least 18 inches around all sides of the container—carefully lay the tarpaulin out to prevent excess folds or wrinkles along the floor, especially around corners

Preparing to Fumigate Bulk Commodities

AP, MP, $ECO_2FUME^{®}$ and $VAPORPH_3OS^{®}$ can be used to fumigate any type of bulk commodity storage for which there is an approved treatment in the PPQ *Treatment Manual*. These include, but are **not** limited to bins, tanks, flat storage, and bunkers. The most important aspects of a successful fumigation, as with any fumigant, are the degree to which the space is sealed and the assurance that the minimum fumigant concentrations are maintained for the required time.

To fumigate bulk commodities, use the procedures outlined in the section, ***Preparing to Fumigate Break Bulk Cargo*** on **page 2-10-21**.

AP and MP Fumigation

Probing

When large quantities of grain or other commodity in bulk are to be treated, it will be necessary to "probe" tablets or pellets into the mass of the commodity for adequate distribution. Specially constructed probes made of steel tubing one and one-quarter inch in diameter are generally available as described below:

- **Head Piece—**Dosing device and numerical counter to indicate number of tablets used
- **Tubing—**Usually in three-foot sections that can be added to one another to provide the desired length
- **End Piece—**Cut obliquely and provided with a hinged flap, closing the entrance to the tube
  - When the tube is inserted into the commodity, the flap is closed and prevents the commodity from entering
  - When the probe is withdrawn, the flap opens due to the slightly larger diameter on the flap
    - The tablets or pellets are then released one at a time as the probe is withdrawn

Grain or other bulk or loose commodities up to 30 feet deep can be probed. Best results are obtained by probing twice every square foot and as regularly as possible. Penetration of phosphine is up to 10 feet below the area in which the tablets are placed. When large bulk grain stores are treated, many probes can be placed prior to treatment. One head piece can be moved from probe to probe, or pellets or tablets can be placed in the tubes by hand (use surgical or disposable thin rubber or polyethylene gloves).

Gas generation starts within four hours of placing the pellets or tablets (depending on relative humidity). Therefore, the whole procedure of pellet or tablet placement or tarpaulin covering must be accomplished within this time frame. It is possible to work in a probed area if the area is covered with a gas-proof tarpaulin. Monitor gas concentrations to determine if toxic levels are approached take corrective action to prevent exposure.

Additional Considerations for Fumigating Bulk Commodities

- For large storage facilities (>25,000 ft^3), consider multiple dispensing points to assist in fumigant distribution
  - Contact the ***Treatment Quality Assurance Unit*** on **page 2-10-36** for a determination on the number of sampling lines for large fumigations

- Based on the size of the structure being fumigated, refer to the $ECO_2FUME^{®}$ and $VAPORPH_3OS^{®}$ Application Manuals for acceptable dispensing equipment
- If it is known ahead of time that grain or cottonseed will require treatment prior to placement in a means of conveyance or storage, the space should be properly sealed before loading—tarpaulins of at least 6 mm thickness should be used if walls are permeable since lighter tarpaulins may tear
- If a bulk shipment is in a large storage facility with a high roof, it may be better to tarp on top of the grain rather than seal the roof
  - When side walls of the facility are **not** gas impervious, tarpaulins (minimum 6 mm thickness) can be placed around the outside of the facility to the height of the commodity

Intransit Ship Board Fumigation

Until further studies provide the appropriate efficacy data, the **Treatment Quality Assurance Unit** does **not** allow the use of $ECO_2FUME^{®}$ or $VAPORPH_3OS^{®}$ fumigant aboard vessels.

However, the solid formulations of AP and MP are approved for use on wood chips for export in ship holds. For guidelines on how to conduct this type of fumigation, refer to the section below, ***Intransit Fumigation of Wood Chips*** on **page 2-10-31**.

Intransit Fumigation of Wood Chips

The TQAU has approved the use of a low-flow recirculation system for the fumigation of coniferous wood chips within ship holds. The technique is based on a patented system for recirculation of phosphine gas in commodity storages such as silos, ship holds, flat storages and other structures. The recirculation system facilitates the rapid and even distribution of phosphine throughout the stored commodity. Phosphine gas is pumped through ductwork using specially designed low volume fans which operate either continuously or intermittently. The gas is drawn from the head space of the ship hold and is blown, via ducting, to the bottom of the hold where it moves upwards through the wood chips to the top of the hold. This recirculation system is a critical component of the fumigation process and is required for all in-transit wood chip fumigations.

Pest of Concern

Coniferous wood chips exported from the United States of America are fumigated to eliminate the pinewood nematode (*Bursaphelenchus xylophilus*) which is a concern to certain importing countries. Heat generated from oxidative processes in the center of the wood chip pile is typically sufficient to kill the pinewood nematode. However, those nematodes that inhabit the wood chips in the outermost layers of the piles and at the bottom of the hold where

temperatures are optimal for their survival are the targets of the fumigation. The incorporation of a recirculation system guarantees phosphine gas will reach all areas of the ship hold to eliminate the pinewood nematode.

Fumigant

Prior to fumigation, the fumigator must verify that the certified applicator follows the EPA-registered label requirements for aluminum phosphide tablet fumigants and the U.S. Coast Guard regulations regarding shipboard fumigation (See Coast Guard Regulations in Appendix B regarding 46 CFR 147A) and applicable State and local laws and regulations.

Aluminum phosphide tablets are preferred over pellets because tablets release the phosphine gas at a slower rate, thus minimizing peak gas concentrations and slowing gas leakage rates. Fumigate with phosphine at 115-145 tablets per 1000 cubic feet (ft^3) according to the label requirements, however, verify the amount of phosphine to use from the EXCERPT database. Refer to***Figure 2-10-2*** on **page 2-10-9** for the amount of phosphine liberated by various products. A PPQ officer must be present during the application of the tablets to verify the proper dosage has been dispensed. For exports, document the treatment in the treatment section of the Phytosanitary Certificate. Record all information regarding the fumigation in the electronic 429 database.

To determine the length of time to fumigate the wood chips while in-transit, refer to ***Figure 2-10-7*** on **page 2-10-32**.

Figure 2-10-7 Commodity temperature and exposure period

Temperature of Commodity	Exposure Period
Below 40 °F	Do **not** fumigate
40-53 °F	10 days (240 hours)
54-59 °F	5 days (120 hours)
60-68 °F	4 days (96 hours)
Above 68 °F	3 days (72 hours)

The temperature should be taken from the surface of the wood chip pile after the commodity is loaded into the ship hold. Insert a calibrated long-stem thermometer to a minimum depth of 6 inches. Measure the ambient air of the ship hold with a calibrated thermometer. It must be a minimum of 40 °F. When the hatch is closed, air temperature will equilibrate to the commodity temperature rather quickly if the hold is filled to capacity. If the commodity and/or ship hold temperatures are below 40 °F the treatment must be postponed until the minimum requirement of 40 °F is met.

Equipment

Fans

The recirculation system must consist of one fan per ship hold. The type of fan used depends on the total volume of the hold. Fans used in recirculation fumigation systems are typically rated in bushels per minute.

Important

To determine the appropriate fan capacity to be used, convert bushels to cubic feet (1 bushel is equal to 1.24 cubic feet) and then refer to **Table 2-10-1**.

Table 2-10-1 Fan Capacity Based on Volume of Hold

Volume of Hold (ft^3)	Fan Capacity (cfm)
62,000 - 248,000	199
248,000 - 372,000	343
372,000 - 744,000	490

EXAMPLE: 124,000 bushels of wood chips are to be fumigated for export. Calculate the total fan capacity (cfm) to be used in the ship hold.

124,000 * 1.24 = 124,000 ft^3

Therefore, use a fan that has the capacity of 199 cfm.

The fans are secured in the headspace, either to a man way ladder or to a platform inside the hold (***Figure 2-10-8*** on **page 2-10-34**). After the fan is installed, connect it to a data logger that has the ability to record the amount of time the fan is operational and when the fan motor was turned on or off during the fumigation. Contact the **Treatment Quality Assurance Unit** for approved data loggers. The information must be presented to the importing country upon arrival to verify the fan was operational for a minimum of 48 hours during the fumigation process. If the records indicate the fan was **not** operational for a minimum of 48 hours, the treatment should be documented as incomplete and the **Treatment Quality Assurance Unit** should be contacted immediately. Record the initial time the fan was turned on in the comments section of the electronic 429 database.

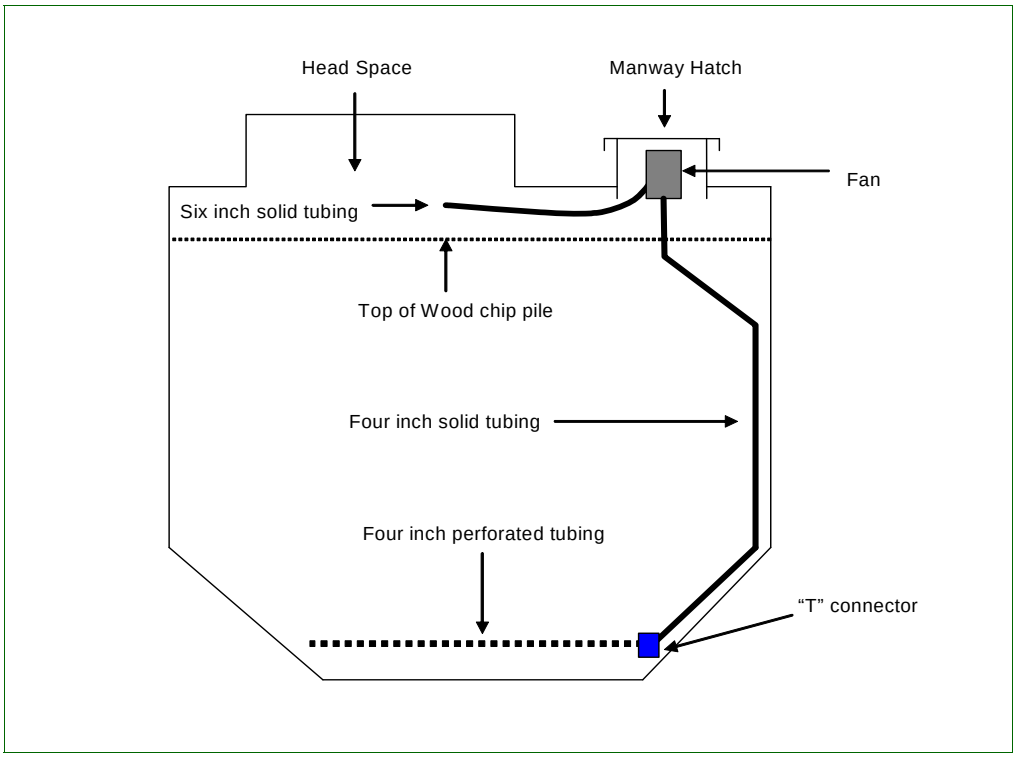

Figure 2-10-8 Side view of a recirculation system

Tubing

Different types of high density corrugated polyethylene tubing are used for the recirculation system (***Figure 2-10-9*** on **page 2-10-35**). Connect 6" diameter solid tubing to the intake side of the fan and place on the surface of the wood chips in the headspace. Connect 4" diameter solid tubing to the exhaust side of the fan and attach behind or beside the man way ladder that runs to the bottom of the hold. Attach a polyethylene "T" connector to the bottom of the 4" diameter, solid tubing at the bottom of the hold. Each side of the "T" connector is attached to 4" diameter perforated tubing which runs in opposite directions around the perimeter of the hold along a minimum of three walls of the hold.

All of the tubing should be taped and/or glued in place before the commodity is loaded into the hold. Conduct a visual inspection of the recirculation system prior to the loading of wood chips. If the recirculation system is **not** installed properly, the fumigation will be delayed until necessary corrections are made to the system.

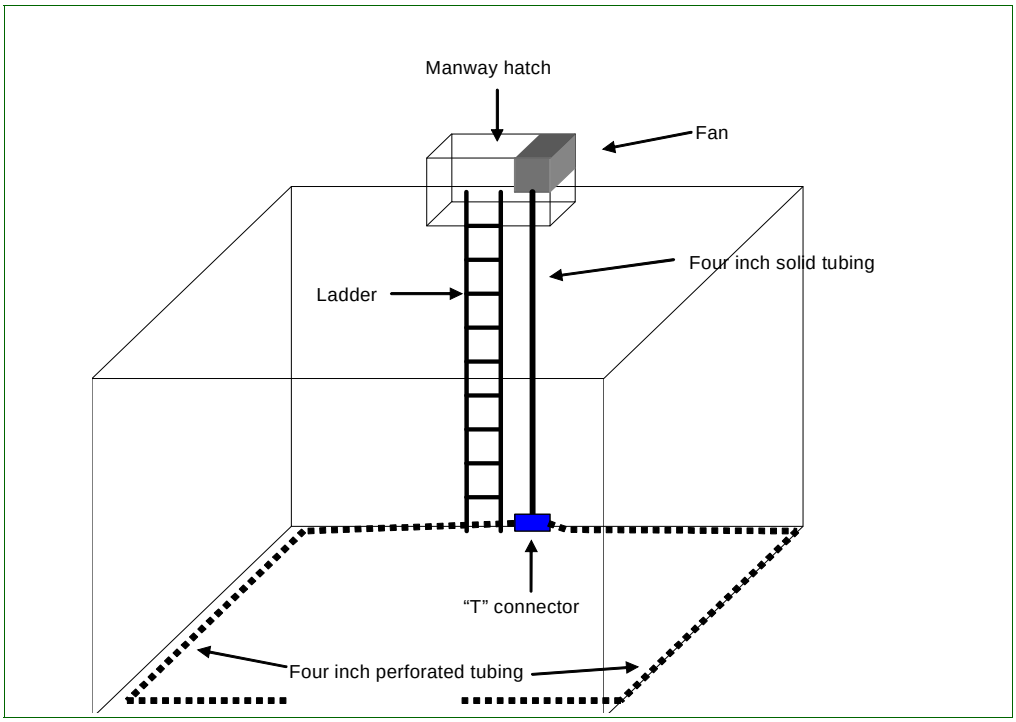

Figure 2-10-9 Three-dimensional view of a recirculation system

Aeration Requirements

Break Bulk, Containers, and Bulk Fumigations

Following completion of treatment, phosphine-treated commodities must be aerated using either electric exhaust fans or by passive aeration in the open air. Personnel are **not** allowed to enter or reenter fumigated areas until gas concentrations are determined to be below the Threshold Limit Values (TLV) for phosphine and carbon dioxide. Check ambient air and the air inside the box, carton, bin etc. of the commodity during aeration. Measure gas concentration levels with a sensitive gas detection device. Aerate all commodities to acceptable tolerance levels (**Table 2-10-2 on page-2-10-36**). Because they can continue to release gas after the initial gas levels have dropped to acceptable levels, continue to monitor densely packed commodities. A certified applicator must be physically present, responsible

for, and maintain visual and/or voice contact with all fumigation workers during the initial opening of the fumigation structure for aeration. Always follow the aeration instructions provided with the fumigant label.

Table 2-10-2 Phosphine Residue Tolerances

Commodity	Tolerance of Phosphine Residues (ppm)	Minimum Aeration Period (hours)
Animal Feeds, Grains, Nuts, and Dates	0.1	48
Processed Foods	0.01	48
Fresh fruits and Vegetables	0.01	48
Nonfood Commodities	<0.3	None
Tobacco	<0.3	48

Disposal of AP and MP Residue

Following treatment with AP, a powdery residue, essentially aluminum hydroxide, will remain. Collect this material and mix it in a container of water to which liquid detergent has been added (two tablespoons of detergent per gallon of water). The liquid should then be buried or deposited in an approved pesticide disposal landfill.

Following treatment with MP, dispose of the plates by burial in an approved landfill or by burning where approved by local ordinances.

Follow the manufacturer's label instructions for detailed disposal guidelines.

Contacts

Cytec®

Cytec Industries
5 Garret Mountain Plaza
West Patterson, NJ 07242
Phone: 973-357-3100
email: INFO@CYTEC.COM

http://www.cytec.com/business/phosphine/products/phosphinegas.shtm

Treatment Quality Assurance Unit

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2

Treatment Manual

Chemical Treatments

Aerosols and Micronized Dusts

Contents

Introduction **2-11-1**
Aerosols **2-11-1**
Micronized Dusts **2-11-2**
Cartridges **2-11-2**
Equipment **2-11-2**
Methods and Procedures for Application **2-11-2**
Treatment of Passenger Compartments and Cargo Aircraft **2-11-2**
Treatment of Separate Cargo Compartments and Containerized or Palletized Cargo **2-11-3**
Precautions for Both Aerosols and Micronized Dusts **2-11-4**
Precautions in Use of CO_2 Fire Extinguishers **2-11-4**

Introduction

This section includes information about aerosols and micronized dusts. Use this information with the d-phenothrin treatments from ***T409—Aircraft*** on **page 5-5-29**, and with ***Table 5-5-2*** on **page 5-5-31**, to conduct a safe and effective aerosol disinfestation.

Aerosols

When applying an aerosol, the dispenser nozzle(s) should be directed upward at a 45° angle and moved from side to side in order to get uniform distribution of the material. During discharge, the dispensing valve should be depressed fully, and the nozzle held 45 cm (18 inches) or more from all surfaces. Devices are available for depressing the valve and expending all the aerosol in the can or a trigger mechanism for ease in dispensing the material. Aerosol dosages are based on a dispensing rate of 1 g per second, unless otherwise noted. The applicator should use a dust mask, or face mask (with filter) for personal protection. The PPQ quarantine dosage shall **not** be applied in the presence of passengers, crew, or animals, except as noted in the schedules.

Micronized Dusts

Both domestic and foreign quarantine programs use dust to kill pests such as the Japanese beetle and pests of foreign origin. This method may be used in treating aircraft, railroad cars, trucks, and palletized or containerized cargo. Specific instructions for domestic quarantine use are included in Program Manuals.

Cartridges

Prefilled cartridges are used (available as follows: green–1 g; yellow–3 g; red–5 g; and blue–13 g). Combinations of these sizes will give the correct amount and the dust may be combined into a single cartridge to reduce the number of individual “shots” required. Care must be taken in combining the material to insure no exposure to the dust occurs through dermal contact or inhalation.

Store filled pesticide cartridges in a cool, dry, protected location. Damaged cartridges and empty cartridges should be disposed of by placing them in refuse containers in accordance with recommendations for the safe disposal of pesticide containers. When treating aircraft, refer to ***T409—Aircraft*** on **page 5-5-29** which lists the cubic capacity and application schedules for most commercial and military aircraft. Do **not** deduct the space occupied by cargo in computing the required treatment rate.

Equipment

Compressed CO_2 or compressed air is used to expel the dust. A modified CO_2 fire extinguisher with a standard release valve may be used. The 10-lb. CO_2 capacity extinguisher, which weighs 35 to 40 pounds when full, is convenient and safe for use. Sufficient gas for 25 to 30 releases is contained in this size. Smaller modified extinguishers are also satisfactory. Compressed air units must be specifically designed for expelling dust and are **not** readily available.

Specifically developed micronized dust guns with proper connections may be available through the Program Support Staff in Riverdale, MD.

Methods and Procedures for Application

Treatment of Passenger Compartments and Cargo Aircraft

All entry doors and other openings should be closed and all ventilation systems stopped before discharge of dust. The door to the pilot’s compartment must be closed. On aircraft with a baggage compartment immediately behind the pilot’s and no door to separate these compartments, place a screen of plastic or other

suitable material between the baggage compartment and the pilot's compartment. Galleys shall be closed off by means of doors or a screen of plastic, etc., which will prevent the entry of the pesticide.

The single nozzle gun recoils or kicks back when discharged. Therefore, it must be held firmly with one hand while the other hand is used to trigger the release of the CO_2. Keep the host between the extinguisher and the gun as straight as possible to reduce kickback. A position should be taken much like that used when firing a large caliber pistol. Rest the bottom of the gun on a solid object if possible. Kneeling on one knee may be necessary if the host to gun is short. A 1-second blast is sufficient. The discharge nozzle should be directed above the top of the seats or cargo to assure unimpeded flow of the dust cloud from the release point.

On smaller types of aircraft, stand behind the first seat to discharge the dust. Leave the aircraft immediately after release; close the door quickly to avoid disturbing proper dust distribution.

In larger aircraft, discharge the dust from the front behind the pilot's compartment or from the rear depending on location of exit doors. Remain in the craft only long enough for the dust cloud to appear to have reached the other end of the craft—about 1 minute. The dust cloud may **not** return from the opposite end of the large aircraft. Judgment should be used by the inspector as to the best location for firing if partitions are present.

A recently designed gun has two nozzles facing in opposite directions. Since the gas and dust are expelled from both nozzles, no "kick" results. The operator should stand in the middle of the large compartment when firing the charge.

After dust has been discharged, the officer will leave the aircraft, close the door, and hold the aircraft closed for 10 minutes.

Unless responsible personnel remain near the craft to prevent inadvertent entry by others, place a treatment notice, PPQ Form 468, on the entry door. Cargo or passenger area ventilation systems shall **not** be in operation during the application and settling periods. After a 15-minute aeration period, the aircraft may be reentered.

Treatment of Separate Cargo Compartments and Containerized or Palletized Cargo

Cargo compartments in bellies of aircraft will be treated by opening the doors sufficiently to insert the applicator nozzle. After firing, close the door quickly and do **not** open for at least 10 minutes. Treatment of such compartments may

require two people, one to operate the doors and the other to operate the gun. Containerized cargo is treated by lifting the cover or otherwise inserting the nozzle in the container. After discharge, the cover should be quickly closed.

Precautions for Both Aerosols and Micronized Dusts

1. Treatment shall **not** be applied when animals or people are present.
2. Food should be removed or covered prior to treatment.
3. Food preparation surfaces and equipment shall be covered to prevent contamination.
4. A suitable respirator, approved by the National Institute of Safety and Health (NIOSH) shall be worn by the person applying the pesticide. **EXCEPTION:** A respirator is **not** required when the pesticide label or this manual specifies that use in the presence of people is acceptable.
5. Goggles are optional equipment and should be worn if the person applying the pesticide experiences any eye irritation.
6. Do **not** smoke or eat during application and **not** until after washing. Wash as soon as possible after application of pesticides.
7. Any pesticide residue noted on smooth surfaces after treatment should be wiped away using a clean damp cloth. (If a deposit of dust is noted on the floor immediately after discharge, a blast of compressed air or CO_2 will usually clear the area.)

Precautions in Use of CO_2 Fire Extinguishers

1. Discharging CO_2 chills metal and can cause freezing injury to bare hands. Do **not** touch the nozzle immediately after discharge. It may be advantageous to wear a glove on the gun hand if several discharges are to be made in close succession. Do **not** hold the release valve open longer than necessary to expel the dust (about a second).
2. Replace the safety pin in the CO_2 tank valve after each use and secure with wire or tape. Accidental release could result in severe injury.
3. Keep the face away from openings when applying material in a luggage compartment or to containerized cargo to avoid dust backlash.
4. Check the flexible hose between the CO_2 tank and dust gun. Pay particular attention to the areas near the connections. Replace the host when it shows wear.

2

Treatment Manual

Chemical Treatments

Dips

Contents

Overview **2-12-1**
Safety and Dip Treatment Equipment and Materials **2-12-1**
Dip Treatment Procedures **2-12-3**
Safety Responsibilities **2-12-5**

Overview

As with other treatments, chemical dips require careful planning and preparation. Make sure you have all the necessary safety and treatment equipment and materials ready before you start the dip treatment procedure. When you handle pesticides, always comply with the pesticide Label instructions, and State and local regulations.

Safety and Dip Treatment Equipment and Materials

The following lists include safety equipment (Personal Protective Equipment, PPE) and basic material that you will need for dip treatments. However, other materials may be required by additional Label requirements that are specific to chemical being used.

Personal Protective Equipment (PPE)

Always check the Label and Material Safety and Data Sheet (MSDS) for additional requirements of personal protective equipment. The following is a basic list of PPE that you will need for dip treatments:

- chemical-resistant footwear (rubber or neoprene boots)
- chemical-resistant gloves (neoprene)
- chemical-resistant headgear for overhead exposure
- chemical-resistant rain suit with hood
- protective eye wear (goggles)
- respirator (per Label and MSDS requirements)

Dip Treatment Equipment and Materials

Always check the Label for additional requirements for equipment and materials. The following is a basic list of equipment and materials you will need for dip treatments:

- Newspaper or any other absorbent paper

Important

Place plastic backed paper on pallets prior to covering with paper and/or absorbent paper to preclude the pesticide being absorbed onto the wood.

- Pesticides

Important

Pesticides should be fresh (**not** over 1 year old). Labels and MSDS must be attached to the pesticide container and all instructions must be followed.

- Mixing containers and dipping containers must be provided with lids to prevent spills during transportation and storage.
- New boxes (when reconditioning or excess contamination of original boxes is **not** possible)
- Fans[1]

Important

A mechanical exhaust is the preferred method of aeration when it is specifically installed to remove chemical fumes from the treatment area. Fans may be used if they do **not** cause airborne pesticides to contaminate the treatment facility or the breathable air. The flow of air should be across the dip vat/container and away from people in the treatment area.

- Pallets[1]

Important

Place plastic backed paper on pallets prior to covering with paper and/or absorbent paper to preclude the pesticide being absorbed onto the wood.

- Plastic bags (4 to 6 mil plastic)[1]
- Shear scissors
- Sponges
- Liquid soap[1]
- Packing material[1]

1 This equipment will be provided by USDA when available.

Dip Treatment Procedures

Step 1—Plan for the Dip Treatment

Before you start the dip treatment, inform the customer (Broker/Importer) of the specific material and personal protective equipment (PPE) that will be needed to perform the dip treatment procedure. All required materials and equipment must be available at the time of treatment.

Step 2—Designate Restricted Use Areas

Designate the following restricted use areas:

- **Measuring and mixing area-** The measuring and mixing area for the specific pesticide(s) must be in a well ventilated area away from food preparation, eating areas, and offices. Areas that contain mechanical exhaust systems are preferred.
- **Plant material dipping area-** The plant material dipping area must be an area where access is limited by a barricade or warning signs. Areas that contain mechanical exhaust systems are preferred.
- **Plant material drying area-** The plant material drying area must have proper air circulation and exhaust ventilation. These areas should be closed to the dipping area. The route from the plant dripping area to the drying area should be lined with plastic backed absorbent paper or plastic and paper to catch excess pesticide solution.

Step 3—Prepare Plant Material

Prepare the plant material for the dip treatment according to the PPQ Treatment Manual and pesticide Label requirements.

Step 4—Prepare the Pesticide Solution

CAUTION

Wear personal protective equipment (PPE) and keep the exhaust system running when you are preparing pesticide solutions. To minimize your exposure to the pesticide dust or airborne particles, keep the pesticide between you and the exhaust.

1. Measure the amount of water required for the treatment.
2. Measure the amount of pesticide required for the treatment.

Important

It is important to use fresh chemicals for every solution. If questions arise during this procedure, stop and seek assistance from the Center for Plant Health Science & Technology (CPHST) (Tel: 919-855-7450).

3. Prepare a pesticide paste as follows:
   A. Add the previously measured amount of water into a clean and empty container, for example, an empty can or plastic container.

B. Form a paste (with dry pesticides) by adding the measured pesticide to the small amount of water and mix gently

C. Dilute the paste by slowly adding more water from the previously measured water

D. Slowly add the concentrated solution(s) to the rest of the measured water

4. Add some drops of liquid soap to the solution (soap is used as a sticking agent).

5. Mix the final solution by stirring it gently.

Step 5—Dip the Plants in the Pesticide Solution

Dip the plants in the solution for the time required by the PPQ Treatment Manual.

Step 6—Remove the Plants from the Pesticide Solution

Remove the plants from the solution and allow excess solution to drip into the dipping container.

Step 7—Dry the Plants

Place the plants on newspaper covered pallets and allow them to dry (make sure to space the plants out for maximum drying).

CAUTION

Plants should be dried thoroughly before releasing them to the customer.

Step 8—Disinfect Original Shipping Containers

Disinfect the original shipping containers with a sponge containing the pesticide solution. The plant material may be packed with new packing material in a previously used container that has been disinfected.

Step 9—Clean Up the Treatment Area and Equipment

Discard all empty containers, excess pesticides, packing materials, plastic bags/backing materials, and newspaper/absorbent paper in compliance with instructions on the Label and State/Local regulations. Decontaminate all treatment areas and equipment while you are wearing your PPE.

Step 10—Release the Cargo

After the plant material is dry, release it to the customer or broker if agreed to by the airline and if it has been released by Customs.

Safety Responsibilities

The PPQ Officer is responsible for the following safety issues:

- Make the broker/importer aware of his or her responsibilities as it pertains to:
  - Materials
  - Personal Protective Equipment (PPE)
  - Health hazard and safety concerns when performing the dip treatment process
- All personnel involved in the dip treatment process are required to wear the appropriate and Label required PPE while performing the treatment. PPQ Officers may need to wear PPE if the dip treatment process area prevents them from observing the process from outside the restricted area.
- Designated dip treatment process areas must be located away from food preparation, eating areas, and offices. Al efforts should be made to place dip treatment processes in an area containing a mechanical exhaust.
- The broker/importer personnel involved with treatments must be aware and briefed on the location of the emergency eyewash and all other required safety equipment. They also need ti be aware of the areas that they will be limited to working within and any other specific restrictions determined by the PPQ Officer in charge of the process. The PPQ Officer monitoring the process should be aware of procedures to be followed in the event of an accidental release of the pesticide or an injury to one of the broker/importer's personnel.
- The broker/importer's personnel should shower as soon as possible after performing a dip treatment. The PPQ Officer should ensure that personnel are aware of the location and route to the shower. Guidance should also include instruction on how to disrobe and dispose of clothing used during dip treatment processes. All contaminated clothing and PPE must be removed before entering the shower room. Contaminated clothing should be placed in plastic bags and PPE in Separate plastic bags.
- Broker/importer personnel should be informed that clothes wore during treatment must be washed in hot water with detergent and that they should be washed separately from other clothes
- The plant material should be released to the Broker/importer only if they are using/provide a vehicle that has a compartment physically separated from the cab, for example, a pick-up truck of tractor trailer.

2

Treatment Manual

Chemical Treatments

Dusts

Contents

This section for future development.

2

Treatment Manual

Chemical Treatments

Sprays

Contents

This section for future development.

3

Treatment Manual

Nonchemical Treatments

Overview

Contents

Overview **3-1-1**
Heat **3-2-1**
Cold Treatment (CT) **3-7-1**
Irradiation **3-8-1**

The Nonchemical Treatment section of this manual is organized by the following nonchemical categories:

- Heat
- Cold
- Irradiation

Use the Table of Contents that follows each tab to quickly find the information you need. If the Table of Contents is **not** specific enough, then turn to the Index to find the topic and its page number.

3

Treatment Manual

Nonchemical Treatments

Heat

Contents

Introduction **3-2-1**
Heat, Hot Water Immersion Treatment **3-3-1**
Heat • Steam Treatments **3-4-1**
Heat • Vapor Heat and Forced Hot Air Treatment **3-5-1**
Heat • Forced Hot Air • Niger Seed **3-6-1**

Introduction

Heat treatments are generally based on maintaining the plant material at a specific temperature for a specified time. Heat treatments, as other quarantine treatments, are designed to kill plant pests without destroying or appreciably devaluing the infested commodity. The following heat treatments are described in this section:

- Hot Water Immersion Treatment
- Steam Treatments
- Vapor Heat and Forced Hot Air Treatment
- Forced Hot Air - Niger Seed

3

Treatment Manual

Nonchemical Treatments

Heat, Hot Water Immersion Treatment

Contents

Hot Water Immersion Treatment (in General) **3-3-2**
- Principle **3-3-2**
- Schedules **3-3-2**
- Procedures **3-3-2**

Checklist of USDA-APHIS Minimum Requirements for Hot Water Immersion Treatment Facilities: General Requirements **3-3-3**
- Proposal Submission **3-3-3**
- On-Site Inspection Option **3-3-4**
- Facility Design **3-3-4**

Electrical and Electronic Components **3-3-5**
- Wiring **3-3-5**
- Computers and Microprocessors **3-3-5**
- Commercial Line Conditioner (Surge Protector) **3-3-5**
- Electrical Generator **3-3-6**
- Fruit Sizing Equipment **3-3-6**

Boilers and Thermostatic Controls **3-3-6**
- Adequate Water Heating Capacity **3-3-6**
- Thermostatic Controls (Set Point) **3-3-6**
- Multiple Set Point Option **3-3-6**

Water Circulation **3-3-7**

Temperature Sensors **3-3-7**
- Type of Sensor **3-3-7**
- Number of Sensors Required and Their Placement **3-3-7**
- Tank Access for Temporary Placement of Portable Sensors **3-3-8**
- Certified Glass-Mercury, Non-mercury, and Digital Thermometer **3-3-8**

Temperature Recorder **3-3-8**
- Automatic Operation **3-3-8**
- Long-Term Recording **3-3-8**
- Recording Frequency **3-3-8**
- Accuracy **3-3-9**
- Repeatability **3-3-9**
- Calibration **3-3-9**
- Range **3-3-9**
- APHIS-Approved Recorder Models **3-3-9**
- Approved Strip Chart (Pen) Recorder Models **3-3-10**
- Approved Data Logger Recorder Models **3-3-10**
- Chart Paper Specifications **3-3-11**

Alarm System **3-3-11**

Safeguarding the Treated Fruit **3-3-12**
Layout and Flow Pattern **3-3-12**
Garbage Disposal **3-3-12**
Quarantine Area **3-3-12**
Pretreatment Warming Options **3-3-13**
Post-Treatment Cooling Options **3-3-13**
Refrigerated Room **3-3-13**
Fans **3-3-13**
Hydrocooling **3-3-13**
Facility Changes **3-3-14**
Safety and Health Checklist **3-3-14**
Work Plan **3-3-15**
Address for Technical Contact **3-3-15**

Hot Water Immersion Treatment (in General)

Principle

Hot water immersion treatment (also called hydrothermal treatment) uses heated water to raise the temperature of the commodity to the required temperature for a specified period of time. This is used primarily for certain fruits that are hosts of fruit flies, but may also be used for nursery stock for a variety of pests.

Schedules

Refer to the appropriate section in the Treatment Manual for Treatment Schedules. The time/temperature relationship varies with the commodity and pest. Typically, the pulp temperature is raised using water heated to between 115 °F and 118 °F for a prescribed period of time.

Procedures

- Before the start of each treatment, examine the facility for proper operation of the heating, circulation, and recording equipment. Examine continuous flow equipment (submerged conveyor belt) at the start of each day or run
- Commodities subject to size restrictions require a preliminary culling procedure to eliminate oversized items prior to treatment
- Conduct all treatments in an approved tank
- Entire treatment will be under the general monitoring of APHIS, and may be further governed by a signed Work Plan (for foreign facilities) or Compliance Agreement (for domestic facilities)

- Load immersion tanks in a manner approved by the U.S. Department of Agriculture (USDA), usually using baskets with perforations that allow adequate water circulation and heat exchange
- Number each treatment container or lot before placing in the immersion tank
- Record the temperature and duration of each hot water dip with an automatic temperature recording system
  - A responsible employee of the packing company must indicate on the printed temperature record the starting time, lot number, duration of each treatment, and initial each entry
  - An alternative recording system can be used only with prior APHIS approval
  - During certification, the average pulp temperature becomes the minimum commercial treatment pulp temperature
  - During commercial treatments, the "Adjusted Tank Sensor Temperature" in is used as the lowest treatment temperature. Refer to ***Figure 6-5-1*** on **page 6-5-3** for more information.
- Stamp all boxes of hot water-treated fruit, *Treated with Hot Water, APHIS-USDA*, together with the numerical designation APHIS has assigned to the particular treatment facility
- When treatment is complete, promptly move commodities treated at origin to an insect-free enclosure
  - Maintain the insect-free commodities throughout the shipping process, this can be accomplished by using insect-proof containers, screened or enclosed rooms, doors with air-curtains, or some combination of the above

Checklist of USDA-APHIS Minimum Requirements for Hot Water Immersion Treatment Facilities: General Requirements

Proposal Submission

Follow the accepted protocol in the Commodity Preclearance Program Management Guidelines when submitting proposals for new hot water facilities.

On-Site Inspection Option

When the construction is 75 percent complete, the firm can request APHIS to make an on-site inspection. This interim inspection is optional. However, a final inspection is required as well as performance tests of the equipment. All costs involved must be prepaid by the requesting firm.

Facility Design

APHIS does **not** provide construction details, but only this list of minimum requirements. Design and construction of the hot water facility is the responsibility of the owner, in consultation with an engineering firm. (Engineering firms and sources of supply are provided in ***Reference Guide to Commercial Suppliers of Treatment and Related Safety Equipment*** on **page H-1-1**.) To take into account variations in facility size, availability of materials, economic feasibility, and individual preference, APHIS allows a wide range of design flexibility.

Although each facility is somewhat unique, there are two basic designs for hot water facilities. The two types are referred to as the *batch system* and the *continuous flow system.*

Batch System (Sometimes Called "Jacuzzi System")

Most hot water immersion treatment facilities are the batch system type. In this system, baskets of fruit are loaded onto a platform, which is then lowered into the hot water immersion tank where the fruit remain at the prescribed temperature for a certain length of time, then are taken out, usually by means of an overhead hoist. In this system, the treatment chart must indicate (by an identifiable marking) when a fruit basket is prematurely removed from the tank. Other alternatives include a solenoid switch, sensor, or similar device that disengages whenever a basket is removed from the treatment tank, or a locking device to make it physically impossible to remove the fruit until the treatment is fully complete.

Continuous Flow System

In the continuous flow type of system, the fruit are submerged (either loosely or in wire or plastic mesh baskets) on a conveyor belt, which moves slowly from one end of the hot water tank to the other. Belt speed is set to ensure the fruits are submerged for the required length of time. This system requires an instrument to monitor the speed of the conveyor belt. This can be accomplished by attaching a speed indicator (encoder) to the gear mechanism. The belt speed is recorded on the same chart as the time and temperature, and also indicates whether the belt is moving or stopped during the treatment cycle. Smaller fruits require less treatment time than larger fruits. Therefore, conveyor belt speed should be adjustable to accommodate treatments of different lengths of time. As an alternative, the belt speed may remain constant, but the length of the submerged portion of the belt is adjusted according to the length of treatment time required for the particular size of fruit. The conveyor must prohibit either forward or backward movement of the fruit during treatment (due to flotation).

Some operators believe that treating fruit while it passes through the system on a conveyor belt is an advantage. Few new systems of this type were built after 1990, presumably because mechanical fruit damage (scratching of the peel) often occurs if the fruit are not in baskets. The system also occupies much more floor space in the plant than a batch system.

Water Quality

The water used for washing, dipping, hydrocooling or showering the fruit should be chlorinated at a level **not** to exceed 200 parts per million (ppm). This level is easier to maintain if the water is first filtered and run through a flocculation process to remove organic material that would otherwise bind with the chlorine.

The facility should check the water for microbial contamination on a regular basis. To maintain sanitary conditions, change water as necessary. Implement standard operating procedures to include water change schedules for all processes that use water. To ensure the safety of the fruit, the facility must clean and sanitize surfaces that come into contact with water, such as wash tanks, hot water tanks, and hydrocooling tanks as often as necessary. To ensure efficient operation, routinely inspect and maintain equipment designed to assist in maintaining water quality, such as chlorine injectors, filtration systems, and backflow devices.

CAUTION

Periodic monitoring by the facility is critical, because chlorine levels above 300 ppm can result in metal corrosion.

Electrical and Electronic Components

Wiring

Electrical wiring throughout the facility must meet both international as well as local safety code requirements. To eliminate shock hazard, earth grounding is required for all electrical wiring located in the vicinity of water. To prevent damage, shield wires inside metal or PVC conduit.

Computers and Microprocessors

To maintain accuracy and reliability, place computers and microprocessors in a climate-controlled (air-conditioned) room. This room should be above tank level, provide a clear view of the treatment tank(s), and be lockable. This room can also serve as an office for the inspector.

Commercial Line Conditioner (Surge Protector)

A commercial line conditioner is recommended for use with computers and microprocessors to provide protection from voltage irregularity (power surges), noise reduction, and harmonic distortion.

Electrical Generator

In the event of a power outage and to provide a secondary source of electricity to enable continued plant operation, an electrical generator is recommended as a backup power supply.

Fruit Sizing Equipment

In the Treatment Schedule, the duration of hot water immersion depends on the particular weight class and variety of the fruit being processed. The inspector must visually inspect and weigh the largest fruit until the inspector is satisfied that all of the fruit is within the weight class, with no more than three fruit over the weight class. The weight inspection must occur for each lot change (orchard or variety) to ensure the accuracy of the sizing equipment. No mangoes will be accepted that are over the weight class.

It is very important to have accurate sizing equipment that sorts the fruit into groups, either by diameter or by weight. (Weight sorting is the preferred method.) If the weight range is too broad, recalibrate the equipment.

Boilers and Thermostatic Controls

Adequate Water Heating Capacity

The hot water facility must have adequate water heating capacity (i.e., a powerful enough boiler), and accurate enough thermostatic controls to hold the water temperature at or above the temperatures prescribed in the Treatment Schedule for the given length of time.

Thermostatic Controls (Set Point)

APHIS requires that the thermostatic controls be automatic. The temperature set point(s) are determined and approved during the official performance test, and must be high enough to ensure the water in the treatment tank will meet or exceed the minimum treatment temperature prescribed for the fruit. Once approved, do **not** tamper with the temperature set points. Temperature set points must remain constant for the entire shipping season. However, if the operator of the facility requests a change in set points, the inspector should conduct a new performance test. If this test is unsuccessful, revert the tanks to their prior set points.

Multiple Set Point Option

Managers of some facilities use multiple set points for each tank. The initial set point is higher than the other set points. All set points will be selected by the facility manager or systems engineer based on results of the preliminary performance test.

Verify the set points during the official performance test, and the same procedure must be repeated on each subsequent commercial treatment. This system works only for tanks that treat only one cage (basket) of fruit at a time.

Important

Tanks are **not** allowed to have any set point that is lower than the standard treatment temperature for the commodity being treated (115 °F in the case of mangoes).

Water Circulation

Install a water circulation system in the tank to provide uniform water temperatures throughout the treatment process and to avoid the formation of cool pockets during treatment. To guarantee that the equipment is **not** turned off during the treatment process, the controls for the circulation pumps or propellers must be tamper resistant. For the safety of personnel working in the area, shield pulleys on all pumps located within six feet of the floor.

After the first five minutes of treatment (with the tank sensor at “lowest temperature permitted at that set point”), differences in the lowest and highest actual temperature sensor readings of more than 1.8 °F may be accepted on a case-by-case basis.

Using a flotation barrier, keep the fruit at least 4 inches (10.2cm) below the water surface during the treatment.

Temperature Sensors

Type of Sensor

Permanently install platinum 100-ohm resistive thermal detectors (RTD sensors) in the lower third of the tank. The resistance of an RTD sensor linearly changes with temperature, whereas thermistors and thermocouples are nonlinear and less stable. Major advantages of RTD sensors include long-term stability, high signal levels, and overall accuracy of the system. Place the sensor unit within the distal 1 inch (2.54cm) of the sensor rod. The sensor must have an outer sheath of 0.25 inch (6.4mm) or less in diameter.

Number of Sensors Required and Their Placement

For continuous flow systems, the minimum number of sensors required is at least 10 per tank, which must be spaced throughout the length of the conveyor. For batch systems, the requirement is at least 2 sensors per tank. However, in tanks that treat multiple baskets (cages) of fruit, there must be at least 1 sensor

per basket position. (A tank with 4 basket positions, for example, would require at least 4 sensors). In both the batch and continuous flow systems, install sensors in the lower third of the tank.

Tank Access for Temporary Placement of Portable Sensors

The hot water tank must be designed to accommodate the temporary placement of numerous portable sensors or probes to be used during the performance testing procedure required for certification or recertification. During the testing procedure and at the direction of the inspector who conducts the performance test, position the temporary sensors throughout the load of fruit. The facility is required to purchase and have available 24 portable thermistor or thermocouple sensors (each with its own flexible cord at least 10 feet in length), and a portable temperature monitor that reads to the nearest one-tenth of a degree.

Certified Glass-Mercury, Non-mercury, and Digital Thermometer

The treatment facility is required to have at least one high-accuracy, water-immersible, certified mercury, non-mercury, or digital thermometer on the premises at all times. This thermometer must be accurate to 0.1 °F (or C) and will cover the range between 113 °F and 118 °F (45 °C to 47.8 °C). It will be used as the standard against which all sensors are calibrated.

Temperature Recorder

Use an automatic temperature recorder (strip chart or data logger) to record the time and temperature during each treatment.

Automatic Operation

The instrument used for recording the time and temperature must be capable of automatic operation whenever the hot water treatment system is activated.

Long-Term Recording

The recording equipment must be capable of nonstop recording for an extended period of time. Continuous flow systems require recording equipment capable of operating for up to 12 consecutive hours.

Recording Frequency

The time interval between prints will be no less than once every two minutes. Alternatively, a strip chart system can be used that gives continuous color pen lines. The numerical print or pen line representing each temperature channel

(sensor) must be uniquely identified by color, number, or symbol. It is **not** necessary to record temperatures from sensors located in portions of the tank **not** in use.

Accuracy

The accuracy of the temperature recording system (i.e., sensors and recorders) must be within 0.5 °F (0.3 °C) of the true temperature (as verified by a certified mercury, non-mercury, or digital thermometer). The temperature variation for the control sensors should be as close to zero as possible.

Repeatability

When used under field conditions over an extended period of time, the recording equipment must be capable of repeatability to within 0.l °F (or C) of the true calibrated readings. Failure to maintain reliability, accuracy, and readability in a previously approved instrument will result in cancelling approval. The design construction and materials must be such that the typical environmental conditions (including vibration) will **not** affect performance.

Calibration

Individually calibrate channels (sensors) against a certified mercury, non-mercury, or digital thermometer reading in tenths of a degree Fahrenheit or Centigrade, within the range of 113 °F to 118 °F (45 °C to 47.8 °C). The engineering firm that installs the recording equipment must also calibrate it. (Calibration equipment often used for this purpose includes, for example, a Decade instrument and relay range cards.) Calibrate the sensors at or near the fruit treatment temperature (around 115 °F), **not** at 32 °F.

Range

The recorder must be programmed to cover the entire range between 113 °F to 118 °F (45 °C to 47.8 °C), with a resolution of one-tenth of a degree. The range should **not** extend below 100 °F (37.8 °C) nor above 130 °F (54.4 °C). If the range band of the recorder is wider than this, restrict it (narrowed) with proper programming.

APHIS-Approved Recorder Models

Some recorder models currently on the market are **not** approved by APHIS for various reasons. For example, if the recorder only displays the sensor numbers and temperatures without making a printout on paper; or if it prints out the temperature data only after the treatment has been completed it is **not** approved by APHIS. (These are known as "memory loggers".) These two types of recorder models do **not** provide an adequate level of monitoring during treatment. Also, revolving circular charts are **not** acceptable because of the difficulty in reading fractions of one degree.

Temperature recorder models presently approved by APHIS are listed below. They can be either of the strip chart or data logger type. Some have adjustable chart speeds. Additional temperature recorder models may be added to this list upon petition to the **TQAU**. To seek APHIS approval for recorder models **not** listed, submit the manufacturer's technical brochure to the **TQAU** for evaluation.

Approved Strip Chart (Pen) Recorder Models

Important

Strip chart recorders are no longer approved for installation in new facilities or used to replace any style of recorder.

- Chessel 346
- Honeywell DPR 100A (3-channel capability)
- Honeywell DPR 100B (6-channel capability)
- Honeywell DPR 100C (3-channel capability)
- Honeywell DPR 100D (6-channel capability)
- Honeywell DPR 180 (36-channel capability)
- Honeywell DPR 1000 (6-channel capability)
- Honeywell DPR-3000, version D4 (32-channel capability)
- Molytek 2702
- Neuberger P1Y
- Toshiba AR201
- Tracor 3000

Approved Data Logger Recorder Models

- ASICS Systems B & C
- Chino AA Series
- Cole Parmer (32-channel capability)
- Contech (10- and 16-channel capability)
  - Model: Smart Seda
- Flotek (must be attached to a printer)
- HACCP Warrior PTR- 4 (4-channel capability)
- HAACP Warrior PTR- 10 (10-channel capability)
- Honeywell DPR I00B (6-channel capability)
- Honeywell DPR-1500 (30-channel capability)

- Honeywell DPR-3000, version D4 (32-channel capability)
- HyThsoft v2
- IBM-PC (must be attached to a printer)
- Koyo, Model Direct Logic DL 350, with Hidro Soft
- Nanmac H30-1
- National Instruments (hardware + software) (64-channel capability)
- Omega OM-205
- Omega OM-503
- Ryan Data Mentor (12-channel capability)
- Tracor Westronics DDR10

Chart Paper Specifications

Celsius or Fahrenheit Scale

Temperature can be recorded either in Fahrenheit or Celsius, although Fahrenheit is preferred by APHIS.

Scale Deflection

Scale deflection on the strip chart paper must be at least 0.10 inches for each degree Fahrenheit, or at least 5mm for each degree Celsius. Greater width between whole degrees, however, is preferred. Between each line representing one degree, there must also be finer lines, each representing subdivisions of one-tenth or two-tenths of a degree, in the range of 113 °F to 118 °F (45 °C to 47.8 °C).

Sample Required

Submit a sample of the strip chart or numerical printout made by the recording equipment to **TQAU**. It should be in the exact format to be used at the facility during the treatment cycle. Each symbol on the print wheel (or ink color, in the case of strip charts) must correspond to and identify the particular sensor that it represents.

Chart Speed

Chart speed for strip chart recorders must be no less than 1 inch for every 5 minutes of treatment time.

Chart Length

The chart paper must be long enough to display at least 1 entire treatment. Continuous flow systems must contain enough chart paper to continuously record temperatures for up to 12 consecutive hours.

Alarm System

An alarm is required for all batch (Jacuzzi) systems, in order to notify packinghouse employees that a treatment has been completed for a particular basket (cage). This system can be an audible noise (such as a horn, buzzer, or bell) or a highly visible light attached to a timing device located on the

equipment that indicates time and temperature. Some facilities use both a noise and a light. To avoid "overcooking," the alarm system alerts the operator of the hoist to remove a basket from the tank at the end of treatment.

Safeguarding the Treated Fruit

Layout and Flow Pattern

Design the flow pattern of the fruit moving through the hot water treatment process to ensure that fruit waiting to be loaded into the hot water immersion tank cannot become mixed with fruit that has already completed treatment. Submit a drawing showing the proposed layout of the packinghouse to **TQAU** for approval.

Garbage Disposal

In order not to attract fruit flies, place cut fruit, culled fruit, rotting fruit, and miscellaneous garbage into covered containers and remove from the premises daily.

Quarantine Area

Bring treated fruit to an insect-free enclosure immediately after treatment. The treated fruit must remain there until loading into insect-proof shipping containers. The designated enclosure is usually a screened room. Packing line equipment, hydrocooling equipment, and a cool storage room (if any), should be located in this area, but this equipment is **not** a requirement. To prevent the movement of untreated fruit (accidentally or intentionally) into the insect-free quarantine area enforce effective procedures.

Screening and Other Materials

Ordinary window screen or mosquito netting (at least 100 mesh per square inch) is sufficient to exclude fruit flies. Inspect it regularly and repair it as often as needed. Solid glass, concrete, drywall, or wooden walls are also acceptable.

Air Curtain

Place on the wall or ceiling prior to entering any quarantine area an apparatus that generates a high-velocity wind barrier or air curtain (such as fans or blowers and associated air-directing chambers or enclosures such as baffles, boxes, etc.). This device must exclude the possible entry of fruit flies into the insect-free enclosure. (For facilities approved prior to July 1, 1997, vertically hang clear plastic flaps, as minimally required, at the doors to the insect-free enclosure.

Loading of Treated Fruit

When **not** in use, close doors leading from the quarantine area to the loading dock. When loading, truck vans and containers must form a fly-proof seal with the exterior wall. Prior to loading, inspect and disinfect truck vans and

containers. If wooden pallets are used, they must be completely free of wood-infesting insects and bark. Apply a numbered APHIS seal to each container before its departure.

Pretreatment Warming Options

Prewarming the fruit is sometimes desirable in order to meet the APHIS requirement that all fruit pulp temperatures be at least 70 °F before start of the certification performance test. At the very least, the fruit pulp temperature must reach the minimum pulp temperature stabilized during the certification test for commercial treatment. After prewarming, take pulp temperatures from the mangoes located at the coldest part of the crates and/or baskets. Do **not** take the pulp temperatures from the mangoes that are located on the outside of the basket or crate.

Post-Treatment Cooling Options

Cooling the fruit after hot water treatment is **not** an APHIS requirement. However, from the standpoint of fruit quality, many facilities choose to install a system to cool the fruit after removal from the hot water.

Hydrocooling of the treated mangoes is allowed after a waiting period of 30 minutes following treatment unless the original dip times indicated in the treatment schedule are extended for 10 minutes. Allowing the fruit to simply stand for at least 30 minutes after being removed from the hot water tank is thought to be helpful in killing immature stages of fruit flies because the mangoes complete their “cooking” process during that time.

Refrigerated Room

The recommended storage temperature for mangoes is between 55 °F and 57 °F (12.8 °C and 13.9 °C) at 85 percent to 90 percent relative humidity. These temperatures delay softening and prolong storage life to approximately 2 to 3 weeks.

Fans

APHIS allows the use of fans in the screen room to blow air over the fruit as soon as they are removed from the hot water tank (if desired). However, the ambient air cannot be less than 70 °F.

Hydrocooling

APHIS allows the use of a cool water tank or shower system, but with the following provisions:

- During the waiting period and hydrocooling period, safeguard the mangoes in a room or tunnel, separate from the hot water tanks
- Water temperature used during hydrocooling must be 70 °F or above
- Water used for hydrocooling should be chlorinated (not to exceed 200 ppm)
  - Any other chemicals, such as fungicides, are optional, but must be approved in advance by the FDA

Facility Changes

Hot water immersion treatment facilities whose construction was approved under earlier guidelines can continue to operate with APHIS approval. Newer facilities, however, are required to meet the current requirements outlined in this checklist, which in most cases are more strict.

Once **TQAU** has formally approved the plans and drawings for a hot water immersion treatment facility, the facility can make no further changes in the equipment without APHIS approval. Any proposed changes or improvements must be described in writing (with accompanying drawings, if necessary) and must be approved by APHIS in writing. Examples of proposed changes include adding additional treatment tanks, adding a cold storage room, and changing the model of the temperature recorder.

Safety and Health Checklist

- Adequate lavatory
- Admission of children or unauthorized persons into the treatment and packing areas prohibited if not accompanied by a responsible employee
- Approved safety ladders or walkways (catwalks, etc.) for observing treatment tank operations
- Electric power meets safety code requirements
  - Electrical wiring, including switches and other connections, contained in metal or PVC conduit and grounded to prevent electrical shock
- Engines, pulleys, drive belts, and other hazardous moving parts, if located within six feet of floor level, guarded with a safety shield or barrier
- Fire extinguisher located near the boiler
- First-aid kit located near moving machinery

- Hard hats for workers and visitors in the treatment and loading areas must wear (this is optional if not required by local regulations)
- Steam and hot water pipes insulated or otherwise protected
- Sufficient lighting provided in working areas

Work Plan

A Work Plan is a formal agreement signed by a representative of each treatment facility in a particular country, the Agriculture Ministry of the host government, and by USDA-APHIS. Work Plans govern the day-to-day operations of each facility and can be improved from one year to the next. Work Plans usually contain additional provisions not included in this checklist.

Fruit exporters are required to operate under general APHIS monitoring and to be in full compliance with all APHIS regulations as outlined in detail in the current Work Plan. The operator of the facility, as well as the inspector assigned to the facility, should each keep a copy available to resolve any disputes.

Address for Technical Contact

TQAU

Center for Plant Health Science & Technology
USDA, APHIS, PPQ, CHPST
Treatment Quality Assurance Unit
1730 Varsity Drive, Suite 400
Raleigh, NC 27606
Tel: 919-855-7450
Fax: 919-855-7493

3

Treatment Manual

Nonchemical Treatments

Heat • Steam Treatments

Contents

Principle **3-4-1**
Steam Pressure Sterilization **3-4-1**
Loose Masses of Material **3-4-1**
Closely Packed Material **3-4-2**
Steam Jet Method **3-4-2**

Principle

Steam at a temperature of 212 °F will destroy most pathogenic microorganisms of the common vegetative forms or the spore types when in the growing or vegetative state in a short period of exposure. Some spores, however, are much more resistant and will withstand prolonged periods of exposure to steam at atmospheric pressure. Saturated steam at temperatures of 240 °F to 248 °F (10 to 15 lbs. pure steam pressure) will destroy the most resistant spores in a brief interval of exposure. However, near-complete air discharge from the autoclave or steam chamber is necessary. When steam is admitted to a chamber from which the air is completely evacuated, the temperature of the steam throughout the chamber will advance at once to the maximum range that can be attained for the pressure carried. If air remains in the chamber, the ultimate temperature will be reduced dependent upon the quantity of air remaining. Refer to a recording or indicating thermometer for correct chamber temperature-pressure relationships.

Steam Pressure Sterilization

Live steam is introduced into a closed chamber containing the material to be treated until the required temperature and pressure are indicated. The temperature/pressure relationship is maintained at or above this point for the required exposure period. The exposure period will depend on the nature of the material, quantity, and its penetrable condition.

Loose Masses of Material

For loose masses of material, which permit rapid and complete penetration of steam to all parts of the mass, no initial vacuum is needed, but air must be released until steam vapor escapes, and exposure at 20 pounds pressure for 10 minutes, 15 lbs. for 15 minutes, or 10 lbs. for 20 minutes is sufficient.

Closely Packed Material

For closely packed material, such as soil or baled straw, special measures are needed to ensure rapid heat penetration to all parts of the material. Baled rice straw, for example, is required to have a density of less than 30 lbs. per cubic foot since penetration at higher densities is too slow to be practical. Soil, if in large containers, will not allow adequate treatment under normal sterilization exposure periods. Quicker penetration of the steam is obtained by first exhausting the air in the chamber to a high vacuum and then introducing live steam until the required positive pressure is reached.

Examples of the pressure-temperature relationships are listed in **Table 3-4-1**. The gauge pressure in pounds per square inch corresponds to the temperature of saturated steam in degrees Fahrenheit. Zero gauge pressure corresponds to an absolute pressure of 14.7 lbs. per square inch. The figures are based upon the complete replacement of air by steam. If air replacement is not complete the temperature for any given pressure will be less than the corresponding temperature.

Table 3-4-1 Pressure Temperature Relationships

Gauge Pressure (lbs. per sq. in.)	Temperature °F
10	239.4
15	249.8
20	258.8
30	274.1
40	286.7
50	297.7
60	307.4

Steam Jet Method

Live steam from a jet or nozzle is forced into or through a more or less loose and open mass of material in such amount and for such period required to raise the temperature of all parts of the mass to approximately 212 °F. This method takes advantage of the considerable latent heat liberated when steam condenses into water. This process does not effect complete sterilization since spore-forming bacteria are not always destroyed. Since no spore-forming bacteria are known that cause plant diseases, however, and fungi are readily killed by the temperatures reached, this process is effective for quarantine purposes if the necessary degree of heat is generated in all parts of the material.

3

Treatment Manual

Nonchemical Treatments

Heat • Vapor Heat and Forced Hot Air Treatment

Contents

Introduction **3-5-1**
Procedures **3-5-1**
Pretreatment **3-5-2**
Loading **3-5-2**
Conducting the Treatment **3-5-3**
Verifying the Treatment **3-5-3**
Post-Treatment Handling **3-5-4**
Record Keeping **3-5-4**
Common Problems and Failure Points **3-5-4**

Introduction

Vapor Heat (VH) and Forced Hot Air (FHA) treatments use heated air to warm fruit to temperatures that are lethal to target pests, primarily fruit flies. Generally, VH treatment differs from FHA only in the relative humidity of the air in the treatment chamber; higher humidity levels may preserve fruit quality. Unless otherwise noted, information in this chapter applies to both VH and FHA treatments for fruits and vegetables.

This chapter describes processes for routine (commercial) treatments for fresh fruits and vegetables at VH and FHA facilities. **See "Certification of Forced Hot Air and Vapor Heat Treatment Facilities" on page-6-7-1** for VH and FHA certification and equipment requirements.

VH treatment schedules can be found in ***T106—Vapor Heat* on page 5-2-70**. FHA treatment schedules can be found in ***T103—High Temperature Forced Air* on page 5-2-59**.

Procedures

Before any treatments are conducted at a facility, the authorized PPQ official should familiarize themselves with the facility and the way the chamber functions. The official should also carefully review the treatment schedule for the commodity(ies) that will be treated, and any special requirements specified during certification, in the workplan or in the compliance agreement.

Pretreatment

Prior to treatment, the PPQ official must ensure that the facility and the chamber are in good working order and the permanent temperature sensors are functioning properly. Conduct a brief facility inspection before any other steps in the treatment process are taken. During this inspection, the official verifies that all safeguarding and quarantine measures are in place and that there are no obvious problems that may affect the treatment. If any deficiencies are found, correct them prior to treatment. After the inspection, the official will assist facility personnel in the calibration of the permanent temperature sensors. Refer to the section ***Calibrating the Permanent Temperature Sensors* on page 6-7-4** "for calibration procedures.

Before treatment, the PPQ official ensures that the commodity meets the requirements specified in the Treatment Manual, the certification conditions, the workplan and/or the compliance agreement. These requirements generally include:

- Fruit size and weight requirements: The process and/or equipment used to sort the fruit should be verified by measuring or weighing the fruit that is to be treated. Sampling rates may be provided in the workplan, compliance agreement or certification conditions. If no rates are provided, weigh and measure 30 suspect fruit per treatment lot. If fruit are found that do **not** meet the size and weight requirements, the sorting process and/or equipment should be evaluated and the fruit resorted.
- Fruit pulp temperature: There are no specific pretreatment fruit pulp temperature requirements. However, the temperature of the fruit pulps within the treatment lot should **not** vary by more than 3.0 °C (5.0 °F). The PPQ official verifies that the pulp temperatures meet this requirement prior to treatment.
- Pest inspection: The PPQ official conducts pest inspections required by the workplan and/or compliance agreement.

Loading

Load the fruit into containers (crates, lugs, or bins) according to the requirements in the certification conditions or workplan. Generally, these requirements will indicate whether or **not** the fruit must be sorted and the volume of fruit allowed in each container.

Load the containers onto pallets or into cabinets according to the requirements in the certification conditions or workplan. These requirements may specify that containers with larger fruit must be located in the colder areas of the stack or that certain layers of containers are left empty when partial loads are treated.

The permanent temperature sensors are placed in the largest fruit in the treatment lot as it is being loaded into the containers. Insert the tip of the sensor into an area of the fruit pulp that will take the longest to reach treatment temperature. The PPQ official monitors the placement of the permanent sensors and verifies that the probes are placed in the locations required by the certification conditions.

Conducting the Treatment

After all the fruit is loaded into the containers and onto the pallets, and the permanent probes are properly installed, load the fruit into the chamber. The chamber doors should be closed and locked to prevent accidental openings. The PPQ official (and the NPPO official, if required by the work plan or compliance agreement) must initial the treatment temperature record and the chamber operator can then initiate the treatment.

During the treatment, the PPQ official must monitor the permanent temperature sensor data to ensure the treatment is proceeding in the approved manner. The PPQ official must also check the chamber for leaks or other problems during the treatment.

Verifying the Treatment

The PPQ official must review the treatment temperature record after the treatment is complete. The official must ensure that the temperature and recording interval requirements have been met. Additionally, the official must verify that the requirements for the duration of the run up and dwell times are conducted according to the treatment schedule. Time requirements for the run up and dwell time are continuous. Once the PPQ official determines that all the treatment requirements are met, the PPQ official must sign and date the treatment record.

Important Treatment Terminology

The following terms are referred to in the treatment schedules:

- **Heat up time:** the minimum time allowed for all the temperature probes to reach the prescribed minimum pulp temperature (may also be referred to as the approach or run-up time)
- **Heat up recording interval:** the time interval required for recording temperatures during the heat up time
- **Minimum air temperature:** the minimum temperature required for the air in the chamber
- **Minimum pulp temperature at end of heat up:** the minimum temperature required for all fruit pulp temperature probes
- **Dwell time:** the length of time all pulp temperature probes must maintain the minimum pulp temperature

- **Dwell recording interval:** the time interval required for recording temperatures during the dwell time
- **Cooling method:** optional and may be either hydrocooling or air cooling

Table 3-5-1 Example of a Treatment Schedule

Heat Up Time:	4 hours
Heat Up Recording Interval:	5 minutes
Minimum Air Temperature:	N/A
Minimum Pulp Temperature at End of Heat Up:	47.2 °C/117.0 °F
Dwell Time:	5 minutes
Dwell Recording Interval:	5 minutes
Cooling Method:	Forced air or Hydrocooling

NOTICE

"N/A" in any of the requirements in the Treatment Schedule indicates that PPQ has no requirement.

Post-Treatment Handling

After the treatment is complete, move the fruit from the chamber into the quarantine area. Cool the fruit according to the requirements listed in the treatment schedule.

Record Keeping

Keep all treatment records at the treatment facility for one year after treatment. The facility must also maintain a record of all problems and/or breakdowns and any maintenance performed on the chamber. All the records listed above must be made available to the PPQ official upon request.

Common Problems and Failure Points

If the temperature recording intervals and minimum temperature requirements are **not** met, the treatment fails. The only exception to this is that a probe may record no data for a single recording interval during the treatment. (Note: This does **not** mean the temperature may be out of range, only that the data may be missing). After reviewing the treatment data, the official should sign and date the data.

If a problem arises during treatment, such as a probe stops recording data or the temperature drops below the required temperature, the treatment will fail. The facility manager must determine if the fruit will be re-treated or will be removed from the chamber into the non-quarantine area.

3 Treatment Manual

Nonchemical Treatments

Heat • Forced Hot Air • Niger Seed

Contents

Dry Heat Treatment Facilities for Niger (Guizotia abyssinica) **3-6-1**
Location of Treatment Facilities in the US **3-6-1**
Checklist of USDA-APHIS Minimum Requirements for Dry Heat Treatment Facilities for Niger Seed Treatment **3-6-1**
Requirements for a Valid Treatment **3-6-2**
Sanitation and Pest Control **3-6-3**

Dry Heat Treatment Facilities for Niger (*Guizotia abyssinica*)

Niger seed is grown as a marginal crop mainly in India, Ethiopia and Burma and is imported into the United States for bird feed. Since Niger seed from India, Ethiopia and Burma is frequently contaminated with Federal Noxious Weed seeds, it is required to be heat treated in accordance with T412 treatment schedule.

Location of Treatment Facilities in the US

Construct the proposed niger treatment facility near the port environs; **not** exceeding 10 miles from the port.

Checklist of USDA-APHIS Minimum Requirements for Dry Heat Treatment Facilities for Niger Seed Treatment

Minimum Requirements for Dry Heat Treatment

- Accuracy of the total temperature recording system must be within plus or minus 0.5°F. (0.3°C) of actual temperatures as recorded by a certified calibrated thermometer
- Action plan is be established to address any pests that may be associated with the storage, treatment, or shipment of niger seed
- All the valves and controls that affect heat flow to the treatment system are secured to avoid manipulation by unauthorized personnel during the treatment process
- Audible alarm or highly visible light is installed on burners or other equipment to indicate system failure and/or when **not** operating properly
- Gear systems used to control the niger seed conveyor (if applicable) are capable of being adjusted as necessary to meet treatment requirements

- Heating controls are automatic and run continuously throughout the treatment process. Manual adjustments are allowed, if necessary.
- Minimum of two temperature probes are situated in the heat-treating equipment in such a way as to determine that all niger seed being treated reaches the target temperature
- Proper sanitation measures are implemented to ensure there are no potential breeding grounds for pests on the premises, and therefore, little risk of reinfestation or cross-contamination
- Seed processing equipment has the capability to divert for retreatment any nontreated or treated seeds that do **not** meet treatment standards
- Speed indicator is present for continuous flow systems.
- Temperature readings are recorded on the chart at time intervals **not** exceeding 4 minutes between each reading
- Temperature recording chart is showing changes in temperature in increments of **not** less than 0.1 inch for each degree Fahrenheit (^{o}F) or 5 mm for each degree Celsius (^{o}C)
- Treated seeds are stored in a location separate from nontreated seeds-the treated and nontreated seeds must be handled in a manner to prevent cross-contamination

Requirements for a Valid Treatment

Facility Requirements

- Facility operators or managers must record the following information on each treatment chart:
  - Date
  - Lot number
  - Operator signature
- Minimum number of temperature recording elements is two fixed temperature probes-accurate time/temperature records will also be maintained for any additional probes
- Treatment must be in a Niger seed facility maintaining current valid approval in good operating order so as to be capable of providing an acceptable treatment

Treatment Requirements

The Niger seed heat treatment schedule will be for at least 15 minutes at 120 °C (248 °F) and the following procedures will be used by operators to determine if treatment standards are met.

- Examine treatment records for completion of treatment
- If any temperature reading falls below 120 °C (248 °F), nullify the treatment for that specific lot of seed and retreat the seed

- If, for any reason records indicate that the niger seed was **not** held at the target temperature for the required time, retreat the niger seed and correct the reason for the faulty treatment before continuing any niger seed treatment
- Verify that the niger seed was kept at the target temperature for the required time

Documentation Requirements

- Maintain a logbook of all niger seed treatments
- Maintain records of equipment breakdowns and repairs and changes or modifications to the treatment process

Sanitation and Pest Control

The Plant and Warehouse premises

The premises must have a cleaning and control program. The facility manager will ensure that there are no potential breeding grounds for pests in the premises, and therefore little risk of reinfestation or cross-contamination.

Containers and Packaging

The facility manager will ensure that packaging, whether used or new, is checked and cleaned for pests so that the packages are **not** a source of pests and contamination

Waste Disposal

To minimize contamination risk and eliminate pest breeding sites, the facility manager will implement a regular waste program for waste and for nonconforming or infested produce.

Post Treatment Requirements

- After treatment and cooling, immediately place the niger seed in new bags-treat or dispose the old bags in a manner that will eliminate regulated pests.
- PPQ will monitor (by sampling the treated seeds periodically) for actionable contaminants
  - Some time in the middles of the bagging process, sample every 25th lot after treatment
  - Perform random inspections and viability tests as needed by PPQ at the Port of Entry

Label each sample with the following information:

- Bill of lading number
- Container and lot number
- Date the sample was taken
- Date the seeds were treated
- Origin of seed
- Vessel name and nationality

Send laboratory results with the above information to:

USDA-APHIS-PPQ-CPHST
Treatment Quality Assurance Unit
1730 Varsity Drive
Suite 400, Raleigh, NC 27606

3

Treatment Manual

Nonchemical Treatments

Cold Treatment (CT)

Contents

Intransit Cold Treatment in Conventional Vessels, Self-Refrigerated (Integral) Containers, and Warehouses **3-7-2**
Precooling Procedures **3-7-2**
Initiating Intransit Cold Treatment in Vessels and Containers **3-7-3**
Verification of Temperature Recording Equipment **3-7-3**
Calibration of Temperature Sensors **3-7-4**
Loading of Commodity in Conventional Vessels and Self-Refrigerated (Integral) Containers—General **3-7-7**
Placement of Temperature Sensors **3-7-10**
Treatment Requirements **3-7-13**
Prepare Documents **3-7-14**
Distribution of Documents **3-7-14**
Clearance of Cold Treated Shipments **3-7-14**
Conventional Vessels **3-7-15**
Self-Refrigerated (Integral) Containers **3-7-18**
Cold Treatment in Refrigerated Warehouses **3-7-20**
Initiating the Cold Treatment **3-7-20**
Placement of Temperature Sensors: **3-7-20**
Contact Information **3-7-21**
TQAU **3-7-21**

Intransit Cold Treatment in Conventional Vessels, Self-Refrigerated (Integral) Containers, and Warehouses

The use of sustained cold temperatures as a means of insect control has been employed for many years. Rigid adherence to specified temperatures and time periods effectively eliminates certain insect infestations. Treatments may be conducted in warehouses, refrigerated compartments of transporting vessels (Conventional Vessels), containers cooled by the ship's refrigeration system (Container Vessels) or by individually refrigerated containers (Self-Refrigerated/Integral Containers). Information concerning conventional vessels, self-refrigerated containers, and warehouses is found in this chapter.

Only certified USDA representatives have permission to conduct warehouse, vessel and/or container approval tests under the general guidance of TQAU. The following website provides information for the testing of specific vessels and/or containers:

https://treatments.cphst.org/vessels

Precooling Procedures

Experience with in-transit cold treatments and Computational Fluid Dynamics (CFD) modeling of refrigerated vessel compartments show that the fruit must be precooled at or below the prescribed cold treatment temperature before loading. Otherwise, a large quantity of fruit in the middle of large pallet groups may require a week or more to reach the cold treatment temperature.

Fruit intended for intransit cold treatment must be precooled to the temperature at which the fruit will be treated prior to beginning treatment.

Precooling cannot be conducted in the conveyance in which the commodity is loaded unless authorized by the APHIS official.

Conduct random fruit pulp sampling in the precooling location prior to loading in order to verify that the commodity has completed precooling.

Use the following general guidelines for fruit pulp sampling in the precooling location:

- Pulp temperatures will be taken by personnel authorized by APHIS, which includes industry representatives

- Take pulp temperatures by probing the fruit on the periphery of the pallet
  - If pulp temperatures are 0.28 °C (0.5 °F) or more above the temperature at which the fruit will be treated, the pallet will remain in the precooling location for further precooling

Also, sample fruit pulp temperatures **immediately** before the fruit is loaded on the intransit cold treatment conveyance. Take fruit pulp temperatures by probing fruit in the **top** of the pallet. An official authorized by APHIS will sample the fruit pulp temperatures in all sections of the load to verify temperatures have **not** risen appreciably. If the pulp temperatures for the sample are 0.28 °C (0.5 °F) or more above the temperature at which the fruit will be treated, the pallet will be rejected and returned to the precooling location for further precooling until the fruit reaches the treatment temperature.

Initiating Intransit Cold Treatment in Vessels and Containers

For cold treatments conducted in approved vessels and containers, the ship's officers will have already received instructions on the APHIS requirements from their owners. However, a discussion by the authorized APHIS official with these individuals will provide for better understanding and cooperation. Such a discussion should include:

- General treatment procedures in accordance with 7CFR 305.15
- Stowage arrangement
- Temperature sensor and instrument calibration testing
- Treatment conditions

Ensure that there is an adequate communication system in place between personnel in the compartments and the recording room.

Verification of Temperature Recording Equipment

Approved vessels and containers must be capable of maintaining fruit pulp temperatures within the specified CT schedules. To monitor these treatments, they must be equipped with a temperature recording device which meets the approval of **TQAU**. All approved temperature recording devices must be password protected and tamperproof and have the ability to record the date, time, sensor number, and temperature during all calibrations and actual treatments.

If APHIS determines that the records and calibrations can be manipulated, the vessel and/or container will be suspended from conducting cold treatments until proper equipment is installed. Submit any changes to the temperature recording and monitoring equipment to **TQAU** for approval before installation

in the vessel or container. Compare the existing equipment with the equipment listed at http://treatments.cphst.org/vessels/ to determine if new equipment has been installed that was **not** approved by TQAU.

Specifications for temperature recording installations and other requirements for approval are discussed in *Certification of Cold Treatment* ***on page 6-4-1***. Refer to *Reference Guide to Commercial Suppliers of Treatment and Related Safety Equipment* ***on page H-1-1*** for a list of approved temperature recorders.

Strip Chart Recorder

Important

Since December 31, 2005, strip chart recorders were no longer acceptable temperature recording devices. Consequently, by December 31, 2008, there should be no strip chart recorders in use for APHIS cold treatment.

Contact TQAU for approved temperature recording instrumentation.

Data Logger

A sufficient supply of log sheets must be available to provide a continuous record of calibration and treatment temperatures. The instrument should be in operation for at least 30 minutes prior to calibration tests. Examine a completed log sheet printout and the functioning of the visual scanner, the printer, and the high limit setting. Check the logsheets for proper format and serialization. Activate the temperature set-point for an alarm printout to verify that this function is operational.

Important

Data logger installations are utilized to record various components of the vessel's operating systems. Temperature recording is only a part of the record produced. Under TQAU approval requirements, the logsheets upon which the intransit cold treatment is recorded are generally more detailed in design than the standard commercial logsheet. They are prepared and serialized to facilitate scanning and to provide a level of security against fraudulent records. The USDA log should be printed on separate sheets with no other ship data interspersed. Data loggers are programmed to print out the temperatures above a set limit in a contrasting color. Some instruments print a symbol to indicate this. The limit is set at the time of loading to a temperature level that coincides with the projected treatment schedule.

Calibration of Temperature Sensors

Calibrate all air and pulp temperature sensors in a clean ice water slurry mixture that is at 0 ^{o}C (32 ^{o}F), the freezing/melting point of freshwater.

1. Check individual sensors to verify that they are properly labeled and correctly connected to the temperature recorder. This can be accomplished by hand warming each sensor when its' number appears on the visual display panel of the recording instrument. A temperature change, which can be observed on the instrument, should occur. If the instrument fails to react, the sensor is incorrectly connected or malfunctioning and should be corrected by the instrument representative.

2. Prepare a mixture of clean ice and fresh water in a clean insulated container.
3. Crush or chip the ice to completely fill the container.
4. Add enough water to stir the mixture.
5. Stir the ice and water for a minimum of 2 minutes to ensure the water is completely cooled and good mixing has occurred.
   - ❖ Generally, the ice will occupy approximately 85 percent of the total volume of the container, with the water occupying the remaining space.
6. Add more ice as the ice melts.
7. Stir the ice water slurry to maintain a temperature of 0 °C (32 °F).
8. Submerge the sensors in the ice water slurry without touching the sides or bottom of the container.
9. Stir the slurry mixture again.
10. Continue testing of each sensor in the ice water slurry until the temperature reading stabilizes.
11. Allow at least a 1 minute interval between two consecutive readings for any one sensor; however, the interval **cannot** exceed 5 minutes.
    - ❖ The difference between the two readings **cannot** exceed 0.1°C.
12. Record at least two consecutive readings on a written calibration report. If the two readings are different, test the sensors again and record the temperature.
13. Contact an instrument company representative immediately if the time interval exceeds the normal amount of time required to verify the reading and accuracy of the sensor and recorder system.
    - ❖ The recorder used with the sensors must be capable of printing or displaying on demand and **not** just at hourly intervals.
14. Have the instrument company representative correct any deficiencies in the equipment before certification.
15. Replace any sensor that reads more than plus or minus 0.3 °C (0.5 °F) from the standard 0 ºC (32 ºF).
16. Replace and recalibrate any sensors that malfunction.
17. Determine the calibration factors to the nearest tenth of one degree Celsius.
18. If the temperature recorder microprocessor can be zeroed, tared, or if the calibration factors can be otherwise entered into the recorder microprocessor for automatic adjustment this **must** be done. In this case,

verify that the adjustment factors have been entered or that the recorder was zeroed or tared by the instrument company representative. Enter zero as the calibration factor for each individual probe in the Online 556 database (if the database is **not** used, then enter zero for each individual probe in the written calibration report that is submitted with the shipment.)

19. If the temperature recorder microprocessor cannot be zeroed, tared, or if the calibration factors cannot be entered into the recorder microprocessor memory (so that they are sustained in memory and can be viewed again after all the factors are entered), the calibration factors for each individual probe must be recorded in the online 556 database (if the database is **not** used, then enter the calibration factors for each individual probe on the written calibration report that is submitted with the shipment.)

20. After the calibration factors have been accounted for, no other changes should be made to the temperature recorder microprocessor.

21. Refer to the section on ***Clearance of Cold Treated Shipments* on page 3-7-14** for complete instructions on entering data into the Form 556 or preparing written calibration reports.

Loading of Commodity in Conventional Vessels and Self-Refrigerated (Integral) Containers—General

Important

In countries with which USDA-APHIS has a cooperative agreement, these activities can be conducted by qualified officials from that country. Contact the **TQAU** for a list of qualified officials.

1. Each compartment or container must contain only one type of fruit loaded in one type of carton.
2. Load fruit directly from the precooling area so fruit temperatures do **not** rise significantly after loading and during the transfer of the container to the vessel.
3. Open the cartons in which the sensors will be located and insert the sensors well into the fruit (**Figure 3-7-1**). The tip of the sensor must **not** extend through the fruit.

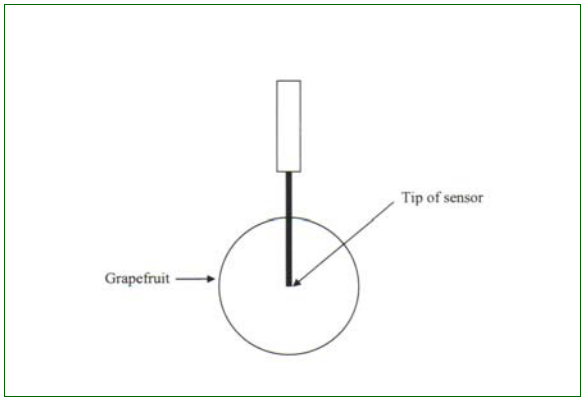

Figure 3-7-1 Proper Placement of Pulp Sensor within Larger Fruit

In the case of small fruit, cover a minimum of two thirds of the tip of the sensor using multiple fruit. If, for example, the fruit is grapes, insert the sensor directly into the grapes in a shis-ka-bob fashion (**Figure 3-7-2**). Completely cover the probe with the top layer of fruit in the top of the box or carton located in the middle of the pallet.

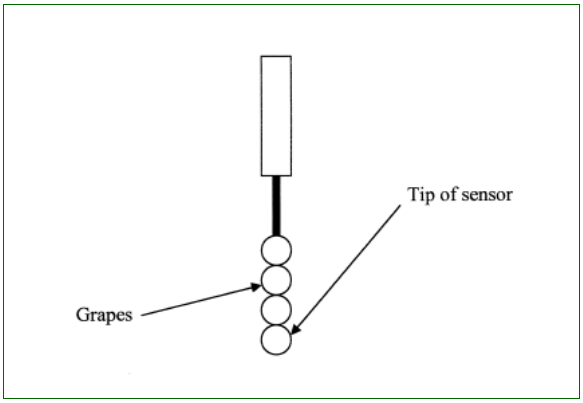

Figure 3-7-2 Proper Placement of Pulp Sensor within Smaller Fruit

4. Securely close the cartons following insertion of the sensors. If the fruit is palletized, it may be necessary to insert the sensor into the fruit from the side of the carton. If the side of the carton or box is opened to insert a sensor, reseal the opened side of the carton or box using tape.

Conventional Vessels

Important

Hanging decks, hatch coamings within vessels and double-stacking of pallets are not approved for intransit cold treatment. The treatment will **not** begin until all double-stacked pallets are reconfigured into a single-stack pallet arrangement and any pallets located in hanging decks or hatch coamings are removed.

Contact **TQAU** for more information regarding hatch coamings or hanging decks for particular vessels.

There are two sensor types used for the compartments during cold treatment.

- Ambient air sensors—the cables which are attached to the ceiling of the compartment, should be long enough to extend from the ceiling to the floor. Place the sensors on the center line of the vessel approximately 30 centimeters from the ceiling. Attach the sensors in such a way that they do **not** touch the bulkhead and are protected from damage from the cargo. One sensor must be located on the fore and aft bulkheads of each compartment.

  In the case of twin deck compartments, two sensors are required in the upper compartment plus one sensor in the lower compartment. Place the lower sensor on the bulkhead furthest from the cooling unit. Ensure that all sensors are readily detachable and stowed in compartments to protect from damage when **not** in use.

- Fruit pulp sensors—the cables which are attached to the side walls of the compartment must be distributed throughout the compartment so that all areas of the compartment can be reached. The cables should be long enough to extend from the hold walls to three meters beyond the center line of the ship hold.

Placement of Temperature Sensors

All of the sensors for conventional vessels must be located at the mid level of the pallets as depicted in **Figure 3-7-3**. The black circles represent pulp sensors.

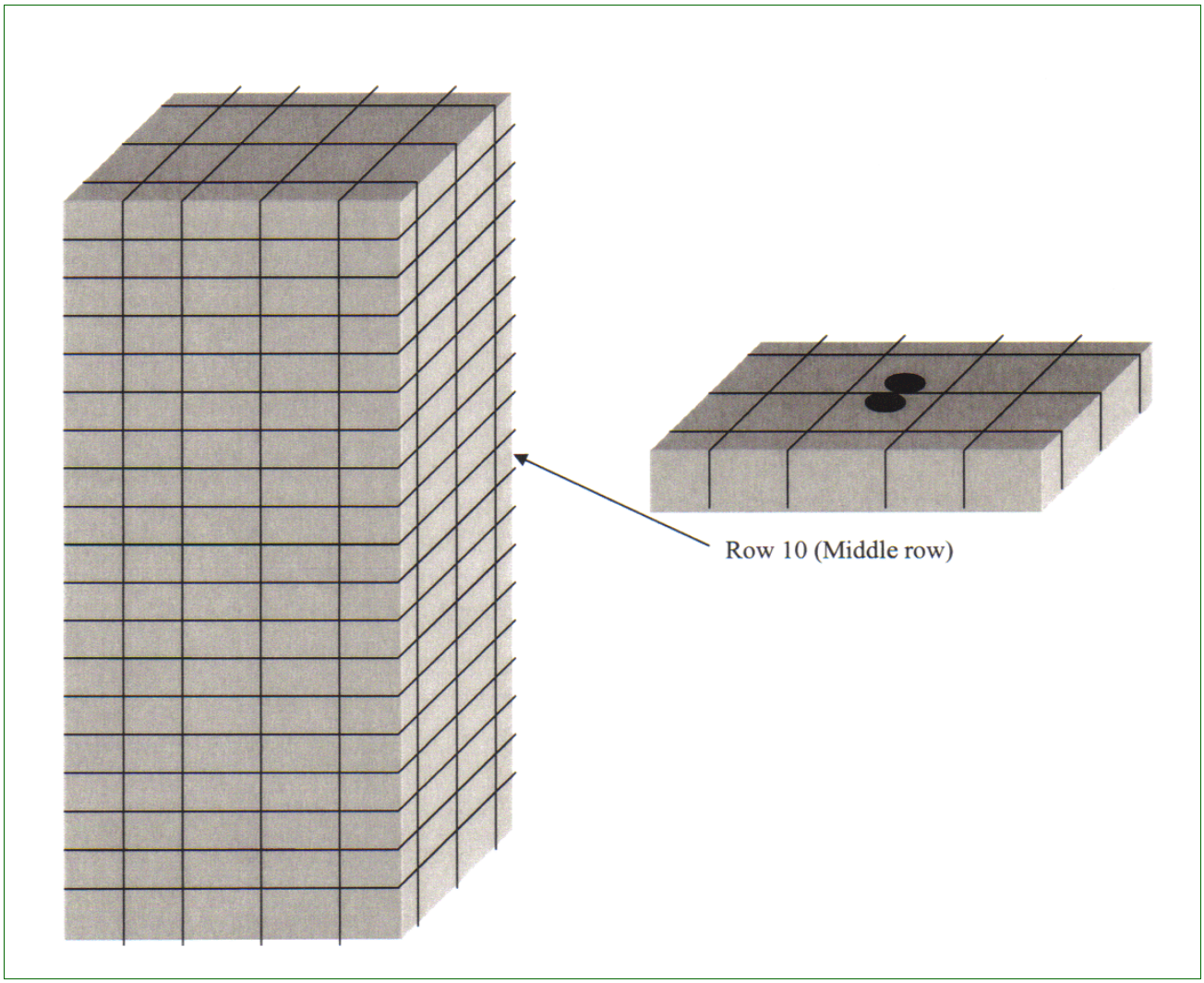

Figure 3-7-3 Fruit stack with middle row temperature probe placement

.

NOTICE

It is highly recommended that more temperature sensors be installed than the minimum number required for each refrigerated compartment. If a sensor malfunctions during a treatment, the certified USDA representative has the option of disregarding it, providing that an additional working sensor is present, and the functional sensors were appropriately placed, certified, and calibrated. Otherwise, the entire treatment must be repeated for the fruit in that compartment.

Self-Refrigerated (Integral) Containers

When loading refrigerated containers, place the warmest fruit in the last quarter of the load (near the back doors of the container), completely cover the floor and ensure that the load is of uniform height.

Place a numbered seal on the loaded container. This must **not** be removed until the load has been cleared at the port of destination.

Use a minimum of three pulp sensors. Place all sensors as far into a box of fruit as possible. Use **Figure 3-7-4** as a general guideline for sensor placement.

- Place the first sensor, labeled USDA1, in a box at the top of the stack of fruit nearest to the air return intake.
- Place the second sensor, labeled USDA2, slightly aft of the middle of the container, halfway between the top and bottom of the stack.
- Place the third sensor, labeled USDA3, one pallet stack in from the doors of the container, halfway between the top and bottom of the stack.

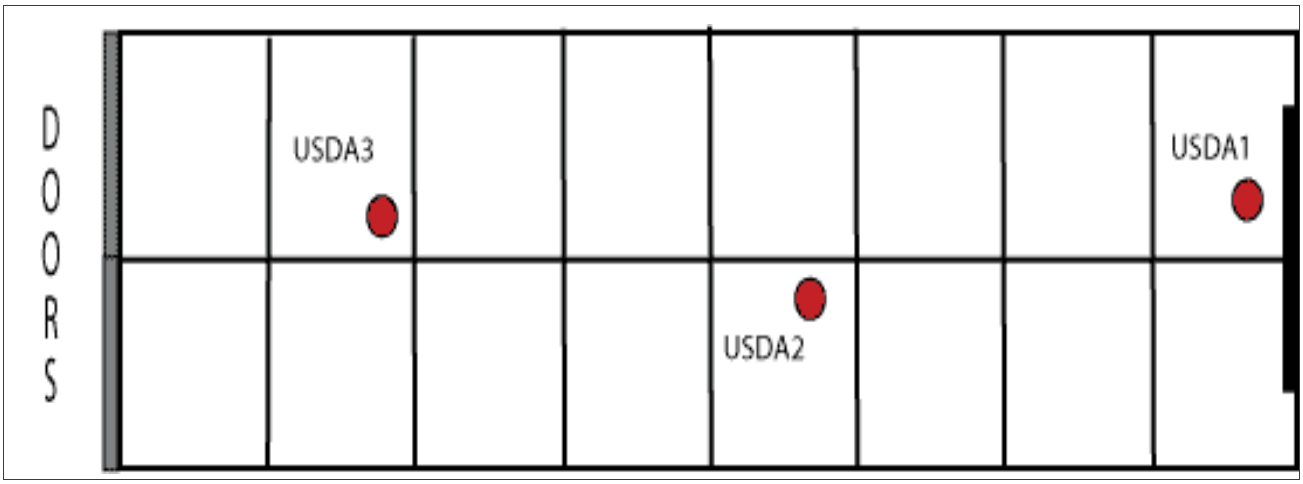

Figure 3-7-4 40 foot Refrigerated Container with 18 Pallets of Fruit (not drawn to scale)

Secure the Load

Place a piece of cardboard that extends from the front edge of the second-to-last pallet row to the back doors on the container floor before the last pallet row is loaded. Once the cardboard is installed properly, load the last pallet row so the pallets rest on top of the cardboard. Place a second piece of cardboard perpendicular to the first piece of cardboard and staple to the cartons in the last pallet row (**Figure 3-7-5**). The placement of the cardboard between the back doors of the container and the last row of pallets aids in maximizing air flow through the pallets. Complete this procedure for all pallets in the last pallet row of the container.

Figure 3-7-5 Proper placement of cardboard between the last pallet row of fruit and the back doors of the container

Treatment Requirements

Temperatures must be recorded at intervals no longer than 1 hour apart. Gaps of longer than 1 hour may invalidate the treatment or cause treatment failure.

Fruit pulp temperatures must be maintained at the temperature specified in the treatment schedule with no more than **0.39 °C (0.7 °F)** variation in temperature between two consecutive hourly readings. Failure to comply with this requirement may result in treatment failure.

The time required to complete the treatment begins when all temperature probes reach the prescribed treatment schedule temperature.

Prepare Documents

Complete the following PPQ forms and worksheets:

- "Calibration of Temperature Probes" record showing the temperature readings as taken from the temperature chart or log sheet during the calibration testing. Record readings to the nearest tenth of one degree. When the loading of each compartment has been completed, obtain the temperature reading of each fruit probe from the temperature recorder and record on this form.
- "Instructions to Captain" form letter.
- "Location of Temperature Sensors" record to show the actual position of each fruit temperature sensor. (See sample form in Appendix A.) This can be accomplished by a written description or by a diagrammatic sketch. Include compartment loading start and end times and dates on the form.
- PPQ Form 203, Foreign Site Certificate (for APHIS pre-inspected fruit)
- Shipper's manifest containing the quantity and kind of commodity.

Distribution of Documents

Conventional Vessels and Self Refrigerated (Integral) Containers

Place the following documents in a sealed envelope and give to the Captain for presentation to the clearance official at the port of arrival.

- Original "Calibration of Temperature Probes"
- Original "Location of Temperature Sensors"
- Copy of the "Instructions to Captain"

For reference purposes, present the Captain with the following documents:

- Original "Instructions to Captain"
- Copy of the "Calibration of Temperature Probes"
- Copy of the "Location of Temperature Sensors"

Send copies of all documents to the clearance official at the port of arrival and to **TQAU**.

Clearance of Cold Treated Shipments

The TQAU is in the process of designing electronic versions of all required cold treatment documentation. In the future the forms that are filled out overseas (excluding the preclearance forms) will be entered on-line through a

secured website so that the port of arrival will be able to view all required documentation before the certified vessel or container undergoing intransit cold treatment arrives at a U.S. port of entry. Until the new database and electronic forms are finished, continue following the instructions listed below.

Off-loading of self-refrigerated containerized fruit that is under treatment must be accomplished rapidly. Containers must be off-loaded and treatment reconvened within 2 or 3 hours from the time the container was disconnected from the refrigerating unit. The pulp sensors should never exceed the maximum allowable treatment temperature.

Observe the stacking pattern. Double stacking is **not** permitted. Do **not** release the shipment if the pallets have been double stacked.

Conventional Vessels

The “Calibration of Temperature Sensors” and “Location of Portable Sensors” documents from the country of origin should have been received at the port of entry prior to the arrival of the carrying vessel.

The document, “Calibration of Temperature Sensors”, is required for all shipments and includes information regarding the loading date and location of temperature sensors within the commodity, as well as calibration correction factors for every sensor.

Check the TQAU web site (http://treatments.cphst.org/vessels/) to familiarize yourself with the compartment layout.

Check the documents, and any accompanying correspondence for comments relating to deficiencies noted at origin. The documents must bear the signature of an APHIS-approved official or of an authorized official of the exporting country. A list of authorized names and signatures for each country is on file at TQAU and is available upon request.

Inform shipping line officials and pier supervisors of the quarantine safeguards to be observed pending clearance. The authorized APHIS official boarding the vessel must have several calibrated thermometers.

PPQ Form 556, In Transit Cold Treatment Report

Complete PPQ Form 556, In Transit Cold Treatment Report. Record the date and time of completion of each compartment and the officer's signature on the temperature chart or log sheet. Do **not** add fruit to the compartment after loading has been completed.

Complete the entries on the PPQ Form 556 during the actual performance of each step of the clearance procedure. The PPQ Form 556 instructions provide for a progressive clearance in the event that treatments are **not** completed before a vessel sails for a second U.S. port.

The Officer responsible for a U.S. vessel is typically the Chief Engineer or Reefer Engineer. The Officer responsible for a Foreign Flag vessel is typically the Chief Officer or Captain.

Inform the ship's officer to withhold discharging the treated commodity until clearance has been completed.

Obtain the clearance officer's copy of the calibration documents from ship's officer (Record in blocks 1-6, and 10).

Proceed to the data logger with the ship's officer and retrieve a temperature printout.

Review the temperature chart.

NOTICE

If the initial treatment period is broken because of excessive temperatures, failure of the recorder, or improper procedure, and the treatment is later restarted, enter the date and time of restart on the second line of item 28. Air temperatures may occasionally exceed treatment temperatures during defrost cycles; however, fruit temperatures should **not** rise appreciably during this time and must **not** exceed the temperature listed in the schedule. During non defrost times, the temperatures of the air sensors should never exceed the maximum allowable treatment temperature. For each compartment of a hold, the hourly sensor printouts will be examined by a PPQ Officer at the port of entry. Based on these records, the PPQ Official will make a determination as to whether to accept the treatment as satisfactory. In case of dispute, the ultimate decision will be made by the Officer in Charge (PPQ), who will take all factors into consideration. Occasionally, for example, there are cases in which one or two sensors in a compartment mechanically malfunctioned during the voyage, due to situations beyond the ship's control (e.g., rough seas). This is generally excusable, as long as the other sensors in the same compartment showed no readings higher than the cold treatment schedule allows. If, however, the ship stopped at another port while in route to the discharge destination in the U.S., but failed to have the facility sensor(s) repaired and recalibrated, it may be considered negligence on the part of the shipping line. The fruit from such refrigerated compartments would have to be retreated (in a cold warehouse) to be eligible for entry.

If a sensor is reading consistently high, it should be tested by using the ice-water bath technique. If this sensor proves to be accurate (i.e, readings within plus or minus 0.3 ^{o}C from zero) then it must be assumed that the high readings obtained in the fruit were indeed accurate, which would be sufficient grounds for rejection. For additional evidence, the PPQ Official can also obtain independent fruit pulp readings from a hand-held portable temperature-sensing instrument in the area of the load where high readings were obtained form the ship's sensor(s).

The vessel is permitted to store logged temperatures on magnetic media instead of printed on paper. However, the stored data must be printed in the presence of the authorized APHIS official.

Assemble logsheets so that a review can be made starting at the beginning of the temperature record. Check the calibration record; compare the actual calibration readings on logsheets with the calibration data on the calibration document (Record in block 23).

NOTICE

Many data logger installations are programmed to record temperature variations to one-hundredth of a degree centigrade (0.01°C). With this high resolution of temperature readings, a deviation of up to three-hundredths of a degree can be expected from consecutive readings in a standard ice water test. Accordingly, calibration certifications that are acceptable under our accuracy requirements show either the average of two consecutive calibration readings or two consecutive readings that are within three-hundredths of a degree centigrade of each other. Report deviations beyond this standard.

Review the logsheets up to when the loading of the compartment was complete. Determine the maximum and minimum fruit temperature at the time the sensors were inserted (Record in blocks 24, 25, and 26).

Continue reviewing the logsheets through the precooling period to the time when treatment commenced. Note abnormalities in the temperature readings that could indicate an irregularity in the treatment process (Record in block 27).

Review the treatment portion of the logsheets for irregularities and excessive temperatures (Record in block 28).

NOTICE

If the initial treatment period is broken because of excessive temperatures, failure of the data logger, or improper procedure, and the treatment is later restarted, enter the date and time of restart on the second line of item 28.

Clearance Action by Authorized APHIS Official

The authorized APHIS official will:

- Release shipment for discharge if all requirements have been met and notify ship's officers, pier superintendents, and Customs and Border Protection Agriculture Inspector(s).
- Hold shipment pending further evaluation if total effects of irregularities are **not** consistent with treatment requirements (Contact the supervisor regarding the reasons for holding the shipment).
- Record all exceptions in narrative form and attach to the clearance report.

Inspection of Load and Compartments

Time permitting, examine the load and compartments during and after unloading. Observe sensor locations, labeling, and physical condition and report irregularities.

Distribution of Clearance Documents

After final clearance, the completed PPQ Form 556 with supporting documents are to be distributed as follows:

- Keep copies of the PPQ Form 556 and the chart printouts at the port of arrival.
- Send copies of the PPQ Form 556 to **TQAU**.

Self-Refrigerated (Integral) Containers

Obtain the temperature printout and match it with the corresponding "Location of Temperature Sensors" and "Calibration of Temperature Probes" documents by using the container or recorder number. Check the documents and any accompanying correspondence for comments relating to deficiencies noted at origin. They must bear the signature of a PPQ Official or of an authorized official of the exporting country.

Compare the printout with the loading document to ensure the calibration factors, recorder start time, recorder serial number and recorder start date are the same. If the information is **not** the same, there must be proof that the equipment was exchanged and calibrated at the country of origin. Undocumented discrepancies will be cause for treatment failure.

Using PPQ Form 556, complete blocks 1-6 and 10. Record the container number in block 24. Six containers can be cleared per form.

Record the maximum and minimum fruit temperatures from the printout at time of loading (Blocks 25 and 26).

Review the temperatures and mark the printout where treatment commences at each temperature according to the appropriate treatment schedule. Determine date and time each treatment commenced (Block 27).

Review the treatment portion of the printout for irregularities and excessive temperatures (Block 28). If necessary, subtract or add correction factors to obtain the true temperature.

NOTICE

If the initial treatment period is broken because of excessive temperatures, failure of the data logger, or improper procedure, and the treatment is restarted, enter the date and time of restart on the second line of Block 27.

Determine the amount of time needed to complete the treatment if the treatment has **not** been completed, and report this to the persons responsible for the container. Check the temperature recordings to determine if the treatment has been completed at the end of the predicted completion period.

Record the last readings of the printout in Block 30. Investigate discrepancies. Submit documentation even if the treatment was negated.

Cold Treatment in Refrigerated Warehouses

The warehouse must be approved by PPQ (see Certifying Facilities).

The shipment must move directly from the port of entry to the cold storage warehouse with no diversion or delay.

The warehouse must provide the necessary security for safeguarding each shipment.

The unloading of containers which arrive at the warehouse under seal must be conducted under PPQ supervision.

Initiating the Cold Treatment

The procedures for the verification of recording equipment and calibration of temperature sensors are the same as those outlined for vessels in ***Intransit Cold Treatment in Conventional Vessels, Self-Refrigerated (Integral) Containers, and Warehouses*** **on page 3-7-2**, ***Initiating Intransit Cold Treatment in Vessels and Containers*** **on page 3-7-3**, ***Verification of Temperature Recording Equipment*** **on page 3-7-3** and ***Calibration of Temperature Sensors*** **on page 3-7-4**. These activities must be performed under the direction of an authorized APHIS official.

Arrange stowage to provide for adequate air distribution throughout the shipment, and to allow for the sampling of pulp temperatures in any desired location. To accomplish this, leave aisles between rows of pallets, with the aisles parallel to the air flow. Allow space between pallets. Double stacking of pallets is **not** allowed; therefore treatments will **not** begin until pallets are reconfigured to a single stacked pallet arrangement. However, rack systems are acceptable provided they have been approved by TQAU.

Placement of Temperature Sensors:

After loading is completed, take fruit temperatures at various locations throughout the load to determine the location of the warmest fruit. Place temperature sensors throughout the load, being sure to place sensors in the warmest areas. Under some conditions, additional air circulation will be required to cool the shipment uniformly. The use of additional fans or blowers will depend on the particular circumstances at the time of treatment.

Placement of sensors should be under the direction of an authorized APHIS official. Insert the sensor well into the fruit. The tip of the sensor must **not** extend through the fruit (**Figure 3-7-1 on page-3-7-7**). If necessary (in the

case of small fruit), the sensor should penetrate multiple fruit (**Figure 3-7-2 on page-3-7-8**). The number and location of the temperature sensors are determined during warehouse certification (**Figure 3-7-6**).

Number of Pallets	Number of Air Sensors	Number of Pulp Sensors	Total Number of Sensors
1 - 100	1	2	3
101 - 200	1	3	4
201 - 300	1	4	5
301 - 400	1	5	6
401 - 500	1	6	7
501 - 600	1	7	8
601 - 700	1	8	9
701 - 800	1	9	10
801 - 900	1	10	11
901 - 1000	1	11	12
1000 +	Must be approved by TQAU		

Figure 3-7-6 Number of Sensors in a Warehouse

Contact Information

TQAU

USDA, APHIS, PPQ, CPHST
Treatment Quality Assurance Unit
1730 Varsity Drive, Suite 400
Raleigh, NC 27606-5202
Email: CPHST_TQAU@aphis.usda.gov
Phone: 919-855-7450
Fax: 919-855-7493

3

Treatment Manual

Nonchemical Treatments

Irradiation

Contents

Introduction **3-8-1**
Authorities and Other Responsible Parties **3-8-2**
Treatment Objectives **3-8-2**
Efficacy **3-8-2**
Treatment **3-8-3**
Dosimetry **3-8-5**
Dose Mapping **3-8-5**
Facility Approval **3-8-5**
Documentation **3-8-5**
Terminology **3-8-6**

Introduction

This chapter provides background and general information for the use of irradiation as a phytosanitary treatment of plant pests. Irradiation was first approved by APHIS in 1997 for use on papayas from Hawaii for export to the U.S. mainland, Guam, Puerto Rico, and the U.S. Virgin Islands. In 2002, irradiation was approved as a phytosanitary treatment for all admissible fresh fruits and vegetables from all countries.

Authorities and Other Responsible Parties

- 7CFR 305.31 through 305.34
- Food and Drug Administration (FDA)

  The FDA is responsible for determining the labelling requirements for irradiated food.
- National nuclear regulatory authority of the country where the facility is located
- International Standard for Phytosanitary Measures #18 (ISPM)

  This International Standard provides technical guidance on the specific procedures for the application of ionizing radiation as a phytosanitary treatment for regulated pests or articles.

Treatment Objectives

The objective of phytosanitary treatments is to prevent the introduction or spread of regulated pests. As a phytosanitary treatment, irradiation may reduce the risk of introduction by achieving certain responses, known as “endpoints,” in the targeted pest(s). These endpoints are:

- Inability to emerge or fly
- Inactivation or devitalization (seeds may germinate but seedlings do not grow; or tubers, bulbs or cuttings do not sprout)
- Mortality
- Sterility (inability to reproduce)

Efficacy

Unlike the Probit 9 mortality required for many chemical and nonchemical quarantine treatments, the use of irradiation as a phytosanitary measure presents a new paradigm to PPQ. The officer inspecting the treated consignment upon arrival in the U.S. may encounter living insects. However, this is to be expected since the treatment endpoint may not necessarily be mortality.

Treatment

There are three types of ionizing radiation:

- Electrons generated from machine sources up to 10 MeV (eBeam)
- Radioactive isotopes (gamma rays from cobalt-60 or cesium-137)
- X-rays (up to 5 MeV)

The unit of measure for absorbed dose from any type of radiation is gray (Gy).

Modified atmospheres, such as low oxygen, may reduce treatment efficacy at a prescribed dose. Do **not** treat commodities that are in an oxygen-deficient environment.

Treatment procedures should also ensure that the minimum absorbed dose (Dmin) is fully attained throughout the commodity to provide the prescribed level of efficacy. Owing to the differences in the configuration of lots being treated, higher doses than the Dmin may be received by some of the commodities to ensure that the Dmin is achieved throughout the configured commodity. All treatments must be certified by verifying Dmin with approved dosimetry systems.

The minimum absorbed dose for the most-tolerant unmitigated pest is required if more than one pest is present. Refer to ***Table 3-8-1*** on **page 3-8-4** to determine the required minimum absorbed dose. For example, if a shipment of grapes is infested with both Mediterranean fruit fly and codling moth, the commodity would be irradiated using a minimum dose of 200 Gy.

There may be additional treatment requirements specific to the pest/host complex. Refer to the treatment schedules listed in ***T105-a-1*** on **page 5-2-68** for detailed information.

Table 3-8-1 summarizes the minimum required doses required for effective treatment of specific pests.:

Table 3-8-1 Pest-Specific Minimum absorbed dose (Gy)

Scientific Name	Common Name	Minimum Absorbed Dose (Gy)
Anastrepha ludens	Mexican fruit fly	70
Anastrepha obliqua	West Indian fruit fly	70
Anastrepha serpentina	Sapote fruit fly	100
Anastrepha suspensa	Caribbean fruit fly	70
Aspidiotus destructor	Coconut scale	150
Bactrocera cucurbitae	Melon fruit fly	150
Bactrocera dorsalis	Oriental fruit fly	150
Bactrocera jarvisi	Jarvis fruit fly	100
Bactrocera tryoni	Queensland fruit fly	100
Brevipalpus chilensis	Chilean false red mite	300
Ceratitis capitata	Mediterranean fruit fly	150
Conotrachelus nenuphar	Plum curculio	92
Copitarsia declora		100
Cryptophlebia ombrodelta	Litchi fruit moth	250
Cryptophlebia illepida	Koa seed worm	250
Cylas formicarius elegantulus	Sweet potato weevil	150
Cydia pomonella	Codling moth	200
Euscepes postfasciatus	West Indian sweet potato weevil	150
Grapholita molesta	Oriental fruit moth	200
Omphisa anastomosalis	Sweet potato vine borer	150
Pseudaulacaspis pentagona	White peach scale	150
Rhagoletis pomonella	Apple maggot	60
Sternochetus mangiferae	Mango seed weevil	300
	All other fruit flies of the family Tephritidae which are **not** listed above	150
	Plant pests of the class Insecta **not** listed above, except pupae and adults of the order Lepidoptera	400

Dosimetry

Dosimetry is the system used by the facility to determine absorbed dose. The absorbed dose is a quantity of radiation energy (measured in Gray (Gy)) absorbed per unit of mass of the commodity.

The dosimetry system should be calibrated in accordance with international standards or appropriate national standards (e.g. Standard ISO/ASTM 51261 *Guide for Selection and Calibration of Dosimetry Systems for Radiation Processing*).

Dose Mapping

Prior to routine treatments, the region(s) of lowest and highest dose absorbance must be mapped for each treatment configuration. Configurations may be defined by a variety of criteria which may vary by facility. Factors that affect dose mapping commonly include:

- Density and composition of the material treated
- Orientation of the product, stacking, volume and packaging
- Shape and/or size

Dose mapping of the product in each geometric packing configuration, arrangement and product density that will be used during routine treatments should be required by APHIS prior to the approval of a facility for the treatment application. Only the configurations approved by the APHIS should be used for actual treatments.

The data obtained from the dose mapping is used to determine the proper number and placement of dosimeters during routine operations.

Facility Approval

Chapter 6-8 of this manual covers the requirements for Irradiation facility approval (***Certifying Irradiation Treatment Facilities*** on **page 6-8-1**).

Documentation

The tracking and reporting of an irradiation treatment is critical to the integrity of the entire irradiation process. Treatment failure is linked to non-compliance, not pest detection. Consequently, an electronic database is being developed to standardize data entry, accurately and quickly produce data summaries and analysis, and allow access to a geographically diverse group of people.

Until this electronic database is fully operational, documentation requirements include the completion of the PPQ Form 203, Foreign Site Certificate of Inspection and/or Treatment.

Important

The Irradiation Reporting and Accountability Database (IRAD) is a component of the Commodity Treatment Information System (CTIS) developed by USDA-APHIS-PPQ-CPHST Treatment Quality Assurance Unit (TQAU). Access to this web-based system will be permitted depending on the user's specific role or function in the irradiation process. TQAU will assign individual usernames and passwords.

Terminology

absorbed dose—Quantity of radiation energy (in gray) absorbed per unit of mass of a specified target [ISPM No. 18]

dose mapping—Measurement of the absorbed dose distribution within a process load through the use of dosimeters placed at specific locations within the process load [ISPM No. 18]

dosimeter—A device that, when irradiated, exhibits a quantifiable change in some property of the device which can be related to absorbed dose in a given material using appropriate analytical instrumentation and techniques [ISPM No. 18]

dosimetry—A system used for determining absorbed dose, consisting of dosimeters, measurement instruments and their associated reference standards, and procedures for the system's use [ISPM No. 18]

gray (Gy)—Unit of absorbed dose where 1 Gy is equivalent to the absorption of 1 joule per kilogram (1 Gy = 1 J.kg-1) [ISPM No. 18]

ionizing radiation—Charged particles and electromagnetic waves that as a result of physical interaction create ions by either primary or secondary processes [ISPM No. 18]

irradiation—Treatment with any type of ionizing radiation [ISPM No. 18]

minimum absorbed dose—The localized minimum absorbed dose within the process load [ISPM No. 18] (Dmin)

radura—internationally recognized symbol used to indicate when a food product has been irradiated

4

Treatment Manual

Residue Monitoring

Overview

Contents

Overview **4-1-1**

Overview

Methyl bromide fumigants, except those with "Q" labels, are subject to requirements of the FIFRA Section 18 Quarantine Exemption. When commodities intended for food or feed are fumigated with methyl bromide under the FIFRA Section 18 Quarantine Exemption, one additional EPA requirement must be met: PPQ must monitor aeration by sampling the gas concentration to determine when a commodity may be released.

NOTICE

Currently, Plant Protection and Quarantine (PPQ) is **not** taking samples of commodities for residue monitoring. However, if residue monitoring becomes necessary, this section provides guidelines for taking samples that will be used for monitoring fumigant residues.

In the past, PPQ used residue monitoring to comply with the Environmental Protection Agency's (EPA's) guidelines for fumigation of edible food or feed products conducted under a Section 18 Quarantine Exemption. PPQ took and analyzed samples of fumigated commodities, and they reported the resulting data yearly to EPA. When a fumigation was conducted under a Section 18 Quarantine Exemption, samples were taken only when the commodity would be eaten by people or fed to animals. When the commodity would **not** be used for food or feed, PPQ did **not** take samples.

For example, if thyme would be used as an herb and fumigated under the schedule (T101-n-2), PPQ would sample the commodity because it would be eaten. On the other hand, if that same thyme were treated but imported as a cut flower, sampling would be unnecessary because it would be used for decoration—**not** eating.

4

Treatment Manual

Residue Monitoring

Instructions for Collecting, Packaging, and Shipping Residue Monitoring Samples

Contents

Safety **4-2-1**
Collecting the Sample **4-2-2**
Pretreatment Sample **4-2-2**
Post-Treatment Samples **4-2-2**
Labeling the Sample **4-2-2**
Storing the Sample **4-2-3**
Shipping Samples **4-2-3**
Quarantine Requirements **4-2-3**

NOTICE

Currently, Plant Protection and Quarantine (PPQ) is **not** taking samples of commodities for residue monitoring. However, if residue monitoring becomes necessary, this section provides guidelines for taking samples that will be used for monitoring fumigant residues.

Safety

Pretreatment samples will be shipped with dry ice. Be sure to store dry ice in well-ventilated areas and to transport dry ice and samples packed in dry ice in well-ventilated containers. Wear gloves when handling dry ice. For detailed information, see ***Hazard Communication and Material Safety Data Sheets*** on **page 7-4-1**.

The Department of Transportation (DOT) considers dry ice a hazardous material and requires that aircraft record the amount of dry ice carried in the cargo hold. Amounts of 5 pounds or less are **not** stringently regulated; however, include the weight of dry ice on the shipping label. In addition, some overnight delivery companies have restrictions on shipping dry ice. Equip shipping containers with loose-fitting lids to prevent an explosive release of sublimating carbon dioxide. Identify dry ice as ORM-A on the shipping label. Also indicate on the label that the package contains diagnostic specimens.

Collecting the Sample

You must take a sample prior to treatment (pretreatment) and after aeration is completed (post-treatment). To avoid contaminating the sample, handle it as little as possible. Take pretreatment and post-treatment samples from the same general location within a given lot (i.e., the same bags, boxes, or other containers).

Some ports receive commodities several times a month. For example, the port of Ft. Lauderdale received 20 shipments of chayote in October 1992. These shipments need **not** be sampled each time. For frequently received commodities, ports should develop a routine sample collection plan, such as one sample collected per week. However, when a new commodity is received or a commodity is received infrequently (once a week or less), collect a sample each time the commodity is treated.

Pretreatment Sample

1. Collect a minimum of 450g (approximately 1 lb.) except for herbs of which you need to collect 150 grams (approximately one-third pound). If you are collecting fruits or vegetables that are heavy (for example grapefruit or yams), be sure to collect at least two pieces of produce that weigh 450g.
2. Place these samples in containers with dry ice.
3. Ship the pretreatment samples separately from post-treatment samples.

Post-Treatment Samples

1. Collect a minimum of 450g (approximately 1 lb.) except for herbs of which you need to collect 150g (approximately one-third pound). If you are collecting fruits or vegetables that are heavy (for example grapefruit or yams), be sure to collect at least two pieces of produce that weigh 450g.
2. Ship the post-treatment samples separately from the pretreatment samples and in accordance with standard shipping practices. If the samples require refrigeration, then ship the samples with wet ice or ice packs. If the samples are normally shipped at ambient temperature (e.g., yams), ship them without ice.

Labeling the Sample

Label each sample container with the State, county, date, and name of contents and whether the sample is “pre” or “post” treatment. For this label, use waterproof ink on a strip of masking tape or other label material. Be sure to

attach the label before leaving the sampling site. Securely fasten a plastic envelope containing the yellow copy of the APHIS Form 2061 to the side of the sampling container. Label this envelope with the same information that you placed on the sample container (State, county, date, and name of contents and whether sample was “pre” or “post” treatment).

Storing the Sample

Immediately place the samples in a freezer or refrigerator until ready to package the samples for shipping.

Shipping Samples

Quarantine Requirements

Contact the State Plant Health Director to determine where to ship the samples. Ship all samples in leakproof, double sealed containers. Ensure the pretreatment sample is secure since it does **not** meet entry requirements for the United States.

Ship samples in coolers with dry ice packed above the samples. The lid of the cooler should be loose fitting to allow gasses to escape. Ship the samples using the contract overnight delivery service or the U.S. Postal Service Overnight Delivery.

5

Treatment Manual

Treatment Schedules

Index to Schedules

Contents

T100 - Schedules for Fruit, Nuts, and Vegetables **5-2-1**
T200 - Schedules for Propagative Plant Material **5-3-1**
T300 - Schedules for Miscellaneous Plant Products **5-4-1**
T400 - Schedules for Miscellaneous Products **5-5-1**
T500 - Schedules for Plant Pests or Pathogens **5-6-1**
T600-Controlled Atmosphere Temperature Treatment System **5-7-1**
Domestic Treatments **5-8-1**

5

Treatment Manual

Treatment Schedules

T100 - Schedules for Fruit, Nuts, and Vegetables

Contents

T101—Methyl Bromide Fumigation **5-2-3**
T102—Water Treatment **5-2-53**
T103—High Temperature Forced Air **5-2-59**
T104—Pest Specific/Host Variable **5-2-62**
T105—Irradiation **5-2-65**
T106—Vapor Heat **5-2-70**
T107—Cold Treatment **5-2-74**
T108—Fumigation Plus Refrigeration of Fruits **5-2-79**
T109—Cold Treatment Plus Fumigation of Fruits **5-2-83**
T110—Quick Freeze **5-2-85**

Reporting Commodity Injury

Record any new or unusual observations relating to injury of commodity and report them to Quarantine Policy, Analysis and Support (QPAS) in Riverdale. Give pertinent details of the treatment and conditions regarding its application. In appraising the effect of a particular treatment, take care to distinguish between the actual or apparent effects directly attributable to the treatment and those relating to factors or conditions not subject to PPQ control.

Commodities in the T100 series are intended for consumption as food or feed. These commodities may have to be treated with methyl bromide to control a pest.

FIFRA Section 18 Exemption

Methyl bromide fumigants, except those with “Q” labels, are subject to requirements of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), Section 18 Quarantine Exemption. When commodities intended for food or feed are fumigated with methyl bromide under the FIFRA Section 18 Quarantine Exemption, one additional EPA requirement must be met: PPQ must monitor aeration by sampling the gas concentration to determine when a commodity may be released.

In this manual, fumigation schedules under the FIFRA Section 18 Quarantine Exemption are identified by the following note:

Important

Do **not** use this treatment schedule if its FIFRA Section 18 Exemption has expired. For the current exemption status, call your local State Plant Health Director (SPHD).

Determine the Correct Label for Fumigation

Always use the label of the fumigant to determine if the commodity can be treated. Fumigation schedules in this publication are intended to clarify and expand commercial labels for methyl bromide. The EPA only authorizes fumigation for commodities that are listed on the label of the gas being used for the fumigation. Also, to comply with State regulations, a fumigant must be registered in the State where it is being used.

Although the EPA only authorizes the use of a pesticide on a crop, animal, or site that is listed on the label of a pesticide, specific pests do not have to be listed on the label to use the pesticide. An amendment to FIFRA in 1978 permits the use of a pesticide to control a pest not on the label if the application is to a crop, animal, or site specified on the label, unless mentioned otherwise.

How Fruits and Vegetables Are Listed

Fruits and vegetables that are to be fumigated with methyl bromide (T101s) will be listed in alphabetical order. Each schedule will have an assigned letter, e.g., Apples T101-a-1, Zucchini T101-h-3. For fruits and vegetables that require treatment as a condition of entry, refer to the Fruits and Vegetables Import Requirement database for the specific treatment.

T101—Methyl Bromide Fumigation

T101-a-1 Apple and Pear[1]

Pest: External feeders

Treatment: **T101-a-1** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
80 °F or above	1.5 lbs	19	14
70-79 °F	2 lbs	26	19
60-69 °F	2.5 lbs	32	24
50-59 °F	3 lbs	38	29
40-49 °F	4 lbs	48	38

T101-a-3 Apricot[2], Peach, Plum[2], Nectarine

Pest: External feeders

Treatment: **T101-a-3** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
80 °F or above	1.5 lbs	19	14
70-79 °F	2 lbs	26	19
60-69 °F	2.5 lbs	32	24
50-59 °F	3 lbs	38	29
40-49 °F	4 lbs	48	38

T101-b-1 Asparagus

Pest: External feeders such as Noctuidae spp., *Thrips* spp. (except *Scirtothrips dorsalis* from Thailand), *Copitarsia* spp.

Treatment: **T101-b-1** MB (“Q” label only) at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
80 °F or above	1.5 lbs	19	14
70-79 °F	2 lbs	26	19
60-69 °F	2.5 lbs	32	24
50-59 °F	3 lbs	38	29
40-49 °F	4 lbs	48	38

1 Fumigation may cause **severe** damage to Chinese, Japanese, Asian and Sand Pears. Obtain the importer’s consent before fumigation.

2 **Pluots** and **plumcots** are considered hybrids of plums and apricots and can be treated using T101-a-3 provided they are treated as a **Section 18 Crisis Exemption**.

T101-b-1-1 Asparagus from Thailand, Australia, and New Zealand

Pest: *Scirtothrips dorsalis* (Thailand), *Halotydeus destructor* (Australia) (New Zealand)

Treatment: **T101-b-1-1** MB ("Q" label only) at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
80 °F or above	2.5 lbs	32	24
70-79 °F	3 lbs	38	29
60-69 °F	4 lbs	48	38

T101-c-1 Avocado (from Hawaii, Israel, or the Philippines)

Pest: *Ceratitis capitata* (Mediterranean fruit fly), *Bactrocera dorsalis* (Oriental fruit fly), and *Bactrocera cucurbitae* (melon fly)

Treatment: **T101-c-1** MB at NAP—tarpaulin or chamber

This treatment is marginal as to host tolerance and shipper should be warned of possible injury. Treatment approved for issuance of 318.13-4e certification.

Temperature	Dosage Rate (lb/1000 ft^3)	Minimum Concentration Readings (ounces) At:		
		0.5 hr	2 hrs	4 hrs
70 °F or above	2 lbs	26	16	14

Important

Do **not** use this treatment schedule if its FIFRA Section 18 Exemption has expired. For the current exemption status, call your local State Plant Health Director (SPHD).

Alternate Treatment—Fumigation plus refrigeration T108

T101-d-1 Banana

Pest: External feeders such as Noctuidae, *Thrips* spp., *Copitarsia* spp.

Treatment: **T101-d-1** MB at NAP—tarpaulin or chamber

This treatment is marginal as to host tolerance and shipper should be warned of possible injury.

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
80 °F or above	1.5 lbs	19	14
70-79 °F	2 lbs	26	19
60-69 °F	2.5 lbs	32	24
50-59 °F	3 lbs	38	29
40-49 °F	4 lbs	48	38

Important

Do **not** use this treatment schedule if its FIFRA Section 18 Exemption has expired. For the current exemption status, call your local State Plant Health Director (SPHD).

T101-e-1 Bean (except for fava bean), dry

Pest: Bruchidae (seed beetles)

Treatment: **T101-e-1** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:					
		0.5 hr	2 hrs	2.5 hrs	3 hrs	3.5 hrs	4 hrs
70 °F or above	3 lbs	38	—	24	—	—	—
60-69 °F	3 lbs	38	29	—	24	—	—
50-59 °F	3 lbs	38	29	—	—	24	—
40-49 °F	3 lbs	38	29	—	—	—	24

see also T101-k-2 or T101-K-2-1 for fresh beans

T101-g-1

Beet

Pest: Internal feeders

Treatment: **T101-g-1** MB chamber, 15" vacuum—chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
90 °F or above	2 lbs	2 hrs
80-89 °F	2.5 lbs	2 hrs
70-79 °F	3 lbs	2 hrs
60-69 °F	3 lbs	2.5 hrs
50-59 °F	3 lbs	3 hrs
40-49 °F	3 lbs	3.5 hrs

NOTICE

As of October 2008, **no commercial** chambers in the United States are approved for the vacuum fumigation of imported commodities. If vacuum treatment is required as a **condition of entry**, the consignment must be destroyed, reexported or returned to country of origin.

T101-g-1-1

Beet

Pest: External feeders

Treatment: **T101-g-1-1** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:				
		0.5 hr	2 hrs	3 hrs	3.5 hrs	4 hrs
90 °F and above	2 lbs	26	19	19	—	—
80-89 °F	2.5 lbs	32	24	24	—	—
70-79 °F	3 lbs	38	29	24	—	—
60-69 °F	3 lbs	38	29	—	24	—
50-59 °F	3 lbs	38	29	—	—	24

T101-h-1 Blackberry

Pest: External feeders such as Noctuidae, *Thrips* spp., *Copitarsia* spp., Pentatomidae, and *Tarsonemus* spp.

Treatment: **T101-h-1** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
80 °F or above	1.5 lbs	19	14
70-79 °F	2 lbs	26	19
60-69 °F	2.5 lbs	32	24
50-59 °F	3 lbs	38	29
40-49 °F	4 lbs	48	38

Important

Do **not** use this treatment schedule if its FIFRA Section 18 Exemption has expired. For the current exemption status, call your local State Plant Health Director (SPHD).

T101-i-1 Blueberry

Pest: External feeders

Treatment: **T101-i-1** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
80 °F or above	1.5 lbs	19	14
70-79 °F	2 lbs	26	19

T101-i-1-1 Blueberry

Pest: *Ceratitis capitata* (Mediterranean fruit fly) and *Anastrepha fraterculus* (South American fruit fly)

Treatment: **T101-i-1-1** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:		
		0.5 hr	2 hrs	3.5 hrs
70 °F or above	2 lbs	26	22	21

T101-n-2

Broccoli (*Brassica oleracea* var. *botrytis*)

Pest: External feeders and leaf miners

Treatment: **T101-n-2** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
70 °F or above	2 lbs	26	14
60-69 °F	2.5 lbs	32	24
50-59 °F	3 lbs	38	29
45-49 °F	3.5 lbs	43	34
40-44 °F	4 lbs	48	38

Important

Do **not** use this treatment schedule if its FIFRA Section 18 Exemption has expired. For the current exemption status, call your local State Plant Health Director (SPHD).

T101-n-2

Broccoli, Chinese (gai lon) (*Brassica albogiabra*)

Pest: External feeders and leaf miners

Treatment: **T101-n-2** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
70 °F or above	2 lbs	26	14
60-69 °F	2.5 lbs	32	24
50-59 °F	3 lbs	38	29
45-49 °F	3.5 lbs	43	34
40-44 °F	4 lbs	48	38

Important

Do **not** use this treatment schedule if its FIFRA Section 18 Exemption has expired. For the current exemption status, call your local State Plant Health Director (SPHD).

T101-n-2

Broccoli raap (rapini) (*Brassica campestris*)

Pest: External feeders and leaf miners

Treatment: **T101-n-2** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
70 °F or above	2 lbs	26	14
60-69 °F	2.5 lbs	32	24
50-59 °F	3 lbs	38	29
45-49 °F	3.5 lbs	43	34
40-44 °F	4 lbs	48	38

Important

Do **not** use this treatment schedule if its FIFRA Section 18 Exemption has expired. For the current exemption status, call your local State Plant Health Director (SPHD).

T101-n-2

Brussels sprouts (*Brassica oleracea* var. *gemmifera*)

Pest: External feeders and leaf miners

Treatment: **T101-n-2** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
70 °F or above	2 lbs	26	14
60-69 °F	2.5 lbs	32	24
50-59 °F	3 lbs	38	29
45-49 °F	3.5 lbs	43	34
40-44 °F	4 lbs	48	38

Important

Do **not** use this treatment schedule if its FIFRA Section 18 Exemption has expired. For the current exemption status, call your local State Plant Health Director (SPHD).

T101-j-1

Cabbage

Includes both European and Chinese cabbage

Pest: External feeders

Treatment: **T101-j-1** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
70 °F or above	2 lbs	26	14
60-69 °F	2.5 lbs	32	24
50-59 °F	3 lbs	38	29
45-49 °F	3.5 lbs	43	34
40-44 °F	4 lbs	48	38

For other *Brassica* spp., use the leafy vegetable schedule, T101-n-2

T101-n-2

Cabbage (*Brassica oleracea*)

Pest: External feeders and leaf miners

Treatment: **T101-n-2** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
70 °F or above	2 lbs	26	14
60-69 °F	2.5 lbs	32	24
50-59 °F	3 lbs	38	29
45-49 °F	3.5 lbs	43	34
40-44 °F	4 lbs	48	38

Important

Do **not** use this treatment schedule if its FIFRA Section 18 Exemption has expired. For the current exemption status, call your local State Plant Health Director (SPHD).

T101-n-2

Cabbage, Chinese (bok choy) (*Brassica chinensis*)

Pest: External feeders and leaf miners

Treatment: **T101-n-2** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
70 °F or above	2 lbs	26	14
60-69 °F	2.5 lbs	32	24
50-59 °F	3 lbs	38	29
45-49 °F	3.5 lbs	43	34
40-44 °F	4 lbs	48	38

Important

Do **not** use this treatment schedule if its FIFRA Section 18 Exemption has expired. For the current exemption status, call your local State Plant Health Director (SPHD).

T101-n-2

Cabbage, Chinese (napa) (*Brassica pekinensis*)

Pest: External feeders and leaf miners

Treatment: **T101-n-2** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
70 °F or above	2 lbs	26	14
60-69 °F	2.5 lbs	32	24
50-59 °F	3 lbs	38	29
45-49 °F	3.5 lbs	43	34
40-44 °F	4 lbs	48	38

Important

Do **not** use this treatment schedule if its FIFRA Section 18 Exemption has expired. For the current exemption status, call your local State Plant Health Director (SPHD).

T101-n-2 Cabbage, Chinese mustard (gai choy) (*Brassica campestris*)

Pest: External feeders and leaf miners

Treatment: **T101-n-2** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
70 °F or above	2 lbs	26	14
60-69 °F	2.5 lbs	32	24
50-59 °F	3 lbs	38	29
45-49 °F	3.5 lbs	43	34
40-44 °F	4 lbs	48	38

Important

Do **not** use this treatment schedule if its FIFRA Section 18 Exemption has expired. For the current exemption status, call your local State Plant Health Director (SPHD).

T101-k-1 Cantaloupe

Pest: External feeders

Treatment: **T101-k-1** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
80 °F or above*	1.5 lbs	19	14
70-79 °F*	2 lbs	26	19
60-69 °F	2.5 lbs	32	24
50-59 °F	3 lbs	38	29
40-49 °F	4 lbs	48	38

***** Use “MB 100” at 70 °F or above, use MB “Q” label at 40 °F or above.

For other melons, see T101-o-2

T101-l-1

Carrot

Pest: External feeders

Treatment: **T101-l-1** MB at NAP—tarpaulin or chamber—chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:				
		0.5 hr	2 hrs	3 hrs	3.5 hrs	4 hrs
90 °F and above	2 lbs	26	19	19	—	—
80-89 °F	2.5 lbs	32	24	24	—	—
70-79 °F	3 lbs	38	29	24	—	—
60-69 °F	3 lbs	38	29	—	24	—
50-59 °F	3 lbs	38	29	—	—	24

T101-m-1

Carrot

Pest: Internal feeders

Treatment: **T101-m-1** MB, chamber, 15" vacuum

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
90 °F or above	2 lbs	2 hrs
80-89 °F	2.5 lbs	2 hrs
70-79 °F	3 lbs	2 hrs
60-69 °F	3 lbs	2.5 hrs
50-59 °F	3 lbs	3 hrs
40-49 °F	3 lbs	3.5 hrs

NOTICE

As of October 2008, **no commercial** chambers in the United States are approved for the vacuum fumigation of imported commodities. If vacuum treatment is required as a **condition of entry**, the consignment must be destroyed, reexported or returned to country of origin.

T101-n-1 Cassava (manihot and yuca)

Pest: External feeders and hitchhikers[3]

Treatment: **T101-n-1** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:			
		0.5 hr	2 hrs	3 hrs	3.5 hrs
90 °F or above	2 lbs	26	19	19	—
80-89 °F	2.5 lbs	32	24	24	—
70-79 °F	3 lbs	38	29	24	—
60-69 °F	3 lbs	38	29	—	24

Important

Do **not** use this treatment schedule if its FIFRA Section 18 Exemption has expired. For the current exemption status, call your local State Plant Health Director (SPHD).

T101-n-2 Cauliflower (*Brassica oleracea* var. *botrytis*)

Pest: External feeders and leaf miners

Treatment: **T101-n-2** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
70 °F or above	2 lbs	26	14
60-69 °F	2.5 lbs	32	24
50-59 °F	3 lbs	38	29
45-49 °F	3.5 lbs	43	34
40-44 °F	4 lbs	48	38

Important

Do **not** use this treatment schedule if its FIFRA Section 18 Exemption has expired. For the current exemption status, call your local State Plant Health Director (SPHD).

3 T101-n-1 should NOT be used for snails, but can be used for slugs.

T101-n-2 Cavalo broccolo (*Brassica oleracea* var. *botrytis*)

Pest: External feeders and leaf miners

Treatment: **T101-n-2** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
70 °F or above	2 lbs	26	14
60-69 °F	2.5 lbs	32	24
50-59 °F	3 lbs	38	29
45-49 °F	3.5 lbs	43	34
40-44 °F	4 lbs	48	38

Important

Do **not** use this treatment schedule if its FIFRA Section 18 Exemption has expired. For the current exemption status, call your local State Plant Health Director (SPHD).

T101-n-1 Celeriac (celery root)

Pest: External feeders

Treatment: **T101-n-1** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:			
		0.5 hr	2 hrs	3 hrs	3.5 hrs
90 °F or above	2 lbs	26	19	19	—
80-89 °F	2.5 lbs	32	24	24	—
70-79 °F	3 lbs	38	29	24	—
60-69 °F	3 lbs	38	29	—	24

Important

Do **not** use this treatment schedule if its FIFRA Section 18 Exemption has expired. For the current exemption status, call your local State Plant Health Director (SPHD).

T101-o-1

Celery (above-ground parts)

Pest: External feeders

Treatment: **T101-o-1** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/ 1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
80 °F or above	1.5 lbs	19	14
70-79 °F	2 lbs	26	19
60-69 °F	2.5 lbs	32	24
50-59 °F	3 lbs	38	29
40-49 °F	4 lbs	48	38

Important

Do **not** use this treatment schedule if its FIFRA Section 18 Exemption has expired. For the current exemption status, call your local State Plant Health Director (SPHD).

For below ground parts, use T101-n-1

T101-p-1

Chayote (fruit only)

Pest: External feeders

Treatment: **T101-p-1** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
80 °F or above	1.5 lbs	19	14
70-79 °F	2 lbs	26	19
60-69 °F	2.5 lbs	32	24
50-59 °F	3 lbs	38	29
40-49 °F	4 lbs	48	38

For below ground parts, use T101-a-2 (Dasheen)

T101-r-1

Cherry

Pest: Insects other than fruit flies

Treatment: **T101-r-1** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
80 °F or above	1.5 lbs	19	14
70-79 °F	2 lbs	26	19
60-69 °F	2.5 lbs	32	24
50-59 °F	3 lbs	38	29
40-49 °F	4 lbs	48	38

T101-s-1

Cherry

Pest: *Rhagoletis indifferens* (Western cherry fruit fly) and *Cydia pomonella* (codling moth)

Treatment: **T101-s-1** MB at NAP—chamber only

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
70 °F or above	2 lbs	2 hrs
60-69 °F	2.5 lbs	2 hrs
50-59 °F	3 lbs	2 hrs
40-49 °F	4 lbs	2 hrs

T101-t-1

Chestnut

Pest: *Cydia splendana* (nut fruit tortrix) and *Curculio* spp.

Treatment: **T101-t-1** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:					
		0.5 hr	2 hrs	3 hrs	4 hrs	5 hrs	6 hrs
90 °F and above	4 lbs	58	34	34	—	—	—
80-89 °F	4 lbs	58	32	—	32	—	—
70-79 °F	5 lbs	72	42	—	42	—	—
60-69 °F	5 lbs	72	40	—	—	40	—
50-59 °F	6 lbs	85	50	—	—	50	—
40-49 °F	6 lbs	85	48	—	—	—	48

see also T101-u-1

Does **not** include water chestnut

T101-u-1 Chestnut

Pest: *Cydia splendana* (nut fruit tortrix) and *Curculio* spp.

Treatment: **T101-u-1** MB in 26" vacuum—chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
80 °F or above	3 lbs	2 hrs
70-79 °F	4 lbs	2 hrs
60-69 °F	4 lbs	3 hrs
50-59 °F	4 lbs	4 hrs
40-49 °F	4 lbs	5 hrs

Does **not** include water chestnut

T101-v-1 Chicory (above-ground parts)

Pest: External feeders

Treatment: **T101-v-1** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
70 °F or above	2 lbs	26	14
60-69 °F	2.5 lbs	32	24
50-59 °F	3 lbs	38	29
45-49 °F	3.5 lbs	43	34
40-44 °F	4 lbs	48	38

Important

Do **not** use this treatment schedule if its FIFRA Section 18 Exemption has expired. For the current exemption status, call your local State Plant Health Director (SPHD).

see T101-n-1 for below-ground parts

see T101-z-1 for below-ground parts

see T101-a-2 for below-ground parts

T101-n-1 Chicory root

Pest: External feeders

Treatment: **T101-n-1** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:			
		0.5 hr	2 hrs	3 hrs	3.5 hrs
90 °F or above	2 lbs	26	19	19	—
80-89 °F	2.5 lbs	32	24	24	—
70-79 °F	3 lbs	38	29	24	—
60-69 °F	3 lbs	38	29	—	24

Important

Do **not** use this treatment schedule if its FIFRA Section 18 Exemption has expired. For the current exemption status, call your local State Plant Health Director (SPHD).

T101-w-1 Cipollini (bulbs)

Pest: *Exosoma lusitanica* (chrysomelid beetle)

Treatment: **T101-w-1** MB in 15" vacuum—chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
80 °F or above	2 lbs.	2 hrs
70-79 °F	3 lbs.	2 hrs
60-69 °F	4 lbs.	2 hrs
50-59 °F	4 lbs.	3 hrs
40-49 °F	4 lbs.	4 hrs

NOTICE

As of October 2008, **no commercial** chambers in the United States are approved for the vacuum fumigation of imported commodities. If vacuum treatment is required as a **condition of entry**, the consignment must be destroyed, reexported or returned to country of origin.

T101-w-1-2 Citrus from U.S. (interstate movement)

Pest: *Ceratitis capitata* (Mediterranean fruit fly)

Treatment: **T101-w-1-2** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
70 °F or above	2 lbs	26	22

Includes only kumquats, lemons, limes, oranges, tangelos, and tangerines for interstate movement

T101-n-2-1 Clementine, Lemon, Lime, Mandarin, and Tangerine from Chile

Pest: External feeders and *Brevipalpus chilensis* (Chilean False Red Mite)

Treatment: **T101-n-2-1** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
80 °F or above	1.5 lbs	19	14
70-79 °F	2 lbs	26	19
60-69 °F	2.5 lbs	32	24
50-59 °F	3 lbs	38	29

T101-j-2-1 Clementines (Tangerines) from Mexico and quarantine areas of the U.S.

Pest: *Anastrepha* spp.

Treatment: **T101-j-2-1** MB at NAP—chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
80 °F or above	2.5 lbs	2 hrs

Load limit **not** to exceed 80 percent of chamber capacity

Inspect a representative sample of the fruit. If the level of infestation with fruit flies is more than 0.5 percent for the lot, then the fruit is ineligible for fumigation.

T101-n-2

Coles (Brassica spp.)*

Pest: External feeders and leaf miners

Treatment: **T101-n-2** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
70 °F or above	2 lbs	26	14
60-69 °F	2.5 lbs	32	24
50-59 °F	3 lbs	38	29
45-49 °F	3.5 lbs	43	34
40-44 °F	4 lbs	48	38

Important

Do **not** use this treatment schedule if its FIFRA Section 18 Exemption has expired. For the current exemption status, call your local State Plant Health Director (SPHD).

Important

*Coles (Brassica spp.), EPA Crop Group 5, are restricted to broccoli (Brassica oleracea var. botrytis); broccoli, Chinese (gai lon) (Brassica albogiabra); broccoli raap (rapini) (Brassica campestris); brussels sprouts (Brassica oleracea var. gemmifera); cabbage (Brassica oleracea); Cabbage, Chinese (bok choy) (Brassica chinensis); Cabbage, Chinese (napa) (Brassica pekinensis); cabbage, Chinese mustard (gai choy) (Brassica campestris); cauliflower (Brassica oleracea var. botrytis); cavalo broccolo (Brassica oleracea var. botrytis); collards (Brassica oleracea var. acephala); kale (Brassica oleracea var. acephala); kohlrabi (Brassica oleracea var. gongyiodes); mizuna (Brassica rapa Japonica Group); mustard greens (Brassica juncea); mustard spinach (Brassica rapa Perviridis Group); rape greens (Brassica napus)

Of these, cabbage (Brassica oleracea) (labeled treatment T101-j-1) is the only vegetable in this group **not** covered by a FIFRA Section 18 Exemption.

T101-n-2

Collard Greens (*Brassica oleracea* var. *acephala*)

Pest: External feeders and leaf miners

Treatment: **T101-n-2** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
70 °F or above	2 lbs	26	14
60-69 °F	2.5 lbs	32	24
50-59 °F	3 lbs	38	29
45-49 °F	3.5 lbs	43	34
40-44 °F	4 lbs	48	38

Important

Do **not** use this treatment schedule if its FIFRA Section 18 Exemption has expired. For the current exemption status, call your local State Plant Health Director (SPHD).

T101-x-1

Copra

(Dried coconuts and whole coconuts without the husk)

Pest: External feeders

Treatment: **T101-x-1** MB (“Q” label only) at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
80 °F or above	1.5 lbs	19	14
70-79 °F	2 lbs	26	19
60-69 °F	2.5 lbs	32	24

T101-x-1-1

Corn-on-the-cob

(Green corn, sweet corn)

Pest: *Ostrinia nubilalis* (European corn borer)

Treatment: **T101-x-1-1** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2.5 hrs
70 °F or above	2.5 lbs	32	24

T101-y-1

Cucumber

Pest: External feeders

Treatment: **T101-y-1** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
80 °F or above	1.5 lbs	19	14
70-79 °F	2 lbs	26	19
60-69 °F	2.5 lbs	32	24
50-59 °F	3 lbs	38	29

T101-z-1

Dasheen

(Eddoe, malanga, tannia, tanya, taro, and yautia)

Pest: External feeders

Treatment: **T101-z-1** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:				
		0.5 hr	2 hrs	3 hrs	3.5 hrs	4 hrs
90 °F or above	2 lbs	26	19	19	—	—
80-89 °F	2.5 lbs	32	24	24	—	—
70-79 °F	3 lbs	38	29	24	—	—
60-69 °F	3 lbs	38	29	—	24	—
50-59 °F	3 lbs	38	29	—	—	24
40-49 °F	4 lbs	48	40	—	—	32

Important

Do **not** use this treatment schedule if its FIFRA Section 18 Exemption has expired. For the current exemption status, call your local State Plant Health Director (SPHD).

T101-a-2 Dasheen

Pest: Internal feeders

Treatment: **T101-a-2** MB chamber, 15" vacuum—chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
90 °F or above	2 lbs	2 hrs
80-89 °F	2.5 lbs	2 hrs
70-79 °F	3 lbs	2 hrs
60-69 °F	3 lbs	2.5 hrs
50-59 °F	3 lbs	3 hrs
40-49 °F	3 lbs	3.5 hrs

Important

Do **not** use this treatment schedule if its FIFRA Section 18 Exemption has expired. For the current exemption status, call your local State Plant Health Director (SPHD).

NOTICE

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T101-b-2 Endive

Pest: External feeders

Treatment: **T101-b-2** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
70 °F or above	2 lbs	26	14
60-69 °F	2.5 lbs	32	24
50-59 °F	3 lbs	38	29
45-49 °F	3.5 lbs	43	34
40-44 °F	4 lbs	48	38

Important

Do **not** use this treatment schedule if its FIFRA Section 18 Exemption has expired. For the current exemption status, call your local State Plant Health Director (SPHD).

T101-c-2 Fava bean (dried)

Pest: Bruchidae (seed beetles)

Treatment: **T101-c-2** MB in 26" vacuum—chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
70 °F or above	3 lbs	3.5 hrs
60-69 °F	3 lbs	4 hrs
50-59 °F	3 lbs	4.5 hrs
40-49 °F	3 lbs	5 hrs

T101-d-2 Fava bean (dried)

Pest: Bruchidae (seed beetles)

Treatment: **T101-d-2** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:					
		0.5 hr	2 hrs	11 hrs	12hrs	13 hrs	14 hrs
70 °F and above	3.5 lbs	46	28	27	—	—	—
60-69 °F	3.5 lbs	46	28		27		
50-59 °F	3.5 lbs	46	28			27	
40-49 °F	3.5 lbs	46	28				27

If fresh, see Green Pod Vegetables

T101-e-2 Garlic

Pest: *Brachycerus* spp. (garlic beetles) and *Dyspessa ulula* (garlic carpenterworm)

Treatment: **T101-e-2** MB in 15" vacuum—chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
90 °F or above	2 lbs	1.5 hrs
80-89 °F	2 lbs	2 hrs
70-79 °F	2.5 lbs	2 hrs
60-69 °F	3 lbs	2 hrs
50-59 °F	3 lbs	3 hrs
40-49 °F	3 lbs	4 hrs

NOTICE

As of October 2008, **no commercial** chambers in the United States are approved for the vacuum fumigation of imported commodities. If vacuum treatment is required as a **condition of entry**, the consignment must be destroyed, reexported or returned to country of origin.

Load limit **not** to exceed 80 percent of chamber capacity

T101-f-2 Ginger (rhizome)

Pest: Internal feeders

Treatment: **T101-f-2** MB in 15" vacuum—chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
90 °F or above	2 lbs	3 hrs
80-89 °F	2.5 lbs	3 hrs
70-79 °F	3 lbs	3 hrs
60-69 °F	3 lbs	3.5 hrs

Important

Do **not** use this treatment schedule if its FIFRA Section 18 Exemption has expired. For the current exemption status, call your local State Plant Health Director (SPHD).

NOTICE

As of October 2008, **no commercial** chambers in the United States are approved for the vacuum fumigation of imported commodities. If vacuum treatment is required as a **condition of entry**, the consignment must be destroyed, reexported or returned to country of origin.

T101-g-2 Ginger (rhizome)

Pest: External feeders

Treatment: **T101-g-2** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:			
		0.5 hr	2 hrs	3 hrs	3.5 hrs
90 °F or above	2 lbs	26	19	19	—
80-89 °F	2.5 lbs	32	24	24	—
70-79 °F	3 lbs	38	29	24	—
60-69 °F	3 lbs	38	29	—	24

Important

Do **not** use this treatment schedule if its FIFRA Section 18 Exemption has expired. For the current exemption status, call your local State Plant Health Director (SPHD).

T101-h-2

Grape

Pest: *Lobesia botrana* (vine moth)

Treatment: **T101-h-2** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
80 °F or above	1.5 lbs	19	14
70-79 °F	2 lbs	26	19
60-69 °F	2.5 lbs	32	24
50-59 °F	3 lbs	38	29
40-49 °F	4 lbs	48	38

T101-h-2-1

Grape

Pest: *Ceratitis capitata* (Mediterranean fruit fly) or *Ceratitis capitata* and *Lobesia botrana* (vine moth)

Treatment: **T101-h-2-1** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:					
		0.5 hr	2 hrs	2.5 hrs	3 hrs	3.5 hrs	4 hrs
70 °F or above	2 lbs	26	22	22	—	21	—
65-69 °F	2 lbs	26	22	22	—	—	19

T101-i-2

Grape

Pest: External feeders and insects other than *Ceratitis capitata* (Mediterranean fruit fly) and *Lobesia botrana* (vine moth)

Treatment: **T101-i-2** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
80 °F or above	1.5 lbs	19	14
70-79 °F	2 lbs	26	19
60-69 °F	2.5 lbs	32	24
50-59 °F	3 lbs	38	29
40-49 °F	4 lbs	48	38

If mealybugs are found, use treatment schedule T104-a-2.

T101-i-2-1

Grape

The yellow color of this treatment indicates that the authority to conduct the treatment comes from an emergency action required by PPQ in order to mitigate the pest risk. The emergency action is pending final regulatory approval.

Pest: *Brevipalpus chilensis* (Chilean false red mite)

Treatment: **T101-i-2-1** MB at NAP—tarpaulin or chamber[4]

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	3 hrs
80 °F or above	1.5 lbs	19	14
70-79 °F	**2 lbs**	**26**	**19**
60-69 °F	2.5 lbs	32	24
50-59 °F	**3 lbs**	**38**	**29**
40-49 °F	4 lbs	48	38

T101-j-2

Grapefruit and other kinds of citrus

Pest: *Aleurocanthus woglumi* (citrus blackfly)

Treatment: **T101-j-2** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
80 °F or above	1.5 lbs	16	12
70-79 °F	1.5 lbs	19	15
65-69 °F	1.75 lbs	23	17

T101-j-2-1

Grapefruit from Mexico and quarantine areas of the U.S.

Pest: *Anastrepha* spp.

Treatment: **T101-j-2-1** MB at NAP—chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
80 °F or above	2.5 lbs	2 hrs

Load limit **not** to exceed 80 percent of chamber capacity

Inspect a representative sample of the fruit. If the level of infestation with fruit flies is more than 0.5 percent for the lot, then the fruit is ineligible for fumigation.

4 If the treatment is conducted in a chamber, decrease the total fumigation time to 2.5 hours.

T101-k-2

Green pod vegetables

Snap, string, yard-long beans, peas[5], pigeon peas, and lablab beans

Two alternative treatments, T101-k-2 or T101-k-2-1

Pest: *Cydia fabivora*, *Epinotia aporema*, and *Maruca testulalis* (exotic legume pod borers) and leaf miners

Treatment: **T101-k-2** MB in 15" vacuum—chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
90 °F or above	0.5 lb	1.5 hrs
80-89 °F	1 lb	1.5 hrs
70-79 °F	1.5 lbs	1.5 hrs
60-69 °F	2 lbs	1.5 hrs
50-59 °F	2.5 lbs	1.5 hrs
40-49 °F	3 lbs	1.5 hrs

T101-k-2-1

Green pod vegetables

Snap, string, yard-long beans, peas[5], pigeon peas,and lablab beans

Two alternative treatments, T101-k-2 or T101-k-2-1

Pest: *Cydia fabivora*, *Epinotia aporema*, and *Maruca testulalis* (exotic legume pod borers) and leaf miners

Alternative treatment: **T101-k-2-1** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
80 °F or above	1.5 lbs	19	14
70-79 °F	2 lbs	26	19
60-69 °F	2.5 lbs	32	24
50-59 °F	3 lbs	38	29

The term “green pod vegetables” refers to legumes, **not** peppers nor okra.

5 Do **not** treat snow peas from Guatemala for Agromyzid leaf miners unless destined for Florida. Refer to Pea Leaf Miner DA-2008-76.

T101-n-2-1-1 Herbs and Spices, Dried (all plant parts and seeds)

Pest: Various stored product pests, **not** including khapra beetle

Treatment: T101-n-2-1-1 MB ("Q" label only) at NAP

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:			
		0.5 hr	4 hrs	16 hrs	24 hrs
70 °F or above	2 lbs	24	16	10	—
60-69 °F	2 lbs	24	16	—	10
50-59 °F	3 lbs	36	24	15	—
40-49 °F	3 lbs	36	24	—	15

Important

If khapra beetle is intercepted on herbs and spices (dried), do **not** use this schedule. Contact the Center for Plant Health Science & Technology (CPHST), tel: 1-919-855-7450.

Important

Dried herbs and spices are restricted to Allspice, (*Pimenta dioica*), Angelica (*Angelica archangelica*), Anise (Anise seed) (*Pimpinella anisum*), Anise star (*Illicium verum*), Annatto (seed), Balm (Lemon balm) (*Melissa officinalis*), Basil (*Ocimum basilicum*), Borage (*Borago officinalis*), Bumet (*Sanguisorba minor*), Camomile (*Anthemis nobilis*), Caper buds (*Capparis spinosa*), Caraway (*Carum carvi*), Curaway, black (*Nigelia sativa*), Cardamom (*Elettaria cardamomum*), Cassia bark (*Cinnamomum aromaticum*), Cassia buds (*Cinnamomum aromaticum*), Catnip (*Nepeta cataria*), Celery seed (*Apium graveolens*), Chervil (dried) (*Anthriscus cerefolium*), Chive (*Allium schoenoprasum*), Chive, Chinese (*Allium tuberosum*), Cinnamon (*Cinnamomum verum*), Clary (*Salvia sciarea*), Clove buds (*Eugenia caryophyllata*), Coriander (cilantro or Chinese parsley) (leaf) (*Coriandrum sativum*), Coriandor (cilantro) (seed) (*Coriandrum sativum*), Costmary (*Chyrsanthemum balsamita*), Culantro (leaf) (*Eryngium foetidum*), Culantro (seed) (*Eryngium foetidum*), Cumin (*Cuminum cyminum*), Curry (leaf) (*Murrya koenigii*), Dill (dillweed) (*Anthemum graveolens*), Dill (seed) (*Anthmum graveolens*), Fennel (common) (*Foeniculum vulgare*), Fennel, Floronce (seed) (*Foeniculum vulgare Azoricum* group), Fenugreek (*Trigonella foenumgraecum*), Grains of paradise (*Afromomum melgueta*), Horehound (*Marribium vulgare*), Hyssop (*Hyssopus officinalis*), Juniper berry (*Juniperus communis*), Lavender (*Lavendula offinalis*), Lemongrass (*Cymbopogon citratus*), Lovage (leaf) (*Levisticum officinale*), Lovage (seed) (*Levisticum officinale*),Mace (*Myristica fragrans*), Marigold (*Calendula officinalis*), Marjoram (*Origanum* spp.) (includes sweet or annual marjoram, wild marjoram, or oregano, and pot marjoram), Mustard (seed) (*Brassica junceca, B. hirta, B. nigra*), Nasturtium (*Tropaeolum majus*), Nutmeg (*Myristica fragrans*) Parsley (dried) (*Pestroselinum crispum*), Pennyroyal (*Mentha pulegium*),Pepper, black (*Piper nigrum*), Poppy (seed) (*Papaver somniferum*), Rosemary (*Rosemarinus officinalis*), Rue (*Ruta graveolens*), Saffron (*Crocus sativus*), Sage (*Salvia officinalis*), Savory summer and winter (*Saturega* spp.), Sweet bay (bay leaf) (*Laurus nobilis*), Tansy (*Tanacetum vulgare*),Tarragon (*Artemisia dracunculus*), Thyme (*Thymus* spp.), Vanilla (*Vanillia planifolia*), Wintergreen (*Gaultheria procumbens*), Woodruff (*Galium odorata*), Wormwood (*Artemisia absinthium*).

T101-n-2 Herbs, fresh (Includes all fresh plant parts except seeds)

Pest: External feeders and leaf miners

Treatment: T101-n-2 MB at NAP-tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
70 °F or above	2 lbs	25	14
60-69 °F	2.5 lbs	32	24
50-59 °F	3 lbs	38	29
45-49 ° F	3.5 lbs	43	34
40-44 ° F	4 lbs	48	38

Important

Do **not** use this treatment schedule if its FIFRA Section 18 Exemption has expired. For the current exemption status, call your local State Plant Health Director (SPHD).

Important

Fresh herbs and spices are restricted to Allspice, (*pimenta dioica*), Angelica (*Angelica archangelica*), Anise (Anise seed) (*Pimpinella anisum*), Anise star (*Illicium verum*), Annatto (seed), Balm (Lemon balm) (*Melissa officinalis*), Basil (*Ocimum basilicum*), Borage (*Borago officinalis*), Bumet (*Sanguisorba minor*), Camomile (*Anthemis nobilis*), Caper buds (*Capparis spinosa*), Caraway (*Carum carvi*), Curaway, black (*Nigelia sativa*), Cardamom (*Elettaria cardamomum*), Cassia bark (*Cinnamomum aromaticum*), Cassia buds (*Cinnamomum aromaticum*), Catnip (*Nepeta cataria*), Celery seed (*Apium graveolens*), Chervil (dried) (*Anthriscus cerefolium*), Chive (*Allium schoenoprasum*), Chive, Chinese (*Allium tuberosum*), Cinnamon (*Cinnamomum verum*), Clary (*Salvia sciarea*), Clove buds (*Eugenia caryophyllata*), Coriander (cilantro or Chinese parsley) (leaf) (*Coriandrum sativum*), Coriandor (cilantro) (seed) (*Coriandrum sativum*), Costmary (*Chyrsanthemum balsamita*), Culantro (leaf) (*Eryngium foetidum*), Culantro (seed) (*Eryngium foetidum*), Cumin (*Cuminum cyminum*), Curry (leaf) (*Murrya koenigii*), Dill (dillweed) (*Anthemum graveolens*), Dill (seed) (*Anthmum graveolens*), Fennel (common) (*Foeniculum vulgare*), Fennel, Floronce (seed) (*Foeniculum vulgare Azoricum* group), Fenugreek (*Trigonella foenumgraecum*), Grains of paradise (*Afromomum melgueta*), Horehound (*Marribium vulgare*), Hyssop (*Hyssopus officinalis*), Juniper berry (*Juniperus communis*), Lavender (*Lavendula offinalis*), Lemongrass (*Cymbopogon citratus*), Lovage (leaf) (*Levisticum officinale*), Lovage (seed) (*Levisticum officinale*),Mace (*Myristica fragrans*), Marigold (*Calendula officinalis*), Marjoram (*Origanum* spp.) (includes sweet or annual marjoram, wild marjoram, or oregano, and pot marjoram), Mustard (seed) (*Brassica junceca, B. hirta, B. nigra*), Nasturtium (*Tropaeolum majus*), Nutmeg (*Myristica fragrans*) Parsley (dried) (*Pestroselinum crispum*), Pennyroyal (*Mentha pulegium*),Pepper, black (*Piper nigrum*), Poppy (seed) (*Papaver somniferum*), Rosemary (*Rosemarinus officinalis*), Rue (*Ruta graveolens*), Saffron (*Crocus sativus*), Sage (*Salvia officinalis*), Savory summer and winter (*Saturega* spp.), Sweet bay (bay leaf) (*Laurus nobilis*), Tansy (*Tanacetum vulgare*),Tarragan (*Artemisia dracunculus*), Thyme (*Thymus* spp.), Vanilla (*Vanillia planifolia*), Wintergreen (*Gaultheria procumbens*), Woodruff (*Galium odorata*), Wormwood (*Artemisia absinthium*).

T101-l-2 Horseradish

Pest: *Baris lepidii* (imported crucifer weevil)

Treatment: **T101-l-2** MB in 15" vacuum—chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
90 °F or above	2 lbs	2 hrs
80-89 °F	2.5 lbs	2 hrs
70-79 °F	3 lbs	2 hrs

NOTICE

As of October 2008, **no commercial** chambers in the United States are approved for the vacuum fumigation of imported commodities. If vacuum treatment is required as a **condition of entry**, the consignment must be destroyed, reexported or returned to country of origin.

T101-n-2 Kale (*Brassica oleracea* var. *acephala*)

Pest: External feeders and leaf miners

Treatment: **T101-n-2** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
70 °F or above	2 lbs	26	14
60-69 °F	2.5 lbs	32	24
50-59 °F	3 lbs	38	29
45-49 °F	3.5 lbs	43	34
40-44 °F	4 lbs	48	38

Important

Do **not** use this treatment schedule if its FIFRA Section 18 Exemption has expired. For the current exemption status, call your local State Plant Health Director (SPHD).

T101-m-2

Kiwi

Three alternative treatments, depending on the pest.

Pest: External feeders (except *Brevipalpus chilensis)*, *Nysius huttoni* (wheat bug)

Treatment: **T101-m-2** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
80 °F or above	1.5 lbs	19	14
70-79 °F	2 lbs	26	19
60-69 °F	2.5 lbs	32	24
50-59 °F	3 lbs	38	29
40-49 °F	4 lbs	48	38

Important

Do **not** use this treatment schedule if its FIFRA Section 18 Exemption has expired. For the current exemption status, call your local State Plant Health Director (SPHD).

T101-m-2-1

Kiwi

Pest: *Ceratitis capitata* (Mediterranean fruit fly)

Treatment: **T101-m-2-1** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:			
		0.5 hr	2 hrs	3.5 hrs	4 hrs
70 °F or above	2 lbs	26	22	21	—
65-69 °F	2 lbs	26	22	—	19

Important

Do **not** use this treatment schedule if its FIFRA Section 18 Exemption has expired. For the current exemption status, call your local State Plant Health Director (SPHD).

T101-m-2-2

Kiwi

The yellow color of this treatment indicates that the authority to conduct the treatment comes from an emergency action required by PPQ in order to mitigate the pest risk. The emergency action is pending final regulatory approval.

Pest: *Brevipalpus chilensis* (Chilean false red mite)

Treatment: **T101-m-2-2** MB at NAP—tarpaulin or chamber[6]

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	3 hrs
80 °F or above	1.5 lbs	19	14
70-79 °F	**2 lbs**	**26**	**19**
60-69 °F	2.5 lbs	32	24
50-59 °F	**3 lbs**	**38**	**29**
40-49 °F	4 lbs	48	38

Important

Do **not** use this treatment schedule if its FIFRA Section 18 Exemption has expired. For the current exemption status, call your local State Plant Health Director (SPHD).

T101-n-2

Kohlrabi (*Brassica oleracea* var. *gongyiodes*)

Pest: External feeders and leaf miners

Treatment: **T101-n-2** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
70 °F or above	2 lbs	26	14
60-69 °F	2.5 lbs	32	24
50-59 °F	3 lbs	38	29
45-49 °F	3.5 lbs	43	34
40-44 °F	4 lbs	48	38

Important

Do **not** use this treatment schedule if its FIFRA Section 18 Exemption has expired. For the current exemption status, call your local State Plant Health Director (SPHD).

6 If the treatment is conducted in a chamber, decrease the total fumigation time to 2.5 hours.

T101-n-2 Leafy vegetables

Pest: External feeders and leaf miners

Treatment: **T101-n-2** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
70 °F or above	2 lbs	26	14
60-69 °F	2.5 lbs	32	24
50-59 °F	3 lbs	38	29
45-49 °F	3.5 lbs	43	34
40-44 °F	4 lbs	48	38

Important

Do **not** use this treatment schedule if its FIFRA Section 18 Exemption has expired. For the current exemption status, call your local State Plant Health Director (SPHD).

Important

Leafy vegetables, EPA Crop Group 4, (Except *Brassica* Vegetables) are restricted to amaranth (leafy amaranth, Chinese spinach, tampala) (*Amaranthus* spp.); arugula (Roquette) (*Eruca sativa*); cardoon (*Cyanara cardunculus*); celery (*Apium graveolens* var. *dulcea*); celery, Chinese (*Apium graveolens* var. *secalinum*); celtuce (*Lactuca sativa* var. *angustana*); chervil (*Anthriscus cerefolium*); chrysanthemum, edible-leaved (*Chrysanthemum coronanium* var. *coronanium*); chrysanthemum, garland (*Chrysanthemum coronarium* var. *spatiosum*); corn salad (*Valerianella locusta*); cress garden (*Lepidium sativum*); cress upland (yellow rocket, winter cress) (*Barbarea vulgaris*); dandelion (*Taraxacum offincinale*); dock (sorrel) (*Rumex* spp.); endive (escarole) (*Cichorium endivia*); fennel, Florence (finochio) (*Foeniculum vulgare Azoricum* Group); lettuce, head and leaf *(Lactuca sativa*); Orach (*Atriplex hortensis*); parsley (*Petroselinum crispum*); purslane, garden (*Portulaca oleracea*); purslane, winter (*Montia perfoliata*); radicchio (red chicory) (*Cichorium intybus*); rhubarb (*Rheum rhabarbarum*); spinach (*Spinacia oleracea*); spinach, New Zealand (*Tetragonia tetragonioides, T. expansa*); spinach, vine (Malabar spinach, Indian spinach) (*Basella alba*); swiss chard (*Beta vulgaris* var. *cicia*). Reference 40 CFR 180.34 (f)(a)(iv)(A)

T101-q-2 Leeks

Pest: Internal feeders (including leafminers)

Treatment: **T101-q-2** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:				
		0.5 hr	2 hrs	2.5 hrs	3 hrs	3.5 hrs
90 °F or above	2 lbs	26	19	—	—	—
80-89 °F	2.5 lbs	32	24	—	—	—
70-79 °F	3 lbs	38	29	—	—	—
60-69 °F	3 lbs	38	26	26	—	—
50-59 °F	3 lbs	38	26	—	26	—
40-49 °F	3 lbs	38	26	—	—	26

T101-e-1 Lentils (Dry)

Pest: Bruchidae (seed beetles)

Treatment: **T101-e-1** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:					
		0.5 hr	2 hrs	2.5 hrs	3 hrs	3.5 hrs	4 hrs
70 °F or above	3 lbs	38	—	24	—	—	—
60-69 °F	3 lbs	38	29	—	24	—	—
50-59 °F	3 lbs	38	29	—	—	24	—
40-49 °F	3 lbs	38	29	—	—	—	24

T101-n-2 Lettuce from Spain

Pest: *Autographa gamma*, *Helicoverpa armigera*, *Mamestra brassicae*, *Spodoptera littoralis*

Treatment: **T101-n-2** MB at NAP—tarpaulin or chamber (see **Leafy vegetables** for treatment schedule)

T101-b-1-1

Lychee (Litchi)

Pest: Mealybugs (Pseudococcidae)

Treatment: **T101-b-1-1** MB (“Q” label only) at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
80 °F or above	2.5 lbs	32	24
70-79 °F	3 lbs	38	29
60-69 °F	4 lbs	48	38

Important

T101-b-1-1 is **not** a substitute for the mandatory cold treatment of lychee from China and Taiwan, T107-h, which targets the pests *Bactrocera dorsalis* (Oriental fruit fly), *Bactrocera curubitae* (melon fly) and ***Conopomorpha sinensis*** (lychee fruit borer). Because mealybugs are **not** controlled by T107-h, T101-b-1-1 can be used as a follow-up treatment if mealybugs are found.

T101-o-2

Melons

(Including honeydew, muskmelon, and watermelon)

Pest: External feeders such as Noctuidae spp., *Thrips* spp., *Copitarsia* spp.

Treatment: **T101-o-2** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
80 °F or above*	1.5 lbs	19	14
70-79 °F*	2 lbs	26	19
60-69 °F*	2.5 lbs	32	24
50-59 °F	3 lbs	38	29
40-49 °F	4 lbs	48	38

* Use “MB 100” at 60 °F or above, use MB “Q” label at 40 °F or above

For cantaloupe, see T101-k-1

T101-n-2

Mizuna (*Brassica rapa Japonica* Group)

Pest: External feeders and leaf miners

Treatment: **T101-n-2** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
70 °F or above	2 lbs	26	14
60-69 °F	2.5 lbs	32	24
50-59 °F	3 lbs	38	29
45-49 °F	3.5 lbs	43	34
40-44 °F	4 lbs	48	38

Important

Do **not** use this treatment schedule if its FIFRA Section 18 Exemption has expired. For the current exemption status, call your local State Plant Health Director (SPHD).

T101-n-2

Mustard greens (*Brassica juncea*)

Pest: External feeders and leaf miners

Treatment: **T101-n-2** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
70 °F or above	2 lbs	26	14
60-69 °F	2.5 lbs	32	24
50-59 °F	3 lbs	38	29
45-49 °F	3.5 lbs	43	34
40-44 °F	4 lbs	48	38

Important

Do **not** use this treatment schedule if its FIFRA Section 18 Exemption has expired. For the current exemption status, call your local State Plant Health Director (SPHD).

T101-n-2 Mustard spinach (*Brassica rapa Perviridis* Group)

Pest: External feeders and leaf miners

Treatment: **T101-n-2** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
70 °F or above	2 lbs	26	14
60-69 °F	2.5 lbs	32	24
50-59 °F	3 lbs	38	29
45-49 °F	3.5 lbs	43	34
40-44 °F	4 lbs	48	38

Important

Do **not** use this treatment schedule if its FIFRA Section 18 Exemption has expired. For the current exemption status, call your local State Plant Health Director (SPHD).

T101-a-3 Nectarine

Pest: External feeders

Treatment: **T101-a-3** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
80 °F or above	1.5 lbs	19	14
70-79 °F	2 lbs	26	19
60-69 °F	2.5 lbs	32	24
50-59 °F	3 lbs	38	29
40-49 °F	4 lbs	48	38

T101-p-2 Okra*

Pest: *Pectinophora gossypiella* (pink bollworm)

Treatment: **T101-p-2** MB at NAP—chamber only

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
90 °F or above	1 lb	2 hrs
80-89 °F	1.5 lbs	2 hrs
70-79 °F	2 lbs	2 hrs
60-69 °F	2.5 lbs	2 hrs
50-59 °F	3 lbs	2 hrs
40-49 °F	3.5 lbs	2 hrs

*Okra may be injured by fumigation if moisture is present. The term “okra” does **not** include Chinese okra (*Luffa* spp.), which is a cucurbit.

T101-q-2 Onion*

Pest: Internal feeders (and leaf miners)

Treatment: **T101-q-2** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:				
		0.5 hr	2 hrs	2.5 hrs	3 hrs	3.5 hrs
90 °F or above	2 lbs	26	19	—	—	—
80-89 °F	2.5 lbs	32	24	—	—	—
70-79 °F	3 lbs	38	29	—	—	—
60-69 °F	3 lbs	38	26	26	—	—
50-59 °F	3 lbs	38	26	—	26	—
40-49 °F	3 lbs	38	26	—	—	26

*The term “onion” includes dry bulbs. It also includes leeks, shallots and chives for both above ground and below ground parts.

T101-j-2-1 Oranges from Mexico and quarantine areas of the U.S.

Pest: *Anastrepha* spp.

Treatment: **T101-j-2-1** MB at NAP—chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
80 °F or above	2.5 lbs	2 hrs

Load limit **not** to exceed 80 percent of chamber capacity

Inspect a representative sample of the fruit. If the level of infestation with fruit flies is more than 0.5 percent for the lot, then the fruit is ineligible for fumigation.

T101-g-1 Parsnip

Pest: Internal feeders

Treatment: **T101-g-1** MB chamber, 15" vacuum—chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
90 °F or above	2 lbs	2 hrs
80-89 °F	2.5 lbs	2 hrs
70-79 °F	3 lbs	2 hrs
60-69 °F	3 lbs	2.5 hrs
50-59 °F	3 lbs	3 hrs
40-49 °F	3 lbs	3.5 hrs

NOTICE

As of October 2008, **no commercial** chambers in the United States are approved for the vacuum fumigation of imported commodities. If vacuum treatment is required as a **condition of entry**, the consignment must be destroyed, reexported or returned to country of origin.

T101-a-3 Peach

Pest: External feeders

Treatment: **T101-a-3** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
80 °F or above	1.5 lbs	19	14
70-79 °F	2 lbs	26	19
60-69 °F	2.5 lbs	32	24
50-59 °F	3 lbs	38	29
40-49 °F	4 lbs	48	38

T101-a-1 Pear[7]

Pest: External feeders

Treatment: T101-a-1 MB at NAP-tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
80 °F or above	1.5 lbs	19	14
70-79 °F	2 lbs	26	19
60-69 °F	2.5 lbs	32	24
50-59 °F	3 lbs	38	29
40-49 °F	4 lbs	48	38

T101-e-1 Peas (Dry)

Pest: Bruchidae (seed beetles)

Treatment: **T101-e-1** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:					
		0.5 hr	2 hrs	2.5 hrs	3 hrs	3.5 hrs	4 hrs
70 °F or above	3 lbs	38	—	24	—	—	—
60-69 °F	3 lbs	38	29	—	24	—	—
50-59 °F	3 lbs	38	29	—	—	24	—
40-49 °F	3 lbs	38	29	—	—	—	24

see T101-k-1 or T101-k-2 for fresh peas

7 Fumigation may cause **severe** damage to Chinese, Japanese, Asian and Sand Pears. Obtain the importer's consent before fumigation.

T101-a-3 Peppers

Pest: Internal pests (except fruit flies) and External pests (except mealy bugs)

Treatment: T101-a-3 MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
80 °F or above	1.5 lbs	19	14
70-79 °F	2 lbs	26	19
60-69 °F	2.5 lbs	32	24
50-59 °F	3 lbs	38	29
40-49 °F	4 lbs	48	38

Important

This treatment is **not** effective against fruit flies or mealy bugs. For fruit flies, use T106-b (vapor heat). For mealy bugs, use T104-a-2 (fumigation). Certain varieties of peppers are sensitive to methyl bromide and may develop darkening of the seed cavity.

T101-r-2 Pineapple

Pest: Internal feeders

Treatment: **T101-r-2** MB ("Q" label only) at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:		
		0.5 hr	2 hrs	6 hrs
70 °F or above	2 lbs	26	22	16

T101-s-2 Pineapple

Pest: External feeders

Treatment: **T101-s-2** MB ("Q" label only if under 70 °F (21.1 °C)) at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
80 °F or above*	1.5 lbs	19	14
70-79 °F*	2 lbs	26	19
60-69 °F	2.5 lbs	32	24
50-59 °F	3 lbs	38	29
40-49 °F**	4 lbs	48	38

* Use "MB 100" at 70 °F or above, use MB "Q" label at 40 °F or above

** 40–49°F temperature range may cause pineapple core to turn purple.

T101-t-2 Plantain

Pest: External feeders such as Noctuidae spp., *Thrips* spp., *Copitarsia* spp.

Treatment: **T101-t-2** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
80 °F or above	1.5 lbs	19	14
70-79 °F	2 lbs	26	19
60-69 °F	2.5 lbs	32	24
50-59 °F	3 lbs	38	29
40-49 °F	4 lbs	48	38

Important

Do **not** use this treatment schedule if its FIFRA Section 18 Exemption has expired. For the current exemption status, call your local State Plant Health Director (SPHD).

T101-a-3 Plum

Pest: External feeders

Treatment: **T101-a-3** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
80 °F or above	1.5 lbs	19	14
70-79 °F	2 lbs	26	19
60-69 °F	2.5 lbs	32	24
50-59 °F	3 lbs	38	29
40-49 °F	4 lbs	48	38

T101-u-2 Potato (white or Irish)

Pest: *Graphognathus* spp. (white fringed beetles)

Treatment: **T101-u-2** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
80 °F or above	2.5 lbs	30	20
70-79 °F	3 lbs	36	24

T101-v-2

Potato (white or Irish)

Pest: *Ostrinia nubilalis* (European corn borer) and *Phthorimaea operculela* (potato tuberworm)

Treatment: **T101-v-2** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
70 °F or above	2.75 lbs	33	22

T101-e-1

Pulses, dried

Pest: Bruchidae (seed beetles)

Treatment: **T101-e-1** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:					
		0.5 hr	2 hrs	2.5 hrs	3 hrs	3.5 hrs	4 hrs
70 °F or above	3 lbs	38	—	24	—	—	—
60-69 °F	3 lbs	38	29	—	24	—	—
50-59 °F	3 lbs	38	29	—	—	24	—
40-49 °F	3 lbs	38	29	—	—	—	24

T101-w-2

Pumpkin

Includes calabaza varieties

Pest: External feeders

Treatment: **T101-w-2** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
80 °F or above	1.5 lbs	19	14
70-79 °F	2 lbs	26	19
60-69 °F	2.5 lbs	32	24

T101-g-1 Radish

Pest: Internal feeders

Treatment: **T101-g-1** MB chamber, 15" vacuum—chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
90 °F or above	2 lbs	2 hrs
80-89 °F	2.5 lbs	2 hrs
70-79 °F	3 lbs	2 hrs
60-69 °F	3 lbs	2.5 hrs
50-59 °F	3 lbs	3 hrs
40-49 °F	3 lbs	3.5 hrs

NOTICE

As of October 2008, **no commercial** chambers in the United States are approved for the vacuum fumigation of imported commodities. If vacuum treatment is required as a **condition of entry**, the consignment must be destroyed, reexported or returned to country of origin.

T101-n-2 Rape greens (*Brassica napus*)

Pest: External feeders and leaf miners

Treatment: **T101-n-2** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
70 °F or above	2 lbs	26	14
60-69 °F	2.5 lbs	32	24
50-59 °F	3 lbs	38	29
45-49 °F	3.5 lbs	43	34
40-44 °F	4 lbs	48	38

Important

Do **not** use this treatment schedule if its FIFRA Section 18 Exemption has expired. For the current exemption status, call your local State Plant Health Director (SPHD).

Of these, cabbage (Brassica oleracea) (labeled treatment T101-j-1) is the only vegetable in this group **not** covered by a FIFRA Section 18 Exemption.

T101-x-2

Raspberry

Pest: External feeders such as Noctuidae spp., *Thrips* spp., *Copitarsia* spp., Pentatomidae spp.

Treatment: **T101-x-2** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
80 °F or above	1.5 lbs	19	14
70-79 °F	2 lbs	26	19
60-69 °F	2.5 lbs	32	24
50-59 °F	3 lbs	38	29
40-49 °F	4 lbs	48	38

Important

Do **not** use this treatment schedule if its FIFRA Section 18 Exemption has expired. For the current exemption status, call your local State Plant Health Director (SPHD).

T101-q-2

Shallots

Pest: Internal feeders (including leaf miners)

Treatment: **T101-q-2** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:				
		0.5 hr	2 hrs	2.5 hrs	3 hrs	3.5 hrs
90 °F or above	2 lbs	26	19	—	—	—
80-89 °F	2.5 lbs	32	24	—	—	—
70-79 °F	3 lbs	38	29	—	—	—
60-69 °F	3 lbs	38	26	26	—	—
50-59 °F	3 lbs	38	26	—	26	—
40-49 °F	3 lbs	38	26	—	—	26

T101-y-2 Squash (winter, summer, and chayote)

Pest: External feeders

Treatment: **T101-y-2** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
80 °F or above	1.5 lbs	19	14
70-79 °F	2 lbs	26	19
60-69 °F	2.5 lbs	32	24
50-59 °F	3 lbs	38	29
40-49 °F	4 lbs	48	38

If zucchini, see **T101-h-3**.

If pumpkin, see **T101-w-2**.

T101-z-2 Strawberry

Pest: External feeders

Treatment: **T101-z-2** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
80 °F or above	1.5 lbs	19	14
70-79 °F	2 lbs	26	19
60-69 °F	2.5 lbs	32	24
50-59 °F	3 lbs	38	29

T101-b-3-1

Sweet Potato *(Ipomoea)*

Pest: External and internal feeders

Treatment: **T101-b-3-1** MB at NAP—tarpaulin or chamber

This treatment is also required for the interstate movement from Hawaii.

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:		
		0.5 hr	2 hrs	4.0 hrs
90 °F or above*	2.5 lbs	32	20	20
80-89 °F*	3 lbs	38	24	24
70-79 °F*	3.5 lbs	44	28	28
60-69 °F	4 lbs	50	32	32

***** Use “MB 100” at 70°F or above, use MB “Q” label at 60 °F or above

NOTICE

Temperatures below 70 °F may cause injury to sweet potatoes. Fumigation below 70 °F is to be made only on specific request from the importer.

NOTICE

Sweet potatoes should be cured, free from surface moisture, and held at the fumigation temperature for 24 hours following treatment. This is **not** mandatory; however, following this advise will help maintain the quality of the fumigated product.

T101-c-3

Tomato (from Hawaii)

Pest: *Ceratitis capitata* (Mediterranean fruit fly)

Treatment: **T101-c-3** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:			
		0.5 hr	2 hrs	3.5 hrs	4 hrs
70 °F or above	2 lbs	26	21	21	—
65-69 °F	2 lbs	26	21	—	19

Treatment is marginal as to host tolerance and shipper should be warned of possible injury.

T101-c-3-1

Tomato (from Chile)

Pest: *Tuta absoluta* (tomato fruit moth) and *Rhagoletis tomatis* (tomato fruit fly)

Treatment: **T101-c-3-1** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
70 °F or above	3 lbs	43	33

T101-d-3 Tuna (Opuntia) and all other fruits from cacti (prickly pear, pitahaya)

Pest: *Ceratitis capitata* (Mediterranean fruit fly)

Treatment: **T101-d-3** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:		
		0.5 hr	2 hrs	3.5 hrs
70 °F or above	2 lbs	26	21	21

Important

Do **not** use this treatment schedule if its FIFRA Section 18 Exemption has expired. For the current exemption status, call your local State Plant Health Director (SPHD).

T101-e-3 Tuna (Opuntia) and all other fruits from cacti (prickly pear, pitahaya)

Pest: External feeders and leaf miners

Treatment: **T101-e-3** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
80 °F or above	1.5 lbs	19	14
70-79 °F	2 lbs	26	19
60-69 °F	2.5 lbs	32	24
50-59 °F	3 lbs	38	29
40-49 °F	4 lbs	48	38

Important

Do **not** use this treatment schedule if its FIFRA Section 18 Exemption has expired. For the current exemption status, call your local State Plant Health Director (SPHD).

T101-g-1 Turnip

Pest: Internal feeders

Treatment: **T101-g-1** MB chamber, 15" vacuum—chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
90 °F or above	2 lbs	2 hrs
80-89 °F	2.5 lbs	2 hrs
70-79 °F	3 lbs	2 hrs
60-69 °F	3 lbs	2.5 hrs
50-59 °F	3 lbs	3 hrs
40-49 °F	3 lbs	3.5 hrs

NOTICE

As of October 2008, **no commercial** chambers in the United States are approved for the vacuum fumigation of imported commodities. If vacuum treatment is required as a **condition of entry**, the consignment must be destroyed, reexported or returned to country of origin.

T101-f-3 Yam (*Dioscorea* spp.)

Pest: Internal and external feeders

Treatment: **T101-f-3** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:		
		0.5 hr	2 hrs	4 hrs
90 °F or above	2.5 lbs	32	20	20
80-89 °F	3 lbs	38	24	24
70-79 °F	3.5 lbs	44	28	28
60-69 °F	4 lbs	50	32	32

NOTICE

Temperatures below 70 °F may cause injury to yams. Fumigation below 70 °F is to be made only on specific request from the importer.

NOTICE

Sweet potatoes and yams should be cured, free from surface moisture, and held at the fumigation temperature for 24 hours following treatment. This is **not** mandatory; however, following this advise will help maintain the quality of the fumigated product.

T101-h-3

Zucchini

Pest: External feeders

Treatment: **T101-h-3** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft')	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
80 °F or above	1.5 lbs	19	14
70-79 °F	2 lbs	26	19
60-69 °F	2.5 lbs	32	24

If another variety of squash, see T101-y-2

T102—Water Treatment

Important

Whenever water comes into contact with fresh produce, the water's quality dictates the potential for pathogen contamination. To reduce the risk of food-borne illnesses, the water used for washing, treatments, and cooling must be fortified with sodium hypochlorite (household bleach), and constantly maintained at a chlorine level **not** to exceed 200 ppm.

T102-b Cherimoya from Chile

Pest: *Brevipalpus chilensis* (Chilean false red mite of grapes)

Treatment: **T102-b** Soapy water and wax

1. Immerse fruit for 20 seconds in soapy water bath of one part soap solution (such as Deterfruit) to 3,000 parts water.
2. Follow the soapy bath with a pressure shower rinse to remove all the soapy excess.
3. Immerse fruit for 20 seconds in an undiluted wax coating (such as Johnson's Wax Primafresh 31 Kosher fruit coating). The wax coating should cover the entire surface of the fruit.

Important

At the port of entry, the PPQ Officer should check to make sure the wax coating covers the entire surface of the fruit.

T102-c Durian and other large fruits such as breadfruit

Pest: External Feeders

Treatment: **T102-c** Warm, soapy water and brushing

1. Add detergent (such as Deterfruit) to warm water (110° to 120 °F) at the rate of one part detergent or soap to 3,000 parts water.
2. Immerse the fruit for at least 1 minute in the warm detergent water.
3. Using a brush with stiff bristles, have the importer or the importer's agent scrub each fruit to remove any insects.
4. Using a pressure shower, have the importer or the importer's agent rinse the fruit free from residue (detergent and dead insects).
5. Inspect each brushed and cleaned fruit. Pay particular attention to external feeders such as mealybugs and scales. If any insects remain, have the fruit retreated or have it destroyed.

T102-e

Limes

Pest: Mealybugs (Pseudococcidae) and other surface pests

Treatment: **T102-e** Hot water immersion

1. Fruit must be treated in a certified hot water immersion treatment tank, and the treatment must be monitored by an inspector.
   - **A.** Fruit must be submerged at least 4 inches below the water's surface.
   - **B.** Water must circulate continually and be kept at 120.2 °F (or above) for 20 minutes. Treatment time begins when the water temperature reaches at least 120.2 °F in all locations of the tank.
2. Cooling and waxing the fruit are both optional, and are the sole responsibility of the processor.

NOTICE

Phytotoxic damage (increased yellowing) may occur if the temperature reaches 125.6 °F or if the treatment duration significantly exceeds 20 minutes.

T102-b-1

Limes from Chile

Pest: *Brevipalpus chilensis* (Chilean false red mite of grapes)

Treatment: **T102-b-1** Soapy water and wax

1. Immerse fruit for 20 seconds in soapy water bath of one part soap solution (such as Deterfruit) to 3,000 parts water.
2. Follow the soapy bath with a pressure shower rinse to remove all the soapy excess.
3. Immerse fruit for 20 seconds in an undiluted wax coating (such as Johnson's Wax Primafresh 31 Kosher fruit coating). The wax coating should cover the entire surface of the fruit.

Important

At the port of entry, the PPQ Officer should check to make sure the wax coating covers the entire surface of the fruit.

T102-d-1

Longan fruit from Hawaii

Pest: *Ceratitis capitata* (Mediterranean fruit fly) and *Bactrocera dorsalis* (Oriental fruit fly)

Treatment: **T102-d-1** Hot water immersion

Important

Fruit must be at ambient temperature before the treatment begins

1. Submerge the fruit at least 4 inches below the water's surface in a hot water immersion treatment tank certified by APHIS.
2. Keep the fruit submerged for 20 minutes after the water temperature reaches at least 120.2 °F in all locations of the tank. The water must circulate continually and be kept at 120.2 °F (or above) for the duration of the treatment.

NOTICE

Phytotoxic damage (increased yellowing) may occur if the temperature exceeds 121.1 °F.

3. Cool the fruit to ambient temperature. Hydrocooling for 20 minutes at 75.2 °F is recommended, though **not** required, to prevent injury to the fruit from the hot water immersion treatment.

T102-d

Lychee (litchi) fruit from Hawaii

Pest: *Ceratitis capitata* (Mediterranean fruit fly) and *Bactrocera dorsalis* (Oriental fruit fly)

Treatment: T102-d Hot water immersion

1. Lychees must be thoroughly examined at the packinghouse by an inspector and found free of ***Cryptophlebia spp.*** (Lychee fruit moth) and other plant pests[8]
2. Fruit must be grown and treated in Hawaii, under monitoring of an inspector, in a certified hot water immersion treatment tank.[9]

   A. Fruit must be submerged at least 4 inches below the water's surface.

8 Because ***Eriophyes litchii*** (lychee mite) cannot be effectively detected by inspection, and would **not** be effectively eliminated by hot water immersion, the lychees may **not** be shipped into Florida. Each carton must be stamped "**Not** for importation into or distribution in Florida."

9 Use of Treatment T102D is at the risk of the shipper. Limited research on fruit quality after treatment application indicated that fruit quality varies among cultivars. 'Kaimana' and 'Kwai Mi' ('Tai So') tolerate the treatment better than 'Brewster' and 'Groff'; no other cultivars were tested.

B. Water must circulate constantly, and be kept at 120.2 °F (or above) for 20 minutes. Treatment time begins when the water temperature reaches at least 120.2 °F in all locations throughout the tank.[10]

Temperatures exceeding 121.1 °F can cause phytotoxic damage.

3. Hydrocooling for 20 minutes at 75.2 °F is recommended, though **not** required, to prevent injury to the fruit from the hot water treatment.

T102-a

Mango

Pest: *Ceratitis capitata* (Mediterranean fruit fly), *Anastrepha spp.*, *Anastrepha ludens* (Mexican fruit fly)

Treatment: **T102-a** Hot water immersion

Fruit must be treated in country of origin at a certified facility and under the monitoring of APHIS personnel.

1. Mangoes must be pre-sorted by weight class. Treatment of mixed loads is **not** allowed.

2. Pulp temperature must be 70 °F or above before start of treatment.

3. Fruit must be submerged at least 4 inches below the water's surface.

4. Water must circulate constantly and be kept at least 115 °F throughout the treatment with the following tolerances:

- ***During the first 5 minutes of a treatment***—Adjusted Tank Temperatures from***Figure 6-5-1*** on **page 6-5-3** that are below 113.7 °F are allowed during the first 5 minutes of a treatment only if the temperature is at least 115 °F at the end of the 5 minute period.
- ***For treatments lasting 65 to 75 minutes***—Adjusted Tank Temperatures from***Figure 6-5-1*** on **page 6-5-3** may fall as low as 113.7 °F for no more than 10 minutes under emergency conditions.
- ***For treatments lasting 90 to 110 minutes***—Adjusted Tank Temperatures from***Figure 6-5-1*** on **page 6-5-3** may fall as low as 113.7 °F for no more than 15 minutes under emergency conditions.

10 Treatment does **not** begin until after the fruit is immersed and the water temperature recovers to 120.2 °F (or above). Therefore, before the start of the treatment, fruit pulp temperatures of 70 °F (or above) are recommended to minimize water temperature recovery time and the overall time fruit are immersed in heated water. Fruit quality of treated lychees with initial pulp temperatures below 68 °F has **not** been studied.

5. Determine the dip time from Tables ***Table 5-2-1*** on **page 5-2-57**, ***Table 5-2-2*** on **page 5-2-57**, or ***Table 5-2-3*** on **page 5-2-58**.

Important

Dip times for T102-a are valid if the fruit is **not** hydrocooled within 30 minutes of removal from the hot water immersion tank.

However, if hydocooling starts immediately after the hot water immersion treatment, then the original dip time must be extended for an additional 10 minutes.

(Hydrocooling is optional and may be done only at temperatures of 70°F or above, for any length of time, or **not** at all.)

Table 5-2-1 Determine Dip Time Based on Origin of Fruit[1]

If the origin of the fruit is:	And the shape of the fruit is:	And the weight is (grams):	Then dip:
Puerto Rico, U.S. Virgin Islands, or West Indies (excluding Aruba, Bonaire, Curacao, Margarita, Tortuga or Trinidad and Tobago)	Flat, elongated varieties[2]	Up to 400 grams	65 minutes
		401 to 570 grams	75 minutes
	Rounded varieties[3]	Up to 500 grams	75 minutes
		501 to 700 grams	90 minutes
		701 to 900 grams	110 minutes

1 Vaild if the fruit is **not** hydrocooled within 30 minutes of removal from the hot water immersion tank.

2 Such as ‘Frances,’ ‘Carrot,’ ‘Zill,’ ‘Ataulfo,’ ‘Carabao,’ ‘Irwin’, and Manila.

3 Such as ‘Tommy Atkins,’ ‘Kent,’ ‘Hayden,’ and ‘Keitt.’

Table 5-2-2 Determine Dip Time Based on Origin of Fruit[1]

If the origin of the fruit is:	And the shape of the fruit is:	And the weight is (grams):	Then dip:
Mexico or Central America (north of and including Costa Rica)	Flat, elongated varieties[2]	Up to 375 grams	65 minutes
		376 to 570 grams	75 minutes
	Rounded varieties[3]	Up to 500 grams	75 minutes
		501 to 700 grams	90 minutes
		701 to 900 grams	110 minutes

1 Vaild if the fruit is **not** hydrocooled within 30 minutes of removal from the hot water immersion tank

2 Such as ‘Frances,’ ‘Carrot,’ ‘Zill,’ ‘Ataulfo,’ ‘Carabao,’ ‘Irwin.’, and Manila.

3 Such as ‘Tommy Atkins,’ ‘Kent,’ ‘Hayden,’ and ‘Keitt.’

Table 5-2-3 Determine Dip Time Based on Origin of Fruit[1]

If the origin of the fruit is:	And the shape of the fruit is:	And the weight is (grams):	Then dip:
Panama, South America or West Indies islands of Aruba, Bonaire, Curacao, Margarita, Tortuga, or Trinidad and Tobago	Flat, elongated varieties[2]	Up to 375 grams	65 minutes
		376 to 570 grams	75 minutes
	Rounded varieties[3]	Up to 425 grams	75 minutes
		426 to 650 grams	90 minutes

1 Vaild if the fruit is **not** hydrocooled within 30 minutes of removal from the hot water immersion tank

2 Such as 'Frances,' 'Carrot,' 'Zill,' 'Ataulfo,' 'Carabao,' 'Irwin.', and Manila.

3 Such as 'Tommy Atkins,' 'Kent,' 'Hayden,' and 'Keitt.'

T102-b-2

Passion Fruit from Chile

Pest: *Brevipalpus chilensis* (Chilean false red mite of grapes)

Treatment: **T102-b-2** Soapy water and wax

1. Immerse fruit for 20 seconds in soapy water bath of one part soap solution (such as Deterfruit) to 3,000 parts water.
2. Follow the soapy bath with a pressure shower rinse to remove all the soapy excess.
3. Immerse fruit for 20 seconds in an undiluted wax coating (such as Johnson's Wax Primafresh 31 Kosher fruit coating). The wax coating should cover the entire surface of the fruit.

Important

At the port of entry, the PPQ Officer should check to make sure the wax coating covers the entire surface of the fruit.

T103—High Temperature Forced Air

T103-a-1 Citrus from Mexico and infested areas in the United States

Pest: *Anastrepha* spp.

Treatment: T103-a-1 High temperature forced air

Heat Up Time:	90 minutes
Heat Up Recording Interval:	2 minutes
Minimum Air Temperature:	N/A
Minimum Pulp Temperature at End of Heat Up:	44 °C/111.2 °F
Dwell Time:	100 minutes
Dwell Recording Interval:	2 minutes
Cooling Method:	Hydrocooling optional

Size Restrictions	Standard Count	Max. Weight/Fruit		Max. Diameter
	bushel	grams	ounces	inches
Navel Orange	100 per 1 2/5	450	15.9	3 3/16
Orange (other than Navel)	100 per 1 2/5	468	16.4	3 13/16
Tangerine	120 per 4/5	245	8.6	—
Grapefruit	70 per 1 2/5	536	18.8	4 5/16

T103-b-1 Citrus from Hawaii

Pest: *Ceratitis capitata* (Mediterranean fruit fly), *Bactrocera dorsalis* (Oriental fruit fly), and *Bactrocera cucurbitae* (melon fly)

Treatment: T103-b-1 High temperature forced air

Heat Up Time:	4 hours
Heat Up Recording Interval:	5 minutes
Minimum Air Temperature:	N/A
Minimum Pulp Temperature at End of Heat Up:	47.2 °C/117.0 °F
Dwell Time:	5 minutes
Dwell Recording Interval:	5 minutes
Cooling Method:	Forced air or Hydrocooling

NOTICE

Tolerance of Citrus to Treatment—Users of this treatment for citrus should test the specific cultivar to determine how well it will tolerate the required heat treatment. Of all citrus species tested to date, grapefruit showed the highest tolerance to this treatment. The tolerance of citrus treated in excess of 7 hours has **not** been determined. Although the method of cooling fruit after treatment is optional, research indicated that forced air cooling using ambient air temperature produced the least fruit injury.

T103-c-1 Mango from Mexico

Pest: *Anastrepha ludens* (Mexican fruit fly), *Anastrepha obliqua* (West Indian fruit fly), and *Anastrepha serpentina* (black fruit fly)

Treatment: T103-c-1 High temperature forced air

Heat Up Time:	N/A
Heat Up Recording Interval:	2 minutes
Minimum Air Temperature:	50.0 °C/122.0 °F
Minimum Pulp Temperature at End of Heat Up:	48.0 °C/118.0 °F
Dwell Time:	2 minutes
Dwell Recording Interval:	2 minutes
Cooling Method:	Forced air or Hydrocooling
Size Restrictions:	Fruit weight must **not** exceed 1 1/2 lbs. (700 grams)

T103-d Mountain Papaya from Chile (T103-d-1) and Papaya from Belize and Hawaii (T103-d-2)

Pest: *Ceratitis capitata* (Mediterranean fruit fly), *Bactrocera dorsalis* (Oriental fruit fly), and *Bactrocera cucurbitae* (melon fly)

Treatment: T103-d-1 High temperature forced air

Heat Up Time:	4 hours
Heat Up Recording Interval:	5 minutes
Minimum Air Temperature:	N/A
Minimum Pulp Temperature at End of Heat Up:	47.2 °C/117.0 °F
Dwell Time:	5 minutes
Dwell Recording Interval:	5 minutes
Cooling Method:	Forced air or Hydrocooling (If papayas are hydrocooled with water lower than 54.5 °F (12.5° C), the fruit may be damaged.)

NOTICE

Tolerance of Papayas to Treatment—To enable the papayas to tolerate the treatment, the fruit may first have to be conditioned. Such conditioning is the responsibility of the shipper and at the shipper's risk.

T103-e Rambutan from Hawaii

Pest: *Ceratitis capitata* (Mediterranean fruit fly), and *Bactrocera dorsalis* (Oriental fruit fly)

Treatment: T103-e-1 High temperature forced air

Heat Up Time:	1 hour
Heat Up Recording Interval:	5 minutes
Minimum Air Temperature:	N/A
Minimum Pulp Temperature at End of Heat Up:	47.2 °C/117.0 °F
Dwell Time:	20 minutes
Dwell Recording Interval:	5 minutes
Cooling Method:	Optional

T104—Pest Specific/Host Variable

For the treatments that follow, never exceed the labeled or Section 18 dosage and time for the specific commodity at the given temperature. Moreover, the specific commodity being treated determines if the schedule is a labeled treatment or one authorized under a Section 18 exemption. For example, oranges cannot be treated for hitchhikers using T104-a-1 at 40-49 °F because this schedule requires 4 lbs. of methyl bromide/1,000 ft^3. Whereas, the methyl bromide "Q" label allows a maximum of only 3 lbs. at this temperature range. Therefore, the oranges would have to be heated to at least 50 °F before fumigation because at 50 °F a dosage of only 3 lbs./1,000 ft^3 is required.

Although the following treatments are pest specific, the treatment schedule for the associated host will determine if and when a pest specific treatment can be used. Always check the schedule for the host before selecting the proper treatment schedule. Also, consult the methyl bromide labeling brochure, and do **not** exceed the restrictions on dosage and exposure time.

T104-a-1 Various Commodities*

Pest: Hitchhikers and surface pests such as: thrips, aphids, scale insects, leaf miners, spider mites (*Tetranychidae*)[11], lygaeid bugs, ants, earwigs, surface-feeding caterpillars, and slugs[12]

Treatment:**T104-a-1** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
80 °F or above	1.5 lbs	19	14
70-79 °F	2 lbs	26	19
60-69 °F	2.5 lbs	32	24
50-59 °F	3 lbs	38	29
40-49 °F	4 lbs	48	38

Important

* To comply with dosage restrictions imposed by the methyl bromide "Q" label, these fruits and vegetables may be fumigated only at the following temperatures (the items bolded are under FIFRA Section 18 Exemption.) For the current exemption status, call your local State Plant Health Director:

40 °F or above (maximum dosage, 4 pounds/1,000 ft^3):
Apple, apricot[1], asparagus, **banana**, **blackberry**, cabbage, **cactus fruit (tuna)**, cantaloupe, **celery**, chayote, cherry, chestnut, **chicory**, cipollino, cucumber, **dasheen**, **endive**, fava bean (dried), **fresh herbs**[2], grape, honeydew melon, **kiwi**, **leafy vegetables**, muskmelon, nectarine, peach, pear[3], pepper, pineapple, **plantain**, plum[1], **raspberry**, **snow peas**[4]**,** squash (summer, winter), stone fruit, sweet potato, watermelon, yam

50 °F or above (maximum dosage, 3 pounds/1,000 ft^3):
Bean, beet, carrot, citron (ethrog), clementine, coconut, corn-on-the-cob (sweet corn), eggplant, garlic, **ginger**, grapefruit, green pod vegetables, horseradish, Jerusalem artichoke, kumquat, lemon, lime, mandarin, okra, onion, orange, parsnip, pea, potato, radish, rutabaga, salsify, strawberry, sugar beet, tangelo, tangerine, tomato, turnip.

60 °F or above (maximum dosage, 2.5 pounds/1,000 ft^3):
Pimento, pumpkin, zucchini.

70 °F or above (maximum dosage, 2 pounds/1,000 ft^3):
Avocado, blueberry, cocoa bean.

1 **Pluots** and **plumcots** are considered hybrids of plums and apricots and can be treated using T104-a-1 provided they are treated as a **Section 18 Crisis Exemption.**

2 Refer to list of approved herbs on **page 5-2-31**.

3 Fumigation may cause **severe** damage to Chinese, Japanese, Asian and Sand Pears. Obtain the importer's consent before fumigation.

4 Snow peas may be damaged at dosages higher than 3 lbs. Obtain the importers consent before fumigating at 4 lbs.

11 DO NOT use T104-a-1 for Chilean False Red Mite (*Brevipalpus chilensis*).

12 Quarantine-significant slugs of the families Agriolimacidae, Arionidae, Limacidae, Milacidae, Philomycidae, and Veronicellidae, including the following genera: *Agriolimax, Arion,Colosius, Deroceras, Diplosolenodese, Leidyula, Limax, Meghimatium, Milax, Pallifera, Pseudoveronicella, Sarasinula, Semperula, Vaginulus,Veronicella*. **Slugs must be treated at 60 °F (2.5 lbs.) or above.**

T104-a-2 Various Commodities*

Pest: Mealybugs (Pseudococcidae)

Treatment: **T104-a-2** MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
80 °F or above	2.5 lbs	32	24
70-79 °F	3 lbs	38	29
60-69 °F	4 lbs	48	38

Important

* To comply with dosage restrictions imposed by the methyl bromide "Q" label, the following fruits and vegetables may be fumigated only at the following temperatures (the items bolded are under Section 18 Exemption. FIFRA Section 18 Exemption. For the current exemption status, call your local State Plant Health Director (SPHD):

60 °F or above (maximum dosage, 4 pounds/1,000 ft^3):
Apple, apricot[1], asparagus, **banana**, **blackberry**, cabbage, cantaloupe, **celery**, chayote, cherry, chestnut, **chicory**, cipolini, cucumber, **dasheen**, **endive**, fava bean (dried), grape, **fresh herbs**[2], honeydew melon, **kiwi**, **leafy vegetables**, **lychee (litchi)**, muskmelon, nectarine, peach, pear[3], pepper, pineapple, **plantain**, plum[1], rambutan, **raspberry**, **snow peas**[4]**,** squash (summer, winter), stone fruit, sweet potato, watermelon.

70 °F or above (maximum dosage, 3 pounds/1,000 ft^3):
Bean, beet, carrot, clementine, citron (ethrog), coconut, corn-on-the-cob (sweet corn), eggplant, garlic, **ginger root**, grapefruit, green pod vegetables, horseradish, Jerusalem artichoke, kumquat, lemon, lime, mandarin, okra, onion, orange, parsnip, potato, radish, rutabaga, salsify, scallion, shallot, strawberry, sugar beet, tangelo, tangerine, tomato, turnip.

80 °F or above (maximum dosage, 2.5 pounds/1,000 ft^3):
Peppers, pimento, pumpkin, zucchini.

1 **Pluots** and **plumcots** are considered hybrids of plums and apricots and can be treated using T104-a-2 provided they are treated as a **Section 18 Crisis Exemption.**

2 Refer to list of approved herbs on **page 5-2-31**.

3 Fumigation may cause **severe** damage to Chinese, Japanese, Asian and Sand Pears. Obtain the importer's consent before fumigation.

4 Snow peas may be damaged at dosages higher than 3 lbs. Obtain the importers consent before fumigating at 4 lbs.

T105—Irradiation

Irradiation (IR) is an approved treatment for all imported fruits and vegetables and for fruits and vegetables moved interstate from Hawaii, Puerto Rico, and the U.S. Virgin Islands. In addition, irradiation can be used against particular pests (Refer to ***Table 5-2-4*** on **page 5-2-66**) of cut flowers and foliage, however, some damage may occur.

Treatment must be conducted at approved facilities in a foreign country, Hawaii, Puerto Rico, US Virgin Islands or any area in the US mainland that does **not** support fruit flies (any state except AL, AZ, CA, FL, GA[13], KY, LA, MS[13], NV, NM, NC[13], SC, TN, TX, or VA).

Refer to chapter ***Certifying Irradiation Treatment Facilities*** on **page 6-8-1** of this manual for facility certification requirements.

Important

When designing the facility's dosimetry system and procedures for its operation, the facility operator must address guidance and principles from American Society for Testing Materials (ASTM) standards or an equivalent standard recognized by the Administrator of APHIS.

(The American Society for Testing and Materials (ASTM) publication, ISO/ASTM 51261-2002 (E), "**Standard Guide for Selection and Calibration of Dosimetry Systems for Radiation Processing"** is available from: ASTM, 100 Barr Harbor Drive, West Conshohocken, Pennsylvania, USA 19428-2959).

13 IR facilities may be located at the airport of Atlanta, GA, maritime ports of Gulfport, MS, and Wilmington, NC, provided the conditions listed in CFR 305.31(b) are met.

The following table lists pest-specific minimum absorbed doses for use on any fruit, vegetable, cut flower or foliage:

Table 5-2-4 Pest-Specific Minimum absorbed dose (Gy)

Scientific Name	Common Name	Minimum Absorbed Dose (Gy)
Anastrepha ludens	Mexican fruit fly	70
Anastrepha obliqua	West Indian fruit fly	70
Anastrepha serpentina	Sapote fruit fly	100
Anastrepha suspensa	Caribbean fruit fly	70
Aspidiotus destructor	Coconut scale	150
Bactrocera cucurbitae	Melon fruit fly	150
Bactrocera dorsalis	Oriental fruit fly	150
Bactrocera jarvisi	Jarvis fruit fly	100
Bactrocera tryoni	Queensland fruit fly	100
Brevipalpus chilensis	Chilean false red mite	300
Ceratitis capitata	Mediterranean fruit fly	150
Conotrachelus nenuphar	Plum curculio	92
Copitarsia declora		100
Cryptophlebia ombrodelta	Litchi fruit moth	250
Cryptophlebia illepida	Koa seedworm	250
Cylas formicarius elegantulus	Sweet potato weevil	150
Cydia pomonella	Codling moth	200
Euscepes postfasciatus	West Indian sweet potato weevil	150
Grapholita molesta	Oriental fruit moth	200
Omphisa anastomosalis	Sweet potato vine borer	150
Pseudaulacaspis pentagona	White peach scale	150
Rhagoletis pomonella	Apple maggot	60
Sternochetus mangiferae	Mango seed weevil	300
	All other fruit flies of the family Tephritidae which are **not** listed above	150
	Plant pests of the class Insecta **not** listed above, except pupae and adults of the order Lepidoptera	400

The minimum absorbed dose for the most-tolerant unmitigated pest is required if more than one pest is present. Refer to ***Table 5-2-4*** on **page 5-2-66** to determine the required minimum absorbed dose. For example, if a shipment of grapes is infested with both Mediterranean fruit fly and codling moth, the commodity would be irradiated using a minimum dose of 200 Gy.

T105-a-1 Various Commodities

Treatment:T105-a-1 (IR @ 150 Gy)

Pests: All fruit flies from the family Tephritidae
(Refer to **Table 5-2-4** for other pests that can be treated at 150 Gy or less.) Treat using a minimum absorbed dose of 150 Gy, **not** to exceed 1000 Gy.

Important

Refer to the **Hawaii/CNMI Manual** for detailed inspection procedures and additional entry requirements for pests **not** managed by 150 Gy or when a 400 Gy dose may be used instead.

Table 5-2-5 Origin and Approved Commodity List for 150 Gy

Origin	Commodity
Hawaii	Abiu, Atemoya, Banana, Breadfruit, *Capsicum* spp., Carambola, *Cucurbita* spp., Curry Leaf, Dragon fruit, Eggplant, Jackfruit, Litchi, Longan, Mangosteen, Melon, Moringa pods (Drumstick), Papaya, Pineapple, Rambutan, Sapodilla, Sweet Potato, and Tomato[1]
Mexico	Carambola, Clementine/Mandarin/Tangerine (*Citrus reticulata*), Grapefruit (*Citrus paradisi*), Mango, Manzano Pepper (*Capsicum pubescens*), Sweet Orange (*Citrus sinensis*)

1 In addition to these commodities, commodities that are currently admissible with a treatment or systems approach could also use irradiation as an alternative treatment, provided all the pests targeted by the treatment or systems approach are neutralized by the irradiation dose.

T105-a-2 Various Commodities

Treatment: T105-a-2 (IR @ 400 Gy)

Pests: Fruit flies from the family Tephritidae and all insect pests **except** adults and pupae of the order Lepidoptera

Treat using a minimum absorbed dose of 400 Gy, **not** to exceed 1000 Gy.

Table 5-2-6 Origin and Approved Commodity List for 400 Gy

Origin	Commodity
Ghana	Eggplant, Okra, Pepper
Hawaii	Banana, Breadfruit, Cowpea (pod), Dragon fruit, Jackfruit, Mangosteen, Melon, Moringa pods (Drumstick), and Sweet Potato
India	Mango
Mexico	Guava
Thailand	Litchi, Longan, Mango, Mangosteen, Pineapple, Rambutan
Viet Nam	Dragon Fruit

T105-a-3 Various Commodities

Treatment: T105-a-3 (IR @ 300 Gy)

Pests: *Sternochetus mangiferae* (Mango seed weevil), and all fruit flies from the family Tephritidae

Treat using a minimum absorbed dose of 300 Gy, **not** to exceed 1000 Gy.

Table 5-2-7 Origin and Approved Commodity List for 300 Gy

Origin	Commodity
Hawaii	Mango

T106—Vapor Heat

T106-a Various Commodities from Mexico: Clementine (T106-a-1), Grapefruit (T106-a-2), Mango (Manilla variety only; T106-a-3), Orange (T106-a-4)

Pest: *Anastrepha* spp. (includes Mexican fruit fly, *A. ludens*)

Treatment: T106-a Vapor heat

Heat Up Time:	8 hours
Heat Up Recording Interval:	5 minutes
Minimum Air Temperature:	N/A
Minimum Pulp Temperature at End of Heat Up:	43.3 °C/110.0 °F
Dwell Time:	6 hours
Dwell Recording Interval:	5 minutes
Cooling Method:	N/A

T106-b Bell Pepper (T106-b-1), Eggplant (T106-b-2), Mountain papaya (T106-b-3), Papaya (T106-b-4), Pineapple (T106-b-5), Squash (T106-b-6), Tomato (T106-b-7), Zucchini (T106-b-8)

Pest: *Ceratitis capitata* (Mediterranean fruit fly), *Bactrocera dorsalis* (Oriental fruit fly), and *Bactrocera cucurbitae* (melon fly)

Treatment: T106-b Vapor heat

Heat Up Time:	N/A
Heat Up Recording Interval:	N/A
Minimum Air Temperature:	112.0 F
Minimum Pulp Temperature at End of Heat Up:	44.4 °C/112.0 °F
Dwell Time:	8.75 hours
Dwell Recording Interval:	5 minutes
Cooling Method:	Optional

Important

Commodities should be exposed at 112 °F to determine tolerance to the treatment before commercial shipments are attempted.

T106-a-1-1 Clementine or Orange from Mexico

Treatment: T106-a-1-1 Vapor heat

Heat Up Time:	6 hours[1]
Heat Up Recording Interval:	5 minutes
Minimum Air Temperature:	N/A
Minimum Pulp Temperature at End of Heat Up:	43.3 °C/110.0 °F
Dwell Time:	4 hours
Dwell Recording Interval:	5 minutes
Cooling Method:	N/A

1 During the initial raising of fruit temperature, the temperature should be raised rapidly in the first 2 hours; the increase over the next 4 hours should be gradual.

T106-f Litchi from Hawaii

Pest: *Ceratitis capitata* (Mediterranean fruit fly), and *Bactrocera dorsalis* (Oriental fruit fly)

Treatment: T106-f Vapor heat

Heat Up Time:	1 hour
Heat Up Recording Interval:	5 minutes
Minimum Air Temperature:	N/A
Minimum Pulp Temperature at End of Heat Up:	47.2 °C/117.0 °F
Dwell Time:	20 minutes
Dwell Recording Interval:	5 minutes
Cooling Method:	Cool water spray

T106-d-1 Mango from the Philippines (the island of Guimaras only)

Pest: *Bactrocera occipitalis*, *Bactrocera cucurbitae*, and *Bactrocera philippinensis*

Treatment: T106-d-1 Vapor heat

Heat Up Time:	4 hours
Heat Up Recording Interval:	5 minutes
Minimum Air Temperature:	N/A
Minimum Pulp Temperature at End of Heat Up:	46.0 °C/114.8 °F
Dwell Time:	10 minutes
Dwell Recording Interval:	1 minute
Cooling Method:	Hydrocooling optional

T106-d Mango from Taiwan

Pest: *Bactrocera dorsalis* (Oriental fruit fly) and *Bactrocera cucurbitae*

Treatment: T106-d Vapor heat

Heat Up Time:	N/A
Heat Up Recording Interval:	N/A
Minimum Air Temperature:	N/A
Minimum Pulp Temperature at End of Heat Up:	47.5 °C/115.7 °F
Dwell Time:	30 minutes
Dwell Recording Interval:	5 minute
Cooling Method:	Cooling required

T106-c Papaya

Pest: *Ceratitis capitata* (Mediterranean fruit fly), *Bactrocera dorsalis* (Oriental fruit fly), and *Bactrocera cucurbitae* (melon fly)

Treatment: T106-c Vapor heat

Heat Up Time:	4 hours
Heat Up Recording Interval:	5 minutes
Minimum Air Temperature:	N/A
Minimum Pulp Temperature at End of Heat Up:	47.2 °C/117.0 °F
Dwell Time:	N/A
Dwell Recording Interval:	N/A
Cooling Method:	Optional

T106-e Yellow Pitaya (*Selenicereus megalanthus*) from Colombia

Pest: *Ceratitis capitata* (Mediterranean fruit fly), *Anastrepha fraterculus* (South American fruit fly)

Treatment: T106-e Vapor heat

Heat Up Time:	4 hours
Heat Up Recording Interval:	5 minutes
Minimum Air Temperature:	N/A
Minimum Pulp Temperature at End of Heat Up:	46.0 °C/114.8 °F
Dwell Time:	20 minutes
Dwell Recording Interval:	5 minutes
Cooling Method:	Hydrocooling optional[1]

1 If post-treatment cooling is conducted, wait 30 minutes after the treatment to start the forced cooling process.

T106-g Rambutan from Hawaii

Pest: *Ceratitis capitata* (Mediterranean fruit fly), and *Bactrocera dorsalis* (Oriental fruit fly)

Treatment: T106-g Vapor heat

Heat Up Time:	1 hour
Heat Up Recording Interval:	5 minutes
Minimum Air Temperature:	N/A
Minimum Pulp Temperature at End of Heat Up:	47.2 °C/117.0 °F
Dwell Time:	20 minutes
Dwell Recording Interval:	5 minutes
Cooling Method:	Optional

T107—Cold Treatment

Pulp of the Fruit

The pulp of the fruit must be at or below the indicated temperature at time of beginning treatment for all cold treatments.

Fruits for Which Cold Treatment Is Authorized

The following cold treatment schedules are authorized by Plant Protection and Quarantine (PPQ) for the control of specific pests associated with shipments of fruit. The cold treatment schedule that must be used for a specific commodity from a specific country is listed in the Fruits and Vegetables Import Requirement database (FAVIR). These cold treatment schedules indicate the specific pests for which they are designed to control.

Treatment upon arrival may be accomplished at authorized ports as named in the permits.

Treatment in transit may be authorized for specifically equipped and approved vessels or containers and from approved countries, for entry at ports named in the permits. Intransit cold treatment authorization must be preceded by a visit to the country of origin by a PPQ Official to explain loading, inspection, and certification procedures to designated certifying officials of country of origin. Refrigerated compartments on carrying vessels and cold storage warehouse must have prior certification by PPQ. Authorization of cold treatments from countries with direct sailing time less than the number of days prescribed for intransit refrigeration treatment must be contingent on importer understanding that prescribed intransit refrigeration period must be met before arrival of vessel at the approved U.S. port.

Gaps in the cold treatment data print-out for pulp sensors and air sensors shall be allowed or disallowed on a case-by-case basis, taking into account the number of gaps, the length of each gap, and the temperatures before and after. Air temperatures may occasionally exceed treatment temperatures during defrost cycles; however, fruit temperatures should **not** rise appreciably during this time. During non-defrost times, the temperatures of the air sensors should never exceed the maximum allowable treatment temperature.

Important

The fruit must be precooled at or below the target treatment temperature prior to loading. A certified USDA representative must sample the fruit pulp temperatures during loading in all sections of the lot until precooling has been accomplished.

T107-a

Apple, Apricot[14], Avocado, Blueberry, Cape Gooseberry, Cherry, Ethrog, Grape, Grapefruit, Kiwi, Lemon, Loquat, Litchi (Lychee), Nectarine, Orange, Ortanique, Peach, Pear, Persimmon, Plum[14], Plumcot, Pomegranate, Pummelo, Quince, Sand Pear, Tangerine (includes Clementine)

Pest: *Ceratitis capitata* (Mediterranean fruit fly) and *Ceratitis rosa* (Natal fruit fly)

Treatment: T107-a Cold treatment

Temperature	Exposure Period
34 °F (1.11 °C) or below	14 days
35 °F (1.67 °C) or below	16 days
36 °F (2.22 °C) or below	18 days

Important

Pretreatment conditioning for avocado (heat shock or 100.4 °F (38 °C) for 10 to 12 hours) is optional and is the responsibility of the shipper. The pretreatment conditioning, which may improve fruit quality, is described in HortScence 29 (10): 1166-1168. 1994. and 30(5): 1052-1053 (1995)

T107-a-1

Apple, Apricot[15], Blueberry, Cherry, Grape, Grapefruit, Kiwi, Mandarin, Nectarine, Orange, Peach, Pear, Plum[15], Pomegranate, Quince, Sweet Orange, Tangelo, Tangerine (includes Clementine)

Pest: *Ceratitis capitata* (Mediterranean fruit fly) and species of *Anastrepha* (other than *Anastrepha ludens)*

Treatment: T107-a-1 Cold treatment

Temperature	Exposure Period
34 °F (1.11 °C) or below	15 days
35 °F (1.67 °C) or below	17 days

14 **Pluots** and **plumcots** are considered hybrids of plums and apricots and can be treated using T107-a**.**

15 **Pluots** and **plumcots** are considered hybrids of plums and apricots and can be treated using T107-a-1**.**

T107-b Apple, Apricot[16], Cherry, Ethrog, Grapefruit, Litchi, Longan, Orange, Peach, Persimmon, Plum[16], Pomegranate, Tangerine (includes Clementine), White Zapote

Pest: *Anastrepha ludens* (Mexican fruit fly)

Treatment: **T107-b** Cold treatment

Temperature	Exposure Period
33 °F (0.56 °C) or below	18 days
34 °F (1.11 °C) or below	20 days
35 °F (1.67 °C) or below	22 days

T107-c Apple, Apricot[17], Carambola, Cherry, Grape, Grapefruit, Orange, Pomegranate, Tangerine (includes Clementine)

Pest: Species of *Anastrepha* (other than *Anastrepha ludens)*

Treatment: **T107-c** Cold treatment

Temperature	Exposure Period
32 °F (0 °C) or below	11 days
33 °F (0.56 °C) or below	13 days
34 °F (1.11 °C) or below	15 days
35 °F (1.67 °C) or below	17 days

T107-d Apple, Grapefruit, Kiwi, Orange, Pear, Tangerine (includes Clementine)

Pest: *Bactrocera tryoni* (Queensland fruit fly)

Treatment: **T107-d** Cold treatment

Temperature	Exposure Period
32 °F (0 °C) or below	13 days
33 °F (0.56 °C) or below	14 days
34 °F (1.11 °C) or below	18 days
35 °F (1.67 °C) or below	20 days
36 °F (2.22 °C) or below	22 days

16 **Pluots** and **plumcots** are considered hybrids of plums and apricots and can be treated using T107-b**.**

17 **Pluots** and **plumcots** are considered hybrids of plums and apricots and can be treated using T107-c.

T107-e Apricot[18], Grape, Nectarine, Peach, Plum[18]

Pest: *Thaumatotibia leucotreta* (false codling moth) and *Ceratitis rosa* (Natal fruit fly)

Treatment: **T107-e** Cold treatment

Temperature	Exposure Period
31 °F (-0.55 °C) or below[1]	22 days

1 The treatment shall **not** commence until all sensors are reading 31 °F (-0.55 °C) or below. If the temperature exceeds 31.5 °F (-0.27 °C), the treatment shall be extended one-third of a day for each day or part of a day the temperature is above 31.5 °F (-0.27 °C). If the exposure period is extended, the temperature during the extension period must be 34° F (1.11 °C) or below. If the temperature exceeds 34 °F (1.11 °C) at any time, the treatment is nullified. Also, some freeze damage to the fruit may occur if the pulp temperature is allowed to drop below approximately 29.5 °F (-1.38 °C) (This varies with the commodity.)

T107-k Citrus

Pest:*Thaumatotibia leucotreta* (false codling moth) and *Ceratitis rosa* (Natal fruit fly)

Treatment: **T107-k** Cold treatment

Temperature	Exposure Period
31 °F (-0.55 °C) or below*	24 days

Important

*The treatment shall be extended 8 hours for each temperature spike that is above 31.5 °F (-0.27 °C). If the temperature spike is longer than 8 hours, add another 8 hours.

For example, if the duration of the temperature spike is:

1 to 8 hours, then ADD 8 hours
9 to 16 hours, then ADD 16 hours
17 to 24 hours, then ADD 24 hours

This treatment is not to exceed 48 days of total treatment duration. If the temperature exceeds 34.0 °F (1.11 °C) at any time, the treatment is nullified.

18 **Pluots** and **plumcots** are considered hybrids of plums and apricots and can be treated using T107-e.

T107-h

Carambola, Litchi (Lychee), Longan, Sand Pear

Pest: *Bactrocera dorsalis* (Oriental fruit fly), *Bactrocera curcubitae* (melon fly) and *Conopomorpha sinensis* (lychee fruit borer)

Treatment: **T107-h** Cold treatment

Temperature	Exposure Period
33.8 °F (0.99 °C) or below	17 days
34.5 °F (1.38 °C) or below	20 days

T107-j

Carambola, Litchi (Lychee), Longan, Sand Pear

Pest: *Bactrocera dorsalis* (Oriental fruit fly)

Treatment: **T107-j** Cold treatment

Temperature	Exposure Period
33.8 °F (0.99 °C) or below	15 days
34.5 °F (1.38 °C) or below	18 days

NOTICE

Use T107-j when *Bactrocera dorsalis is* the **ONLY** pest of concern that is identified by APHIS PPQ import requirements.

T107-g

Pecans and Hickory Nuts

Pest: *Curculio caryae* (Pecan weevil)

Treatment: **T107-g** Cold treatment

Temperature	Exposure Period
0 °F (-17.78 °C) or below	7 days

T107-f

Ya Pear from China

Treatment: **T107-f** Cold treatment

Temperature	Exposure Period
32 °F (0 °C) or below	10 days
33 °F (0.56 °C) or below	11 days
34 °F (1.11 °C) or below	12 days
35 °F (1.67 °C) or below	14 days

T108—Fumigation Plus Refrigeration of Fruits

Fruits for Which Fumigation Followed by Cold Treatment Is Authorized

The following treatment schedules (fumigation followed by cold treatment) are authorized by Plant Protection and Quarantine (PPQ) for the control of specific pests associated with shipments of fruit. The treatment schedule that must be used for a specific commodity from a specific country is listed in the Fruits and Vegetables Import Requirement database (FAVIR). These treatment schedules indicate the specific pests for which they are designed to control.

Important

For Hawaiian-grown avocados, research has shown that, during the process of cold treatment (T108-a), a single transient heat spike of no greater than 39.6 °F (4.2 °C) and no longer than 2 hours, during or after 6 days of cold treatment, does **not** affect the efficacy of the treatment. However, in the absence of supporting research, such a tolerance for heat spikes shall **not** be extended to other fruits.

Important

Cold treatment in break-bulk vessels must be initiated by an APHIS Officer when shipments are from Italy, and Taiwan. However, cold treatment in containers may be initiated by treatment technicians from these countries only because they have been trained to initiate cold treatments for containers and **not** break-bulk vessels

NOTICE

Some varieties of fruit may be injured by exposure to MB. Importers should be encouraged to treat small samples of fruit to determine tolerance levels before shipping commercial quantities. The USDA is **not** liable for damages caused by quarantine.

T108-a Apple, Apricot[19], Avocado, Cherry, Grape, Kiwi, Nectarine, Peach, Pear[20], Plum[19], Quince

Pest: *Bactrocera cucurbitae* (melon fly), *Bactrocera dorsalis* (Oriental fruit fly), *Bactrocera tryoni* (Queensland fruit fly), *Brevipalpus chiliensis* (Chilean false red mite), *Ceratitis capitata* (Mediterranean fruit fly), *Lobesia botrana* (grapevine moth)

Treatment: **T108-a** Fumigation plus Cold treatment
Three alternative schedules based upon the fumigation exposure time

Important

Pretreatment conditioning for avocado (heat shock or 100.4 °F (38 °C) for 10 to 12 hours) is optional and is the responsibility of the shipper. The pretreatment conditioning, which may improve fruit quality, is described in HortScence 29 (10): 1166-1168. 1994. and 30(5): 1052-1053 (1995)

NOTICE

Check the Fruits and Vegetables Import Requirement database (FAVIR) to determine the required treatments for a commodity from a specific country.

Important

Some varieties of fruit may be injured by the 3-hour exposure. Importers should be encouraged to test treat small quantities to determine tolerance before shipping commercial quantities

Important

Time lapse between fumigation and start of cooling **not** to exceed 24 hours.

19 **Plumcot** and **pluot** are considered hybrids of plums and apricots and may also be treated using T108-a provided they are treated under a **Section 18 Crisis exemption.**

20 Fumigation may cause **severe** damage to Chinese, Japanese, Asian and Sand Pears. Obtain the importer's consent before fumigation.

T108-a-1

Treatment: **T108-a-1**[21] MB at NAP—tarpaulin or chamber followed by cold treatment

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
70 °F (21.11 °C) or above	2 lbs	25	18
Followed by cold treatment			

Refrigeration	
Temperature	**Exposure Period**
33 to 37 °F (0.56 to 2.77 °C)	4 days
OR 38 to 47 °F (3.33 to 8.33 °C)	11 days

T108-a-2

Treatment: **T108-a-2**[22] MB at NAP—tarpaulin or chamber followed by cold treatment

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:		
		0.5 hr	2 hrs	2.5 hrs
70 °F (21.11 °C) or above	2 lbs	25	18	18
Followed by cold treatment				

Refrigeration	
Temperature	**Exposure Period**
34 to 40 °F (1.11 to 4.44 °C)	4 days
OR 41 to 47 °F (5.0 to 8.33 °C)	6 days
OR 48 to 56 °F (8.88 to 13.33 °C)	10 days

21 **DO NOT** use T108-a-1 for Chilean False Red Mite (*Brevipalpus chilensis*). Use T108-a-3.
22 **DO NOT** use T108-a-2 for Chilean False Red Mite (*Brevipalpus chilensis*). Use T108-a-3.

T108-a-3

Treatment: **T108-a-3** MB at NAP—tarpaulin or chamber followed by cold treatment

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:			
		0.5 hr	2 hrs*	2.5 hrs	3 hrs
70 °F (21.11 °C) or above	2 lbs	25	18	18	17
Followed by cold treatment					

Refrigeration	
Temperature	**Exposure Period**
43 °F to 47 °F (6.11 to 8.33 °C)	3 days
OR 48 °F to 56 °F (8.88 to 13.33 °C)	6 days

T108-b

Apple, Grape, and Pear[23]

Pest: *Austrotortrix* spp. and *Epiphyas* spp. (light brown apple moth complex), *Bactrocera tryoni* (Queensland fruit fly), *Ceratitis capitata* (Mediterranean fruit fly) and other fruit flies

Treatment: T108-b MB at NAP—tarpaulin or chamber followed by cold treatment

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
50 °F (10 °C) or above	1.5 lbs	23	20
40-49 °F (4.44 to 9.44 °C)	2 lbs	30	25
Followed by cold treatment			

Temperature	Exposure Period
33 °F (0.56 °C) or below	21 days

Important

Load **not** to exceed 80 percent of chamber capacity. Time lapse between fumigation and start of cooling **not** to exceed 24 hours.

23 Fumigation may cause **severe** damage to Chinese, Japanese, Asian and Sand Pears. Obtain the importer's consent before fumigation.

T109—Cold Treatment Plus Fumigation of Fruits

T109-d-1 Apple, Grape, and Pear[24] from Australia

Pest: *Austrotortrix* spp. and *Epiphyas* spp. (light brown apple moth complex), *Bactrocera tryoni* (Queensland fruit fly), *Ceratitis capitata* (Mediterranean fruit fly) and other fruit flies

Treatment: T109-d-1 Cold treatment followed by MB at NAP—tarpaulin or chamber

Temperature	Exposure Period
33 °F (0.56 °C) or below	21 days
Followed by MB at NAP—tarpaulin or chamber	

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
70 °F (21.11 °C) or above	2 lbs	30	25
60 to 69 °F (15.55 to 20.55 °C)	2.5 lbs	36	28
40 to 59 °F (4.44 to 15 °C)	3 lbs	44	36

Alternate treatment for *Austrotortrix* and *Epiphyas* is fumigation plus refrigeration (***T108-b*** on **page 5-2-82**).

Alternate treatment for grapes from Australia as a fruit fly precautionary treatment for *Bactrocera tryoni* and *Ceratitis capitata* is fumigation plus refrigeration (***T108-a*** on **page 5-2-80** and ***T108-b*** on **page 5-2-82**).

NOTICE

Load **not** to exceed 80 percent of capacity.

24 Fumigation may cause **severe** damage to Chinese, Japanese, Asian and Sand Pears. Obtain the importer's consent before fumigation.

T109-a Apple ('Fuji' Apple from Japan and Korea)

Pest: *Carposina niponensis* (peach fruit moth), *Conogethes punctiferalis* (yellow peach moth), *Tetranychus viennensis* (fruit tree spider mite), *Tetranychus kanzawai* (Kanzawa mite)

Two alternative schedules based on type of container

T109-a-1

Treatment: **T109-a-1** (apples in plastic field bins at maximum load factor 50 percent or less) Cold treatment followed by MB at NAP—tarpaulin or chamber

Temperature	Exposure Period
34 °F (1.11 °C) or below	40 days
Followed by MB at NAP—tarpaulin or chamber	

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
50 °F or (10 °C) above	3 lbs	44	36

T109-a-2

Treatment: **T109-a-2** (apples in only cardboard cartons at maximum load factor 40 percent or less) Cold treatment followed by MB at NAP—tarpaulin or chamber

Temperature	Exposure Period
34 °F (1.11 °C) or below	40 days
Followed by MB at NAP—tarpaulin or chamber	

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
59 °F (15 °C) above	2 lbs 6 oz	35	29

T110—Quick Freeze

There are two alternative Quick Freeze treatments, depending on whether the commodity is to be treated and released or destroyed. The commodities listed in **Figure 5-2-1** below are **not** eligible for this treatment:

Important

Avocados with seeds are prohibited from South America, Central America, or Mexico; **Citrus with peel** is prohibited from Afghanistan, Andaman Islands, Argentina, Bangladesh, Brazil, Cambodia, China (People's Republic of), Comoros, Côte d'Ivoire, Federated States of Micronesia, Fiji Islands, Home Island in Cocos (Keeling) Islands, Hong Kong, India, Indonesia, Japan and adjacent islands, Korea, Laos, Madagascar, Malaysia, Maldives, Mauritius, Mozambique, Myanmar, Nepal, Oman, Pakistan, Papua New Guinea, Paraguay, Philippines, Reunion Islands, Rodrigues Islands, Ryukyu Islands, Saudi Arabia, Seychelles, Sri Lanka, Taiwan, Thailand, Thursday Island, United Arab Emirates, Uruguay, Vietnam, Yemen, and Zaire. **Mangoes with seeds** are prohibited from Barbados, Dominica, French Guiana, Guadeloupe, Martinique, St. Lucia, and all countries outside of North, Central, and South America and their adjacent islands (which include the Caribbean Islands and Bermuda). **Black currants** are enterable only to areas specified in the import permit. **Corn-on-the-cob** is prohibited from Albania, Algeria, Bosnia and Hercegovina, Croatia, Cyprus, Egypt, France, Greece, Israel, Italy, Lebanon, Libya, Malta, Macadonia, Morocco, Sardinia, Slovenia, Spain, Syria, Tunisia, and Turkey.

Never use this treatment for the control of bruchid beetles in dried beans. Research has shown that a treatment of -18 °C (-0.4 °F) for 14 days would be needed to be efficacious.

Figure 5-2-1 Commodities Ineligible for Quick Freeze Treatment

T110-a

Treatment: T110-a — Quick Freeze

1. Initially, lower the commodity's temperature to 0 °F (-17.77 °C) or below.
2. Hold the commodity's temperature at 20 °F (-6.66 °C)or below for at least 48 hours.

   The commodity may be transported during the 48-hour treatment period, but at no time may the commodity's temperature rise above 20 °F (-6.66 °C) prior to release.

All fruits and vegetables (except for the commodities listed in **Figure 5-2-1**) are enterable from all foreign countries after receiving this treatment in accordance with 7CFR 319.56-2c. Also, interstate movement of all fruits and vegetables from offshore areas of the United States (except mango from Hawaii) is authorized in the frozen state after being quick frozen.

Freezing will ruin the market quality of most fresh fruits and vegetables, except for thick-skinned items such as durian and coconut. Generally, this treatment is used on fruits and vegetables that will be processed into another form (e.g., for puree, juice, or mashed vegetables).

T110-b

Treatment: T110-b — Quick Freeze for Destruction

Important

T110-b may ONLY be used with permission from CPHST Treatment Quality Assurance Unit.

Contact 919-855-7457 for official approval.

1. Initially, lower the commodity's temperature to 0 °F (-17.77 °C) or below.
2. Hold the commodity's temperature at 20 °F (-6.66 °C)or below for at least 48 hours.

   The commodity may be transported during the 48-hour treatment period, but at no time may the commodity's temperature rise above 20 °F (-6.66 °C) prior to release.
3. After treatment, transport the commodity to a landfill for deep burial.

This treatment is considered an acceptable method of destroying most commodities in lieu of returning them to the country of origin, with the exceptions listed in the **Figure 5-2-1 on page-5-2-85** at the beginning of this treatment schedule.

5

Treatment Manual

Treatment Schedules

T200 - Schedules for Propagative Plant Material

Contents

The following schedules of the T200 series are arranged by category such as a specifically named plant, type of plant, character of growth, or pest.

Important

Plant and plant parts treated under the T200 series schedules are **not** to be used for food or feed purposes.

T201—Plants

T201-q Aquatic plants infested with freshwater snails 5-3-3
T201-e-1 and T201-e-2 Bromeliads 5-3-4
T201-f-1 and T201-f-2 Cacti and other succulents 5-3-4
T201-g-1, T201-g-2 and T201-g-3 Chrysanthemum spp., rooted and unrooted cuttings 5-3-5
T201-l Commodities infested with quarantine-significant slugs 5-3-6
T201-h-1 Cycads—excluding Dioon edule (chestnut dioon) 5-3-7
T201-a-1 and T201-a-2 Deciduous woody plants (dormant) 5-3-7
T201-h-2 Dioon edule (chestnut dioon) 5-3-8
T201-i-1 and T201-i-2 Dieffenbachia spp., Dracaena spp., Philodendron spp. (plants and cuttings) 5-3-9
T201-b-1 Evergreens*, (Broadleaved genera, such as Azalea, Berberis, Camellia, Ilex, and Photinia) 5-3-10
T201-k-1 Foliated hosts plants of Dialeurodes citri (citrus whitefly), excluding Osmanthus americanus 5-3-11
T201-c-1 and T201-c-2 Greenhouse-grown plants, herbaceous plants and cuttings, and greenwood cuttings of woody plants 5-3-11
T201-n Host plants of Aleurocanthus woglumi (citrus blackfly) 5-3-13
T201-o-1 and T201-o-2 Host plants of Omalonyx unguis and Succinea spp. (snails) 5-3-13
T201-k-2 Nonfoliated hosts plants of Dialeurodes citri (citrus whitefly), excluding Osmanthus americanus 5-3-14
T201-d-1, T201-d-2 , T201-d-3, T201-d-4, and T201-d-5 Orchids, plants, and cuttings 5-3-14
T201-e-3-1 and T201-e-3-2 Pineapple slips 5-3-16
T201-j Pines (Pinus spp.) from Canada 5-3-17
T201-m-1 Plant cuttings (Scion wood)* 5-3-18

T201-m-2 Plant cuttings (greenwood cuttings of woody plants and herbaceous plant cuttings)* 5-3-18
T201-m-3 and T201-m-4 Plant cuttings (root cuttings)* 5-3-19
T201-p Plant material not tolerant to fumigation 5-3-20

T202—Bulbs, Corms, Tubers, Rhizomes, and Roots

T202-b Astilbe roots 5-3-23
T202-c Banana roots 5-3-23
T202-j Garlic 5-3-24
T202-e-1 Gladiolus spp. 5-3-24
T202-f Horseradish roots 5-3-25
T202-g Lily bulbs packed in subsoil 5-3-25
T202-h **Lycoris 5-3-26**
T202-i-1 **Narcissus 5-3-26**
T202-a-1 Selaginella spp. (Resurrection plants) 5-3-27
T202-d Yams (Dioscorea spp.) and Sweet Potatoes (Ipomoea spp.) 5-3-28

T203—seeds

T203-m Avocado (seeds only, without pulp) 5-3-29)
T203-e Chestnuts (does not include water chestnuts) and Acorns 5-3-29
T203-i-1 Conifer seeds (species with small seeds, such as Picea spp., Pinus sylvestris, and Pinus mugo) 5-3-30
T203-f-1 Cottonseed—bagged, packaged, or in bulk 5-3-31
T203-k Macadamia nuts (as seeds) 5-3-33)
T203-g-1 Pods and seed of Kenaf, Hibiscus, and Okra 5-3-32
T203-h—Rosmarinus seeds 5-3-33
T203-l Seeds 5-3-34
T203-b Seeds excluding seeds of Vicia spp. 5-3-34
T203-o-1 Seeds of Casuarina 5-3-35
T203-p Seeds of Citrus (Rutaceae family) 5-3-37
T203-j Seeds of Hevea brasiliensis (rubber tree) 5-3-35
T203-o-3 Seeds of Leguminosae = Fabaceae, etc. 5-3-36
T203-o-5 Seeds of Lonicera and Other seeds 5-3-36
T203-o-2 Seeds of Umbelliferae 5-3-37
T203-d-1 Seeds of Vicia spp. (vetch seeds) excluding seeds of Vicia faba 5-3-37
T203-l Seeds of Vicia spp. (vetch seeds) including seeds of Vicia faba 5-3-38
T203-a-1Seeds not specifically listed in the T203 Schedules 5-3-34
T203-n Seeds with infested pulp 5-3-38

NOTICE

Plant Tolerance. In general, nursery stock should be fumigated in a normal atmospheric pressure (NAP) chamber. Damage may occur when treatment is performed under a tarpaulin. When selecting a treatment for a particular pest, consider the tolerance of the plant material to the treatment. Refer to the "Handbook of Plant Tolerances to Quarantine Treatments" to determine if a genus or species is tolerant to treatment.

The condition of the plants at the time of treatment may have a bearing on reaction to treatment.

Any new or unusual observations relating to treatment tolerance of treated material should be recorded and reported to the Center for Plant Health Science & Technology (CPHST), giving details of the treatment and the conditions of application. In appraising the effects of a particular treatment, take care to distinguish between the actual or apparent effects attributable to the treatment and those **not** related to the treatment.

NOTICE

Seeds for Propagation. Precautionary treatment for small lots of seeds (1 lb or less) is **not** required if you can inspect 100 percent of the seeds and you do **not** find any pests.

NOTICE

Containers. Give boxes, crates, and other propagative containers the same treatment as the propagative material with which they are associated. Exceptions are necessary, however, when significant pests are found infesting containers or packing materials that would not be controlled by the treatment required for the contents.

NOTICE

Dipping. In lieu of fumigation, an approved chemical dip may be recommended for those plants known to be intolerant to fumigants. Plants, including the roots, should be entirely submerged in the chemical dip for 30 seconds. Agitating the plants while immersed in the solution will eliminate air pockets and aid in obtaining complete coverage of the plants with the pesticide. For approved fungicidal dips, see the appropriate section in the T500 Treatment Schedules.

Important

Use fresh chemicals in preparing the dip solution for same day use. Wear rubber gloves while dipping plants to prevent pesticides from coming in contact with skin. Wash the gloves in soap and water before removing. Also, thoroughly wash hands and arms in soap and water after removing the gloves. Do not eat or smoke while working with pesticides.

T201—Plants

T201-q Aquatic plants infested with freshwater snails

Pest: Snails of the following families: Amphulariidae, Bulinidae, Limnaeidae, Planorbidae, Viviparidae

Treatment: T201-q—Hot water treatment 112 °F for 10 minutes. *Elodea Danes* and *Cabomba caroliniana* plants not tolerant to this treatment. Inspection stations should refer to their reference report guide for host tolerances to the hot water treatment.

T201-e-1

Bromeliads

Pest: External feeders

Treatment: T201-e-1 MB (“Q” label only) at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
90-96 °F	2 lbs	1.5 hrs
80-89 °F	2 lbs	2 hrs
70-79 °F	3 lbs	2 hrs
60-69 °F	3 lbs	2.5 hrs
50-59 °F	3 lbs	3 hrs

T201-e-2

Bromeliads

Pest: Internal feeders such as borers and miners

Treatment: T201-e-2 MB (“Q” label only) at 15" vacuum

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
90-96 °F	2 lbs	1.5 hrs
80-89 °F	2 lbs	2 hrs
70-79 °F	3 lbs	2 hrs
60-69 °F	3 lbs	2.5 hrs
50-59 °F	3 lbs	3 hrs

T201-f-1

Cacti and other succulents

Two schedules based on type of pest

Pest: External feeders (other than soft scales) infesting collected dormant and nondormant plant material

Treatment: T201-f-1 MB (“Q” label only) at NAP—tarpaulin or chamber)

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period:	
		Brachyrhinus larvae	All others
90-96 °F	2 lbs	2.5 hrs	2 hrs
80-89 °F	2.5 lbs	2.5 hrs	2 hrs
70-79 °F	3 lbs	2.5 hrs	2 hrs
60-69 °F	3 lbs	3 hrs	2.5 hrs
50-59 °F	3 lbs	3.5 hrs	3 hrs
40-49 °F	3 lbs	4 hrs	3.5 hrs

T201-f-2 Cacti and other succulents

Two schedules based on type of pest

Pest: Borers and soft scales

Treatment: T201-f-2 MB (“Q” label only) in 15" vacuum

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period:	
		Brachyrhinus larvae	All others
90-96 °F	2 lbs	2.5 hrs	2 hrs
80-89 °F	2.5 lbs	2.5 hrs	2 hrs
70-79 °F	3 lbs	2.5 hrs	2 hrs
60-69 °F	3 lbs	3 hrs	2.5 hrs
50-59 °F	3 lbs	3.5 hrs	3 hrs
40-49 °F	3 lbs	4 hrs	3.5 hrs

Important

Vacuum fumigation requires prior consent of the importer. If consent is denied, entry should be refused unless hand removal plus 100 percent inspection is feasible.

NOTICE

Obtain consent of the importer prior to treatment of the following plants since some damage may occur:

Bromeliads, see ***T201-e-3-1*** on **page 5-3-16**
Kalenchoe synsepala, see ***T201-p*** on **page 5-3-20**
Sedum adolphi, see ***T201-p*** on **page 5-3-20**

T201-g-1 *Chrysanthemum* spp., rooted and unrooted cuttings

NOTICE

Obtain consent of the importer prior to fumigation since some damage may occur.

Pest: Aphids

Treatment: T201-g-1 MB (“Q” label only) at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
70 °F or above	0.75 lb	2 hrs

T201-g-2 *Chrysanthemum* spp., rooted and unrooted cuttings

Pest: External feeders

Treatment: T201-g-2 Malathion-carbaryl chemical dip—Hand removal of pests of infested parts *plus* a malathion-carbaryl chemical dip. Solution prepared by adding 3 level tablespoons of 25 percent malathion wettable powder and 3 level tablespoons of 50 percent carbaryl wettable powder to each gallon of water. The addition of a sticker-spreader formulation may be required for hard to wet plants. Use fresh chemicals and prepare dip for the same day use. Plants, including the roots, should be entirely submerged in the chemical dip for 30 seconds.

T201-g-3 *Chrysanthemum* spp., rooted and unrooted cuttings

Pest: Leafminers, aphids, mites, etc.*

Treatment: T201-g-3—Hot water at 110-111 °F for 20 minutes

*This treatment is marginal as to host tolerance.

Important

Chrysanthemum spp. from the Dominican Republic and Colombia when infested with Agromyzid leaf miners requires no treatment unless destined to Florida.

T201-l Commodities infested with quarantine-significant slugs

Pest: Quarantine significant slugs of the families Agriolimacidae, Arionidae, Limacidae, Milacidae, Philomycidae, and Veronicellidae, including the following genera:

Agriolimax	***Leidyula***	***Pseudoveronicella***
Arion	***Limax***	***Sarasinula***
Colosius	***Meghimatium***	***Semperula***
Deroceras	***Milax***	***Vaginulus***
Diplosolenodes	***Pallifera***	***Veronicella***

Treatment: T201-l MB (“Q” label only) at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
90-96 °F	1 lb	12	9
80-89 °F	1.25 lbs	15	12
70-79 °F	1.5 lbs	18	15
60-69 °F	1.75 lbs	22	19

T201-h-1 Cycads—excluding *Dioon edule* (chestnut dioon)

Pest: External feeders

Treatment: T201-h-1 MB (“Q” label only) in 15" vacuum

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
90-96 °F	2 lbs	2 hrs
80-89 °F	2.5 lbs	2 hrs
60-79 °F	3 lbs	2 hrs
40-59 °F	3 lbs	2.5 hrs

T201-a-1 Deciduous woody plants (dormant)

Pest: External feeders

Treatment: T201-a-1 MB (“Q” label only) at NAP

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period:	
		Brachyrhinus larvae	All others
90-96 °F	2 lbs	2.5 hrs	2 hrs
80-89 °F	2.5 lbs	2.5 hrs	2 hrs
70-79 °F	3 lbs	2.5 hrs	2 hrs
60-69 °F	3 lbs	3 hrs	2.5 hrs
50-59 °F	3 lbs	3.5 hrs	3 hrs
40-49 °F	3 lbs	4 hrs	3.5 hrs

For gypsy moth egg masses, use ***T313-a*** on **page 5-4-37** or ***T313-b*** on **page 5-4-37**.

Important

If treating for mealybugs, use ***T305-c*** on **page 5-4-18**.

NOTICE

This schedule is not entirely satisfactory for use against egg masses of *Yponomeuta malinellus* (apple ermine moth).

T201-a-2

Deciduous woody plants (dormant)

root cuttings, scion wood cuttings, and nonfoliated citrus whitefly host—such as *Acer, Berberis, Fraxinus, Philadelphus, Rosa, Spiraea,* and *Syringa*

Pest: Borers

Treatment: T201-a-2 MB ("Q" label only) in 26" vacuum

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period:	
		Brachyrhinus larvae	All others
90-96 °F	2 lbs	2.5 hrs	2 hrs
80-89 °F	2.5 lbs	2.5 hrs	2 hrs
70-79 °F	3 lbs	2.5 hrs	2 hrs
60-69 °F	3 lbs	3 hrs	2.5 hrs
50-59 °F	3 lbs	3.5 hrs	3 hrs
40-49 °F	3 lbs	4 hrs	3.5 hrs

Important

Citrus whitefly hosts, **see** ***T201-k-1*** on **page 5-3-11** Evergreens* broadleaved genera

T201-h-2

Dioon edule (chestnut dioon)

For other cycads see cycads

Pest: External feeders

Treatment: T201-h-2 MB ("Q" label only) in 26" vacuum

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
90-96 °F	2 lbs	2 hrs
80-89 °F	2.5 lbs	2 hrs
60-79 °F	3 lbs	2 hrs
40-59 °F	3 lbs	2.5 hrs

T201-i-1 *Dieffenbachia* spp., *Dracaena* spp., *Philodendron* spp. (plants and cuttings)

Pest: External feeders

Treatment: T201-i-1 MB (“Q” label only) at NAP—chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
90-96 °F	2 lbs	1.5 hrs
80-89 °F	2 lbs	2 hrs
70-79 °F	3 lbs	2 hrs
60-69 °F	3 lbs	2.5 hrs
50-59 °F	3 lbs	3 hrs

Important

This treatment may cause leaf tip burn in *Dieffenbachia* (dumbcane).

T201-i-2 *Dieffenbachia* spp., *Dracaena* spp., *Philodendron* spp. (plants and cuttings)

Pest: Internal feeders

Treatment: T201-i-2 MB (“Q” label only) in 26" vacuum

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
90-96 °F	2 lbs	1.5 hrs
80-89 °F	2 lbs	2 hrs
70-79 °F	3 lbs	2 hrs
60-69 °F	3 lbs	2.5 hrs
50-59 °F	3 lbs	3 hrs

Immature and tender plants and cuttings, and species and varieties known or considered to be affected by MB, should **not** be fumigated without consent of the importer. Without such consent, entry should be denied.

NOTICE

This schedule may cause leaf tip burn in *Dieffenbachia* (dumbcane).

T201-b-1 Evergreens*, (Broadleaved genera, such as *Azalea*, *Berberis*, *Camellia*, *Ilex*, and *Photinia*)

(Coniferous genera, such as *Cedrus*, *Cupressus*, *Juniperus*, *Podocarpus*, *Thuja*, and *Taxus*)

Pest: External feeder

Treatment: T201-b-1 MB ("Q" label only) at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3):		Exposure Period:	
	***Brachyrhinus* larvae**	**All others**	***Brachyrhinus* larvae**	**All others**
90-96 °F	2 lbs	1.5 lbs	2.5 hrs	2 hrs
80-89 °F	2.5 lbs	2 lbs	2.5 hrs	2 hrs
70-79 °F	3 lbs	2.5 lbs	2.5 hrs	2 hrs
60-69 °F	3 lbs	2.5 lbs	3 hrs	2.5 hrs
50-59 °F	3 lbs	2.5 lbs	3.5 hrs	3 hrs
40-49 °F	3 lbs	2.5 lbs	4 hrs	3.5 hrs

Important

*If treating for mealybugs, fumigate at 60 °F or above.

Exceptions:

Araucaria spp., **see** ***T201-c-1*** on **page 5-3-11**
Azalea indica, **see** ***T201-c-2*** on **page 5-3-12**
Cycads, **see** ***T201-l*** on **page 5-3-6**
Citrus whitefly hosts, **see** ***T201-k-1*** on **page 5-3-11**
Daphne spp., **see** ***T201-c-1*** on **page 5-3-11**
Lavandula spp., **see** ***T201-p-1*** on **page 5-3-20**
Osmanthus americanus, **see** ***T201-p-2*** on **page 5-3-21**
Pinus from Canada to certain States, **see** ***T201-j*** on **page 5-3-17**
Peanuts with gypsy moth egg masses, **see** ***T313-a*** on **page 5-4-37**

NOTICE

Some species and varieties of evergreens, particularly in *Azalea* and *Juniperus* have low tolerances and should be fumigated as in schedule T201-c; those known or believed to be intolerant should be handled under T201-p. For tolerance data, see Handbook of Plant Tolerances to Quarantine Treatments.

T201-k-1 Foliated hosts plants of *Dialeurodes citri* (citrus whitefly), excluding *Osmanthus americanus*

For Osmathus americanus, see T201-p

Pest: *Dialeurodes citri* (citrus whitefly)

Treatment: T201-k-1 MB (“Q” label only) at NAP

Temperature	Dosage Rate (lb/1,000 ft^3):		Exposure Period:
	***Brachyrhinus* larvae**	**All others**	
85-96 °F	1.5 lbs	1 lb	4 hrs
80-84 °F	2.5 lbs	2 lbs	2.5 hrs
70-79 °F	2 lbs	2 lbs	3.5 hrs

T201-c-1 Greenhouse-grown plants, herbaceous plants and cuttings, and greenwood cuttings of woody plants

For cut flowers and greenery, use T305-a, which is identical to this schedule).

Pest: External feeders*, leaf miners, thrips

Treatment: T201-c-1 MB (“Q” label only) at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
80-90 °F	1.5 lbs	19	12
70-79 °F	2 lbs	24	16
60-69 °F	2.5 lbs	30	20
50-59 °F	3 lbs	36	24
40-49 F	3.5 lbs	41	27

Important

*If treating for mealybugs, fumigate with 2.5 lbs. at 60 °F or above.

T201-c-2 Greenhouse-grown plants, herbaceous plants and cuttings, and greenwood cuttings of woody plants

Pest: Borers, soft scales

Important

For cut flowers and greenery, use ***T305-b*** on **page 5-4-17**, which is identical to this schedule.

Treatment: T201-c-2 MB ("Q" label only) in 15" vacuum

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
80-90 °F	2.5 lbs	2 hrs
70-79 °F	3 lbs	2 hrs
60-69 °F	3 lbs	2.5 hrs
50-59 °F	3 lbs	3 hrs
40-49 °F	3 lbs	3.5 hrs

Vacuum fumigation requires prior consent of the importer. If consent is denied, refuse entry unless T201-c-1, plus hand removal of these pests is feasible. For shipments of a size to permit 100 percent inspection, plants with these pests may be handled separately. Vacuum fumigation is **not** required for soft scales known to be widely distributed in the United States.

Important

Exceptions to Schedules T201-c-1 and 2

- Bromeliads, see ***T201-e-3-1*** on **page 5-3-16**
- Cacti and other succulents, see ***T201-j*** on **page 5-3-17**
- *Chrysanthemum* spp., see***T201-g-1*** on **page 5-3-5**
- Cycads, see ***T201-l*** on **page 5-3-6**
- Cyclamen mites, ***T201-a-2*** on **page 5-3-8**
- *Dieffenbachia* spp., *Dracaena* spp., and *Philodendron* spp., see ***T201-i-1*** on **page 5-3-9**
- *Kalanchoe synsepala*, see ***T201-p-1*** on **page 5-3-20**
- *Lavandula* spp., see ***T201-p-2*** on **page 5-3-21**
- Orchids, see ***T201-d-1*** on **page 5-3-14**
- *Osmanthus americanus*, see ***T201-p*** on **page 5-3-20**
- *Pelargonium* spp., see ***T201-p*** on **page 5-3-20**
- *Sedum adolphi*, see ***T201-p*** on **page 5-3-20**
- Plants infested with *Succinea horticola*, see ***T201-o-1*** on **page 5-3-13**
- Plants infested with *Veronicella* or other slugs, see ***T201-l*** on **page 5-3-6**

T201-n

Host plants of *Aleurocanthus woglumi* (citrus blackfly)

Pest: *Aleurocanthus woglumi* (citrus blackfly)

Treatment: T201-n MB ("Q" label only) at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
85 °F or above	1 lb	13	9
80-85 °F	1.25 lbs	16	12
70-79 °F	1.5 lbs	19	15
65-69 °F	1.75 lbs	23	17

Precautions within citrus blackfly quarantine areas:

- Conduct tarpaulin fumigations in shaded areas, if possible, to prevent the development of high space temperatures within the tarpaulin enclosure.
- Fumigate 4 to 5 days after plants are dug, balled, and burlapped, if possible.
- Roots and soil should be moist prior to fumigation. Watering should be deferred for 12 hours after fumigation unless there is wilting, in which case, water as needed.
- Avoid excessive air circulation during fumigation or during the post-treatment aeration period.
- Avoid placing plants in direct sunlight after fumigation.

T201-o-1

Host plants of *Omalonyx unguis* and *Succinea spp.* (snails)

Important

These treatments are for use on plants that may **not** tolerate fumigation. Use either of the following treatments.

Pest: *Omalomyx unguis* and *Succinea spp.* (snails)

Treatment: T201-o-1 Water Spray—Use a high-pressure water spray on the foliage to flush snails from the plants. Care should be taken **not** to spray the root systems of conifers since they will be damaged. The run-off drain must be screened to catch snails before drainage into the sewer system. Reinspect plants after wash.

T201-o-2 Host plants of *Omalonyx unguis* and Succinea spp. (snails)

Treatment: **T201-o-2** Chemical Dip—Dip plants with a Malathion-carbaryl chemical dip. Solution prepared by adding 3 level tablespoons of 25 percent Malathion wettable powder and 6 level teaspoons of 50 percent carbaryl wettable powder per gallon of water with a sticker-spreader formulation.

T201-k-2 Nonfoliated hosts plants of *Dialeurodes citri* (citrus whitefly), excluding *Osmanthus americanus*

Pest: *Dialeurodes citri* (citrus whitefly)

Treatment: T201-k-2 MB ("Q" label) at NAP

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period:	
		Brachyrhinus larvae	All others
90-96 °F	2 lbs	2.5 hrs	2 hrs
80-89 °F	2.5 lbs	2.5 hrs	2 hrs
70-79 °F	3 lbs	2.5 hrs	2 hrs
60-69 °F	3 lbs	3 hrs	2.5 hrs
50-59 °F	3 lbs	3.5 hrs	3 hrs
40-49 °F	3 lbs	4 hrs	3.5 hrs

T201-d-1 Orchids, plants, and cuttings

Pest: External feeders, other than soft scales

Collected: Dormant or nondormant

Treatment: T201-d-1 MB ("Q" label only) at NAP tarpaulin or chamber,

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period:	
		Brachyrhinus larvae	All others
90-96 °F	2 lbs	2.5 hrs	2 hrs
80-89 °F	2.5 lbs	2.5 hrs	2 hrs
70-79 °F	3 lbs	2.5 hrs	2 hrs
60-69 °F	3 lbs	3 hrs	2.5 hrs
50-59 °F	3 lbs	3.5 hrs	3 hrs
40-49 °F	3 lbs	4 hrs	3.5 hrs

Important

If treating for mealybugs, use ***T305-c*** on **page 5-4-18**.

T201-d-2

Orchids, plants, and cuttings

Pest: External feeders (other than soft scales) infesting greenhouse-grown plant material

Treatment: T201-d-2 MB (“Q” label only) at NAP tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
90-96 °F	1 lb	2 hrs
80-89 °F	1.5 lbs	2 hrs
70-79 °F	2 lbs	2 hrs
60-69 °F	2.5 lbs	2 hrs
50-59 °F	3 lbs	2 hrs
40-49 °F	3.5 lbs	2 hrs

T201-d-3

Orchids, plants, and cuttings

Pest: Borers, cattleya fly, *Mordellistena* spp., soft scales, *Vinsonia* spp.

Treatment: T201-d-3 MB (“Q” label only) in 15" vacuum

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
90-96 °F	3 lbs	1 hr
80-89 °F	3 lbs	1.5 hrs
70-79 °F	3 lbs	2 hrs
60-69 °F	3 lbs	2.5 hrs
50-59 °F	3 lbs	3 hrs
40-49 °F	3 lbs	3.5 hrs

For nondormant plants, collected or greenhouse grown, vacuum fumigation requires prior consent of the importer. If consent denied, entry should be refused unless T201-a-1 plus hand removal of these pests is feasible. Plant shipments of a size to permit 100 percent inspection and pest removal may be handled separately.

T201-d-4

Orchids, plants, and cuttings

Pest: Cecidomyid galls

Treatment: **T201-d-4** Excised in all cases

T201-d-5 Orchids, plants, and cuttings

Pest: Leaf miner, *Eurytoma* spp., infesting *Rhynchostylis*

Treatment: T201-d-5 Hot water—118 °F for 0.5 hour followed by a cool water bath

NOTICE

Some varieties of Orchids may be sensitive to methyl bromide (MB) treatments. These varieties include *Cymbidium, Cypripedium,* and *Phalaenopis.* As an alternative to MB treatments that may damage orchids, **see** ***T201-p*** on **page 5-3-20**

T201-e-3-1 Pineapple slips

Two alternative schedules

Pest: Various

Treatment: T201-e-3-1 MB ("Q" label only) at NAP

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
90-96 °F	1.5 lbs	2 hrs
80-89 °F	2 lbs	2 hrs
70-79 °F	2.5 lbs	2 hrs
60-69 °F	3 lbs	2 hrs

T201-e-3-2 Pineapple slips

Alternative schedule

Treatment: T201-e-3-2 MB ("Q" label only) in 26" vacuum

Temperature	Dosage Rate| (lb/1,000 ft^3)	Exposure Period
90-96 °F	1.5 lbs	1.5 hrs
80-89 °F	2 lbs	1.5 hrs
70-79 °F	2.5 lbs	1.5 hrs
60-69 °F	3 lbs	1.5 hrs

NOTICE

Some varieties of bromeliads may be sensitive to methyl bromide (MB) treatments. These varieties include *Aechmea* spp., *Billbergia* spp., *Guzmania* spp., *Nidularium* spp., *Vriesia* spp., and other broad shiny-leafed types, and thin-leafed types. As an alternative to MB treatments that may damage bromeliads, **see** ***T201-p*** on **page 5-3-20.**

T201-j

Pines (*Pinus* spp.) from Canada

Destined to California, Idaho, Oregon, and Utah

Pest: *Rhyacionia buoliana* (European pine shoot moth)

Treatment: T201-j MB (“Q” label only) at NAP

Dosage rate for all schedules is 4 lbs MB (51 oz. minimum concentration)

Temperature	Exposure Period	Temperature	Exposure Period
75 °F	2 hrs	59 °F	2 hrs 41 min
74 °F	2 hrs 1 min	58 °F	2 hrs 43 min
73 °F	2 hrs 2 min	57 °F	2 hrs 46 min
72 °F	2 hrs 4 min	56 °F	2 hrs 49 min
71 °F	2 hrs 7 min	55 °F	2 hrs 52 min
70 °F	2 hrs 9 min	54 °F	2 hrs 55 min
69 °F	2 hrs 11 min	53 °F	2 hrs 58 min
68 °F	2 hrs 14 min	52 °F	3 hrs 1 min
67 °F	2 hrs 16 min	51 °F	3 hrs 5 min
66 °F	2 hrs 19 min	50 °F	3 hrs 8 min
65 °F	2 hrs 22 min	49 °F	3 hrs 12 min
64 °F	2 hrs 25 min	48 °F	3 hrs 15 min
63 °F	2 hrs 28 min	47 °F	3 hrs 19 min
62 °F	2 hrs 31 min	46 °F	3 hrs 24 min
61 °F	2 hrs 35 min	45 °F	3 hrs 28 min
60 °F	2 hrs 38 min		

Important

This is a precautionary treatment for pine trees with or without roots and twigs and branches of all *Pinus* species except that Christmas trees and other pine decorative materials are exempt from the fumigation requirement during the period November 1 through December 31.

Prior consent of the importer is required for fumigation at temperatures above 65 °F or below 50 °F and also for all bare-rooted pines, since some damage may occur.

T201-m-1 Plant cuttings (Scion wood)*

Pest: External feeders

Treatment: T201-m-1 MB ("Q" label only) at NAP—tarpaulin or chamber

Important

*See exceptions to plant cuttings.

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period:	
		Brachyrhinus larvae	All others
90-96 °F	2 lbs	2.5 hrs	2 hrs
80-89 °F	2.5 lbs	2.5 hrs	2 hrs
70-79 °F	3 lbs	2.5 hrs	2 hrs
60-69 °F	3 lbs	3 hrs	2.5 hrs
50-59 °F	3 lbs	3.5 hrs	3 hrs
40-49 °F	3 lbs	4 hrs	3.5 hrs

T201-m-2 Plant cuttings (greenwood cuttings of woody plants and herbaceous plant cuttings)*

Pest: External feeders

Treatment: T201-m-2 MB ("Q" label only) at NAP—tarpaulin or chamber

Important

*See exceptions to plant cuttings.

Temperature	Dosage Rate (lb/1000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
80-90 °F	1.5 lbs	19	12
70-79 °F	2 lbs	24	16
60-69 °F	2.5 lbs	30	20
50-59 °F	3 lbs	36	24
40-49 °F	3.5 lbs	41	27

T201-m-3 Plant cuttings (root cuttings)*

Pest: External feeders

Treatment: T201-m-3 MB ("Q" label only) at NAP—chamber

Important

*See exceptions to plant cuttings.

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period:	
		Brachyrhinus larvae	All others
90-96 °F	2 lbs	2.5 hrs	2 hrs
80-89 °F	2.5 lbs	2.5 hrs	2 hrs
70-79 °F	3 lbs	2.5 hrs	2 hrs
60-69 °F	3 lbs	3 hrs	2.5 hrs
50-59 °F	3 lbs	3.5 hrs	3 hrs
40-49 °F	3 lbs	4 hrs	3.5 hrs

T201-m-4 Plant cuttings (root cuttings)*

Pest: External feeders

Treatment: T201-m-4 MB ("Q" label only) at NAP—tarpaulin

Temperature	Dosage Rate (lb/1000 ft^3)	Minimum Concentration Readings (ounces) At:				
		0.5 hr	2.5 hrs	3 hrs	3.5 hrs	4 hrs
90-96 °F	2 lbs	24	16	—	—	—
80-89 °F	2.5 lbs	30	20	—	—	—
70-79 °F	3 lbs	36	24	—	—	—
60-69 °F	3 lbs	36	—	24	—	—
50-59 °F	3 lbs	36	—	—	24	—
40-49 °F	3 lbs	36	—	—	—	24

Important

*See exceptions to plant cuttings.

Important

Exceptions to Plant Cutting Commodities Treated with T201-m-1, T201-m-2, T201-m-3, and T201-m-4:

Avocado, see ***T201-p*** on **page 5-3-20**
Chrysanthemum, see ***T201-g-1*** on **page 5-3-5**
Dieffenbachia, see ***T201-i-1*** on **page 5-3-9**
Dracaena, see ***T201-i-2*** on **page 5-3-9**
Lavandula, see ***T201-p*** on **page 5-3-20**
Orchids, see ***T201-d-1*** on **page 5-3-14**
Philodendron, see ***T201-i-1*** on **page 5-3-9**

T201-p Plant material not tolerant to fumigation

Three treatments based on pest

Propagative material known to be sensitive to fumigation (see Handbook of Plant Tolerance to Quarantine Treatments) should be handled by the following methods for “quarantine action” pests. The selection of the method will depend upon the character of the plant material and the type of pests that may be found.

T201-p-1 Plant material not tolerant to fumigation

Pest: Actionable Pests Excluding Scale Insects

Treatment: **T201-p-1** Hand removal—With the exception of scale insects, hand removal of pests or infested parts and detailed inspection to ensure plants are pest free. If the characteristics of the plant growth, volume, or the type of pest are such that hand removal plus inspection may **not** provide a pest free shipment, then see ***T201-p-2*** on **page 5-3-21** or ***T201-p-3*** on **page 5-3-22**.

T201-p-2 Plant material not tolerant to fumigation

Pest: Actionable Pests

Treatment: **T201-p-2** Hand removal plus chemical dip—Hand removal of pests of infested parts *plus* a malathion-carbaryl chemical dip. Solution prepared by adding 3 level tablespoons of 25 percent malathion wettable powder and 3 level tablespoons of 50 percent carbaryl wettable powder to each gallon of water. The addition of a sticker-spreader formulation may be required for hard to wet plants. Use fresh chemicals and prepare dip for the same day use. Plants, including the roots, should be entirely submerged in the chemical dip for 30 seconds.

Important

When the actionable pests are scale insects or their immature crawlers, prepare the solution by adding 4 level tablespoons of 25 percent malathion wettable powder (if the label allows) and 3 level tablespoons of 50 percent carbaryl wettable power to each gallon of water. Labels registered for this concentration are currently available from the following companies:

Micro-Flo Company LLC
Memphis, TN
Product: Malathion 25-WP
EPA Registration No. 051036-00033
(Tel 901-432-5131)

Cheminova Inc.
Oak Hill Park
1700 Route 23, Suite 210
Wayne, NJ 07470
Product Fyfanon 25 WP
EPA Registration No. 067760-00016
(Tel 201-305-6600)

NOTICE

Methoxychlor (50 percent wettable powder) may be substituted for carbaryl. Do **not** use methoxychlor on chrysanthemums. Other formulations of malathion, carbaryl, and methoxychlor may be substituted for the ones mentioned in this treatment, provided that the final dilution of the acting ingredients in the dip are the same, by weight. For example, you would need to use twice as much carbaryl wettable powder if the active ingredient were 25 percent instead of 50 percent.

T201-p-3 Plant material not tolerant to fumigation

Pest: Actionable Pests

Treatment: **T201-p-3** Hot water treatment—Hot water at 112 °F for 20 minutes. **Not** effective against all insects. Some plants may **not** be tolerant.

Important

This treatment is authorized in lieu of fumigation as a precautionary treatment following the hand removal of the visible “action” pests or infected plant parts. This alternative treatment is **not** recommended for mature scale insects. (Schedule ***T201-c-1*** on **page 5-3-11** is recommended for armored scales and schedule ***T201-c-2*** on **page 5-3-12** is recommended for soft scales.) If hand removal is **not** feasible or complete, or insecticidal coverage cannot be assured because of volume or nature of the plant material, the importer should be given the options of either fumigating at his own risk or returning shipment to origin.

T202—Bulbs, Corms, Tubers, Rhizomes, and Roots

T202-b Astilbe roots

Pest: *Brachyrhinus* larvae

Treatment: T202-b MB (“Q” label only) in 26" vacuum

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
70-96 °F	4 lbs	2 hrs
60-69 °F	4 lbs	2.5 hrs
50-59 °F	4 lbs	3 hrs
40-49 °F	4 lbs	4 hrs

For roots received in large cases packed in peat moss, temperatures apply to packing materials, if lower than root temperatures.

T202-c Banana roots

Pest: External feeders

Treatment: T202-c Hot water 110 °F for 30 minutes as pretreatment followed by 120 °F for 60 minutes. Requires consent of importer. Deny entry without consent unless 100 percent inspection plus pest removal is feasible.

T202-j Garlic

Pest: ***Brachycerus*** spp. (garlic beetles) and *Dyspessa ulula* (Bkh.) (onion/garlic carpenterworm)

Treatment: T202-j MB (“Q” label only) in 15" vacuum

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
90-96 °F	2 lbs	1.5 hrs
80-89 °F	2 lbs	2 hrs
70-79 °F	2.5 lbs	2 hrs
60-69 °F	3 lbs	2 hrs
50-59 °F	3 lbs	3 hrs
40-49 °F	3 lbs	4 hrs

Important

Load limit **not** to exceed 80 percent of chamber.

Important

This treatment is a precautionary requirement for *Brachycerus* spp. (garlic beetles) and *Dyspessa ulula* (Bkh.) (onion/garlic carpenterworm).

T202-e-1 *Gladiolus* spp.

Two alternative schedules

Pest: *Taeniothrips simplex* (gladiolus thrips)

Treatment: T202-e-1 MB (“Q” label only) at NAP

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
90-96 °F	2 lbs	3 hrs
80-89 °F	2.5 lbs	3 hrs
70-79 °F	3 lbs	3 hrs
60-69 °F	3 lbs	3.5 hrs
50-59 °F	3 lbs	4 hrs
40-49 °F	3 lbs	4.5 hrs

T202-e-2

Gladiolus spp.

Pest: *Taeniothrips simplex* (gladiolus thrips)

Treatment: T202-e-2 MB ("Q" label only) in 26" vacuum

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
90-96 °F	2 lbs	2 hrs
80-89 °F	2.5 lbs	2 hrs
70-79 °F	3 lbs	2 hrs
60-69 °F	3 lbs	2.5 hrs
50-59 °F	3 lbs	3 hrs
40-49 °F	3 lbs	3.5 hrs

T202-f

Horseradish roots

Pest: External feeders

Treatment: T202-f MB in 15" vacuum

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period:	
		Brachyrhinus larvae	All others
90-96 °F	2 lbs	2.5 hrs	2 hrs
80-89 °F	2.5 lbs	2.5 hrs	2 hrs
70-79 °F	3 lbs	2.5 hrs	2 hrs
60-69 °F	3 lbs	3 hrs	2.5 hrs
50-59 °F	3 lbs	3.5 hrs	3 hrs
40-49 °F	3 lbs	4 hrs	3.5 hrs

T202-g

Lily bulbs packed in subsoil

Pest: Internal feeders

Treatment: T202-g MB ("Q" label only) at NAP

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
90-96 °F	2 lbs	3 hrs
80-89 °F	2.5 lbs	3 hrs
70-79 °F	3 lbs	3 hrs
60-69 °F	3 lbs	3.5 hrs
50-59 °F	3 lbs	4 hrs
40-49 °F	3 lbs	4.5 hrs

Load limit 50 percent of chamber volume. Remove all wooden case covers. Overnight or longer aeration advisable.

T202-h

Lycoris

Pest: *Taeniothrips eucharii*

Treatment: T202-h MB in 26" vacuum

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period:	
		***Brachyrhinus* larvae**	**All others**
90-96 °F	2 lbs	2.5 hrs	2 hrs
80-89 °F	2.5 lbs	2.5 hrs	2 hrs
70-79 °F	3 lbs	2.5 hrs	2 hrs
60-69 °F	3 lbs	3 hrs	2.5 hrs
50-59 °F	3 lbs	3.5 hrs	3 hrs
40-49 °F	3 lbs	4 hrs	3.5 hrs

T202-i-1

Narcissus

Pest: *Steneotarsonemus laticeps* (bulb scale mite)

Treatment: T202-i-1 MB (“Q” label only) at NAP

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
90-96 °F	3 lbs	2 hrs
80-89 °F	3.5 lbs	2 hrs
70-79 °F	4 lbs	2 hrs
60-69 °F	4 lbs	2.5 hrs
50-59 °F	4 lbs	3 hrs
40-49 °F	4 lbs	3.5 hrs

T202-i-2

Narcissus

Pest: *Steneotarsonemus laticeps* (bulb scale mite)

Treatment: T202-i-2 MB (“Q” label only) in 26" vacuum chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
90-96 °F	2 lbs	2 hrs
80-89 °F	2.5 lbs	2 hrs
70-79 °F	3 lbs	2 hrs
60-69 °F	3 lbs	2.5 hrs
50-59 °F	3 lbs	3 hrs
40-49 °F	3 lbs	3.5 hrs

T202-i-3 *Narcissus*

Pest: *Steneotarsonemus laticeps* (bulb scale mite)

Treatment: T202-i-3 Hot water, 110-111 °F for 1 hour

Important

Exposure measured from time bulbs reach 110 °F pulp temperature. Hot water should be applied *within 1 month after normal harvest,* or flower bud injury may develop.

T202-a-1 *Selaginella* spp. (Resurrection plants)

Pest: External feeders

Treatment: T202-a-1 MB ("Q" label only) at NAP—Chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period:	
		Brachyrhinus larvae	All others
90-96 °F	2 lbs	2.5 hrs	2 hrs
80-89 °F	2.5 lbs	2.5 hrs	2 hrs
70-79 °F	3 lbs	2.5 hrs	2 hrs
60-69 °F	3 lbs	3 hrs	2.5 hrs
50-59 °F	3 lbs	3.5 hrs	3 hrs
40-49 °F	3 lbs	4 hrs	3.5 hrs

T202-a-2 *Selaginella* spp. (Resurrection plants)

Pest: External feeders

Treatment: T202-a-2 MB ("Q" label only) at NAP—Tarpaulin

Temperature	Dosage Rate (lb/1000 ft^3)	Minimum Concentration Readings (ounces) At:				
		0.5 hr	2.5 hrs	3 hrs	3.5 hrs	4 hrs
90-96 °F	2 lbs	24	16	—	—	—
80-89 °F	2.5 lbs	30	20	—	—	—
70-79 °F	3 lbs	36	24	—	—	—
60-69 °F	3 lbs	36	—	24	—	—
50-59 °F	3 lbs	36	—	—	24	—
40-49 °F	3 lbs	36	—	—	—	24

T202-a-3 *Selaginella* spp. (Resurrection plants)

Pest: Internal feeders

Treatment: T202-a-3 MB ("Q" label only) in 26" vacuum—chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period:	
		Brachyrhinus larvae	All others
90-96 °F	2 lbs	2.5 hrs	2 hrs
80-89 °F	2.5 lbs	2.5 hrs	2 hrs
70-79 °F	3 lbs	2.5 hrs	2 hrs
60-69 °F	3 lbs	3 hrs	2.5 hrs
50-59 °F	3 lbs	3.5 hrs	3 hrs
40-49 °F	3 lbs	4 hrs	3.5 hrs

T202-d Yams (*Dioscorea* spp.) and Sweet Potatoes (*Ipomoea* spp.)

Pest:

Treatment: T202-d MB ("Q" label only) at NAP

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
90-96 °F	2.5 lbs	4 hrs
80-89 °F	3 lbs	4 hrs
70-79 °F	3.5 lbs	4 hrs
60-69 °F	4 lbs	4 hrs

NOTICE

Temperatures below 70 °F may cause injury to yams. Fumigations below 70 °F should only be made with consent of importer. The tuberous roots should be cured, free from surface moisture, and held at fumigation temperatures for 24 hours following treatment. Mandatory for yams for all foreign countries except Japan, Dominican Republic into Puerto Rico, and all of the West Indies into the U.S. Virgin Islands. Also, for interstate movement of sweet potatoes from Hawaii.

T203—Seeds

T203-m Avocado (seeds only, without pulp)

Pest: Avocado seed weevils (*Conotrachelus* spp., *Heilipus lauri*, and *Caulophilus latinasus*); avocado stem weevil (*Copturus aguacatae*), and avocado seed moth (*Stenoma catenifer*)

Treatment: T203-m MB (“Q” label only) in 26" vacuum

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
90-96 °F	2 lbs	2 hrs
80-89 °F	3 lbs	2 hrs
70-79 °F	4 lbs	2 hrs
60-69 °F	4 lbs	3 hrs
50-59 °F	4 lbs	4 hrs
40-49 °F	4 lbs	5 hrs

T203-e Chestnuts (does not include water chestnuts) and Acorns

From all countries except Canada and Mexico

Pest: Internal feeders

Treatment: T203-e (mandatory treatment) MB (“Q” label only) in 26" vacuum

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
80-96 °F	3 lbs	2 hrs
70-79 °F	4 lbs	2 hrs
60-69 °F	4 lbs	3 hrs
50-59 °F	4 lbs	4 hrs
40-49 °F	4 lbs	5 hrs

T203-i-1 Conifer seeds (species with small seeds, such as *Picea* spp., *Pinus sylvestris*, and *Pinus mugo*)

Two schedules based on type of pest

For species with small seeds, such as *Picea* spp., *Pinus sylvestris*, and *Pinus mugo*, in bags containing 75 lbs. draw an initial vacuum of at least 24 inches. Once the MB is introduced, then reduce the vacuum to NAP. This procedure is necessary for efficient penetration and distribution of the fumigant. Conifer seeds in bags of more than 75 lbs. each should be aerated in a well ventilated area for 24 hours, small seeds should be aerated for 48 hours.

Pest: External feeders

Treatment: T203-i-1 MB (“Q” label only) at NAP

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
80-96 °F	2.5 lbs	2.5 hrs
70-79 °F	3 lbs	2.5 hrs
60-69 °F	3 lbs	3 hrs
50-59 °F	3 lbs	3.5 hrs
40-49 °F	3 lbs	4 hrs

Important

Load limit is 30 percent of chamber space. Moisture should **not** be added in fumigation of dry seeds.

T203-i-2 Conifer seeds (species with small seeds, such as *Picea* spp., *Pinus sylvestris*, and *Pinus mugo*)

Pest: Internal feeders, nutlike seeds, or when seeds are tightly packed so as to make fumigant penetration questionable.

Treatment: T203-i-2 MB (“Q” label only) in 26" vacuum

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
80-96 °F	2.5 lbs	2.5 hrs
70-79 °F	3 lbs	2.5 hrs
60-69 °F	3 lbs	3 hrs
50-59 °F	3 lbs	3.5 hrs
40-49 °F	3 lbs	4 hrs

Important

Load limit is 50 percent of chamber space. Plastic or impermeable liners should be removed or well perforated. This schedule is **not** entirely effective against some species of Chalcid wasps.

T203-f-1

Cottonseed—bagged, packaged, or in bulk

Four alternative schedules

Pest: External feeders

Treatment: T203-f-1 MB (“Q” label only) at NAP—chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
60 °F or above	6 lbs	12 hrs
OR	3 lbs	24 hrs
40-59 °F	7 lbs	12 hrs
OR	4 lbs	24 hrs

Important

Load limit is 50 percent of chamber volume.

T203-f-2

Cottonseed—bagged, packaged, or in bulk

Pest: External feeders

Treatment: T203-f-2 MB (“Q” label only) at NAP—tarpaulin

Temperature	Dosage Rate (lb/1000 ft^3)	Minimum Concentration Readings (ounces) At:			
		0.5 hr	2 hrs	12 hrs	24 hrs
60 °F or above	7 lbs	54	56	27	—
OR	5 lbs	40	40	—	20
40-59 °F	8 lbs	64	64	32	—
OR	6 lbs	48	48	—	24

T203-f-3

Cottonseed—bagged, packaged, or in bulk

Pest: External feeders

Treatment: T203-f-3 MB (“Q” label only) in 26" vacuum—chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
40 °F or above	4 lbs	2 hrs

Important

Load limit is 50 percent of chamber volume.

T203-f-4 Cottonseed—bagged, packaged, or in bulk

Pest: External feeders

Treatment: T203-f-4 Phosphine at NAP

Temperature	Dosage Rate (gms/1000 ft^3)	Minimum Concentration Readings (ppm) At:	
		72 hrs	120 hrs
50 °F or above	60[1] g	225[2]	50 or above

1 60 g/1000 ft^3 (28.3 m^3) is equivalent to 2.1 g/m^3.

2 An average reading with no reading less than 50 ppm.

Relative humidity must be 40 percent or higher when commodity enclosed.

Aerate minimum of 24 hours.

T203-g-1 Pods and seed of Kenaf, Hibiscus, and Okra

Three alternative schedules

Pest: Internal feeders

Treatment: T203-g-1 MB (“Q” label only) at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1000 ft^3)	Minimum Concentration Readings (ounces) At:		
		0.5 hr	12 hrs	24 hrs
60-96 °F	2 lbs	24	12	—
OR	1 lb	12	—	5
40-59 °F	3 lbs	36	17	—
OR	2 lbs	24	—	10

T203-g-2 Pods and seeds of Kenaf, Hibiscus,and Okra

Pest: Internal feeders

Treatment: T203-g-2 MB (“Q” label only) in 26" vacuum—chamber (kenaf and okra seed only)

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
40 °F or above	4 lbs	2 hrs

Important

Load limit is 50 percent of chamber volume.

T203-g-3

Pods and seed of Kenaf, Hibiscus, and Okra

Pest: Internal feeders

Treatment: T203-g-3 Phosphine at NAP

Temperature	Dosage Rate (gms/1000 ft^3)	Minimum Concentration Readings (ppm) At:	
		72 hrs	120 hrs
50 °F or above	60[1] g	225[2]	50

1 60 g/1000 ft^3 (28.3 m^3) is equivalent to 2.1 g/m^3.

2 An average reading with no reading less than 50 ppm.

Relative humidity must be 40 percent or higher when commodity enclosed.

Aerate minimum of 24 hours.

T203-k

Macadamia nuts (as seeds)

Pest: *Cryptophlebia illepida* (koa seedworm)

Treatment: T203-k MB (“Q” label only) at NAP

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
70 °F or above	2 lbs	2 hrs
60-69 °F	2.5 lbs	2 hrs
50-59 °F	3 lbs	2 hrs
40-49 °F	3.5 lbs	2 hrs

T203-h

Rosmarinus seeds

Pest: Juvenile *Helicella* spp. (snails) or Internal Feeders

Treatment: T203-h MB (“Q” label only) at 26" vacuum

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
70 °F or above	4 lbs	4 hrs

T203-l

Seeds

Pest: *Trogoderma granarium* (khapra beetle)

Treatment: T203-l MB (“Q” label only) at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1000 ft^3)	Minimum Concentration Readings (ounces) At:			
		0.5 hr	2 hrs	4 hrs	12 hrs
90 °F or above	2.5 lbs	30	20	20	15
80-89 °F	3.5 lbs	42	30	30	20

NOTICE

If seed is intended for propagation, this dosage rate may damage seed by sterilization.

T203-b

Seeds excluding seeds of *Vicia* spp.

Pest: Bruchidae (seed beetles) excluding the beetles of *Caryedon* spp.

Treatment: T203-b MB (“Q” label only) in 26" vacuum

Temperature	Dosage Rate (lb/1,000 ft^3):		Exposure Period:	
	Caryedon spp.	All others	*Caryedon* spp.	All others
70-96 °F	5 lbs	3 lbs	2 hrs	2.5 hrs
60-69 °F	—	3 lbs	—	3 hrs
50-59 °F	—	3 lbs	—	3.5 hrs
40-49 °F	—	3 lbs	—	4 hrs

T203-o

(deleted)

T203-a-1

Seeds not specifically listed in the T203 Schedules

Pest: External feeders

Treatment: T203-a-1 MB (“Q” label only) at NAP

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
80-96 °F	2.5 lbs	2.5 hrs
70-79 °F	3 lbs	2.5 hrs
60-69 °F	3 lbs	3 hrs
50-59 °F	3 lbs	3.5 hrs
40-49 °F	3 lbs	4 hrs

NOTICE

Load limit is 30 percent of chamber space. Moisture should **not** be added in fumigation of dry seeds. Normally, dry seed shipments arriving in wet or damp condition may be injured. This schedule may scald coconut husks. (Some tropical or nutlike seeds are usually shipped damp.)

T203-a-2

Seeds not specifically listed in the T203 Schedules

Pest: Internal feeders, except Megastigmas spp.

Treatment: T203-a-2 MB (“Q” label only) in 26" vacuum

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
80-96 °F	2.5 lbs	2.5 hrs
70-79 °F	3 lbs	2.5 hrs
60-69 °F	3 lbs	3 hrs
50-59 °F	3 lbs	3.5 hrs
40-49 °F	3 lbs	4 hrs

Important

Load limit is 50 percent of chamber space. Plastic or impermeable liners should be removed or well perforated.

T203-o-1

Seeds of *Casuarina*

Pest: *Bootanomyia* spp. (in *Casuarina*)

Treatment: T203-o-1 MB (“Q” label only) in 26" vacuum

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
70 °F or above	3.5 lbs	6 hrs

T203-j

Seeds of *Hevea brasiliensis* (rubber tree)

Pest: Seed-boring insects

Treatment: T203-j MB (“Q” label only) at NAP

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
80-96 °F	2.5 lbs	2 hrs
70-79 °F	3 lbs	2 hrs
60-69 °F	3 lbs	2.5 hrs

T203-o-3

Seeds of *Leguminosae = Fabaceae*

Pest: *Bruchophagus* spp., *Eurytoma* spp.

Treatment: T203-o-3 MB (“Q” label only) in 26" vacuum

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
70 °F or above	4 lbs	4 hrs

Two alternative schedules

T203-c

Seeds of Leguminosae = Fabaceae, etc.

Pest: *Caryedon* spp.

Treatment: T203-c MB (“Q” label only) at NAP

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
50 °F or above	2 lbs	24 hrs

Alternative treatment: T203-a-2 (under 26" vacuum)

T203-o-4-1

Seeds of Leguminosae = Fabaceae

Pest: *Caryedon* spp. (in or with, etc.)

Treatment: T203-o-4-1 MB (“Q” label only) in 26" vacuum

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
50 °F or above	2 lbs	24 hrs

T203-o-4-2

Seeds of Leguminosae = Fabaceae

Pest: *Caryedon* spp. (in or with, etc.)

Treatment: T203-o-4-2 MB (“Q” label only) in 26" vacuum

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
70 °F or above	3.5 lbs*	3 hrs

T203-o-5

Seeds of *Lonicera* and Other seeds

Pest: *Rhagoletis cerasi* (European cherry fruit fly) pupae (Diptera: Tephritidae)

Treatment: T203-o-5 MB (“Q” label only) at NAP

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
70 °F or above	4 lbs*	8 hrs

NOTICE

*If seed is intended for propagation, the dosage rate may damage seed by sterilization.

T203-p

Seeds of Citrus (Rutaceae family)

Pest: Citrus Canker (*Xanthomonas citri*)

Treatment: T203-p Hot water plus Chemical Dip

1. Wash the seed if any mucilaginous material, such as pulp, is adhering to the seed.
2. Immerse the seed in water heated to 125 °F (51.6 °C) or higher for 10 minutes.
3. Then, immerse the seed in a solution containing 200 parts per million sodium hypochlorite at a pH of 6.0 to 7.5 for at least 2 minutes.

T203-o-2

Seeds of *Umbelliferae*

Pest: *Systole* spp. (in Umbelliferae)

Treatment: T203-o-2 MB (“Q” label only) in 26" vacuum

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
80-86 °F	2.5 lbs	3.5 hrs
70-79 °F	3 lbs	3.5 hrs
60-69 °F	3 lbs	4 hrs
50-59 °F	3 lbs	4.5 hrs
40-49 °F	3 lbs	5 hrs

T203-d-1

Seeds of *Vicia* spp. (vetch seeds) excluding seeds of *Vicia faba*

Pest: Bruchidae (seed beetles)

Treatment: T203-d-1 MB (“Q” label only) at NAP

Temperature	Dosage Rate (lb/1000 ft^3)	Minimum Concentration Readings (ounces) At:					
		0.5 hr	2 hrs	11 hrs	12 hrs	13 hrs	14 hrs
70 °F or above	3.5 lbs	46	28	27	—	—	—
60-69 °F	3.5 lbs	46	28	—	27	—	—
50-59 °F	3.5 lbs	46	28	—	—	27	—
40-49 °F	3.5 lbs	46	28	—	—	—	27

T203-d-2 Seeds of *Vicia* spp. (vetch seeds) including seeds of *Vicia faba*

Pest: Bruchidae (seed beetles)

Treatment: T203-d-2 MB (“Q” label only) in 26" vacuum

Temperature	Dosage Rate (lb/ 1,000 ft^3)	Exposure Period:	
		Vicia faba	All others
70-96 °F	3 lbs	3.5 hrs	2.5 hrs
60-69 °F	3 lbs	4 hrs	3 hrs
50-59 °F	3 lbs	4.5 hrs	3.5 hrs
40-49 °F	3 lbs	5 hrs	4 hrs

NOTICE

Seed shipments arriving wet or damp may be injured.

T203-n Seeds with infested pulp

Pest: Fruit flies and other pulp-infesting insects

Treatment: T203-n Depulping

1. Place seed in wire basket.
2. Immerse in water at 118-125 °F for 25 minutes.
3. Remove pulp from seed under running tap water.

Important

This treatment is effective only for fruit flies, as well as some other pulp infesting insects. Fumigation may also be required for seed weevils and other internal and external feeding insects.

5

Treatment Manual

Treatment Schedules

T300 - Schedules for Miscellaneous Plant Products

Contents

The following schedules are listed by product.

T301—Cotton and Cotton Products 5-4-2
T302—Grains and Seeds Not Intended for Propagation 5-4-8
T303—Rice 5-4-13
T304—Alpha (alfa) Grass and Handicrafts (Stipa tenacissima, Ampelodesma mauritanicus) 5-4-16
T305—Cut Flowers and Greenery 5-4-17
T306—Bags and Bagging Material, Covers 5-4-18
T307—Khapra Beetle Infested Material 5-4-21
T308—Tobacco, for Export 5-4-22
T309—Broomcorn and Broomcorn Articles 5-4-25
T310—Tick-Infested Materials (Nonfood) 5-4-26
T311—Hay, Baled 5-4-28
T312—Oak Logs and Lumber 5-4-29
T313—Christmas Trees 5-4-37
T314—Logs and Firewood 5-4-38

Important

Exposure period may be extended for any commodity which cannot be used for food or propagation. This extension is only a matter of convenience for the importer and is intended only for the purpose of reducing treatment costs. The request for extension must come from the importer or his authorized representative and should be confirmed in writing. A letter is not required for each treatment. A single blanket request should be considered as acceptable and renewed each year as required.

During the extended exposure period, the concentrations must remain stable and the prescribed minimums be met at the end of the extension. Otherwise, the treatment may be voided and retreatment required. Examples of commodities for which extended exposure periods may be approved include: cotton piece goods, baled cotton, bagging, wood, marble, soil as such, etc. Examples of commodities for which *no* extension may be approved include: cottonseed, grain, tobacco, etc. An extension of exposure period for other purposes is not permitted except as may be prescribed in various schedules for concentration readings below minimum.

Additional safety precautions, including additional aeration, may be required because of the extended exposure period. The PPQ officer or the commercial fumigator will specify any needed precautions.

T301—Cotton and Cotton Products

T301-a-3 Baled lint or linters

Pest: *Pectinophora* spp.

Treatment: T301-a-3—MB (“Q” label only) at NAP—tarpaulin

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:			
		0.5 hr	2 hrs	12 hrs	24 hrs
40 °F or above	7 lbs	84	60	30	—
OR	4 lbs	60	40	—	20

T301-b-1-1 Baled lint, linters, waste, piece goods, gin trash

Two alternative treatments

Pest: *Trogoderma granarium* (khapra beetle)

Treatment: T301-b-1-1—MB (“Q” label only) at NAP—tarpaulin

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:		
		0.5 hr	2 hrs	24 hrs*
60 °F or above	8 lbs	96	64	35
40-59 °F	11 lbs	132	88	50

*In addition to the space concentration readings, you must take a commodity concentration reading. The minimum concentration reading for commodity reading is as follows: For 60 °F or above—25 oz.; for 40-59 °F—30 oz.

Important

Load limit is 50 percent of chamber volume. Concentration readings may be omitted for chamber fumigations.

T301-b-1-2 Baled lint, linters, waste, piece goods, gin trash

Pest: *Trogoderma granarium* (khapra beetle)

Treatment: T301-b-1-2—MB (“Q” label only) at NAP—chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
60 °F or above	8 lbs	3 hrs
40-59 °F	9 lbs	3 hrs

T301-a-7 Cottonseed (samples and bulk)

Pest: *Pectinophora* spp.

Treatment: T301-a-7—Acid delinting and heat treatment (alternative treatment)

Cottonseed delinting is primarily intended for the elimination of surface-borne disease organisms. It is also effective against insects. To be completely effective against insects, this treatment must be carried out at approximately 145 °F (by the application of sufficient heat to the seed, or acid, or both) or by raising the temperature of the delinted seed during the subsequent drying process to 145 °F for a period of not less than 45 seconds or at least 140 °F for a period of not less than 8 minutes.

Important

This treatment schedule is not applicable to cottonseed infested with boll weevil, *Anthonomus grandis*.

Also, this treatment largely destroys the cottonseed's ability to germinate.

T301-b-2 Cottonseed, cottonseed products, or samples

Pest: *Trogoderma granarium* (khapra beetle)

Treatment: T301-b-2—MB ("Q" label only) at NAP—tarpaulin

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:		
		0.5 hr	2 hrs	12 hrs
90 °F or above	2.5 lbs	30	20	15
80-89 °F	3.5 lbs	42	30	20

The sorptive rates of commodities vary. When a commodity is known or suspected to be sorptive, take more gas readings than normal. Additional fumigant is added as prescribed on ***Special Procedures for Adding Gas and Extending Exposure Period*** on **page 2-4-24**.

Important

Items known to be sorptive or items whose sorptive properties are unknown are **not** to be fumigated in chambers at NAP unless gas readings are taken.

When both woodborers and khapra beetles are involved, use schedule ***T404-d*** on **page 5-5-19**.

Important

Cottonseed products (other than cottonseed) treated under this schedule are **not** to be used for food or feed.

T301-b-3 Cottonseed meal

Pest: *Trogoderma granarium* (khapra beetle)

Treatment: T301-b-3—MB ("Q" label only) at NAP

Important

Concentration readings should be obtained within the commodity. Concentration readings **not** required for chamber fumigations.

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:				
		0.5 hr	2 hrs	24* hrs	28* hrs	32* hrs
90 °F or above	4 lbs	48	32	25	—	—
80-89 °F	6 lbs	72	48	30	—	—
70-79 °F	8 lbs	96	64	35	—	—

*In addition to the space concentration readings, you must take a commodity concentration reading. The minimum concentration reading for commodity reading is as follows: For 90-96 °F—10 oz.; for 80-89 °F—15 oz.; and for 70-79 °F—20 oz.

**Optional

Important

Cottonseed meal treated with this schedule is **not** to be used for food or feed.

T301-c

Cotton and cotton products

Pest: *Globodera rostochiensis* (golden nematode)

Treatment: T301-c—MB ("Q" label) at NAP—chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
40 °F or above	8 lbs	16 hrs
	10.5 lbs	12 hrs

T301-d-1-1

Cotton and cotton products

Two alternative treatments

Pest: *Anthonomus grandis* (boll weevil)

Treatment: T301-d-1-1—MB ("Q" label only) at NAP—tarpaulin

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:				
		0.5 hr	2 hrs	3 hrs	4 hrs	8 hrs
90 °F or above	2.5 lbs	30	20	—	—	—
80-89 °F	3 lbs	36	28	—	—	—
70-79 °F	4 lbs	48	36	—	—	—
60-69 °F	4 lbs	50	—	34	—	—
55-59 °F	5 lbs	64	—	48	—	—
50-54 °F	5.5 lbs	70	—	—	50	—
40-49 °F	6 lbs	80	—	—	54	40

T301-d-1-2

Cotton and cotton products

Pest: *Anthonomus grandis* (boll weevil)

Treatment: T301-d-1-2—Phosphine at NAP—tarpaulin or chamber

Temperature	Dosage Rate (g/1,000 ft^3)	Minimum Concentration Readings (ppm) At 72 hours:
50 °F or above	36 g*	225**

*36g/1,000ft^3 (28.3m^3) is equivalent to 1.27 g/m^3.
**An average reading with no reading less than 50 ppm.

Important

Refer to the Equipment Section for a description of the MityVac pump and the Port-a-sens phosphine detector.

Important

Refer to ***Table 5-4-3*** on **page 5-4-39** for data on amount of phosphine liberated by various products.

T301-a-1-1 Lint, linters, cottonseed, cottonseed hulls, gin trash, waste, cottonseed meal, or other baled or bulk commodities (except samples)

Pest: *Pectinophora* spp.

Treatment: T301-a-1-1—MB ("Q" label only) at NAP—chamber

Temperature	Dosage Rate (lb/1,000 ft^3) for:		Exposure Period
	Bulk shipments	Other than bulk shipments	
60 °F or above	6 lbs	6 lbs	12 hrs
OR	4 lbs	3 lbs	24 hrs
40-59 °F	7 lbs	7 lbs	12 hrs
OR	5 lbs	4 lbs	24 hrs

T301-a-1-2 Lint, linters, cottonseed, cottonseed hulls, gin trash, waste, cottonseed meal, or other baled or bulk commodities (except samples)

Pest: *Pectinophora* spp.

Treatment: T301-a-1-2—MB ("Q" label only) in 26" vacuum—chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
60 °F or above	8 lbs	3 hrs
40-59 °F	9 lbs	3 hrs

NOTICE

For propagative seed cotton, refer to ***T203-f-1*** on **page 5-3-31** through ***T203-f-4*** on **page 5-3-32**.

T301-a-6 Lint, linters, and cottonseed (bulk, sacked, or packaged cottonseed, lint or linters, cottonseed hulls, gin trash, and all other baled or bulk cotton commodities)

Pest: *Pectinophora* spp.

Treatment: T301-a-6—Phosphine at NAP

Temperature	Dosage Rate (g/1,000 ft^3)	Minimum Concentration Readings (ppm) At:	
		72 hrs	120 hrs
50 °F or above	60 g*	225**	50***

* 60 g/1,000ft^3 (28.3m^3) is equivalent to 2.1g/m^3.
** An average reading with no reading less than 50 ppm.
***An average of 50 PPM or more.

Aerate commodity 24 hours and/or make appropriate tests for presence of gas.

Important

Refer to ***Table 5-4-3*** on **page 5-4-39** for data on amount of phosphine liberated by various products.
Refer to ***Equipment*** on **page 8-1-1** for a description of the MityVac pump and the Port-a-sens phosphine detector.

T301-a-2

Lint (except baled lint or linters), cottonseed (except packaged cottonseed), cottonseed hulls, gin trash, waste, cottonseed meal, or other baled or bulk commodities (excluding samples)

Pest: *Pectinophora* spp.

Treatment: T301-a-2—MB (“Q” label only) at NAP—tarpaulin

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:			
		0.5 hr	2 hrs	12 hrs	24 hrs
40 °F or above	7 lbs	84	60	30	—
OR	5 lbs	60	40	—	20

T301-a-4

Packaged cottonseed

Pest: *Pectinophora* spp.

Treatment: T301-a-4—MB (“Q” label only) at NAP—tarpaulin

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:			
		0.5 hr	2 hrs	12 hrs	24 hrs
40 °F or above	7 lbs	84	60	30	—
OR	5 lbs	60	40	—	20

T301-a-5-1

Samples of cotton and cotton products

Two alternative treatments

Pest: *Pectinophora* spp.

Treatment: T301-a-5-1—MB at NAP—chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
40 °F or above	3 lbs	24 hrs

T301-a-5-2

Samples of cotton and cotton products

Pest: *Pectinophora* spp.

Treatment: T301-a-5-2—MB in 26" vacuum—chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
40 °F or above	4 lbs	2 hrs

T302—Grains and Seeds Not Intended for Propagation

Important

If grain and seeds **are for propagation**, use appropriate treatment in T203 schedules

T302-g-1 Acorns not intended for propagation

Two alternative treatments

Pest: *Cydia splendana* (nut fruit tortrix) and *Curculio* spp. (weevils)

Treatment: T302-g-1—MB at NAP—tarpaulin, chamber, or van container

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:					
		0.5 hr	2 hrs	3 hrs	4 hrs	5 hrs	6 hrs
90-95 °F	4 lbs	58	32	34	—	—	—
80-89 °F	4 lbs	58	32	—	34	—	—
70-79 °F	5 lbs	72	40	—	42	—	—
60-69 °F	5 lbs	72	40	—	—	40	—
50-59 °F	6 lbs	85	48	—	—	50	—
40-49 °F	6 lbs	85	48	—	—	—	48

T302-g-2 Acorns not intended for propagation

Pest: *Cydia splendana* (nut fruit tortrix) and *Curculio* spp. (weevils)

Treatment: T302-g-2—MB in 26" vacuum—chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
80-96 °F	3 lbs	2 hrs
70-79 °F	4 lbs	2 hrs
60-69 °F	4 lbs	3 hrs
50-59 °F	4 lbs	4 hrs
40-49 °F	4 lbs	5 hrs

Important

Either T302-g-1 or T302-g-2 required from all countries except Canada and Mexico. Treated commodity **not** to be used for food or feed.

T302-a-1-1

Ear corn

Two alternative treatments

Pest: Borers

Treatment: T302-a-1-1—MB at NAP—chamber only

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
70 °F or above	2 lbs	6 hrs

T302-a-1-2

Ear corn

Pest: Borers

Treatment: T302-a-1-2—Dry heat

168 °F minimum air temperature for not less than 2 hours; ears spread in single layers on slats or wire shelves.

T302-c-1

Grains and seeds not intended for propagation (e.g., guar "gum")

Pest: *Trogoderma granarium* (khapra beetle)

Treatment: T302-c-1—MB ("Q" gas only) at NAP—tarpaulin.

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:		
		0.5 hr	2 hrs	12 hrs
90 °F or above	2.5 lbs	30	20	15
80-89 °F	3.5 lbs	42	30	20
70-79 °F	4.5 lbs	54	40	25
60-69 °F	6 lbs	72	50	30
50-59 °F	7.5 lbs	90	60	35
40-49 °F	9 lbs	108	70	40

The sorptive rates of commodities vary. When a commodity is known or suspected to be sorptive (see ***T307-a*** on **page 5-4-21**), take more gas readings than normal. Additional fumigant is added as prescribed on ***Aerating Sorptive Commodities in Containers—Indoors and Outdoors*** on **page 2-4-44**.

Important

Items known to be sorptive or items whose sorptive properties are unknown are **not** to be fumigated in chambers at NAP unless gas readings are taken.

When both woodborers and khapra beetles are involved, use schedule ***T404-d*** on **page 5-5-19**.

T302-c-2 Grains and seeds not intended for propagation(e.g., guar "gum")

NOTE: Load limit is 75 percent of chamber volume.

Pest: *Trogoderma granarium* (khapra beetle)

Treatment: T302-c-2—MB ("Q" label gas) in 26" vacuum—chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
60 °F or above	8 lbs	3 hrs
40-59 °F	9 lbs	3 hrs

T302-c-3 Grains and seeds not intended for propagation (e.g., guar "gum")

Pest: *Trogoderma granarium* (khapra beetle)

Treatment: T302-c-3—MB ("Q" gas only) in 26" NAP—chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
90-96 °F	2.5 lbs	12 hrs
80-89 °F	3.5 lbs	12 hrs
70-79 °F	4.5 lbs	12 hrs
60-69 °F	6 lbs	12 hrs
50-59 °F	10 lbs	12 hrs
40-49 °F	12 lbs	12 hrs

The sorptive rates of commodities vary. When a commodity is known or suspected to be sorptive (see ***T307-a*** on **page 5-4-21**), take more gas readings than normal. Additional fumigant is added as prescribed on ***Special Procedures for Adding Gas and Extending Exposure Period*** on **page 2-4-24**.

Important

Items known to be sorptive or items whose sorptive properties are unknown are **not** to be fumigated in chambers at NAP unless gas readings are taken.

When both woodborers and khapra beetles are involved, use schedule T404-d.

T302-d

Grains and seeds not intended for propagation and contaminated with cottonseed

Pest: *Pectinophora* spp.

Treatment: See Cotton and Cotton Products, ***T301-a-1-1*** on **page 5-4-6** or ***T301-a-1-2*** on **page 5-4-6**.

Important

Alternate method—screening for removal of cotton seed contamination.

T302-e-1

Grains and seeds not intended for propagation

Two alternative treatments

Pest: Insects other than *Trogoderma granarium* (khapra beetle)

Treatment: T302-e-1—MB (“Q” label only) at NAP—chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
80-96 °F	2.5 lbs	2.5 hrs
70-79 °F	3 lbs	2.5 hrs
60-69 °F	3 lbs	3 hrs
50-59 °F	3 lbs	3.5 hrs
40-49 °F	3 lbs	4 hrs

T302-e-2

Grains and seeds not intended for propagation

Pest: Insects other than *Trogoderma granarium* (khapra beetle)

Treatment: T302-e-2—MB (“Q” label only) at 26" vacuum—chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
80-96 °F	2.5 lbs	2.5 hrs
70-79 °F	3 lbs	2.5 hrs
60-69 °F	3 lbs	3 hrs
50-59 °F	3 lbs	3.5 hrs
40-49 °F	3 lbs	4 hrs

Important

Load limit is 50 percent of chamber volume. This vacuum treatment primarily for material so packed or packaged as to make fumigant penetration questionable.

T302-f Grains and seeds (excluding Rosmarinus seed) not intended for propagation

Pest: Snails

Treatment: T302-f—Mechanical separation by screening or hand removal. If **not** feasible, entry should be denied when snails are of agricultural or public health significance, or treat using appropriate schedule as listed in T403-a.

Important

For *Rosmarinus* seed use ***T203-h*** on **page 5-3-33**

T302-b-1-1 Shelled corn

Treatment: T302-b-1-1 ***Reserved***

T302-b-1-2 Shelled corn contaminated with cottonseed

Pest: *Pectinophora* spp.

Treatment: T302-b-1-2

Important

See ***T301-a-1-1*** on **page 5-4-6** or ***T301-a-1-2*** on **page 5-4-6**

Important

Shelled corn treated with T301 is **not** to be used for food or feed.

T303—Rice

T303-a-1 Rice (*Oryza* spp.)[1] seed

Important

T303-a-1,-2,-3 are to be used for:

- Rice seed moving interstate from Puerto Rico
- Rice seed harvested from greenhouses under Emergency Action Notice for Panicle Rice Mite

The yellow color of these three alternative treatments indicates that the authority to conduct the treatment comes from the Federal Order for Panicle Rice Mite DA-2008-29 and is pending regulatory approval.

Treatment: T303-a-1 Phosphine

Pest: Panicle Rice Mite (*Steneotarsonemus spinki*)

Temperature	Dosage Rate (g/1,000 ft^3)	Minimum Concentration Readings (ppm) At:		
		24 hrs	48 hrs	72 hrs
68 °F or above	30-90[1] g	350	350	350

1 25 ppm = 1 g/1000 ft^3 of phosphine liberated

Important

If any of the required minimum concentration readings are **not** met, the treatment must be ABORTED. However, phosphine gas may be added to prevent failure if a previous successful reading indicates the minimum will most likely **not** be met for a subsequent reading. Any addition of gas MUST occur immediately after a successful reading is recorded. DO **NOT** add time.

T303-a-2 Rice (*Oryza* spp.)[1] seed

Treatment: T303-a-2 MB at NAP

Pest: Panicle Rice Mite (*Steneotarsonemus spinki*)

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:		
		0.5 hr	2 hrs	12 hrs
80 °F or above	1.25 lbs	15	12	10

Important

Depending on seed moisture content, fumigation with methyl bromide will result in reduced seed germination. Inform the importer and obtain a waiver of PPQ liability if MB treatment is used.

1 Including, but **not** limited to, *O.sativa* (cultivated paddy rice) and *O.latifolia* (weedy red rice) and *Cyperus iria*.

T303-a-3 Rice (*Oryza* spp.)[2] seed

Treatment: T303-a-3 Cold treatment

Pest: Panicle Rice Mite (*Steneotarsonemus spinki*)

Temperature	Time (hrs)
17.6 °F (-8 °C)	72

Treat rice seed at 17.6 °F (-8 °C) for a minimum of 72 hours. This treatment is feasible for small-scale seed treatments.

T303-d-1 Articles made with rice straw

Two alternative treatments

Pest: Fungous diseases of rice or internal feeders

Treatment: T303-d-1—Dry heat at 180-200 °F for 2 hours

T303-d-2 Articles made with rice straw

Pest: Fungous diseases of rice or internal feeders

Treatment: T303-d-2—Steam sterilization

Temperature	Pressure	Exposure Period
260 °F	20 lbs	15 minutes
250 °F	15 lbs	20 minutes

T303-d-2-1 Articles made with rice straw

Pest: Fungous diseases of rice or internal feeders

Treatment: T303-d-2-1—Steam sterilization, use ***T303-b-1*** on **page 5-4-15**

T303-d-2-3 Articles made with rice straw for indoor use only

Pest: Internal feeders

Treatment: T303-d-2-3—MB (“Q” label only) at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:			
		0.5 hr	2 hrs	4 hrs	24 hrs
60 °F or above	2.5 lbs	30	20	20	15
50-59 °F	3 lbs	36	25	24	20
40-49 °F	4 lbs	48	35	32	25

2 Including, but **not** limited to, *O.sativa* (cultivated paddy rice) and *O.latifolia* (weedy red rice) and *Cyperus iria*.

T303-d-2-2 Articles made with rice straw for indoor use only

Pest: Internal feeders

Treatment: T303-d-2-2—MB (“Q” label only) in 26" vacuum

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
60 °F or above	2.5 lbs	2.5 hrs
50-59 °F	3.5 lbs	2.5 hrs
40-49 °F	5 lbs	2.5 hrs

T303-b-1 Rice straw and hulls imported for purposes other than approved processing

Two alternative treatments based on how commodity is packed

Pest: Fungous diseases of rice

Treatment: T303-b-1—Steam sterilization, for closely packed commodity

Introduce the live steam into a 28" vacuum until pressure reaches 10 lbs and hold for 20 minutes. (Steam sterilization is **not** practical for the treatment of bales having a density greater than 30 lbs. per cubic foot.)

T303-b-2 Rice straw and hulls imported for purposes other than approved processing

Pest: Fungous diseases of rice

Treatment: T303-b-2—Steam sterilization, for commodity packed as loose masses

Use ***T303-b-1*** on **page 5-4-15** or, if without initial vacuum, bleed air until steam vapor escapes.

T303-c-1 Rice straw and hulls imported in small lots of 25 lbs. or less

Important

T303-c-1 is suspended until further notice. (01-14-08)

Pest: Fungous diseases of rice

Treatment: T303-c-1—Dry heat at 212 °F for 1 hour

T304—Alpha (alfa) Grass and Handicrafts (*Stipa tenacissima, Ampelodesma mauritanicus*)

T304-a

Alpha (alfa) grass and handicrafts (*Stipa tenacissima*, *Ampelodesma mauritanicus*)

Two alternative treatments

Pest: Infested with *Harmolita* spp. (jointworms)

Treatment: T304-a—MB at NAP—chamber only

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
60 °F or above	2.5 lbs	32 hrs
50-59 °F	3.5 lbs	32 hrs
40-49 °F	4.5 lbs	32 hrs

T304-b

Alpha (alfa) grass and handicrafts (*Stipa tenacissima*, *Ampelodesma mauritanicus*)

Treatment: T304-b—MB in 26" vacuum

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
60 °F or above	2.5 lbs	2.5 hrs
50-59 °F	3.5 lbs	2.5 hrs
40-49 °F	5 lbs	2.5 hrs

T305—Cut Flowers and Greenery

T305-a Cut flowers and greenery

Important

The "external pests" controlled by this schedule do **not** include dormant snails. Refer to ***T201-o-1*** on **page 5-3-13** through ***T201-p-3*** on **page 5-3-22**.

Pest: External feeders, leafminers, hitchhikers, surface pests, and slugs[3]

Treatment: T305-a—MB ("Q" label only) at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
80-89 °F	1.5 lbs	19	12
70-79 °F	2 lbs	24	16
60-69 °F	2.5 lbs	30	20
50-59 °F	3 lbs	36	24
40-49 °F*	3.5 lbs	41	27

* For leafminers, use the initial dosage rate of 4 lbs/1,000 ft^3.

T305-b Cut flowers and greenery

Pest: Borers or soft scales

Treatment: T305-b—MB ("Q" label only) in 15" vacuum

Important

Vacuum fumigation requires prior consent of the importer. If consent denied, refuse entry unless T305-a plus hand removal of these pests is feasible. Vacuum fumigation is **not** required for soft scales known to be widely distributed in the U.S.

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
80-90 °F	2.5 lbs	2 hrs
70-79 °F	3 lbs	2 hrs
60-69 °F	3 lbs	2.5 hrs
50-59 °F	3 lbs	3 hrs
40-49 °F	3 lbs	3.5 hrs

3 Quarantine significant slugs of the families Agriolimacidae, Arionidae, Limacidae, Milacidae, Philomycidae, and Veronicellidae, including the following genera:
Agriolimax, Arion,Colosius, Deroceras, Diplosolenodese, Leidyula, Limax, Meghimatium, Milax, Pallifera, Pseudoveronicella, Sarasinula, Semperula, Vaginulus, Veronicella
Slugs must be treated at 60 °F or above (2.5 lbs. or greater)

T305-c

Cut flowers and greenery

Pest: Mealybugs

Treatment: T305-c—MB (“Q” label only) at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
80 °F or above	2.5 lbs	32	24
70-79 °F	3 lbs	38	29
60-69 °F	4 lbs	48	38

T306—Bags and Bagging Material, Covers

T306-a

Bags and bagging material or covers used to contain root crops

Pest: *Globodera rostochiensis* (golden nematode)

Treatment: T306-a—MB (“Q” label only) in 26" vacuum

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
40 °F or above	8 lbs	16 hrs
	10.5 lbs	12 hrs
	16 lbs	8 hrs

T306-b

Bags and bagging material or covers used for cotton only

Pest: *Pectinophora* spp.

Treatment: T306-b—MB at NAP—chamber

Temperature	Dosage Rate (lb/1,000 ft^3) for:		Exposure Period
	Bulk shipments	Other than bulk shipments	
60 °F or above	6 lbs	6 lbs	12 hrs
60 °F or above	4 lbs	3 lbs	24 hrs
40-59 °F	7 lbs	7 lbs	12 hrs
40-59 °F	5 lbs	4 lbs	24 hrs

T306-c-1 Bags and bagging material or covers

Two alternative treatments

Pest: *Trogoderma granarium* (khapra beetle)

Treatment: T306-c-1—MB (“Q” label only) at NAP

Important

Concentration readings should be obtained within the commodity.
Concentration readings **not** required for chamber fumigations.

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:				
		0.5 hr	2 hrs	24[1] hrs	28[1] hrs	32[1] hrs
90 °F or above	4 lbs	48	32	25	—	—
80-89 °F	6 lbs	72	48	30	—	—
70-79 °F	8 lbs	96	64	35	—	—
60-69 °F	12 lbs	144	96	50	—	—
50-59 °F	12 lbs	144	96	50	50	—
40-49 °F	12 lbs	144	96	50	50[2]	50

1 In addition to the space concentration readings,commodity concentration reading must be taken. The minimum concentration reading for commodity reading is as follows: For 90-96 °F—10 oz.; for 80-89 °F—15 oz.; and for 70-79 °F—20 oz.

2 Optional

T306-c-2 Bags and bagging material or covers

Pest: *Trogoderma granarium* (khapra beetle)

Treatment: T306-c-2—MB (“Q” label only) in 26" vacuum

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
60 °F or above	8 lbs	3 hrs
40-59 °F	9 lbs	3 hrs

T306-d-1 Bagging from unroasted coffee beans

Two alternative treatments

Pest: Various

Treatment: T306-d-1—MB ("Q" label only) at NAP

Important

Concentration readings should be obtained within the commodity. Concentration readings **not** required for chamber fumigations.

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:				
		0.5 hr	2 hrs	24* hrs	28* hrs	32* hrs
90 °F or above	4 lbs	48	32	25	—	—
80-89 °F	6 lbs	72	48	30	—	—
70-79 °F	8 lbs	96	64	35	—	—
60-69 °F	12 lbs	144	96	50	—	—
50-59 °F	12 lbs	144	96	50	50	—
40-49 °F	12 lbs	144	96	50	50	50

*In addition to the space concentration readings, you must take a commodity concentration reading. The minimum concentration reading for commodity reading is as follows: For 90-96 °F—10 oz.; for 80-89 °F—15 oz.; and for 70-79 °F—20 oz.

T306-d-2 Bagging from unroasted coffee beans

Two alternative treatments

Pest: Various

Treatment: T306-d-2—MB ("Q" label only) in 26" vacuum

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
60 °F or above	8 lbs	3 hrs
40-59 °F	9 lbs	3 hrs

Important

Load limit maximum 75 percent of chamber volume.

T307—Khapra Beetle Infested Material

T307-a

Feeds and milled products heated as a part of the processing procedure, or other commodities that can be subjected to heat

Pest: Khapra beetle

Treatment: T307-a—Heat treatment

Important

This treatment should **not** be used except when specifically authorized in each case by the Quarantine Policy, Analysis and Support (QPAS), Riverdale, MD, office.

180 °F in any part of a processing procedure or at 150 °F for a total of 7 minutes, the commodity being moved through or manipulated in the heated area in a manner to ensure that all parts meet the time and temperature requirements.

Miscellaneous products infested with Khapra beetle

Pest: Khapra beetle

Treatment: Summary of fumigation treatments for infested material

Important

Bags and bagging, see***T306-c-1*** on **page 5-4-19**
Cotton products, see ***T301-b-1-1*** on **page 5-4-2**
Finely ground oily meals, see***T306-c-1*** on **page 5-4-19**
Grains and seeds, see***T302-c-1*** on **page 5-4-9**
Flour, see ***T306-c-1*** on **page 5-4-19**
Sorptive materials, see ***T302-g-1*** on **page 5-4-8**.
Goatskins, lambskins, sheepskins (skins and hides), see “T416” on ***T416—Goatskins, Lambskins, Sheepskins (Skins and Hides)*** on **page 5-5-46**

Important

The following commodities have shown relatively high sorption:
Carpet backing, Cinnamon quill, Cocoa mats, Cocoa powder, Lumber, Myrobalan, Pistachio nuts, Polymide waste, Potato starch, Rubber (crepe or crude) Vermiculite, Wool (raw, except pulled)

All other commodities, see ***T302-g-1*** on **page 5-4-8**

T308—Tobacco, for Export

T308-e Blended strip tobacco for export

Pest: *Lasioderma serricorne* (Cigarette beetle) and *Ephestia elutella* (Tobacco moth)

Treatment: T308-e—Vacuum-steam flow method

1. Evacuate the chamber to the wet bulb temperature of 35 °F (0.2 in. Hg. absolute or 29.8 in. Hg. vacuum) to remove air from the tobacco mass and facilitate steam penetration.
2. Introduce steam until 160 °F is reached while maintaining vacuum to evacuate gases pushed ahead of the steam. Hold at 160 °F for 3 minutes to allow the steam to condense within the tobacco mass for the temperature to equilibrate.
3. Re-evacuate to 110 °F.
4. Introduce steam to 135 °F for 3 minutes to allow the steam to condense within the tobacco mass and for the temperature to equilibrate.

T308-c Leaf tobacco for export

Pest: *Lasioderma serricorne* (cigarette beetle) and *Ephestia elutella* (tobacco moth)

Treatment: T308-c—Vacuum-steam flow process followed by reconditioning

For leaf tobacco—flowing steam at 170 °F for 15 minutes in 23" vacuum. Followed by reconditioning of the tobacco to 12 to 13 percent moisture content.

T308-d Stored tobacco for export

Pest: *Lasioderma serricorne* (cigarette beetle) and *Ephestia elutella (*tobacco moth)

Treatment: T308-d—Kabat® (active ingredient—methoprene) is an insect growth regulator applied at the rate of 0.2 lbs. (3.9 fluid oz.) per 1,000 lbs. of tobacco.

Application should be made directly to tobacco immediately prior to compaction in hogsheads. Assure complete coverage by using multi-directional sprays and tumbling. Kabat® may be applied by use of a proportional dilution apparatus or by preparation of a dilute spray solution. Follow mixing and application instructions on the label. Zoecon Corporation will be responsible for ensuring that receivers in foreign countries will accept this treatment in lieu of fumigation.

In most cases, indication of Kabat® treatment need not be shown on the phytosanitary certificate. PPQ prefers that tobacco exporting firms utilize the letterhead certification of treatment rather than relying on the phytosanitary certificate to convey this information to foreign receivers. However, if requested, an additional declaration may be made showing application rates as supplied by the exporter if it has been determined through periodic inspection of a firm's facilities that application of the protectant is an integral part of the processing procedure.

T308-a-1 Tobacco for export (flue-cured and burley in hogshead and cases; turkish in bales; cigar filler/binder in cases or bales; and cigar wrappers in bales)

Four alternative treatments

Pest: *Lasioderma serricorne* (cigarette beetle) and *Ephestia elutella* (tobacco moth)

Treatment: T308-a-1—MB in 28" vacuum

Flue-cured and burley in hogshead and cases; Turkish in bales; cigar filler/binder in cases or bales; and cigar wrappers in bales

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
70 °F or above	4 lbs	4 hrs

T308-a-2 Tobacco for export (flue-cured and burley in hogshead and cases; turkish in bales; cigar filler/binder in cases or bales; and cigar wrappers in bales)

Treatment: T308-a-2—MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
70 °F or above	1.25 lbs	72 hours
45-69 °F	2 lbs	72 hrs

T308-b-1 Tobacco for export (flue-cured and burley in hogshead and cases; turkish in bales; cigar filler/binder in cases or bales; and cigar wrappers in bales)

Treatment: T308-b-1—Phosphine at NAP—Tarpaulin or freight containers

Temperature	Dosage Rate (g/1,000 ft^3)	Minimum Concentration Readings (ppm) At:	
		96 hrs	144 hours
Greater than 68 °F	33 g*	200	—
61-68 °F	33 g*	—	300

* 33g/1,000 ft^3 is equivalent to 1.17 g/m^3.

Important

The tobacco industry's Sanitation Committee considers “starting time” as the time when the minimum concentration reading is reached. It is recommended that concentration monitoring be done every 6 hours leading up to “starting time,” then again at completion (96 or 120 hours later). [Note that this concept differs from the “starting time” in other phosphine fumigation schedules. In those cases, “starting time” starts when the aluminum phosphide or magnesium phosphide are first introduced.]

NOTICE

Gas concentration readings and temperature readings must be taken in the middle of a tightly packed bale.The fumigation does **not** begin until the gas concentration readings reach minimum required levels.

Important

Refer to the Equipment Section of this manual for a discussion of the MityVac hand-operated gas sampling pump and the Port-a-sens phosphine monitor. See ***Table 5-4-3*** on **page 5-4-39** for data on amount of phosphine liberated by various products.

T308-b-2 Tobacco for export (flue-cured and burley in hogshead and cases; turkish in bales; cigar filler/binder in cases or bales; and cigar wrappers in bales)

Treatment: T308-b-2—Phosphine at NAP—Warehouses

Temperature	Dosage Rate (g/1,000 ft^3)	Minimum Concentration Readings (ppm) At:	
		96 hrs	144 hours
Greater than 68 °F	20 g*	200	—
61-68 °F	20 g*	—	300

* 20g/1,000 ft^3 is equivalent to 0.71 g/m^3.

Important

The tobacco industry's Sanitation Committee considers “starting time” as the time when the minimum concentration reading is reached. It is recommended that concentration monitoring be done every 6 hours leading up to “starting time,” then again at completion (96 or 120 hours later). [Note that this concept differs from the “starting time” in other phosphine fumigation schedules. In those cases, “starting time” starts when the aluminum phosphide or magnesium phosphide are first introduced.].

NOTICE

Gas concentration readings and temperature readings must be taken in the middle of a tightly packed bale.The fumigation does **not** begin until the gas concentration readings reach minimum required levels.

Important

Refer to ***Table 5-4-3*** on **page 5-4-39** for the amount of phosphine liberated by various products

T309—Broomcorn and Broomcorn Articles

T309-a

Broomcorn and broomcorn articles

Four alternative schedules

Pest: *Ostrinia nubilalis* (European corn borers), ticks, and saw flies

Treatment: T309-a—MB in 26" vacuum

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period for:	
		Sawflies	Other than sawflies
60 °F or above	2.5 lbs	5 hrs	2.5 hrs
50-59 °F	3.5 lbs	5 hrs	2.5 hrs
40-49 °F	5 lbs	5 hrs	2.5 hrs

T309-b-1

Broomcorn and broomcorn articles

Pest: *Ostrinia nubilalis* (European corn borers), ticks, and saw flies

Treatment: T309-b-1—MB at NAP—chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
60 °F or above	2.5 lbs	16 hrs
50-59 °F	3.5 lbs	16 hrs
40-49 °F	4.5 lbs	16 hrs

T309-b-2

Broomcorn and broomcorn articles

Pest: *Ostrinia nubilalis* (European corn borers), ticks, and saw flies

Treatment: T309-b-2—MB at NAP—Railroad car, reefer, highway van, tarpaulin

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:			
		0.5 hr	2 hrs	4 hrs	24 hrs
60 °F or above	3 lbs	36	24	20	15
50-59 °F	5 lbs	60	40	30	20
40-49 °F	7 lbs	84	56	40	25

T309-c

Broomcorn and broomcorn articles

Pest: *Ostrinia nubilalis* (European corn borers), ticks, and saw flies

Treatment: T309-c—Steam sterilization (alternate treatment)

Introduce live steam into 25" vacuum until pressure reaches 10 psi and 240 °F, then hold for 20 minutes.

T310—Tick-Infested Materials (Nonfood)

T310-a

Nonfood materials

Three alternative treatments

Pest: Ticks

Treatment: T310-a—MB (“Q” label only) at NAP

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:							
		0.5 hr	2 hrs	3 hrs	4 hrs	5 hrs	7 hrs	8 hrs	16 hrs
90 °F or above	4 lbs	55	32	45	—	—	—	—	—
80-89 °F	5 lbs	65	40	52	—	—	—	—	—
70-79 °F	6 lbs	75	48	—	50	—	—	—	—
60-69 °F	7 lbs	88	56	—	—	60	—	—	—
50-59 °F	8 lbs	100	64	—	—	—	70	—	—
40-49°F	8 lbs	100	—	—	—	—	—	65	50

NOTICE

Always check the fumigant label for the proper dosage used on the commodity being treated.

T310-b

Nonfood materials

Treatment: T310-b—MB (“Q” label only) in 26" vacuum

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
80 °F or above	3 lbs	2.5 hrs
70-79 °F	3 lbs	3.5 hrs
60-69 °F	4 lbs	4 hrs
50-59 °F	5.5 lbs	5 hrs

Important

For all fumigations with MB, if commodity temperature is known or considered to have been below the temperature range during the previous 48 hours, use the next lower range to calculate dosage.

T310-c

Nonfood materials

Treatment: T310-c ***(Vacant)***

T310-d

Nonfood materials

Treatment: T310-d—Sulfuryl fluoride at NAP

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:		
		0.5 hr	2 hrs	24 hrs
70 °F or above	2 lbs	25	16	20
50-69 °F	2.5 lbs	32	20	24
40-49 °F	3 lbs	40	24	28

Important

Fumigations below 50 °F to be used only on an emergency basis and specifically authorized by Quarantine Policy, Analysis and Support (QPAS) in Riverdale MD.

T311—Hay, Baled

T311 Baled hay

Pest: *Mayetiola destructor* (Hessian fly), *Oulema melanopus* (cereal leaf beetle)

Treatment: T311 Phosphine at NAP

Temperature	Dosage Rate (g/1,000 ft^3)	Minimum Concentration Readings (ounces) At:			
		0.5 hr	2 hrs	24 hrs	168 hrs
50 °F or above	60	45	30	15	15

Aerate 24 hours or until a level at or below 0.3 ppm is determined.

See ***Table 5-4-3*** on **page 5-4-39** for data on amount of phosphine liberated by various products.

T312—Oak Logs and Lumber

There are two alternative treatments for the MB fumigation of Oak logs, T312-a and T312-a-Alternative. Do **not** combine the schedules.

***Special Procedures for Adding Gas to Oak Logs Using T312-a or T312-a-Alternative* on page 2-4-29** provides specific instructions for the correct actions to take at each gas concentration reading. Refer to this section (specifically **Table 2-4-8 on page-2-4-30** and **Table 2-4-9 on page-2-4-33**) for every reading.

The following is a list of IMPORTANT items to remember when conducting either of these treatments:

- Take gas concentration readings 30 minutes after adding gas and record the readings in the CPHST-TQAU electronic 429 Fumigation database.
  - To access the 429 database go to: http://cphst.aphis.usda.gov/tqau/
- Run the fans for 30 minutes and take gas concentration readings whenever additional gas is added.
- Ensure that the gas concentration readings **do not differ more than 4 ounces among the sampling lines**. If they do, run the fans for 30 more minutes to equalize the gas.
- Use DriRite® and Ascarite® during the fumigation. Replace the DriRite® when it changes color from blue to pink. Replace the Ascarite® when the granules become hard or moist.
- Aerate the logs for a minimum of 48 hours. Follow aeration procedures under sections ***Aerating Sorptive Commodities in Containers—Indoors and Outdoors*** on **page 2-4-44** and ***Aerating Sorptive, Noncontainerized Cargo—Indoors and Outdoors*** on **page 2-4-42**.
- Add additional time onto the end of the fumigation and record the gas concentration reading in the electronic 429 database. Explain the reason the treatment was extended in the Remarks section of the PPQ Form 429.

Important

The 72 hour reading MUST be taken even if the fumigation has been extended. Take the 72 hour reading and then take the extra reading as required by **Table 2-4-8 on page-2-4-30** or **Table 2-4-9 on page-2-4-33** in the section ***Special Procedures for Adding Gas to Oak Logs Using T312-a or T312-a-Alternative* on page 2-4-29**.

T312-a

Oak logs

Pest: Oak Wilt Disease

Treatment T312-a—MB ("Q" label only) at NAP

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At[1]:						
		0.5 hr	2 hrs	12 hrs	24 hrs	36 hrs	48 hrs	72 hrs
40 °F or above	15 lbs	240	240	200	120	160	120	80

1 Refer to **Table 5-4-1** for adding gas at each reading.

T312-a-Alternative

Oak logs-Alternative

Pest: Oak Wilt Disease

Treatment T312-a-Alternative—MB ("Q" label only) at NAP

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At[1]:				
		0.5 hr	2 hrs	24 hrs	48 hrs	72 hrs
40 °F or above	15 lbs	240	240	140	140	100

1 Refer to **Table 5-4-2** for adding gas at each reading.

T312-b

Oak lumber

Pest: Oak Wilt Disease

Treatment T312-b—MB ("Q" label only) at NAP

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:					
		0.5 hrs	2 hrs	12 hrs	24[1] hrs	36 hrs	48 hrs
40 °F or above	15 lbs	240	160	100	40	120	80

1 After 24 hours, add enough fumigant to bring the concentration up to 240 oz.

Special Procedures for Adding Gas to Oak Logs Using T312 or T312-a-Alternative

There are two alternative treatments for the MB fumigation of Oak logs. Refer to **Table 5-4-1** and **Table 5-4-2** for actions to take during the fumigation of Oak Logs using T312-a or T312-a-Alternative.

Use the following formula to calculate the amount of gas to add to the enclosure:

1.6 × (number of oz. below the required minimum) × (volume in ft^3)/1,000 ft^3 = oz. of gas to add.

After adding gas, run the fans for 30 minutes and take additional gas concentration readings.

Refer to **Table 5-4-1** if using T312-a and **Table 5-4-2** if using T312-a-Alternative to determine how much additional time must be added to the fumigation to compensate for the low gas concentrations.

EXAMPLE: The treatment schedule is T312-a-Alternative. The size of the enclosure is 2400 ft^3. The required reading at 48 hours must be a minimum of 140 ounces. The actual lowest reading is 132 ounces. Calculate the amount of gas to add to the enclosure using the formula:
1.6 x (the number of ounces below 140) x (volume in ft^3)/1000 ft^3
ANSWER:
140-132=8
1.6 x 8 x 2400=30,720/1000 = 30.72 ounces of gas to add
30.72/16 = 1.92 pounds of gas to add

Determine the amount of time to add by referring to **Table 5-4-2**. In this example, 1 hour will be added to the total fumigation time.
Take the regularly scheduled reading at 72 hours (the minimum should be 100 ounces.)
Take another reading at 73 hours (the minimum should be 100 ounces.)
If the minimum is **not** 100 ounces, add more gas and time according to **Table 5-4-2**.

Instructions for Adding Gas and Time to Schedule T312-a

Do **not** combine Schedules T312-a and T312-a-Alternative. The treatment must be aborted if any individual gas concentration reading is 50 percent or more below the minimum required concentration.

Table 5-4-1 Determine Gas Concentration Values and Corrections for Oak Log Fumigations using Schedule T312-a

If the Reading is Taken At:	And the lowest individual concentration reading is:	Then:
0.5 hour	121-239	1. ADD gas, and 2. EXTEND exposure by 0.5 hour
	0-120	ABORT
2 hours	160-239	1. ADD gas, and 2. EXTEND exposure by 0.5 hour
	121-159	1. ADD gas, and 2. EXTEND exposure by 1.0 hour
	0-120	ABORT
12 hours	190-199	1. ADD gas, and 2. EXTEND exposure by 0.5 hour
	180-189	1. ADD gas, and 2. EXTEND exposure by 1.0 hour
	170-179	1. ADD gas, and 2. EXTEND exposure by 1.5 hours
	160-169	1. ADD gas, and 2. EXTEND exposure by 2.0 hours
	150-159	1. ADD gas, and 2. EXTEND exposure by 2.5 hours
	140-149	1. ADD gas, and 2. EXTEND exposure by 3.0 hours
	130-139	1. ADD gas, and 2. EXTEND exposure by 3.5 hours
	120-129	1. ADD gas, and 2. EXTEND exposure by 4.0 hours
	110-119	1. ADD gas, and 2. EXTEND exposure by 4.5 hours
	101-109	1. ADD gas, and 2. EXTEND exposure by 5.0 hours
	0-100	ABORT

Table 5-4-1 Determine Gas Concentration Values and Corrections for Oak Log Fumigations using Schedule T312-a (continued)

If the Reading is Taken At:	And the lowest individual concentration reading is:	Then:
24 hours	120-239	1. Add gas to bring the total concentration to 240 ounces. 2. DO **NOT** ADD TIME.
	110-119	1. ADD gas, and 2. EXTEND exposure by 1.0 hour
	100-109	1. ADD gas, and 2. EXTEND exposure by 2.0 hours
	90-99	1. ADD gas, and 2. EXTEND exposure by 3.0 hours
	80-89	1. ADD gas, and 2. EXTEND exposure by 4.0 hours
	70-79	1. ADD gas, and 2. EXTEND exposure by 5.0 hours
	61-69	1. ADD gas, and 2. EXTEND exposure by 6.0 hours
	0-60	ABORT
36 hours	150-159	1. ADD gas, and 2. EXTEND exposure by 1.0 hour
	140-149	1. ADD gas, and 2. EXTEND exposure by 1.5 hours
	130-139	1. ADD gas, and 2. EXTEND exposure by 2.5 hours
	120-129	1. ADD gas, and 2. EXTEND exposure by 3.0 hours
	110-119	1. ADD gas, and 2. EXTEND exposure by 4.0 hours
	100-109	1. ADD gas, and 2. EXTEND exposure by 4.5 hours
	90-99	1. ADD gas, and 2. EXTEND exposure by 5.5 hours
	81-89	1. ADD gas, and 2. EXTEND exposure by 6.0 hours
	0-80	ABORT

Table 5-4-1 Determine Gas Concentration Values and Corrections for Oak Log Fumigations using Schedule T312-a (continued)

If the Reading is Taken At:	And the lowest individual concentration reading is:	Then:
48 hours	110-119	1. ADD gas, and 2. EXTEND exposure by 1.0 hour
	100-109	1. ADD gas, and 2. EXTEND exposure by 2.0 hours
	90-99	1. ADD gas, and 2. EXTEND exposure by 3.0 hours
	80-89	1. ADD gas, and 2. EXTEND exposure by 4.0 hours
	70-79	1. ADD gas, and 2. EXTEND exposure by 5.0 hours
	61-69	1. ADD gas, and 2. EXTEND exposure by 6.0 hours
	0-60	ABORT
72 hours	70-79	1. ADD gas, and 2. EXTEND exposure by 3.0 hours
	60-69	1. ADD gas, and 2. EXTEND exposure by 6.0 hours
	50-59	1. ADD gas, and 2. EXTEND exposure by 9.0 hours
	41-49	1. ADD gas, and 2. EXTEND exposure by 12.0 hours
	0-40	ABORT

Important

If additional time has been added to the treatment, the 72 hour reading AND the extended time reading MUST be taken. If the minimum of 80 ounces is **not** met, time and gas MUST be added according to this Table.

Instructions for Adding Gas and Time to Schedule T312-a-Alternative

Do **not** combine schedules T312-a and T312-a-Alternative.

Table 5-4-2 Determine Gas Concentration Values and Corrections for Oak Log Fumigations using schedule T312-a-Alternative

If the Reading is Taken At:	And the any individual concentration reading is:	Then:
0.5 hours	121-239	1. ADD gas, and 2. DO **NOT** EXTEND exposure.
	0-120	ABORT
2 hours	160-239	1. ADD gas, and 2. DO **NOT** EXTEND exposure
	121-159	1. ADD gas, and 2. EXTEND exposure by 1.0 hour
	0-120	ABORT
24 hours	140-239	1. Add gas to bring the total concentration to 240 ounces. 2. DO **NOT** ADD TIME.
	130-139	1. ADD gas, and 2. EXTEND exposure by 1.0 hour
	120-129	1. ADD gas, and 2. EXTEND exposure by 2.5 hours
	110-119	1. ADD gas, and 2. EXTEND exposure by 4.0 hours
	100-109	1. ADD gas, and 2. EXTEND exposure by 5.5 hours
	90-99	1. ADD gas, and 2. EXTEND exposure by 7.0 hours
	80-89	1. ADD gas, and 2. EXTEND exposure by 8.5 hours
	71-79	1. ADD gas, and 2. EXTEND exposure by 10.0 hours
	0-70	ABORT

Table 5-4-2 Determine Gas Concentration Values and Corrections for Oak Log Fumigations using schedule T312-a-Alternative (continued)

If the Reading is Taken At:	And the any individual concentration reading is:	Then:
48 hours	130-139	1. ADD gas, and 2. EXTEND exposure by 1.0 hour
	120-129	1. ADD gas, and 2. EXTEND exposure by 2.5 hours
	110-119	1. ADD gas, and 2. EXTEND exposure by 4.5 hours
	100-109	1. ADD gas, and 2. EXTEND exposure by 6.0 hours
	90-99	1. ADD gas, and 2. EXTEND exposure by 8.5 hours
	80-89	1. ADD gas, and 2. EXTEND exposure by 9.5 hours
	71-79	1. ADD gas, and 2. EXTEND exposure by 11 hours
	0-70	ABORT
72 hours	90-99	1. ADD gas, and 2. EXTEND exposure by 1.5 hours
	80-89	1. ADD gas, and 2. EXTEND exposure by 4.0 hours
	70-79	1. ADD gas, and 2. EXTEND exposure by 7.5 hours
	60-69	1. ADD gas, and 2. EXTEND exposure by 8.5 hours
	51-59	1. ADD gas, and 2. EXTEND exposure by 11.0 hours
	0-50	ABORT

Important

If additional time has been added to the treatment, the 72 hour reading AND the extended time reading MUST be taken. If the minimum of 100 ounces is not met, time and gas MUST be added according to this Table.

T313—Christmas Trees

NOTICE

Cut trees at least 2 weeks prior to treatment in order to reduce possible damage by the fumigant to the trees.

T313-a

Cut conifer Christmas trees

Pest: *Lymantria dispar* (gypsy moth) egg masses

Treatment: T313-a—MB ("Q" label only) at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:				
		0.5 hr	2.5 hrs	3 hrs	4 hrs	4.5 hrs
75 °F or above	1.5 lbs	18	12	—	—	—
70-74 °F	2 lbs	24	16	—	—	—
60-69 °F	2.5 lbs	30	—	24	—	—
60-69 °F	3 lbs	36	24	—	—	—
50-59 °F	3 lbs	36	—	—	24	—
50-59 °F	4 lbs	48	32	—	—	—
40-49 °F	3.5 lbs	42	—	—	—	28
40-49 °F	5 lbs	60	40	—	—	—

T313-b

Cut pine Christmas trees and pine logs

Pest: *Tomicus piniperda* (pine shoot beetle)

Treatment: T313-b—MB ("Q" label only) at NAP—chamber or tarpaulin

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:			
		2 hrs	3 hrs	3.5 hrs	4 hrs
60 °F or above	3 lbs	43	—	—	36
60 °F or above	4 lbs	57	48	—	—
50-59 °F	3.5 lbs	50	—	—	42
50-59 °F	4 lbs	57	—	48	—
40-49 °F	4 lbs	57	—	—	48

Important

If treating pine Christmas trees for both gypsy moth egg masses and the pine shoot beetle, use the schedule for the pine shoot beetle since it is more potent.

T314—Logs and Firewood

These heat treatment procedures may employ steam, hot water, kilns, or any other method that raises the temperature of the **center** of the log to the minium required temperature for the time specified. Procedures for obtaining internal log temperature can be found in the chapter "Methyl Bromide-Tarpaulin", section ***Logs and Lumber* on page 2-4-15**.

The heat treatment must be performed at an approved facility that maintains a current compliance agreement. The PPQ official will review facility treatment records to ensure the treatment temperature and duration requirements have been met.

Contact USDA-APHIS-CPHST-PPQ Pest Survey Detection and Exclusion Laboratory at 508-563-9303 ext. 259 for a list of approved facilities, temperature monitoring equipment and operational guidelines.

Important

For annual facility certification guidelines, follow the procedures in "***Certifying Facilities for the Heat Treatment of Firewood* on page 6-9-1**.

T314-a Regulated Wood Articles[4], including *Fraxinus* (Ash Logs and firewood) and all Hardwood Firewood from Emerald Ash Borer quarantine areas

Pest: Various Wood Pests, including *Agrilus planipennis* (Emerald Ash Borer)

Treatment: T314-a—Heat treatment

Unit	Temperature	Time (minutes)
°F	160.0	75
°C	71.1	75

T314-b All logs (including firewood) from Gypsy Moth quarantine areas

Pest: *Lymantria dispar* (Gypsy Moth egg masses)

Treatment: T314-b—Heat treatment

Unit	Temperature	Time (minutes)
°F	132.8	30
°C	56.0	30

4 Regulated wood articles are considered to be unprocessed logs; lumber; any whole tree; any cut tree or any portion of a tree not solely consisting of leaves, flowers, fruits, buds, or seeds; bark; cork; laths; hog fuel; sawdust; painted raw wood products; wood mulch; wood shavings; pickets; stakes; shingles; solid wood packing materials; humus; compost; and litter. (7 CFR 319.40-1)

Table 5-4-3 Amount of Phosphine Liberated by various Products. Calculate amount of product needed by using the amount of phosphine released as shown in the right column.

Product	Type	Unit and weight in grams	Grams of phosphine*
Degesch Fumi-Cel®	MP	1 plate; 117.0	33.0
Degesch Fumi-Strip®	MP	16 plates; 1872.0	528.0
Degesch Phostoxin®	AP	1 tablet; 3.0	1.0
Degesch Phostoxin® Tablet Prepac Rope	AP	1 prepac; 99.0 (strip or rope of 33 tablets)	33.0
Detia	AP	1 tablet; 3.0	1.0
Detia Rotox AP	AP	1 pellet; 0.6	0.2
Detia Gas EX-B	AP	1 bag or sachet; 34.0	11.4
Fumiphos tablets	AP	1 tablet; 3.0	1.0
Fumiphos pellets	AP	1 pellet; 0.6	0.2
Fumiphos bags	AP	1 bag; 34.0	11.0
Fumitoxin	AP	1 tablet; 3.0	1.0
Fumitoxin	AP	1 pellet; 0.6	0.2
Fumitoxin	AP	1 bag; 34.0	11.0
Gastoxin	AP	1 tablet; 3.0	1.0
Gastoxin	AP	1 pellet; 0.6	0.2
“L” Fume	AP AP	1 pellet; 0.5 1 pellet; 0.6	0.18 0.22
Phos-Kill	AP	1 tablet; 3.0	1.1
Phos-Kill	AP	1 pellet; 0.6	0.22
Phos-Kill	AP	1 bag; 34.0	12.0

* Reacts with moisture in the air to yield grams of phosphine.

5

Treatment Manual

Treatment Schedules

T400 - Schedules for Miscellaneous Products

Contents

Commodities treated with the following schedules are **not** to be used for food or feed.

T401—Railroad Cars (Empty) **5-5-2**
T402—Ships, Containers, and Surrounding Area **5-5-3**
T403—Miscellaneous Cargo (Nonfood, Nonfeed Commodities) **5-5-7**
T404—Wood Products Including Containers **5-5-13**
T405—Bags and Bagging Material **5-5-21**
T406—Golden Nematode Contaminations **5-5-22**
T407—Mechanical Cotton Pickers and Other Cotton Equipment **5-5-25**
T408—Soil as Such and Soil Contaminating Durable Commodities **5-5-26**
T409—Aircraft **5-5-29**
T410—Tick Infestations **5-5-42**
T411—Ant Infestations—Nonplant Products **5-5-42**
T412—Noxious Weed Seeds (Devitalization Treatment) **5-5-42**
T413—Brassware from Mumbai (Bombay), India **5-5-43**
T414—Inanimate, Nonfood Articles with Gypsy Moth Egg Masses **5-5-44**
T415—Garbage **5-5-45**
T416—Goatskins, Lambskins, Sheepskins (Skins and Hides) **5-5-46**

Important

Exposure period may be extended for any commodity which cannot be used for food or propagation. This extension is only a matter of convenience for the importer and is intended only for the purpose of reducing treatment costs. The request for extension must come from the importer or his authorized representative and should be confirmed in writing. A letter is not required for each treatment. A single blanket request should be considered as acceptable and renewed each year as required.

During the extended exposure period, the concentrations must remain stable and the prescribed minimums be met at the end of the extension. Otherwise, the treatment may be voided and retreatment required. Examples of commodities for which extended exposure periods may be approved include cotton piece goods, baled cotton, bagging, wood, marble, soil as such, etc. Examples of commodities for which *no* extension may be approved include cottonseed, grain, tobacco, etc. An extension of exposure period for other purposes is **not** permitted except as may be prescribed in various schedules for concentration readings below minimum.

Additional safety precautions, including additional aeration, may be required because of the extended exposure period. The PPQ officer or the commercial fumigator will specify any needed safety precautions.

T401—Railroad Cars (Empty)

T401-a Railroad cars (empty)

Pest: *Pectinophora gossypiella* (pink bollworm) and fruit flies

Treatment: T401-a—MB (“Q” label only) at NAP

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
40 °F or above	4 lbs	12 hrs
OR	8 lbs	3 hrs

T401-b Railroad cars (empty)

Pest: *Trogoderma granarium* (khapra beetle)

Treatment: T401-b—MB (“Q” label only) at NAP—tarpaulin covered car

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:		
		0.5 hr	2 hrs	12 hrs
90 °F or above	2.5 lbs	30	20	15
80-89 °F	3.5 lbs	42	30	20
70-79 °F	4.5 lbs	54	40	25
60-69 °F	6 lbs	72	50	30
50-59 °F	7.5 lbs	90	60	35
40-49 °F	9 lbs	108	70	40

T401-c Railroad cars (empty)

Pest: For nematode cysts

Treatment: T401-c—High pressure steam cleaning *or* formaldehyde wetting spray (1 part 40 percent commercial formalin to 9 parts water).

Important

Under FIFRA Section 2(ee), it is permissable to use a method of application **not** prohibited by the labeling unless the labeling specifically states that the product may be applied only by the methods specified on the labeling. Therefore, a wetting spray may be used in this case if the label refers to the application of formaldehyde as a fumigant and does **not** specifically restrict the method of application to fumigation."

The debris and/or runoff from the cleaning procedure must be handled in a manner approved by local and port authority guidelines.

T402—Ships, Containers, and Surrounding Area

T402-b-3-2 Asphalt surfaces and asphalt-base painted surfaces

Pest: *Trogoderma granarium* (khapra beetle)

Treatment: T402-b-3-2—Malathion spray at 2 gal/1,000 ft^2 or to the point of runoff.

Asphalt surface, asphalt-base paint—3 percent spray prepared by adding 1 lb. of 25 percent malathion wettable powder to each gal. of water.

T402-c Empty holds (precautionary treatment for grain exports)

Pest: Without khapra beetle infestation

Treatment: T402-b—MB at NAP

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
60 °F or above	1 lb	10 hrs
50-59 °F	1 lb	12 hrs
40-59 °F	1.5 lbs	12 hrs

Important

Operate fans during gas introduction and for 30 minutes thereafter. During exposure period, operate fans for 30 minutes every 3 hours.

Important

If khapra beetle is present, see ***T401-b*** on **page 5-5-2.**

T402-b-3-1 Metal and wood surfaces such as decks, bulkheads, piers, and other areas not subject to fumigation

Pest: *Trogoderma granarium* (khapra beetle)

Treatment: T402-b-3-1—Malathion spray at 2 gal/1,000 ft^2 or to the point of runoff.

Metal and wood surfaces—3 percent spray prepared by mixing 1/2 pt. emulsifiable concentrate (57 percent premium grade malathion) per gal. of water.

Malathion is toxic to fish, birds, and other wildlife. Keep out of lakes, streams, ponds, tidal marshes, and estuaries. Do **not** apply where fish and other aquatic life are important resources or where water is used for irrigational purposes, recreational purposes, or domestic purposes. Do **not** apply where runoff is likely to occur.

T402-d Ship decks (metal, concrete, asphalt, or wood)

Pest: Miscellaneous hitchhiking insects (e.g., crickets, scarab beetles, ants, Africanized honeybee swarms)

Treatment: T402-d—Residual insecticidal spray (1 percent to 5 percent strength, according to label directions), using malathion, chlorpyrifos, or cyfluthrin (Tempo)

Apply the insecticide to dry surfaces as a fine spray or mist, according to the manufacturer's label. Direct the spray to areas on the decks where the insects congregate, with special attention to corners, cracks, and crevices.

Important

Do not treat freshly painted surfaces.

Avoid pooling or runoff. If rain is imminent, use a spreader-sticker in the spray mixture, or postpone spraying weather-exposed decks until the storm has passed and the decks have thoroughly dried. Submarines are exempt from treatment.

Important

Do not release the ship from quarantine until the application has dried, and no live inspects are seen.

If the insects are capable of flight (e.g., scarab beetles), the ship must move offshore for at least one mile (which is beyond the normal flight range of most insects) while the insecticide is being applied.

T402-a-1 Ship holds and any nonplant cargo material within holds

Pest: Quarantine-significant snails of the family Achatinidea, including the following genera:

Achatina *Lignus*
Archachatina *Limicolaria*

Treatment: T402-a-1—MB ("Q" label only) at NAP

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:		
		0.5 hr	2 hrs	24 hrs
55 °F or above	8 lbs	96	65	35

T402-a-2 Ship holds and any nonplant cargo material within holds

Pest: Quarantine-significant snails of the family Hygromiidae, including the following genera:

Candidula *Monarcha* *Xeropicta*
Cernuella *Platytheba* *Xerosecta*
Cochlicella *Pseudotrichia* *Xerotricha*
Helicella *Trochoidea*
Helicopsis *Xerolenta*

Treatment: T402-a-2—MB ("Q" label only) at NAP

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:				
		0.5 hr	2 hrs	24 hrs	48 hrs	72 hrs
55 °F or above	8 lbs	95	64	62	60	40

T402-a-3 Ship holds and any nonplant cargo material within holds

Pest: Quarantine-significant snails of the families Helicidae and Succineidae, including the following genera:

Caracollina *Omalonyx*
Cepaea *Otala*
Cryptomphalus *Succinea*
Helix *Theba*

Treatment: T402-a-3—MB ("Q" label only) at NAP

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:					
		0.5 hr	2 hrs	10 hrs	12 hrs	16 hrs	24 hrs
80 °F or above	6 lbs	70	48	40	—	—	—
55-79 °F	6 lbs	70	48	—	—	40	—
40-54 °F	8 lbs	96	64	—	—	—	39

T402-b-1 Ship holds and storerooms that do not contain finely milled products such as flour or appreciable quantities of tightly packed cargo such as baled materials

Pest: *Trogoderma granarium* (khapra beetle)

Treatment: T402-b-1—MB ("Q" label only) at NAP–tarpaulin covered car

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:		
		0.5 hr	2 hrs	12 hrs
90 °F or above	2.5 lbs	30	20	15
80-89 °F	3.5 lbs	42	30	20
70-79 °F	4.5 lbs	54	40	25
60-69 °F	6 lbs	72	50	30
50-59 °F	7.5 lbs	90	60	35
40-49 °F	9 lbs	108	70	40

T402-b-2 Ship holds and storerooms that contain milled products, or with appreciable quantities of tightly packed or baled material

Pest: *Trogoderma granarium* (khapra beetle)

Treatment: T402-b-2—MB ("Q" label only) at NAP

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:		
		0.5 hr	4 hrs	24* hrs
90-96 °F	4 lbs	48	35	25
80-89 °F	6 lbs	72	50	30
70-79 °F	8 lbs	96	65	35

*In addition to the space concentration readings, you must take a commodity concentration reading. The minimum concentration reading for commodity reading is as follows: For 90-96 °F—10 oz.; for 80-89 °F—15 oz.; for 70-79 °F—20 oz.;

Important

Concentration readings not required for chamber fumigation.

Important

Some ships' masters or agents prefer to abandon flour or other finely milled products to qualify for the 12 hours schedule (***T401-b*** on **page 5-5-2**). This practice should not be discouraged if PPQ approved incineration or steam sterilization facilities are available within the port city. Small quantities may be burned or boiled on board the vessel, but in no case should the material be removed from treatment in PPQ facilities. Such articles must be left in the storeroom during the 12-hour fumigation and then removed under PPQ safeguards. This will serve to reduce the possibility of pest dispersal when the articles are removed under PPQ supervision.

T403—Miscellaneous Cargo (Nonfood, Nonfeed Commodities)

T403-a-1 Miscellaneous cargo (nonfood, nonfeed commodities)

Pest: Quarantine-significant snails of the family Achatinidae, including the following genera:

Achatina *Lignus*
Archachatina *Limicolaria*

Treatment: T403-a-1—use T402-a-1 for temperatures of 55 °F and above, use T403-a-6 for temperatures below 55 °F

Important

Commodity or product temperature must reach treatment temperature before exposure time begins.

T403-a-2-1 Miscellaneous cargo (nonfood, nonfeed commodities)

Three alternative treatments

Pest: Quarantine-significant snails of the family Hygromiidae, including the following genera:

Candidula *Monarcha* *Xeropicta*
Cernuella *Platytheba* *Xerosecta*
Cochlicella *Pseudotrichia* *Xerotricha*
Helicella *Trochoidea*
Helicopsis *Xerolenta*

Treatment: T403-a-2-1—MB (“Q” label only) at NAP

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:			
		0.5 hr	2 hrs	48 hrs	72 hrs
55 °F or above	8 lbs	95	64	60	40

T403-a-2-2 Miscellaneous cargo (nonfood, nonfeed commodities)

Treatment: T403-a-2-2—MB in 26" vacuum

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
70 °F or above	8 lbs	16 hrs

T403-a-2-3 Miscellaneous cargo (nonfood, nonfeed commodities)

Treatment: T403-a-2-3—Cold treatment (for temperatures below 55 °F)

Temperature	Exposure Period
0 °F	48 hrs

T403-a-3 Miscellaneous cargo (nonfood, nonfeed commodities)

Pest: Quarantine-significant slugs of the families Agriolimacidae, Arionidae, Limacidae, Milacidae, Philomycidae, and Veronicellidae, including the following genera:

Agriolimax	*Leidyula*	*Pseudoveronicella*
Arion	*Limax*	*Sarasinula*
Colosius	*Meghimatium*	*Semperula*
Deroceras	*Milax*	*Vaginulus*
Diplosolenodes	*Pallifera*	*Veronicella*

Treatment: T403-a-3—MB at NAP

Temperature	Dosage Rate (lb/1000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	2 hrs
90-96 °F	1 lb	12	9
80-89 °F	1.25 lbs	15	12
70-79 °F	1.5 lbs	18	15
60-69 °F	1.75 lbs	22	19

T403-a-4-1 Miscellaneous cargo (nonfood, nonfeed commodities)

Three alternative schedules

Pest: Quarantine-significant snails of the family Helicidae, including the following genera:

Caracollina	*Helix*
Cepaea	*Otala*
Cryptomphalus	*Theba*

Treatment: T403-a-4-1—MB at NAP

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:					
		0.5 hr	2 hrs	10 hrs	12 hrs	16 hrs	24 hrs
80 °F or above	6 lbs	70	48	40	—	—	—
55-79 °F	6 lbs	70	48	—	—	40	—
40-54 °F	8 lbs	96	64	—	—	—	39

Important

If the fumigation is done at a temperature range of 40 to 54°F, use Methyl Bromide Q gas only.

T403-a-4-2

Miscellaneous cargo (nonfood, nonfeed commodities)

Treatment: T403-a-4-2—MB ("Q" label only) in 26" vacuum

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
70 °F or above	6 lbs	6 hrs

T403-a-4-3

Miscellaneous cargo (nonfood, nonfeed commodities)

Treatment: T403-a-4-3—Cold treatment, use ***T403-a-6-1*** on **page 5-5-10** for temperatures below 55 °F

T403-a-5-1

Miscellaneous cargo (nonfood, nonfeed commodities)

Three alternative treatments

Pest: Quarantine-significant snails of the families Bradybaenidae and Succineidae, including the following genera:

Bradybaena *Omalonyx*
Cathaica *Succinea*
Helicostyla *Trishoplita*

Treatment: T403-a-5-1—MB ("Q" label only) at NAP

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:			
		0.5 hr	2 hrs	10 hrs	16 hrs
80 °F or above	6 lbs	72	48	40	—
40-79 °F	6 lbs	70	48	—	40

T403-a-5-2

Miscellaneous cargo (nonfood, nonfeed commodities)

Treatment: T403-a-5-2—MB ("Q" label only) in 26" vacuum

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
40 °F or above	6 lbs	6 hrs

T403-a-5-3

Miscellaneous cargo (nonfood, nonfeed commodities)

Treatment: T403-a-5-3—Cold Treatment, use ***T403-a-6-1*** on **page 5-5-10** for temperatures below 40 °F

Important

Commodity or product must reach treatment temperature before exposure time begins.

T403-a-6-1 Miscellaneous cargo (nonfood, nonfeed commodities)

Three alternative treatments

Pest: Quarantine-significant snails sensitive to Cold Treatment, members of the families Bradybaenidae, Helicidae, Helicellidae, Hygromiidae, and Succineidae, including the following genera:

Bradybaena	*Cochlicella*	*Trochoidea*
Candidula	*Helicella*	*Xerolenta*
Cepaea	*Helicostyla*	*Xeropicta*
Cathaica	*Theba*	*Xerosecta*
Cernuella	*Trishoplita*	*Xerotricha*

Treatment: T403-a-6-1—Cold Treatment

Temperature	Exposure Period
0 °F	48 hrs

T403-a-6-2 Miscellaneous cargo (nonfood, nonfeed commodities)

Pest: Quarantine-significant snails sensitive to Cold Treatment, certain members of the family Helicidae, including the following genera:

Helix	*Otala*

Treatment: T403-a-6-2—Cold Treatment

Temperature	Exposure Period
0 °F	32 hrs
10 °F	48 hrs

T403-a-6-3 Miscellaneous cargo (nonfood, nonfeed commodities)

Pest: Quarantine-significant snails sensitive to Cold Treatment, of the family Achatinidae, including the following genera:

Achatina	*Lignus*
Archachatina	*Limicolaria*

Treatment: T403-a-6-3—Cold Treatment

Temperature	Exposure Period
0 °F	8 hrs
10 °F	16 hrs
20 °F	24 hrs

T403-b Miscellaneous cargo (nonfood, nonfeed commodities)

Pest: *Trogoderma granarium* (khapra beetle)

Treatment: T403-b—MB at NAP, use T401-b or T402-b-2

T403-c Miscellaneous cargo (nonfood, nonfeed commodities)

Pest: *Globodera rostochiensis* (golden nematode)

Treatment: T403-c—MB (“Q” label only) in 26" vacuum

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
40 °F or above	8 lbs	16 hrs
	10.5 lbs	12 hrs
	16 lbs	8 hrs

T403-d Miscellaneous cargo (nonfood, nonfeed commodities)

Pest: Wood Borers or termites

Treatment: T403-d see T404 schedules

T403-e-1-1 Miscellaneous cargo (nonfood, nonfeed commodities) that is not sorptive or difficult to penetrate

Pest: Quarantine-significant insects not specifically provided for elsewhere in nonfood or nonfeed commodities

Treatment: T403-e-1-1—MB (“Q” label only) at NAP—tarpaulin

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:		
		0.5 hr	2 hrs	12 hrs
90 °F or above	2.5 lbs	30	20	15
80-89 °F	3.5 lbs	42	30	20
70-79 °F	4.5 lbs	54	40	25
60-69 °F	6 lbs	72	50	30
50-59 °F	7.5 lbs	90	60	35
40-49 °F	9 lbs	108	70	40

T403-e-1-2 Miscellaneous cargo (nonfood, nonfeed commodities) that is sorptive or difficult to penetrate

Pest: Quarantine-significant insects not specifically provided for elsewhere in nonfood or nonfeed commodities

Treatment: T403-e-1-2—MB ("Q" label only) at NAP

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:				
		0.5 hr	4 hrs	24 hrs	28 hrs	32 hrs
90-96 °F	4 lbs	48	35	25*	—	—
80-89 °F	6 lbs	72	50	30*	—	—
70-79 °F	8 lbs	96	65	35*	—	—
60-69 °F	12 lbs	144	95	50*	—	—
50-59 °F	12 lbs	144	95	—	50*	—
40-49 °F	12 lbs	144	95	—	—	50*

*In addition to the space concentration readings, you must take a commodity concentration reading. The minimum concentration reading for commodity reading is as follows: For 90-96 °F—10 oz.; for 80-89 °F—15 oz.; for 70-79 °F—20 oz.; for 60-69 °F—30 oz; for 50-59 °F—30 oz; and 40-49 °F—30 oz.

This fumigation schedule may be used, for example, on finely miled products and on material that is tightly packed or baled.

T403-e-2 Miscellaneous cargo (nonfood, nonfeed commodities) that is not sorptive or difficult to penetrate

Pest: Quarantine-significant pests other than insects

Important

This would include quarantine-significant snails of the families Helicarionidae, Streptacidae, Subulinidae, and Zontidae, as well as other noninsect pests.

Treatment: T403-e-2—MB ("Q" label only) at NAP tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:			
		0.5 hr	2 hrs	24 hrs	48 hrs
40 °F or above	10 lbs	140	130	120	80

T403-f

Miscellaneous cargo (nonfood, nonfeed commodities)

Pest: *Pieris* spp. (cabbageworms—all life stages) and all other *Lepidoptera**. Also hitchiking insects, including non-*Lepidoptera*.

Treatment: T403-f—MB at NAP

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:	
		0.5 hr	3 hrs
70 °F or above	3 lbs	36	16
60-69 °F	3.5 lbs	40	19
50-59 °F	4 lbs	45	21
45-49 °F	4.5 lbs	49	24
40-44 °F	5 lbs	54	27

Important

*A 3-hour exposure easily kills all Lepidopterous hitchhikers, including gypsy moth, and is preferred over using the much longer schedules that are aimed more at khapra beetles (T404-b-1 and T402-b-2). This schedule should not be used for mollusks (snails and slugs) or for any insect with cryptic habits (e.g., ants or borers), or for insects in diapause.

T404—Wood Products Including Containers[1]

T404-b-5-1

Metal, wood, concrete, or other surfaces not subject to fumigation

Pest: Borers (wood wasps, Cerambycids, and Dinoderus)

Treatment: T404-b-5-1—Chlorpyrifos spray

Use Dursban 4E as a 1 percent chlorpyrifos spray using suitable hand- or power-operated ground spray equipment. To be applied only by or under the supervision of pest control operators or other trained personnel responsible for inspect control programs.

To prepare the spray, thoroughly mix 79 ml (2-2/3 fl oz) of Dursban 4E with water to make up a total of 1 gal. of mixture (equivalent to 2.1 gal. in 100 gal. of water) and spray to the point of runoff.

1 **Use Treatment Schedule *T404-d* on page 5-5-19 for the fumigation of any bamboo products.**

T404-c-2

Wood products including containers

Pest: Termites (for borers see T404-b-1-1 and T404-b-1-2)

Treatment: T404-c-2—SF at NAP

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:			
		0.5 hr	2 hrs	16 hrs	24 hrs
70 °F or above	1 lb	12	8	8	—
60-69 °F	1.5 lbs	18	12	—	8
50-59 °F	2.5 lbs	32	20	—	20

Do not use filters containing sodium hydroxide (Ascarite®) with this fumigant.

T404-a

Wood products including containers

Pest: *Globodera rostochiensis* (golden nematode)

Treatment: T404-a—MB (“Q” label only) in 26" vacuum

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
40 °F or above	8 lbs	16 hrs
	10.5 lbs	12 hrs
	16 lbs	8 hrs

T404-b-1-1

Wood products including containers

WARNING

Ascarite® filter must be mounted on the T/C Analyzer when taking concentration readings for the following Mb-NAP treatments.

Four alternative treatments

Pest: See following pest list for T404-b-1-1, T404-b-1-2, and T404-b-4

Treatment: T404-b-1-1—MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:			
		0.5 hr	2 hrs	4 hrs	16 hrs[1]
70 °F or above	3 lbs	36	30	27	25
40-69 °F	5 lbs	60	51	46	42

1 If the 4- and 16-hour readings would occur outside of normal working hours, then the fumigation may be extended to a total of 24 hours, instead of 16. In that case, the 24-hr minimum concentration reading would be 25 (for the initial 3-lb dosage), or 42 (for the initial 5-lb dosage).

Important

For termites use T404-c schedules.

Important

1. Minimum concentration must be met in chamber fumigations of sorptive materials. (Refer to ***Sorption* on page 2-3-6**.)
2. For fumigating of hardboard (Masonite), an initial dosage of 10 lb/1,000 ft^3 is recommended. Inspector should be prepared to provide extra attention to maintaining minimum concentrations when fumigating this commodity.
3. If both termites and borers are present at 40-69 °F, use the schedule for borers with exposure extended to 20 hours. Use same minimum concentrations.
4. Use an Ascarite filter (in addition to a Drierite filter) if any of the following conditions apply:
   The wood is uncured (“green”).
   The wood is manifested as guatamba wood.
   In the two cases above, water vapor or other gases may be evolved during the fumigation, which give false (additive) readings on the gas analyzer.
5. If the 4- and 16-hour readings would occur outside of normal working hours, then the fumigation may be extended to a total of 24 hours, instead of 16. In that case, the 24-hr minimum concentration reading would be 25 (for the initial 3-lb dosage), or 42 (for the initial 5-lb dosage).
6. Resume use of fans anytime a difference of 4 oz. or more occurs between the highest and lowest reading.
7. Readings more than 5 oz. below minimum at end of exposure negates treatment. For readings less than 5 oz. below minimum at the end of exposure period, add 2 oz/1,000 ft^3 for each ounce below minimum and extend exposure for 4 hours.
8. A reduction in dosage is allowed when fumigating nonsorptive commodities such as marble, shells, metal containers, etc., which have infested crating associated with them providing the following additional conditions are met:
   Use only new 4-mil or 6-mil tarpaulins.
   No truck trailer, van, or railroad car fumigations are permitted unless the carrier is covered with a 6-mil tarpaulin which is then sealed to the ground.
   Use five or more sampling leads to determine minimum concentrations.
9. When fumigating wood commodities (e.g., dunnage, crating, logs) the proper fumigation temperature may be determined by inserting the tip of a dial thermometer or other temperature probe in a hole in the wood. A hole can be made with an electric or hand-powered drill or an awl. The hole diameter should be just large enough to insert the probe shaft (to lessen the influence of surrounding air). The depth should be 2 inches or half the thickness of the wood. Different areas of the load should be probed and the lowest temperature used in determining fumigation temperature. Determine the wood temperature 5 to 10 minutes after drilling the hole to allow the heat generated during drilling to dissipate.

T404-b-1-2 Wood products including containers

Pest: See following pest list for T404-b-1-1, T404-b-1-2, and T404-b-4

Treatment: T404-b-1-2—MB in 26" vacuum

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
70 °F or above	4 lbs	4 hrs
40-69 °F	4 lbs	5 hrs

T404-b-2 Wood products including containers

Pest: Borers (wood wasps, carpenter ants, carpenter bees, and termites)

Treatment: T404-b-2—SF at NAP

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:						
		0.5 hr	2 hrs	4 hrs	12 hrs	16 hrs	24 hrs	32 hrs
70 °F or above	4 lbs	48	45	40	—	32	—	—
60-69 °F	4 lbs	48	45	40	36	—	32	—
50-59 °F	5 lbs	60	56	52	48	—	40	—
40-49 °F	6.5 lbs	76	71	66	60	—	52	—
OR	5 lbs	60	57	53	49	—	44	40

Important

Do not use a filter containing sodium hydroxide (Ascarite®) with this fumigant.

Sulfuryl Fluoride (SF) is **NOT** an approved quarantine treatment for wood-boring beetles because SF has difficulty in penetrating insect eggs; therefore, many eggs will still hatch following fumigation. SF treatment of wood should be authorized only for brood-tending species of insects such as termites, bees, wasps, and ants. Even if all eggs are not killed, the hatching larvae will die of starvation, due to lack of care.

T404-b-4 Wood products including containers

Pest: See following pest list for T404-b-1-1, T404-b-1-2, and T404-b-4

Treatment: T404-b-4—Kiln Sterilization

Dry bulb temperature	Wet bulb depression	Relative humidity	Moisture content	Thickness of lumber	Expo-sure*
140 °F	7 °F	82 percent	13.8 percent	1 inch 2 inches 3 inches	3 hrs 5 hrs 7 hrs
130 °F	16 °F	60 percent	9.4 percent	1 inch 2 inches 3 inches	10 hrs 12 hrs 14 hrs
125 °F	15 °F	61 percent	9.7 percent	1 inch 2 inches 3 inches	46 hrs 48 hrs 50 hrs

Important

Use this pest list for T404-b-1-1, T404-b-1-2, and T404-b-4

Coleoptera (beetles):

Bostrichidae (branch and twig borers)
Buprestidae (metallic or flat-headed borers)
Cerambycidae (long-horned or round-headed borers)
Curculionidae (wood-boring and root-feeding weevils)
Lyctidae (powder-post beetles)
Lymexylonidae (ship timber beetles)
Passalidae (bess beetles)
Platypodidae (pin-hole borers)
Rhyzophagidae (root-eating beetles)
Salpingidae (narrow-wasted bark beetles)
Scolytidae (bark/engraver beetles; also ambrosia/timber beetles)
Trogositidae (bark-gnawing beetles)

Hymenoptera (bees, wasps, and ants):

Formicidae (carpenter ants)
Orussidae (parasitic wood wasps)
Siricidae (wood wasps)
Syntexicae (incense-cedar wood wasps)
Xylocopidae (carpenter bees)
Xyphydriidae (wood wasps)

Isoptera (termites)

Lepidoptera (moths):

Cossidae (carpenter worms)
Sesiidae (clear-winged moths)

T404-c-1-1 Wood products including containers

WARNING

If using a T/C analyzer, an Ascarite® filter must be mounted when taking concentration readings for the following MB-NAP treatments.

Two alternative treatments

Pest: Termites

Important

For borers, see ***T404-b-1-1*** on **page 5-5-14**.

Treatment: T404-c-1-1—MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:				
		0.5 hr	2 hrs	4 hrs	16 hrs	24 hrs
40 °F or above	3 lbs	36	30	27	25	24

Important

- Minimum concentration must be met in NAP chamber fumigations of sorptive materials. (see ***Sorption*** on **page 2-3-6** for a list of sorptive materials.)
- If both termites and borers are present at 40 °F–60 °F, use the schedule for borers with exposure extended to 20 hours. Use same minimum concentrations.
- Guatamba wood squares and green wood may emit a gas which gives a reading additive to MB on the fumiscope. Use of a filter containing sodium hydroxide (Ascarite®) will eliminate this contaminative gas.

T404-c-1-2 Wood products including containers

Treatment: T404-c-1-2—MB in 26" vacuum

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
70 °F or above	4 lbs	3 hrs
40-69 °F	4 lbs	4 hrs

T404-d

Wood products including containers

WARNING

If using a T/C Analyzer, an Ascarite® filter must be mounted when taking concentration readings for the following MB-NAP treatments.

Pest: Borers and *Trogoderma granarium* (khapra beetle)

Treatment: T404-d—MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:				
		0.5 hr	2 hrs	4 hrs	16 hrs[1]	24 hrs
80 °F or above	3.5 lbs	36	33	30	25	17
70-79 °F	4.5 lbs	50	45	40	25	22
60-69 °F[2]	6 lbs	65	55	50	42	29
50-59 °F	7.5 lbs	80	70	60	42	36
40-49 °F[3]	9 lbs	85	76	70	42	42

1 If the 16-hour reading is **not** performed, the 24-hour reading **must** have the following minumum concentrations: For 80 °F or above—25 oz.; for 70-79 °F—25 oz.; for 60-69 °F—42 oz; for 50-59 °F—42 oz; and 40-49 °F—42 oz.

2 Due to label restrictions, use MB-100 gas may not be used at 60 °F or below.

3 MB Q-gas may be used at any temperature above 40 °F.

T404-e—Approved marking for regulated wood packing material

The wood packing material[2] must be stamped in a visible location on each article, with a legible and permanent mark that indicates the article has met the treatment required. The mark must be approved by the International Plant Protection Convention (IPPC). The currently approved mark shown in **Figure 5-5-1** below. XX would be replaced by the country code, 000 by the producer number, and YY by the treatment type (HT or MB).

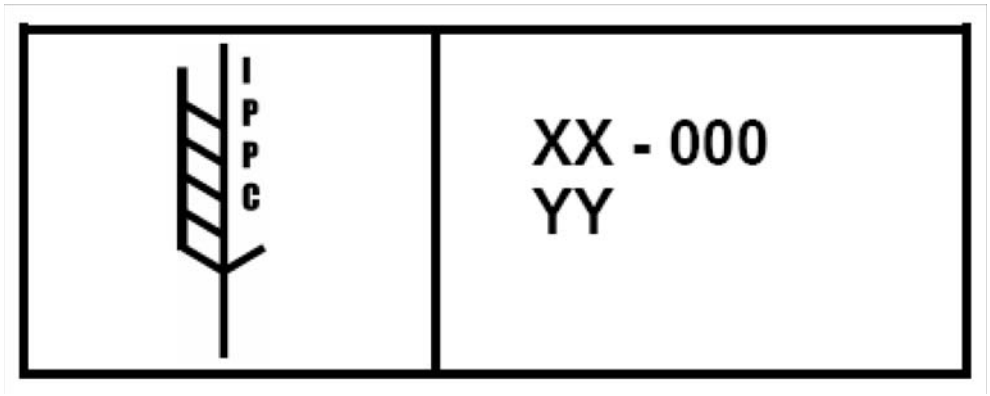

Figure 5-5-1 Example of International Plant Protection Convention Marking

T404-e-1

Regulated wood packing material (WPM)

Two alternative treatments

Pest: Various

Treatment: T404-e-1—MB at NAP—tarpaulin

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:				
		0.5 hr	2 hrs	4 hrs	16 hrs	24 hrs
69.8 °F or above	3 lbs	36	36	31	28	24
61°-69.8 °F	3.5 lbs	42	42	36	32	28
51.8°-61 °F	4 lbs	48	48	42	36	32

2 Regulated wood packing material is defined as all types of wood packaging materials used for or for use with cargo to prevent damage, including, but not limited to, dunnage, crating, pallets, packing blocks, drums, cases, and skids. Excluded from the definition of wood packaging materials are:
Pieces of wood that are less than 6mm or 0.24 inches in any dimension
- Loose wood packing materials, such as wood shavings, excelsior, etc.
- Processed wood packing materials that have received more than primary processing, such as plywood, corrugated board, fiberboard, veneer, whiskey and wine barrels, oriented strand boards, etc.

T404-e-2 Regulated wood packing material (WPM)

Pest: Various

Treatment: T404-e-2

Heat treatment to achieve a minimum core temperature of 56 °C (132.8 °F)for a minimum of 30 minutes. Treatments must be conducted in USDA-approved facilities. Contact CPHST in Raleigh, NC for facility specifications.

T404-f *Pinus radiata* wood chips from Chile and *Eucalyptus* wood chips from South America

Treatment: T404-f—Surface Pesticide

Refer to **Table 5-5-1** for the chemical name and percentage of active ingredients. Spray the wood chips with the pesticide mixture so that all the chips are completely exposed to the chemicals. To prevent against infestation by plant pests, safeguard the wood chips during the interval between treatment and export.

Table 5-5-1 Pesticide Treatment for *Pinus radiata* and *Eucalyptus* Wood Chips

Percentage of Active Ingredient (a.i.)	Pesticide
64.8	didecyl dimethyl ammonium chloride
7.6	3-iodo-2-propynl butylcarbamate
44.9	chlorpyrifos phosphorothioate

T405—Bags and Bagging Material

See T306 schedules

T406—Golden Nematode Contaminations

T406-a Miscellaneous cargo (nonfood, nonfeed commodities)

Pest: *Globodera rostochiensis* (golden nematode)

Treatment: T406-a—MB in 26" vacuum, use T403-c

T406-c Piers, barges, railroad cars, automobiles, used farm equipment, etc.

Pest: *Globodera rostochiensis* (golden nematode)

Treatment: T406-c—Steam Cleaning

Steam at high pressure until all soil is removed. Treated surfaces should be thoroughly wet and heated. The debris and/or runoff from the cleaning procedure must be handled in a manner approved by local and port authority guidelines.

T406-b Used farm equipment, construction equipment, containers, etc.

Pest: *Globodera rostochiensis* (golden nematode)

Treatment: T406-b—MB (“Q” label only) at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/ 1,000 ft^3)	Minimum Concentration Readings (ounces) At:		
		0.5 hr	2 hrs	24 hrs
60 °F or above	15 lbs	180	120	120

NOTICE

Soil should be easily crumbled but not wet. The soil should not exceed 12 inches in the smallest dimension.

T406-d

Used farm equipment (without cabs), construction equipment (without cabs), and used containers

Pest: *Globodera rostochiensis* (golden nematode)

Treatment: T406-d—Steam at NAP—tarpaulin, or tent

Steam heat for 60 minutes after all temperature sensors reach 140°F (60°C). (see sensor placement and other requirements below)

Important

This treatment must be conducted under the following minimum ambient air temperatures, which will vary with the volume of the treatment enclosure:

- For treatment enclosures of 4,000 ft^3 or less, the minimum air temperature is 40 °F.
- For treatment enclosures greater than 4,000 ft^3 and less than or equal to 6,000 ft^3, the minimum air temperature is 60 °F.

This treatment is not recommended for treatment enclosures greater than 6,000 ft^3.

Step 1—Determine if the temperature and volume requirements can be met

If you cannot meet the temperature and enclosure volume requirements, do not use this treatment.

Step 2—Assemble articles to be treated

Articles to be treated should be placed as close together as possible. Arrange articles to allow space for placement of the steam distribution manifold.

Step 3—Place the steam distribution manifold pipe beneath articles to be treated

The steam distribution manifold should be assembled and placed beneath the articles to be treated in order to facilitate steam distribution. A flexible steam introduction hose, approximately 20 feet in length, connects the steam generator to a 10 foot long U-shaped pipe capped at the ends, with 0.5 inch holes every 12 inches. This pipe serves as the steam distribution manifold.

Step 4—Place temperature recording sensors on the article to be treated

Enclosures of 4,000 ft^3 or less

When the treatment is being conducted in enclosures 4,000 ft^3 or less, use at least four temperature recording sensors in addition to the sensor on the steam generator. Place sensors in hard-to-treat cracks or crevices on the equipment or containers. Position sensors in the following locations:

1. Front high—near the top of the front of the equipment or load

2. Center middle—midway from the top and bottom of the center of the equipment or load
3. Center bottom—bottom of the center of the equipment or load, but at least 3 inches above the floor if the equipment is flush with the floor
4. Rear bottom—bottom of the rear of the equipment, but at least 3 inches above the floor if the equipment is flush with the floor

Enclosures greater than 4,000 ft^3 and less than or equal to 6,000 ft^3

When the treatment is being conducted in enclosures greater than 4,000 ft^3 and less than or equal to 6,000 ft^3, use at least eight temperature recording sensors in addition to the sensor on the steam generator. Again, place sensors in hard-to-treat cracks or crevices on the equipment or containers. Position probes in the following locations:

1. Front high—near the top of the left side of the front of the equipment or load
2. Front low—bottom of the right side of the front of the equipment or load, but at least 3 inches above the floor if the equipment is flush with the floor
3. Center high—near the top of the center of the equipment or load on the right side
4. Center middle—midway from the top and bottom of the center of the equipment or load
5. Center low—bottom of the center of the equipment or load on the left side, but at least 3 inches above the floor if the equipment is flush with the floor
6. Rear high—near the top of the rear of the equipment on the right side
7. Rear middle—midway from the top and bottom of the rear of the equipment
8. Rear low—bottom of the rear of the equipment or load on the left side, but at least 3 inches above the floor if the equipment is flush with the floor.

Step 5—Enclose the article to be treated with a trapaulin or tent

If a tarpaulin (6 mil plastic) is used instead of a tent, pad sharp edges of the equipment or containers before covering with the tarp.

If the equipment or containers will be moved into an enclosure, such as a tent, it may be more practical to place the temperature sensors after this step. In either case, the front of the equipment or load and the front of the enclosure should face in the same direction.

Step 6—Place the steam generator at an open end of the enclosure and seal the enclosure

The steam generator is placed approximately 20 feet from the front of the enclosure and connected to a steam introduction line (hose.) The steam introduction line is connected to the steam distribution manifold pipe which is situated under the articles to be treated. The enclosure is sealed at the base including the point at which the introduction line enters the enclosure. An airtight seal is not essential for steam treatment; therefore small pinholes are acceptable.

Step 7—Steam heat the enclosure for 60 minutes after all temperature sensors reach a minimum 140°F (60°C)

Important

Use only a steam generator approved by APHIS.

The maximum temperature in the enclosure should not exceed 160°F (71°C).

The temperature should be recorded once every 2 minutes during the treatment.

T407—Mechanical Cotton Pickers and Other Cotton Equipment

T407

Mechanical cotton pickers and other cotton equipment

Pest: *Pectinophora gossypiella* (pink bollworm)

Treatment: T407—MB ("Q" label only) at NAP—tarpaulin, chamber, railroad car, or van

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:				
		0.5 hr	2 hrs	3 hrs	4 hrs	12 hrs
40 °F or above	4 lbs	48	—	—	—	21
	8 lbs	96	—	64	—	—

Important

This treatment is designed to kill exposed larvae, larvae within green cotton bolls or single locks of seed cotton, or loose trash. Any materials such as sacked or bulked seed, cotton waste, lint, linters, or any packaged commodity shall be treated in accordance with T301.

T408—Soil as Such and Soil Contaminating Durable Commodities

T408-e-1 Herbarium specimens of mosses and liverworts in soil and originating in golden nematode-free countries

Pest: (Precautionary)

Treatment: T408-e-1—MB (“Q” label only) in 26" vacuum (Precautionary fumigation)

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
70 °F or above	2 lbs	3.5 hrs

T408-e-2 Herbarium specimens of mosses and liverworts in soil and originating in golden nematode-free countries

Pest: *Globodera rostochiensis* (golden nematode)

Treatment: T408-e-2—MB (“Q” label only) in 26" vacuum

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
40 °F or above	8 lbs	16 hrs
	10.5 lbs	12 hrs
	16 lbs	8 hrs

T408-a Soil as such

Two alternative treatments

Pest: Various pests and pathogens found in soil (including striga)

Treatment: T408-a—Dry heat—

Temperature	Exposure Period
230 °F to 249 °F	16 hours
250 °F to 309 °F	2 hours
310 °F to 379 °F	30 minutes
380 °F to 429 °F	4 minutes
430 °F to 450 °F	2 minutes

Soil to be spread in layers 0.5 inches in depth to ensure uniform heat penetration. The exposure period does not begin until the entire mass reaches 250 °F.

T408-b

Soil as such

Pest: Various pest and pathogens found in soil

Treatment: T408-b—Steam—250 °F at 15 lbs pressure (p.s.i.) for 0.5 hour

Preheat laboratory autoclaves. Restrict soil depth to 2 inches when treating quantities of soil in trays. Restrict each package weight to 5 lbs. or less when treating individual packages. Load with adequate spacing. Large commercial steam facilities which operate at pressures up to 60 lbs. psi will permit treatment of greater soil depth.

T408-b-1

Soil contaminating durable commodities (e.g., equipment, cobblestone, marble)

Pest: Various pests and pathogens found in soil

Treatment: Steam Cleaning

Steam at high pressure until all soil is removed. Treated surfaces should be thoroughly wet and heated. The debris and/or runoff from the cleaning procedure must be handled in a manner approved by local and port authority guidelines.

T408-c-1

Soil as such

Two alternative treatments

Pest: *Globodera rostochiensis* (golden nematode)

Treatment: T408-c-1—MB (“Q” label only) in 26" vacuum,
see ***T403-c*** on **page 5-5-11** for loose and friable material only.

Soil to be fumigated in containers—no dimensions of which can exceed 24 inches.

T408-c-2

Soil as such

Pest: *Globodera rostochiensis* (golden nematode)

Treatment: T408-c-2—MB (“Q” label only) at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/ 1,000 ft^3)	Minimum Concentration Readings (ounces) At:		
		0.5 hr	2 hrs	24 hrs
60 °F or above	15 lbs	180	120	72

Important

Soil should be friable, moist, but not wet. Soil must not be more than 12 inches in depth. If stacked in containers, 12 inches of space must be left between levels.

T408-d-1

Soil as such

Two alternative treatments

Pest: Insects

Treatment: T408-d-1—Screening through 16 mesh screens will remove most larvae and pupae, except smaller types.

T408-d-2

Treatment: T408-d-2—Freezing—0 °F for 5 days

T408-f

Soil contaminated durable commodities (e.g., equipment, cobblestone, marble)(precautionary treatment)

Pest: Soil fungi, nematodes, and certain soil insects

Treatment: T408-f—Steam Cleaning

Steam at high pressure until all soil is removed. Treated surfaces should be thoroughly wet and heated.

The debris and/or runoff from the cleaning procedure must be handled in a manner approved by local and port authority guidelines.

T408-g-1

Soil contaminated nonfood or nonfeed commodities

Two alternative treatments

Pest: *Striga* spp. (witchweed)

Treatment: T408-g-1—MB (“Q” label only) (tarpaulin)

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
60 °F or above	10 lbs	24 hrs
	20 lbs	15.5 hrs

T408-g-2

Soil contaminated nonfood or nonfeed commodities

Pest: *Striga* spp. (witchweed)

Treatment: T408-g-2—MB (“Q” label only) (tarpaulin)

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:		
		0.5 hr	2 hrs	24 hrs
60 °F or above	15 lbs	164	120	72

Important

Soil must be friable, moist, but not wet. The soil shall not exceed 12 inches in least dimension.

T409—Aircraft

T409-a

Aircraft

Pest: *Trogoderma granarium* (khapra beetle)

Treatment: T409-a

Important

Contact Regional Director for specific instructions.

T409-b

Aircraft

Pest: Hitchhiking pests other than khapra beetle, fruit flies, and soft-bodied insects

Treatment: T409-b—d-phenothrin aerosols (10 percent)—apply at rate of 8g/1,000 ft^3

Important

Aerosol disinfestation of U.S. military aircraft must conform to requirements in the latest edition of "Quarantine Regulations of the Armed Forces" (Army Reg. 40-12; SECNAVINST 6210.2A; AFR 161-4).

Currently, d-phenothrin aerosol (10 percent) is available from Sumitomo Chemical Company LTD, 5-33, Kitahama 4-Chrome, Chuo-ku, Osaka 541-8550, Japan (EPA Reg. No. 10308-21)

Determine the number of seconds to spray the aerosal

The time needed to spray the aerosol is a function the following three things:

- Volume of the aircraft (in 1000 cubic feet)
- Spray rate of the nozzle (in grams per second)
- Required application rate for the pesticide (in grams per 1000 cubic feet)

This relationship is shown in the following formula:

$$Volume\ of\ Aircraft \times \left(\frac{Required\ Application\ Rate}{Spray\ Rate\ of\ Nozzle}\right) = Time\ Needed\ to\ Spray\ Aersol$$

Use ***Table 5-5-2*** on **page 5-5-31** through ***Table 5-5-24*** on **page 5-5-41** to determine the spray time when using 10 percent d-phenothrin, which requires an application rate of 8 grams per 1000 cubic feet, and a nozzle with a spray rate of 5 gram per second.

CAUTION

Currently, d-phenothrin aerosol (10 percent) is available from Sumitomo Chemical Company LTD, 5-33, Kitahama 4-Chrome, Chuo-ku, Osaka 541-8550, Japan (EPA Reg. No. 10308-21). The labeled application rate is 8 grams per 1000 cubic feet, and the spray rate of the aerosol can is 5 grams per second. Calculations for spray times beginning with ***Table 5-5-2*** on **page 5-5-31** are based on the spray rate of 5 gram per second. To have better control of spray times of one second or less, you can use an extender tube on the nozzle of the aerosol can. The extender tube can cut the spray rate in half. For example, if a can of d-phenothrin normally sprays at a rate of 5 grams per second, the extender tube would reduce this rate to 2.5 grams per second and the correct spraying time would then be twice the time listed beginning with ***Table 5-5-2*** on **page 5-5-31**.

Also, the aircraft volumes in Table 5-5-1 represent standard configurations of aircraft. Check with the captain or contact the follow manufacturers to determine if the aircraft has been modified from the standard configuration, and determine the actual volume.

Airbus Industries of North America, Inc.

593 Herndon Parkway
Herndon, VA 20170
Telephone: (703) 834-3400
Fax: (703) 834-3550
Website: http://www.airbus.com/body.html

Boeing Commercial Aeroplane Group

P.O. Box 3707, Mail Stop 74-31
Seattle, WA 98124-2207
Telephone: (425) 237-3657
Website: http://www.boeing.com/commercial.com

Fairchild Aerospace Corp.

P.O. Box 790490
San Antonio, TX 78279-0490
Telephone: (210) 824-2313

McDonald-Douglas Corporation

Military Aircraft Section
P.O. Box 516
St. Louis, MO 63166
Telephone: (314) 233-5360
Fax: (314) 232-7528

Aerospatiale

Web site: http://www.aerospatiale.fr/products/avions

Casa

Web site: http://www.casa.es252

Determine the Spray Time for 10 percent d-phenothrin with a labeled application rate of 8 grams per 1000 cu. ft. and nozzle dispersion rate of 5 grams per second

Table 5-5-2 Airbus Industries

Aircraft, model, and series	Area	Volume ft^3	Aerosol Calculations		
			1,000 ft^3 Units	Grams/ 1,000 ft^3	Spray Time in Seconds
A300	Cabin	27,100	27.1	8	43.5
	Pit-#1	3,722	3.7	8	6.0
	Pit-#2	1,265	1.3	8	2.0
	Pit-#3	565	.6	8	1.0
A300-600R (passenger) (long-range)	Cabin	?			?
	Forward	1,134	1.1	8	2.0
	Aft	1,134	1.1	8	2.0
	Bulk	400	.4	8	0.5
A300-600 (freighter)	Main	9,950	10.0	8	16.0
	Pit-Fwd	1,900	1.9	8	3.0
	Pit-Aft	2,250	2.2	8	3.5
A300-600 (FEDEX)	Main	19,069	19.1	8	30.5
	Pit-Fwd	2,684	2.7	8	4.5
	Pit-Aft	2,154	2.2	8	3.5
	Pit-Back	742	.7	8	1.0
A300 (convertible)	Main	11,943	11.9	8	19.0
A300B4 (freighter)	Main	9,950	10.0	8	16.0
	Pit-Fwd	1,900	1.9	8	3.0
	Pit-Aft	1,850	1.9	8	3.0
A310 (freighter)	Main	7,950	8.0	8	13.0
	Pit-Fwd	1,260	1.3	8	2.0
	Pit-Aft	1,550	1.6	8	2.5

Table 5-5-2 Airbus Industries

Aircraft, model, and series	Area	Volume ft^3	Aerosol Calculations		
			1,000 ft^3 Units	Grams/ 1,000 ft^3	Spray Time in Seconds
A310 (FEDEX)	Main	14,650	14.7	8	23.5
	Pit-Fwd	1,942	1.9	8	3.0
	Pit-Aft	1,271	1.3	8	2.0
	Pit-Back	742	.7	8	1.0
A320-200 (passenger)	N/A	982	.9	8	1.5

Table 5-5-3 Antonov

Aircraft, model, and series	Area	Volume ft^3	Aerosol Calculations		
			1,000 ft^3 Units	Grams/ 1,000 ft^3	Spray Time in Seconds
AN 124 and 126	N/A	26,485	26.5	8	42.5

Table 5-5-4 ATR

Aircraft, model, and series	Area	Volume ft^3	Aerosol Calculations		
			1,000 ft^3 Units	Grams/ 1,000 ft^3	Spray Time in Seconds
ATR 42 (CTO) (Container Transport Option)	Bulk	890	.9	8	1.5
ATR 72 (CTO)	Bulk	1,285	1.3	8	2.0

Table 5-5-5 BAC (British Aircraft Corp)

Aircraft, model, and series	Area	Volume ft^3	Aerosol Calculations		
			1,000 ft^3 Units	Grams/ 1,000 ft^3	Spray Time in Seconds
111-200, 300, and 400	Cabin	4,056	4.1	8	6.5
	Pit-Fwd	380	.4	8	0.5
	Pit-Aft	154	.2	8	0.5
111-500	Cabin	5,094	5.1	8	8.0
	Pit-Fwd	451	.5	8	1.0
	Pit-Aft	260	.3	8	0.5
VC 10	Cabin	6,750	6.8	8	11.0
	Pit-Fwd	744	.7	8	1.0
	Pit-Aft	820	.8	8	1.5
Super VC 10	Cabin	7,850	7.9	8	12.5
	Pit-Fwd	744	.7	8	1.0
	Pit-Aft	820	.8	8	1.5

Table 5-5-6 BAC (Aerospatiale)

Aircraft, model, and series	Area	Volume ft^3	Aerosol Calculations		
			1,000 ft^3 Units	Grams/ 1,000 ft^3	Spray Time in Seconds
Concorde	Cabin	5,100	5.1	8	8.0
	Pit-Fwd	241	.2	8	0.5
	Pit-Aft	468	.5	8	1.0

Table 5-5-7 Boeing

Aircraft, model, and series	Area	Volume ft^3	Aerosol Calculations		
			1,000 ft^3 Units	Grams/ 1,000 ft^3	Spray Time in Seconds
707-120, 120B, and 220	Cabin	7,484	7.5	8	12.0
	Pit-Fwd	755	.8	8	1.5
	Pit-Aft	910	.9	8	1.5
	Fl.Deck	451	.5		1.0
707-320C	Bulk	7,548	7.5	8	12.0
707-320, 420	Cabin	8,074	8.0	8	13.0
	Pit-Fwd	870	.9	8	1.5
	Pit-Aft	905	.9	8	1.5
	Fl. Deck	451	.5	8	1.0
720	Cabin	6,860	6.9	8	11.0
	Pit-Fwd	688	.7	8	1.0
	Pit-Aft	690	.7	8	1.0
	Fl. Deck	451	.5	8	1.0
727-100C	Bulk	4,168	4.2	8	7.0
727-100 (passenger)	Cabin	4,560	4.6	8	7.5
	Pit-Fwd	900	.9	8	1.5
	Pit-Aft	425	.4	8	0.5
	Fl. Deck	451	.5	8	1.0
727-200C	Bulk	8,032	8.0	8	13.0
727-200 (passenger)	Cabin	6,561	6.6	8	10.5
	Pit-Fwd	690	.7	8	1.0
	Pit-Aft	760	.8	8	1.5
	Fl. Deck	451	.5	8	1.0
737-100	Cabin	4,636	4.6	8	7.5
	Pit-Fwd	280	.3	8	0.5
	Pit-Aft	406	.4	8	0.5
737-200 (passenger)	Cabin	4,636	4.6	8	7.5
	Pit-Fwd	370	.4	8	0.5
	Pit-Aft	505	.5	8	1.0
737-200C	Bulk	3,602	3.6	8	6.0
737-300	Cabin	4,900	4.9	8	8.0
	Pit-Fwd	425	.4	8	1.0
	Pit-Aft	650	.7	8	1.0
	Fl. Deck	225	.3	8	0.5

Table 5-5-7 Boeing (continued)

Aircraft, model, and series	Area	Volume ft^3	Aerosol Calculations 1,000 ft^3 Units	Grams/ 1,000 ft^3	Spray Time in Seconds
737-400	Cabin	5,600	5.6	8	9.0
	Pit-Fwd	600	0.6	8	1.0
	Pit-Aft	770	0.8	8	1.5
	Fl. Deck	225	0.2	8	0.5
737-500	Cabin	4,340	4.3	8	7.0
	Pit-Fwd	290	.3	8	0.5
	Pit-Aft	535	.5	8	1.0
	Fl. Deck	255	.3	8	0.5
747 Combi	—	6,886	6.9	8	11.0
747F	—	22,952	23.0	8	37.0
747-100, 200	Cabin	27,650	27.7	8	44.5
	Pit-Fwd	3,485	3.5	8	6.0
	Pit-Aft	3,015	3.0	8	5.0
	Fl. Deck	920	.9	8	1.5
	U. Deck	1,370	1.4	8	2.0
	Belly	1,000	1.0	8	1.5
747-300,400	Cabin	27,650	27.7	8	44.5
	Pit-Fwd	3,485	3.5	8	5.5
	Pit-Aft	3,015	3.0	8	5.0
	Fl. Deck	920	.9	8	1.5
	U. Deck	2,800	2.8	8	4.5
	Belly	1,000	1.0	8	1.5
757-200 (passenger)	Pit-Fwd	652	.6	8	1.0
	Pit-Aft	1,086	1.1	8	2.0
757-200PF	Bulk	8,405	8.4	8	13.5
767-200	Main	14,255	14.3	8	23.0
	Pit-Fwd	1,470	1.5	8	2.5
	Pit-Aft	1,470	1.5	8	2.5
767-300 (passenger)	Cabin	10,497	10.5	8	17.0
	Pit-Fwd	1,920	1.9	8	3.0
	Pit-Aft	1,680	1.7	8	2.5
	Aft+Bulk	430	.4	8	0.5
777-200	Cabin	20,700	20.7	8	33.0
	Pit-Fwd	280	.3	8	0.5
	Pit-Aft	4,630	4.6	8	7.5
	Aft+Bulk	4,220	4.2	8	6.5

Table 5-5-8 Canadair

Aircraft, model, and series	Area	Volume ft^3	Aerosol Calculations 1,000 ft^3 Units	Grams/ 1,000 ft^3	Spray Time in Seconds
CL-44	Bulk	6,235	6.2	8	10.0
CL-440	Bulk	13,798	13.8	8	22.0

Table 5-5-9 Casa

Aircraft, model, and series	Area	Volume ft^3	Aerosol Calculations		
			1,000 ft^3 Units	Grams/ 1,000 ft^3	Spray Time in Seconds
C-212	N/A	777	.8	8	1.5
ATR 72 (CTO)	N/A	1,528	1.5	8	2.5

Table 5-5-10 Cessna

Aircraft, model, and series	Area	Volume ft^3	Aerosol Calculations		
			1,000 ft_3 Units	Grams/ 1,000 ft^3	Spray Time in Seconds
Caravan	N/A	452	.5	8	1.0

Table 5-5-11 Convair

Aircraft, model, and series	Area	Volume ft^3	Aerosol Calculations		
			1,000 ft^3 Units	Grams/ 1,000 ft^3	Spray Time in Seconds
240	Cabin	1,650	1.7	8	2.5
	Pit-Fwd	193	.2	8	0.5
	Belly	88	.1	8	---[1]
340 & 44-	Cabin	1,816	1.8	8	3.0
	Pit-Fwd	158	.2	8	0.5
	Pit-Aft	193	.2	8	0.5
	Belly	78	.1	8	----[1]
880 & 800M	Cabin	5,802	5.8	8	9.5
	Pit-Fwd	415	.4	8	0.5
	Pit-Aft	488	.5	8	1.0
990	Cabin	6,336	6.3	8	10.0
	Pit-Fwd	488	.5	8	1.0
	Pit-Aft	497	.5	8	1.0

1 In these small volume spaces, use the extender and calulate the application time using a rate of 2.5 grams per second. At a rate of 2.5 grams per second, the following table will give the spray time:

1,000 ft^3 UnitsSpray TIme in Seconds

0.10.5
0.20.5
0.31.0
0.41.5

Table 5-5-12 de Havilland

Aircraft, model, and series	Area	Volume ft^3	Aerosol Calculations		
			1,000 ft^3 Units	Grams/ 1,000 ft^3	Spray Time in Seconds
Dash 7, Series 100 (all cargo)	N/A	240	.2	8	0.5
DHC-6 Twin Otter, Series 300 (cargo version)	Fwd Aft Bulk	38 88 384	.1 .1 .4	8 8 8	---[1] ---[1] 0.5
Dash 7, Series 100, Combi (50 passengers)	N/A	240	.2	8	0.5
Dash 7, Series 100, Combi (18 passengers)	N/A	240	.2	8	0.5
Dash 8, Series 300, Combi (49 passengers)	N/A	400	.4	8	0.5
Dash 8, Series 100, Combi (37 passengers)	N/A	300	.3	8	0.5
Dash 8, Series 100, Combi (20 passengers)	N/A	775	.8	8	1.5

1 In these small volume spaces, use the extender and calulate the application time using a rate of 2.5 grams per second. At a rate of 2.5 grams per second, the following table will give the spray time:

1,000 ft^3 Units	Spray TIme in Seconds
0.1	0.5
0.2	0.5
0.3	1.0
0.4	1.5

Table 5-5-13 Dornier

Aircraft, model, and series	Area	Volume ft^3	Aerosol Calculations		
			1,000 ft^3 Units	Grams/ 1,000 ft^3	Spray Time in Seconds
228-212	N/A	642	.6	8	1.0

Table 5-5-14 Embraer

Aircraft, model, and series	Area	Volume ft^3	Aerosol Calculations 1,000 ft^3 Units	Grams/ 1,000 ft^3	Spray Time in Seconds
EMB-120 Brasilia	N/A	1,193	1.2	8	2.0
EMB-110 Brasilia	N/A	523	.5	8	1.0

Table 5-5-15 Fairchild

Aircraft, model, and series	Area	Volume ft^3	Aerosol Calculations 1,000 ft^3 Units	Grams/ 1,000 ft^3	Spray Time in Seconds
Expediter	NA	580	.6	8	1.0
Metro II & IIA	NA	580	.6	8	1.0
F27	Cabin Pit	2,900 192	2.9 .2	8 8	4.5 0.5
FH11227	Cabin Pit	3,200 192	3.2 .2	8 8	5.0 0.5

Table 5-5-16 Fokker

Aircraft, model, and series	Area	Volume ft^3	Aerosol Calculations 1,000 ft^3 Units	Grams/ 1,000 ft^3	Spray Time in Seconds
F27	N/A	198	.2	8	0.5
F28	N/A	290	.3	8	0.5
F100C	Bulk	2,070	2.0	8	3.0

Table 5-5-17 Lockheed

Aircraft, model, and series	Area	Volume ft^3	Aerosol Calculations 1,000 ft^3 Units	Grams/ 1,000 ft^3	Spray Time in Seconds
Electra	Cabin Pit-Fwd Pit-Aft	5,160 254 274	5.2 .3 .3	8 8 8	8.5 0.5 0.5
L1011 (100) (200) (250)	Cabin Pit-Fwd Pit-Ctr Pit-Aft Galley	23,100 1,600 1,600 700 1,380	23.1 1.6 1.6 .7 1.4	8 8 8 8 8	37.0 2.5 2.5 1.0 2.0
L-1011-1	Cargo Holds	3,900	3.9	8	6.0
L-100-30	N/A	6,057	6.1	8	10.0

Table 5-5-18 McDonnel-Douglas

Aircraft, model, and series	Area	Volume ft^3	Aerosol Calculations		
			1,000 ft^3 Units	Grams/ 1,000 ft^3	Spray Time in Seconds
DC-3	Bulk	1,300	1.3	8	2.0
DC-6 (cargo)	Bulk	3,354	3.4	8	5.5
DC-6 (passengers)	Cabin	4,332	1.3	8	7.0
	Pit-Fwd	200	.2	8	0.5
	Pit-Aft	173	.2	8	0.5
DC-6A	Cabin	4,375	4.4	8	7.0
	Pit-Fwd	267	.3	8	0.5
	Pit-Aft	300	.3	8	0.5
DC-6B	Cabin	4,375	4.4	8	7.0
	Pit-Fwd	276	.3	8	0.5
	Pit-Aft	242	.2	8	0.5
DC-7B	Cabin	4,612	4.6	8	7.0
	Pit-Fwd	267	.3	8	0.5
	Pit-Aft	364	.4	8	0.5
DC-7C	Cabin	4,778	4.8	8	7.5
	Pit-Fwd	312	.3	8	0.5
	Pit-Aft	339	.3	8	0.5
DC-8-50	Cabin	12,911	12.9	8	20.5
	Pit-Fwd	690	.7	8	1.0
	Pit-Aft	700	.7	8	1.0
DC-8-54F	Main	5,984	6.0	8	9.5
	Pit-Fwd	690	.7	8	1.0
	Pit-Aft	700	.7	8	1.0
DC-8-55F	Main	5,878	5.9	8	9.5
	Pit-Fwd	690	.7	8	1.0
	Pit-Aft	700	.7	8	1.0
DC-8-61 & 63	Cabin	15,955	16.0	8	25.5
	Pit-Fwd	1,290	1.3	8	2.0
	Pit-Aft	1,210	1.2	8	2.0
DC-8-62	Cabin	13,739	13.7	8	22.0
	Pit-Fwd	799	.8	8	1.5
	Pit-Aft	816	.8	8	1.5
DC-8-62CF	Main	6,442	6.4	8	10.0
	Pit-Fwd	800	.8	8	1.5
	Pit-Aft	815	.8	8	1.5
DC-8-63F and DC-8-73F	Main	10,350	10.4	8	16.5
	Pit-Fwd	1,290	1.3	8	2.0
	Pit-Aft	1,210	1.2	8	2.0
DC-8-71CF	Main	8,148	8.1	8	13.0
	Pit-Fwd	1,290	1.3	8	2.0
	Pit-Aft	1,210	1.2	8	2.0
DC-8-61CF & 71CF	Main	15,472	15.5	8	25.0
	Pit-Fwd	1,290	1.3	8	2.0
	Pit-Aft	1,210	1.2	8	2.0

Table 5-5-18 McDonnel-Douglas (continued)

Aircraft, model, and series	Area	Volume ft^3	Aerosol Calculations 1,000 ft^3 Units	Grams/ 1,000 ft^3	Spray Time in Seconds
DC-9-10	Cabin	4,056	4.1	8	6.5
	Pit-Fwd	1,000	1.0	8	1.5
	Pit-Aft	619	0.6	8	1.0
DC-9-10AF	Main	2,386	2.4	8	4.0
	Pit-Fwd	373	.4	8	0.5
	Pit-Aft	327	.3	8	0.5
DC-9-30	Cabin	5,094	5.1	8	8.0
	Pit-Fwd	1,386	1.4	8	2.0
	Pit-Aft	832	.8	8	1.5
DC-9-32AF	Main	3,300	3.3	8	5.5
	Pit-Fwd	562	.6	8	1.0
	Pit-Aft	333	.3	8	0.5
DC-9-33CF	Main	2,944	2.9	8	4.5
	Pit-Fwd	562	.6	8	1.0
	Pit-Aft	333	.3	8	0.5
DC-40	Cabin	5,535	5.5	8	9.0
	Pit-Fwd	1,290	1.3	8	2.0
	Pit-Aft	1,040	1.0	8	1.5
DC-10-10CF & 10F, also DC-10-30CF & 30F	Main	12,236	12.2	8	19.5
	Pit-Fwd	3,020	3.0	8	5.0
	Pit-Ctr	1,935	1.9	8	3.0
	Pit-Aft	510	.5	8	1.0
	Fl. Deck	400	.4	8	0.5
MD 8-61/63	Main	11,173	11.2	8	18.0
	Pit-Fwd	1,290	1.3	8	2.0
	Pit-Aft	1,210	1.2	8	2.0
MD8-62	Main	8,862	8.9	8	14.0
	Pit-Fwd	800	.8	8	1.5
	Pit-Aft	815	.8	8	1.5
MD9-10	Main	3,582	3.6	8	6.0
	Pit-Fwd	393	.4	8	0.5
	Pit-Aft	254	.3	8	0.5
MD9-30	Main	4,525	4.5	8	7.0
	Pit-Fwd	562	.6	8	1.0
	Pit-Aft	333	.3	8	0.5
MD9-40	Main	4,926	4.9	8	8.0
	Pit-Fwd	618	.6	8	1.0
	Pit-Aft	350	.4	8	0.5
MD-11F	Main Deck	15,530	15.5	8	25.0
	Lower Deck	4,976	5.0	8	8.0
MD-11 Combi	Main	5,822	5.8	8	9.5
	Pit-Fwd	3,655	3.7	8	6.0
	Pit-Ctr	2,685	2.7	8	4.5
	Pit-Aft	510	.5		1.0

Table 5-5-18 McDonnel-Douglas (continued)

Aircraft, model, and series	Area	Volume ft^3	Aerosol Calculations		
			1,000 ft^3 Units	Grams/ 1,000 ft^3	Spray Time in Seconds
MD-80 JT8D-217	Lower Hold	1,253	1.3	8	2.0
MD-80 JT8D-219	Lower Hold	1,013	1.0	8	1.5
MD 81 & 82	Cargo	1,253	1.3	8	2.0
MD-83	Cargo	1,013	1.0	8	1.5
MD-87	Cargo	938 or 697	.9 .7	8 8	1.5 1.0
MD-88	Cargo	1,013 or 1,253	1.0 1.3	8 8	1.5 2.0

Table 5-5-19 SAAB

Aircraft, model, and series	Area	Volume ft^3	Aerosol Calculations		
			1,000 ft^3 Units	Grams/ 1,000 ft^3	Spray Time in Seconds
340 B/QC	N/A	1,303	1.3	8	2.0

Table 5-5-20 Shorts

Aircraft, model, and series	Area	Volume ft^3	Aerosol Calculations		
			1,000 ft^3 Units	Grams/ 1,000 ft^3	Spray Time in Seconds
330	N/A	1,230	1.2	8	2.0
360 and 360-F	N/A	1,450	1.5	8	2.5

Table 5-5-21 Sidely

Aircraft, model, and series	Area	Volume ft^3	Aerosol Calculations		
			1,000 ft^3 Units	Grams/ 1,000 ft^3	Spray Time in Seconds
Carvelle	Cabin Pit-Fwd Pit-Aft	5,600 258 116	5.6 .3 .1	8 8 8	9.0 0.5 ---[1]

1 In these small volume spaces, use the extender and calulate the application time using a rate of 2.5 grams per second. At a rate of 2.5 grams per second, the following table will give the spray time:

1,000 ft^3 UnitsSpray TIme in Seconds

0.10.5
0.20.5
0.31.0
0.41.5

Table 5-5-22 Tupolev

Aircraft, model, and series	Area	Volume ft^3	Aerosol Calculations		
			1,000 ft^3 Units	Grams/ 1,000 ft^3	Spray Time in Seconds
TU-154	Bulk	5,000	5.0	8	8.0

Table 5-5-23 Vickers

Aircraft, model, and series	Area	Volume ft^3	Aerosol Calculations		
			1,000 ft^3 Units	Grams/ 1,000 ft^3	Spray Time in Seconds
Merchantman	Bulk	5,040	5.0	8	8.0
Viscount	Bulk	3,000	3.0	8	5.0

Table 5-5-24 Military Aircraft

Aircraft, model, and series	Area	Volume ft^3	Aerosol Calculations		
			1,000 ft^3 Units	Grams/ 1,000 ft^3	Spray Time in Seconds
C-5A	Main	46,651	46.7	8	74.5
	U. Deck	6,147	6.1	8	10.0
	Fwd. &			8	
	Fl. Deck	5,147	5.1	8	8.0
	U. Floor	6,294	6.3	8	10.0
C-17	Main	20,875	20.9	8	33.5
C-26	Cabin	500	.5	8	1.0
	Pit	198	.2	8	0.5
C-130	Main	8,340	8.3	8	13.5
C-130 LG382		4,737	4.7	8	7.5
C-130 LG385-G		6,057	6.1	8	10.0
C-135	Cabin	6,000	6.0	8	9.5
C-141	Main	12,000	12.0	8	19.0
C-141B	Main	13,701	13.7	8	22.0
KC-10	Cabin	4,056	4.1	8	6.5
	Pit-Fwd	1,000	1.0	8	1.5
	Pit-Aft	619	.6	8	1.0

T410—Tick Infestations

T410 Nonplant articles (i.e., bat guano, fence posts, etc.)

Pest: Ticks

Treatment: Use T310 schedules, Tick-infested materials (nonfood)

T411—Ant Infestations—Nonplant Products

T411

Pest: Ants

Treatment: T411—MB at NAP

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At: 0.5 hr	2.5 hrs	3 hrs	3.5 hrs	4 hrs
90-96 °F	2 lbs	24	16	—	—	—
80-89 °F	2.5 lbs	30	24	—	—	—
70-79 °F	3 lbs	36	24	—	—	—
60-69 °F	3 lbs	36	—	24	—	—
50-59 °F	3 lbs	36	—	—	24	—
40-49 °F	3 lbs	36	—	—	—	24

T412—Noxious Weed Seeds (Devitalization Treatment)

T412-a *Guizotia abyssinica* (niger seed)

Pest: Weed seeds of the following genera:
Asphodelus fistulosus (onionweed)
Digitaria spp. (includes African couchgrass)
Oryza spp. (red rice)
Paspalum scrobiculatum (Kodo-millet)
Prosopis spp. (includes mesquites)
Solanum viarum (tropical soda apple)
Striga spp. (witchweed)
Urochloa panicoides (liver-seed grass)

Treatment: T412-a—Dry Heat Treatment at 248°F (120°C) for 15 minutes

Important

Do not start counting time until the entire mass reaches the required temperature.

T412-b-1 Noxious weed seeds (devitalization treatment)

Pest: *Cuscuta* spp.

Two alternative treatments

Treatment: T412-b-1—Dry heat—commodity heated to 212°F (100°C) for 15 minutes

T412-b-2 Noxious weed seeds (devitalization treatment)

Pest: *Cuscuta* spp.

Treatment: T412-b-2—Steam heat—commodity heated to 212°F (100°C) for 15 minutes

T412-b-3 Deleted

T413—Brassware from Mumbai (Bombay), India

T413-a Brassware from Mumbai (Bombay), India

Two alternative treatments

Pest: *Trogoderma granarium* (khapra beetle)

Treatment: T413-a—MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:		
		0.5 hr	2 hrs	12 hrs
90 °F or above	2.5 lbs	30	20	15
80-89 °F	3.5 lbs	42	30	20
70-79 °F	4.5 lbs	54	40	25
60-69 °F[1]	6 lbs	72	50	30
50-59 °F	7.5 lbs	90	60	35
40-49 °F[2]	9 lbs	108	70	40

1 Use MB 100 gas at 60 °F or above.

2 Use MB "Q" gas at 40 °F or above.

Important

When both woodborers and khapra beetles are involved, use schedule ***T404-d*** on **page 5-5-19**.

T413-b

Brassware from Mumbai (Bombay), India

Treatment: T413-b—MB in 26" vacuum

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
60 °F or above[1]	8 lbs	3 hrs
40-59 °F[2]	9 lbs	3 hrs

1 Use MB 100 gas at 60 °F or above.

2 Use MB "Q" gas at 40 °F or above.

NOTICE

Load limit is 75 percent of chamber volume.

T414—Inanimate, Nonfood Articles with Gypsy Moth Egg Masses

T414

Inanimate, nonfood articles with Gypsy Moth egg masses

Pest: Gypsy Moth egg masses

Treatment: T414—MB at NAP—tarpaulin or chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:				
		0.5 hr	4 hrs	8 hrs	12 hrs	16 hrs
50 °F or above	3.5 lbs	42	28	—	—	—
	2.5 lbs	30	20	14	—	—
	2 lbs	24	16	12	12	10
40-49 °F	4.5 lbs	54	36	—	—	—
	3.25 lbs	38	26	18	—	—
	2.25 lbs	30	20	14	14	12

Important

For *Lymantria dispar* (gypsy moth) egg masses on such items as outdoor household articles, quarry products, lumber, logs, and timber products.

T415—Garbage

Three alternative treatments are approved. The treatments can be used for commodity destruction.

T415-a

Garbage

Pest: Insect pest and pathogens

Treatment: T415-a—Heat Treatment- Incinerate to ash.

Important

Caterers under compliance agreement using an incinerator for garbage must comply with the following conditions:

- Incinerator must be capable of reducing garbage to ash
- Incinerator must be maintained adequately to assure continued operation

T415-b

Garbage

Pest: Insect pest and pathogens

Treatment: T415-b—Dry heat or Steam- commonly heated to internal temperature of 212 °F (100 °C) for 30 minutes folllowed by burial in a landfill.

Important

Caterers under compliance agreement using a sterilizer must comply with the following conditions:

The sterilizer must be capable of heating garbage to an internal temperature of 212° F and maintaining it at that temperature for a minimum of 30 minutes.

Reevaluate and adjust the sterilization cycle twice a year using a thermocouple to recalibrate the temperature recording device. Adjusting the sterilization cycle semiannually will assure that all garbage processed is heated to a minimum internal temperature of 212° F for at least 30 minutes, and that the temperature recording device accurately reflects the internal temperature of the sterilizer.

NOTICE

Observe all reevaluations and adjustments.

The operator is to date and initial time/temperature records for each batch of garbage sterilized. The supervisor is to review and sign each time/temperature record. The facility must retain records for 6 months for review by PPQ.

Clean the drain in the bottom of the sterilizer between each cycle to assure proper heat circulation

T415-c

Garbage

Pest: Insect pest and pathogens

Treatment: T415-c—Grinding and discharge into an approved sewage system

Important

Grinding and discharging is allowed into an approved sewage system. An approved sewage system is designed and operated in such a way as to preclude the discharge of sewage effluents onto land surfaces or into lagoons or other stationary waters, is adequate to prevent the dissemination of plant pests and livestock or poultry diseases, and is certified by an appropriate government official as currently complying with the applicable laws for environmental protection.

T416—Goatskins, Lambskins, Sheepskins (Skins and Hides)

Three alternative treatments

Important

Fur, horsehair articles, and leather goods (skins and hides), may cause off-odors that may be unacceptable when exposed to methyl bromide (MB).

Important

Items known to be sorptive or items whose sorptive properties are unknown are not to be fumigated in chambers at NAP unless gas concentration readings are taken.

T416-a-1

Goatskins, lambskins, sheepskins (skins and hides)

Pest *Trogoderma granarium* (khapra beetle)

Treatment MB (“Q” gas only) at NAP—tarpaulin

Temperature	Dosage Rate (lb/ 1,000 ft^3)	Minimum Concentration Readings (ounces) At:		
		0.5 hr	2 hrs	12 hrs
90 °F or above	2.5 lbs	30	20	15
80-89 °F	3.5 lbs	42	30	20
70-79 °F	4.5 lbs	54	40	25
60-69 °F	6 lbs	72	50	30
50-59 °F	7.5 lbs	90	60	35
40-49 °F	9 lbs	108	70	40

The sorptive rates of commodities vary. When a commodity is known or suspected to be sorptive (see ***Sorption*** on **page 2-3-6**), take more gas readings than normal. Additional fumigant is added as prescribed on ***Additional Readings*** on **page 2-4-22**.

When both woodborers and khapra beetles are involved, use schedule ***T404-d*** on **page 5-5-19**.

T416-a-2 Goatskins, lambskins, sheepskins (skins and hides)

NOTICE

Load limit is 75 percent of chamber volume.

Pest *Trogoderma granarium* (khapra beetle)

Treatment MB (“Q” label gas) in 26” vacuum

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
60 °F or above	8 lbs	3 hrs
40-59 °F	9 lbs	3 hrs

T416-a-3 Goatskins, lambskins, sheepskins (skins and hides)

Pest *Trogoderma granarium* (khapra beetle)

Treatment MB (“Q” gas only) in 26" vacuum—chamber

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
90-96 °F	2.5 lbs	12 hrs
80-89 °F	3.5 lbs	12 hrs
70-79 °F	4.5 lbs	12 hrs
60-69 °F	6 lbs	12 hrs
50-59 °F	10 lbs	12 hrs
40-49 °F	12 lbs	12 hrs

Amount of Phosphine liberated by various products

Calculate amount of product needed by using the amount of phosphine released as shown in the right column.

Table 5-5-25 Amount of Phosphine Liberated by Various Products

Product	Type	Unit and weight in grams	Grams of phosphine*
Degesch Fumi-Cel®	MP	1 plate; 117.0	33.0
Degesch Fumi-Strip®	MP	16 plates; 1872.0	528.0
Degesch Phostoxin®	AP	1 tablet; 3.0	1.0
Degesch Phostoxin® Tablet Prepac Rope	AP	1 prepac; 99.0 (strip or rope of 33 tablets)	33.0
Detia	AP	1 tablet; 3.0	1.0
Detia Rotox AP	AP	1 pellet; 0.6	0.2
Detia Gas EX-B	AP	1 bag or sachet; 34.0	11.4
Fumiphos tablets	AP	1 tablet; 3.0	1.0
Fumiphos pellets	AP	1 pellet; 0.6	0.2
Fumiphos bags	AP	1 bag; 34.0	11.0
Fumitoxin	AP	1 tablet; 3.0	1.0
Fumitoxin	AP	1 pellet; 0.6	0.2
Fumitoxin	AP	1 bag; 34.0	11.0
Gastoxin	AP	1 tablet; 3.0	1.0
Gastoxin	AP	1 pellet; 0.6	0.2
“L” Fume	AP AP	1 pellet; 0.5 1 pellet; 0.6	0.18 0.22
Phos-Kill	AP	1 tablet; 3.0	1.1
Phos-Kill	AP	1 pellet; 0.6	0.22
Phos-Kill	AP	1 bag; 34.0	12.0

*Reacts with moisture in the air to yield grams of phosphine.

5

Treatment Manual

Treatment Schedules

T500 - Schedules for Plant Pests or Pathogens

Contents

The following Schedules are listed by plant pest or pathogen

General Schedules

T501—Pest: Chrysomyxa spp. 5-6-3
Pest: Chrysomyxa spp. 5-6-3
Pest: Cercospora spp. 5-6-3
Pest: Phoma chrysanthemi 5-6-3
T502—Pest: Potato cyst nematode 5-6-4
T503—Pest: Diseases listed in 7CFR 319.24: Downy Mildews and Physoderma diseases of Maize 5-6-5
T504—Pest: Flag smut 5-6-5
T505—T505—Treatment for Infestation of Chrysomyxa spp. on various commodities 5-6-6
T506—Pest: Potato cyst nematode 5-6-7
T507—Pest: Phyllosticta bromeliae, Uredo spp. (when destined to Florida, refuse entry) 5-6-8.
Pest: Septoria gentianae 5-6-8
T508—Pest: Rusts 5-6-8
T509—**Pest: Cylindrosporium camalliae 5-6-9**
Pest: Hemileia spp. Leptosphaeria spp. Mycosphaerella spp. Opiodothella orchidearum Phomopsis orchidophilia Phyllachora spp. Phyllosticta spp. Sphenospora spp. Sphaerodothis spp. Uredo spp. (except U. scabies) 5-6-9
T510—Pest: Various corn-related diseases 5-6-9
T511—Pest: Xanthomonas axonopodis, pv. citri (citrus canker) 5-6-10
T512—(Deleted) 5-6-10
T513—Pest: Ascochyta spp. 5-6-10
T514—**Pest: Xanthomonas albilineans and X. vasculorum 5-6-11**
T515—Pest: Various sugarcane-related diseases 5-6-11
T516 (Deleted) 5-6-12)
TT517 (Deleted) 5-6-12)
T518—Pest: Various rice-related diseases 5-6-12
T519—Pest: Various rice-related diseases 5-6-12
T520—**Pest: Verticillium albo-atrum 5-6-14**

Hot Water Treatments

T551—**Pest: Globodera rostochiensis, G. pallida 5-6-14**
T552—**Pest: Bulb nematodes: Ditylenchus dipsaci, D. destructor 5-6-14**

T553—Pest: Root-knot nematodes (Meloidogyne spp.) 5-6-15)
Pest: Lesion nematodes (Pratylenchus spp.) 5-6-15
Pest: Golden nematodes (Globodera rostochiensis and G. pallida) 5-6-15
Pest: Foliar nematodes (Aphelenchoides fragariae) 5-6-15
Pest: Cyst nematodes (Heterodera humuli) 5-6-15
T554—Pest: Bulb nematodes—Ditylenchus dipsaci and D. destructor 5-6-16
T555—Pest: Bulb nematodes—Ditylenchus dipsaci 5-6-16
T556—Pest: Root-knot nematodes (Meloidogyne spp.) 5-6-16
T557—Pest: Meloidogyne spp. and Pratylenchus spp. 5-6-16
T558—Pest: Pratylenchus spp. (surface diseases) 5-6-17
T559—Pest: White tip nematode (Aphelenchoides besseyi) 5-6-17
T560—Pest: Meloidogyne spp. 5-6-17.
T561—Treatment for Infestations of Cercospora mamaonis and Phomopsis carica-papayae on Papayas 5-6-17
T562—(deleted) 5-6-18
T563—(deleted) 5-6-18
T564—Pest: Foliar nematodes (Aphelenchoides fragariae) 5-6-20
T565—**Pest: Ditylenchus destructor 5-6-18**
Pest: Ditylenchus dipsaci 5-6-19i
Pest: Aphelenchoides subtenuis, Ditylenchus destructor 5-6-18
Pest: Globodera rostochiensis, G. pallida 5-6-19
T566—Pest: Precautionary treatment for corn-related diseases 5-6-19
Pest: Aphelenchoides fragariae 5-6-19
T567—Pest: Bulb nematodes (Ditylenchus dipsaci) 5-6-19
T568—Pest: Foliar nematodes (Aphelenchoides fragariae) 5-6-20
T569—Pest: Foliar nematodes (Aphelenchoides fragariae) 5-6-20
T570—Pest: Pratylenchus spp. 5-6-20.
Pest: Aphelenchoides fragariae spp. 5-6-20
T571—(Deleted) 5-6-20

The following section lists the recommended treatments or actions to be applied to items or commodities found infected with various diseases, or infested with various plant pests including nematodes. Commodities may include cut flowers and greenery, propagative plant materials, as well as entire plants. Due to recent restrictions and prohibitions on the use of certain chemicals, every effort has been made to substitute the best alternative treatment available to us. The diseases and commodities for which these treatments are recommended are listed in the Index to Schedules and with the following treatment schedules. Ports should endeavor to make post-treatment examinations or arrange to have the consignee or importer submit data concerning the material following the treatment. Ports should forward any information of this nature to:

Center for Plant Health Science & Technology
USDA-APHIS-PPQ-CPHST
Treatment Quality Assurance Unit
1730 Varsity Drive, Suite 400
Raleigh, NC 27606

T501—Treatment for infestation of Chrysomyxa spp., Cercospora spp., and Phoma chrysanthemi on various commodities

T501-1 Azalea

Pest: *Chrysomyxa* spp.

Treatment: T501-1 Remove infected parts and treat all plants of same species in shipment with 4-4-50 Bordeaux dip or spray.

Important

See alternative treatment **T501-1** for *Chrysomyxa* spp.

T501-2 Azaleodendron

Pest: *Chrysomyxa* spp.

Treatment: T501-2 Remove infected parts and treat all plants of same species in shipment with 4-4-50 Bordeaux dip or spray.

Important

see alternative treatment **T501-1** for *Chrysomyxa* spp.

T501-4 Chrysanthemum

Pest: *Phoma chrysanthemi*

Treatment: T501-4 Remove infected parts and treat all plants of same species in shipment with 4-4-50 Bordeaux dip or spray.

T501-5 Christmas trees

Pest: *Phoma chrysanthemi*

Treatment: T501-5 Remove infected parts and treat all plants of same species in shipment with 4-4-50 Bordeaux dip or spray.

T501-3 Orchid

Pest: *Cercospora* spp.

Treatment: T501-3 Remove infected parts and treat all plants of same species in shipment with 4-4-50 Bordeaux dip or spray.

T501-6 Rhododendron

Pest: *Chrysomyxa* spp.

Treatment: T501-6 Remove infected parts and treat all plants of same species in shipment with 4-4-50 Bordeaux dip or spray.

Important

see alternative treatment **T501-2** for *Chrysomyxa* spp.

T502—Treatment for infestation of Potato cyst nematode on various commodities

T502-1 Bags and bagging used for commodities grown in soil

Pest: Potato cyst nematode

Treatment: T502-1 Methyl bromide—8 lbs/1,000 ft^3 for 16 hours in 26" vacuum at 40 °F or above.

T502-2 Covers used for commodities grown in soil

Pest: Potato cyst nematode

Treatment: T502-2 Methyl bromide—8 lbs/1,000 ft^3 for 16 hours in 26" vacuum at 40 °F or above.

T502-3 Soil

Pest: Potato cyst nematode

Treatment: T502-3 Methyl bromide—8 lbs/1,000 ft^3 for 16 hours in 26" vacuum at 40 °F or above.

T503—Treatments for Infestations of Downy Mildews and Physoderma diseases of Maize

T503-1 Bags and bagging (used) for small grains

Pest: Diseases listed in 7CFR 319.24: Downy Mildews and Physoderma diseases of Maize

Alternative treatments:

Treatment: T503-1-2 Hot water treatment—soak in water slightly below boiling (212 °F) for 1 hour.

Treatment: T503-1-3 Live steam for 10 minutes at 240 °F, NAP. For baled material, live steam at 10 pounds pressure for 20 minutes.

Treatment: T503-1-4 Dry heat at 212 °F for 1 hour. Treat small bales only.

T503-2 Covers used for small grains

Pest: Diseases listed in 7CFR 319.24: Downy Mildews and Physoderma diseases of Maize

Alternative treatments:

Treatment: T503-2-2 Hot water treatment—soak in water slightly below boiling (212 °F) for 1 hour.

Treatment: T503-2-3 Live steam for 10 minutes at 240 °F, NAP. For baled material, live steam at 10 pounds pressure for 20 minutes.

Treatment: T503-2-4 Dry heat at 212 °F for 1 hour. Treat small bales only.

T504—Treatment for Infestation of Flag Smut on various commodities

T504-1 Bags and bagging (used) for small grains

Pest: Flag smut

Alternative treatments:

Treatment: T504-1-1 Dry heat at 212 °F for 1 hour. Treat small bales only.

Treatment: T504-1-2 Steam at 10 pounds pressure at 242 °F (114 °C) for 20 minutes.

T504-2 Covers used for wheat

Pest: Flag smut
Alternative treatments:

Treatment: T504-2-1 Dry heat at 212 °F for 1 hour. Treat small bales only.

Treatment: T504-2-2 Steam at 10 pounds pressure at 242 °F (114 °C) for 20 minutes.

T505—Treatment for Infestation of *Chrysomyxa* spp. on various commodities

T505-1 Azaleodendron

Pest: Chrysomyxa spp.
Alternative treatments:

Treatment: T505-1-1 Treat with mancozeb or other approved fungicide of equal effectiveness. (Use label instructions for treatment.)

Treatment: T505-1-2 see alternative treatment T501

T505-2 Rhododendron

Pest: Chrysomyxa spp.
Alternative treatments:

Treatment: T505-2-1 Treat with mancozeb or other approved fungicide of equal effectiveness. (Use label instructions for treatment.)

Treatment: T505-2-2 see alternative treatment T501-1.

T506—Treatment for Infestation of Potato Cyst Nematode on various commodities

T506-1

Containers

Pest: Potato cyst nematode
Alternative treatments:

Treatment: T506-1-1 MB (“Q” label only) in 26" vacuum

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
40 °F or above	8 lbs	16 hrs
OR	10.5 lbs	12 hrs
OR	16 lbs	8 hrs

Treatment: T506-1-3 High pressure steam. see nonplant articles T506C.

T506-2

Nonplant articles

Pest: Potato cyst nematode
Alternative treatments:

Treatment: T506-2-1 MB (“Q” label only) in 26" vacuum

Temperature	Dosage Rate (lb/1,000 ft^3)	Exposure Period
40 °F or above	8 lbs	16 hrs
OR	10.5 lbs	12 hrs
OR	16 lbs	8 hrs

Treatment: T506-2-3 High pressure steam.

Live steam is introduced into a closed chamber containing the material to be treated until the required temperature and pressure are indicated. The temperature/pressure relationship is maintained at or above this point for the required exposure period. The exposure period will depend on the nature of the material, quantity, and its penetrable condition.

For loose masses of material which permit rapid and complete penetration of steam to all parts of the mass, no initial vacuum is needed but air must be released until steam vapor escapes, and exposure at 20 pounds pressure for 10 minutes, 15 pounds for 15 minutes, or 10 pounds for 20 minutes is sufficient.

For closely packed material, such as soil, special measures are needed to ensure rapid heat penetration to all parts of the material. Soil, if in large containers, will not allow adequate treatment under normal sterilization

exposure periods. Quicker penetration of the steam is obtained by first exhausting the air in the chamber to a high vacuum and then introducing live steam until the required positive pressure is reached.

T507—Treatment for Infestation of *Phyllosticta bromeliae*, *Uredo* and *Septoria gentianae* on various commodities

T507-1 Bromeliads

Pest: *Phyllosticta bromeliae, Uredo* spp. (when destined to Florida, refuse entry)

Treatment: T507-1 Remove infected leaves and treat all plants of same species in shipment with Captan following label directions.

Important

Advise importer or consignee that treatment may cause commodity damage.

T507-2 *Gentiana*

Pest: *Septoria gentianae*

Treatment: T507-2 Remove infected leaves and treat all plants of same species in shipment with Captan following label directions.

Important

Advise importer or consignee that treatment may cause commodity damage.

T508—Treatment for Infestation of Rusts on various commodities

T508-1 Orchids (to Florida)

Pest: Rusts

Treatment: T508-1 ***For rust-infected shipments to Florida:*** Refuse entry to all infected plants and all other plants of the same species or variety in the shipment. Treat other orchid species in the shipment (which may have become contaminated) with Captan. Repackage treated orchids in clean shipping containers. For rusts on orchids to States other than Florida, follow the procedures in T509.

T509—Treatment for Infestation of Various Plant Pests of Camellia and Orchids

T509-1 Camellia

Pest: *Cylindrosporium camalliae*

Alternative treatments:

Treatment: T509-1-1 ***Light infection:*** Remove infected leaves and dip or spray plant with 4-4-50 Bordeaux. Dry quickly and thoroughly before release.

Treatment: T509-1-2 ***Heavy infection:*** Refuse entry.

T509-2 Orchids

Pest: *Hemileia* spp.
Leptosphaeria spp.
Mycosphaerella spp.
Opiodothella orchidearum
Phomopsis orchidophilia
Phyllachora spp.
Phyllosticta spp.
Sphenospora spp.
Sphaerodothis spp.
Uredo spp. (except *U. scabies*)

Alternative treatments:

Treatment: T509-2-1 ***Light infection:*** Remove infected leaves and dip or spray plant with 4-4-50 Bordeaux. Dry quickly and thoroughly before release.

Treatment: T509-2-2 ***Heavy infection:*** Refuse entry.

T510—Treatment for Infestation of Various Corn-Related diseases

T510-1 Corn (seed) (Commercial lots (not for propagation))

Pest: Various corn-related diseases

Treatment: T510-1 Live steam from jet or nozzle into loose masses of material until all parts reach 212 °F.

T510-2 Corn (seed) (Small lots for propagation but not for food, feed, or oil purposes)

Pest: Various corn-related diseases

Treatment: T510-2 Treat seeds with a dry application of Mancozeb in combination with Captan. Disinfect bags by: 1) Dry heat at 212 °F for 1 hour. Treat small bales only; or 2) Steam at 10 pounds pressure at 40 °F for 20 minutes.

T511—Precautionary treatment for Infestations of Xanthomonas axonopodis, pv. citri (citrus canker)

T511-1 Citrus and other Rutaceous seeds from citrus canker countries

Pest: *Xanthomonas axonopodis*, pv. *citri* (citrus canker)

Treatment: T511-1 seeds shall be treated for possible infection with citrus canker bacteria by first washing the seeds if any mucilaginous materials is adhering. Next, immerse the seeds in water at 125 degree F or higher for 10 minutes. Then immerse seed for a period of at least 2 minutes in a 0.525 percent sodium hypochlorite (Clorox) solution at a pH of 6.0 to 7.5. Drain, dry and repack near original moisture content.

Important

A 0.525 percent sodium hypochlorite solution is prepared by diluting 1 part Clorox (containing 5.25 percent sodium hypochlorite) in 9 parts of water. If using "ultra strength" chlorine bleach, use only 3/4 as much bleach.

T512—(Deleted)

T513—Treatment for Infestations of *Ascochyta* on various commodities

T513-1 Orchids

Pest: *Ascochyta* spp.

Treatment: T513-1 Defoliate if leaf-borne only; refuse entry if pseudo-bulbs infected.

T514—Treatment for Infestations of *Xanthomonas albilineans* and *X. vasculorum*

T514-1 Saccharum (sugarcane) (seed pieces)

Pest: *Xanthomonas albilineans and X. vasculorum*

Treatment: T514-1 Presoak in water at room temperature for 24 hours then immerse in water at 122 °F for 3 hours.

This treatment may damage sprouted cane.

T514-2 Saccharum (sugarcane) (True seed (fuzz))

Pest: *Xanthomonas albilineans and X. vasculorum*

Treatment: T514-2 Immerse in 0.525 percent sodium hypochlorite solution for 30 minutes followed by at least 8 hours air drying before packaging. (Dilute 1 part Clorox or similar solution containing 5.25 percent sodium hypochlorite; if using “ultra strength” chlorine bleach, use only 3/4 as much bleach).

T514-3 Saccharum (sugarcane) (Bagasse)

Pest: *Xanthomonas albilineans and X. vasculorum*

Treatment: T514-3 Dry heat treatment for 2 hours at 158 °F.

T514-4 Saccharum (sugarcane) (Field and processing equipment)

Pest: *Xanthomonas albilineans and X. vasculorum*

Treatment: T514-4 Remove all debris and soil from equipment with water at high pressure (300 pounds per square inch minimum) or with steam.

T515—Treatment for Infestations of various Sugarcane-Related diseases

T515-1 Sugarcane (Baled)

Pest: Various sugarcane-related diseases
Alternative treatments:

Treatment: T515-1 Introduce live steam into 25" vacuum until pressure reaches 15 to 20 pounds. Hold until center of bale is 220 °F–230 °F and maintain for 30 minutes.

T515-2-1 Sugarcane (Loose Sugarcane)

Treatment: T515-2-1 Introduce steam into 25" vacuum (or if with initial vacuum, “bleed” air until steam vapor fills chamber).

T515-2-3 Sugarcane (Loose Sugarcane)

Treatment: T515-2-3 Dry heat—212 °F for 1 hour.

T515-2-4 Sugarcane (Loose Sugarcane)

Treatment: T515-2-4 Pulped in water at 190 °F–205 °F, followed by drying at 212 °F for 1 hour.

T515-2-5 Sugarcane (Loose Sugarcane)

Treatment: T515-2-5 Flash heated to 1,000 °F (Arnold dryer).

T516 (Deleted)

T517 (Deleted)

T518—Treatment for Infestations of Various Rice-Related diseases

T518-1 Brooms made of rice straw

Pest: Various rice-related diseases

Treatment: T518-1 Dry heat at 170 °F for 4.5 hours—may take 2 hours to reach this temperature.

T518-2-1 Novelties made of rice straw

Two alternative treatments

Pest: Various rice-related diseases

Treatment: T518-2-1 Dry heat at 180 °F–200 °F for 2 hours

T518-2-2 Novelties made with rice straw

Pest: Various rice-related diseases

Treatment: T518-2-2 Steam sterilization

Temperature	Pressure	Exposure Period
260 °F	20 lbs	15 minutes
250 °F	15 lbs	20 minutes

T519—Treatment for Infestations of Various Rice-Related diseases

T519-1 Closely packed rice straw and hulls

Pest: Various rice-related diseases

Treatment: T519-1 Introduce steam into 28" vacuum until pressure reaches 10 pounds and hold for 20 minutes.

T519-2 Loose rice straw and hulls

Pest: Various rice-related diseases

Treatment: T519-2 Introduce steam into 28" vacuum (or if without initial vacuum, “bleed” air until steam vapor escapes) until pressure reaches 20 pounds AND temperature 259 °F and hold for 10 minutes (OR 10 pounds and 240 °F for 20 minutes).

Important

see also **T518-1**.

T520—Treatment for Infestation of Verticillium albo-atrum on various commodities

T520-1 Seeds of alfalfa (*Medicago falcata, M. gaetula, M. glutinosa, M. media, and M. sativa*) from Europe

Pest: *Verticillium albo-atrum*
Alternative treatments:

Treatment: T520-1-1 Dust with 75 percent Thiram at the rate of 166 grams per 50 kilograms of seed (3.3g/kg).

Treatment: T520-1-2 Treat with a slurry of Thiram 75 WP at a rate of 166 grams per 360 milliliters of water per 50 kilograms of seed (3.3g pesticide/7.2ml water/kg seed).

T551—Treatment for Infestation of *Globodera rostochiensis* and *G. pallida* (Nematodes) on *Convallaria* (pips)

T551-1 Convallaria (pips)

Pest: *Globodera rostochiensis, G. pallida*

Treatment: T551-1 Keep pips frozen until time for treatment, then thaw enough to separate bundles one from another just before treatment begins. Without preliminary warm-up, immerse in hot water at 118 °F for 30 minutes, following with a 5 minute drain, finishing with 5 minutes cooling dip or hosing with tap water.

T552—Treatment for Infestation of *Ditylenchus dipsaci and D. destructor*

T552-1 *Allium, Amaryllis,* and Bulbs (NSPF)

Pest: Bulb nematodes: *Ditylenchus dipsaci, D. destructor*

Treatment: T552-1 Presoak bulbs in water at 75 °F for 2 hours, then at 110 °F–111 °F for 4 hours.

T553—Treatment for Infestations of Nematodes on various plant commodities

T553-1

Achimenes, Actinidia, *Agapanthus, Aloe, Amorphophallus* (bulbs), *Ampelopsis, Anchuse, Anemone, Astilbe, Begonia* (tubers), *Bletilla hyacinthina* (bulbs) (NSPF), Cactus, Calliopsis, *Campanula, Cestrum*, *Cimicifuga, Cissus, Clematis, Convolvulus japonicus*, Corytholoma, *Curcuma* (turmuric), *Cyclamen, Cytisus*, Dahlia (tubers), *Dracaena*, *Epimendium pinnatum* (only; other spp. not tolerant), *Euonymus alata* (only), *Eupatorium, Euphorbia, Fragaria* (strawberry), Gardenia, *Gentiana*, *Gerbera*, Gesneria, *Geum, Gladiolus*, *Heliopsis, Helleborus, Hibiscus, Hosta, Hoya, Iris, Jasminum*, Kaempferia, Kohleria, Naegelia, Orchid, *Ornithogalum, Paeonia*, *Passiflora*, Polyanthes (tuberose), *Primula*, Reichsteineria, *Sansevieria, Scabiosa*, *Sedum,* Senecio (Lingularis), *Thompsonia nepalensis*, Tydaea, *Verbena, Vitis* (grape), *Weigela, Zantedeschia*, Zingiberaceae

Pest: Root-knot nematodes (*Meloidogyne* spp.)

Treatment: T553-1 Hot water at 118 °F for 30 minutes.

T553-2

Anchusa, Astilbe, Clematis, Dicentra, Gardenia, Helleborus, Hibiscus, Kniphofia, Primula

Pest: Lesion nematodes (*Pratylenchus* spp.)

Treatment: T553-2 Hot water at 118 °F for 30 minutes.

T553-3

Armoracea (horseradish roots), bulbs (NSPF)

Pest: Golden nematodes (*Globodera rostochiensis* and *G. pallida*)

Treatment: T553-3 Hot water at 118 °F for 30 minutes.

T553-4

***Bletilla hyacinthina* (alternate treatment: T564)**

Pest: Foliar nematodes (*Aphelenchoides fragariae*)

Treatment: T553-4 Hot water at 118 °F for 30 minutes.

T553-5

Humulus

Pest: Cyst nematodes (*Heterodera humuli*)

Treatment: T553-5 Hot water at 118 °F for 30 minutes.

T554—Treatment for Infestations of *Ditylenchus dipsaci* and *D. destructor* on Hyacinthus

T554-1 *Hyacinthus* (bulbs), *Iris* (bulbs and rhizomes), *Tigridia*

Pest: Bulb nematodes—*Ditylenchus dipsaci* and *D. destructor*

Alternative treatments

Treatment: T554-1-1 Presoak in water at 70 °F–80 °F for 2.5 hours, followed by hot water immersion at 110 °F–111 °F for 1 hour.

Treatment: T554-1-2 Hot water immersion at 110 °F–111 °F for 3 hours with no presoaking.

T555—Treatment for Infestations of *Ditylenchus dipsaci* on *Narcissus*

T555-1 *Narcissus* (bulbs)

Pest: Bulb nematodes—*Ditylenchus dipsaci*

Treatment: T555-1 Presoak in water at 70 °F–80 °F for 2 hours, then at 110 °F–111 °F until all bulbs reach that temperature and hold for 4 hours.

T556—Treatment for Infestations of Root-Knot Nematodes (*Meloidogyne* spp.) on *Calla*

T556-1 *Calla* (rhizomes)

Pest: Root-knot nematodes (*Meloidogyne* spp.)

Treatment: T556-1 Dip in hot water at 122 °F for 30 minutes.

T557—Treatment for Infestations of *Meloidogyne* spp. and *Pratylenchus* spp. on *Chrysanthemum* (not including *Pyrethrum*)

T557-1 *Chrysanthemum* (not including *Pyrethrum*)

Pest: *Meloidogyne* spp. and *Pratylenchus* spp.

Treatment: T557-1 Dip in hot water at 118 °F for 25 minutes.

T558—Treatment for Infestations of *Pratylenchus* surface diseases on *Fragaria* (strawberry)

T558-1 *Fragaria* (strawberry)

Pest: *Pratylenchus* spp. (surface diseases)

Treatment: T558-1 Dip in hot water at 127 °F for 2 minutes.

T559—Treatment for Infestations of Foliar Nematodes on *Begonia* and *Oryza* (paddy rice)

T559-1 *Begonia*

Pest: White tip nematode (*Aphelenchoides besseyi)*

Treatment: T559-1 Dip in hot water at 118 °F for 5 minutes.

T559-2 *Oryza* (paddy rice)

Pest: White tip nematode (*Aphelenchoides besseyi)*

Treatment: T559-2 Dip in hot water at 132.8 °F (56 °F) for 15 minutes.

T560—Treatment for Infestations of *Meloidogyne* spp. on *Rosa*

T560-1 *Rosa* spp. (except *multiflora*, which is not tolerant)

Pest: *Meloidogyne* spp.

Treatment: T560-1 Dip in hot water at 123 °F for 10 minutes.

T561—Treatment for Infestations of *Cercospora mamaonis* and *Phomopsis carica-papayae* on Papayas

T561 Papayas

Pest: *Cercospora mamaonis* and *Phomopsis carica-papayae*

Treatment: T561-1 Dip in hot water at 120.2 °F (49 °C) for 20 minutes.

T562—(deleted)

T563—(deleted)

T564—Treatment for Infestations of Foliar Nematodes on various commodities

T564-1 *Astilbe*, *Bletilla hyacinthina, Cimicifuga, Epimendium pinnatum* (only; other spp. not tolerant), *Hosta, Paeonia*

Pest: Foliar nematode (*Aphelenchoides besseyi*)

Treatment: T564-1 Presoak in water at 68 °F for 1 hour followed by hot water soak at 110 °F for 1 hour. Then dip in cold water and let dry.

Important

see Alternative treatment for **Bletilla hyacinthina**: **T553-1**

T565—Treatment for Infestations of Nematodes on various commodities

T565-1 Amaryllis

Pest: *Ditylenchus destructor*

Treatment: T565-1 Hot water at 110 °F for 4 hours. (Should be done immediately after digging.)

T565-2 Crocus

Pest: *Aphelenchoides subtenuis, Ditylenchus destructor*

Treatment: T565-2 Hot water at 110 °F for 4 hours. (Should be done immediately after digging.)

T565-3 Gladiolus

Pest: *Ditylenchus destructor*

Treatment: T565-3 Hot water at 110 °F for 4 hours. (Should be done immediately after digging.)

T565-4 Scilla

Pest: *Ditylenchus dipsaci*

Treatment: T565-4 Hot water at 110 °F for 4 hours. (Should be done immediately after digging.)

T565-5 *Solanum* (potato tubers)

(see Restricted Entry Orders, Part 321)

Pest: *Globodera rostochiensis, G. pallida*

Treatment: T565-5 Hot water at 110 °F for 4 hours. (Should be done immediately after digging.)

T566—Treatment for Infestations of various diseases on Broomcorn, Broomcorn Articles, and Lilium (bulbs)

T566-1 Broomcorn

Pest: Precautionary treatment for corn-related diseases

Treatment: T566-1 Hot water at 102 °F.

T566-2 Broomcorn Articles

Pest: Precautionary treatment for corn-related diseases

Treatment: T566-2 Hot water at 102 °F.

T566-3 Lilium (bulbs)

Pest: *Aphelenchoides fragariae*

Treatment: T566-3 Hot water at 102 °F.

T567—Treatment for Infestations of Bulb nematodes on various commodities

T567-1 *Muscari, Ornithogalum, Polyanthes* (tuberose)

Pest: Bulb nematodes (*Ditylenchus dipsaci*)

Treatment: T567-1 Dip in hot water at 113 °F for 4 hours.

T568—Treatment for Infestations of Foliar nematodes on Senecio

T568-1 Senecio (Lingularis)

Pest: Foliar nematodes (*Aphelenchoides fragariae*)

Treatment: T568-1 Treat with hot water at 110 °F for 1 hour.

T569—Treatment for Infestations of Foliar nematodes on *Fragaria* (strawberry)

T569-1 *Fragaria* (strawberry)

Pest: Foliar nematodes (*Aphelenchoides fragariae*)

Treatment: T569-1 Hot water at 121 °F for 7 minutes. (National Plant Board Conference, Tennessee, 1968)

T570—Treatment for Infestations of various diseases Acalypha and Aconitum

T570-1 Acalypha

Pest: *Pratylenchus* spp.

Treatment: T570-1 Hot water dip at 110 °F for 50 minutes. (Tolerance **not** established.)

T570-2 Aconitum

Pest: *Aphelenchoides fragariae* spp.

Treatment: T570-2 Hot water dip at 110 °F for 50 minutes. (Tolerance **not** established.)

T571—(Deleted)

5

Treatment Manual

Treatment Schedules

T600-Controlled Atmosphere Temperature Treatment System

Contents

Controlled Atmosphere Temperature Treatment System(CATTS) **5-7-1**
Nectarines and Peaches **5-7-2**
Apples **5-7-3**
Sweet Cherries **5-7-3**

Controlled Atmosphere Temperature Treatment System(CATTS)

Controlled atmosphere temperature treatment system (CATTS) combines forced moist or vapor hot air with controlled atmosphere (i.e. low oxygen, high carbon dioxide).

The treatments are conducted in a chamber similar to a vapor heat or forced hot air chamber that has the capability of introducing nitrogen and carbon dioxide. Once this atmosphere is established, temperature ramp-up begins. When the treatment target temperature is reached, it is sustained for a minimum treatment time.

Important

All fruit must be at or above room temperature before treatment begins. Treating cold fruit will cause phytotoxicity.

All of the following treatments share several common factors:

- Air speed equivalent to 1.3—2.0 meters per second as measured by an anemometer
- Modified atmosphere equivalent to 1 percent O_2 and 15 percent CO_2
- Relative humidity greater than or equal to 90 percent

Important

CATTS treatments are currently approved for commodities exported from the U.S. into certain countries. The treatments have **not** yet been approved for imported commodities or domestic movement of these commodities. Regulatory approval is pending.

For more information, contact PPQ Risk Management and Plants for Planting Treatment Specialist, 301-734-5210.

T601-a

Nectarines and Peaches

Two alternative treatments.

Pest: *Cydia pomonella* (Codling moth) and *Grapholita molesta* (Oriental fruit moth)

Treatment: T601-a-1—CATTS

Units	Ramp-Up Rate (per hour)[1]	Final Temperature	Internal fruit (core) Temperature within 2.5 hours[2]	Time at Core Temperature (minutes)	Total Treatment TIme (hours)
°F	53.6	114.8	109.4	30	3
°C	12.0	46.0	43.0	30	3

1 The temperature ramp-up rate is the rate (in hours) at which the temperature changes in the chamber. Add 10 minutes to the total treatment time for every 10 minute increase in ramp-up time.

2 The core of the fruit must reach 109.4 °F (43.0 °C) within 2.5 hours.

Treatment: T601-a-2—CATTS

Units	Ramp-Up Rate (per hour)[1]	Final Temperature	Internal fruit (core) Temperature within 2.25 hours[2]	Time at Core Temperature (minutes)	Total Treatment TIme (hours)
°F	75.2	114.8	110.3	15	2.5
°C	24.0	46.0	43.5	15	2.5

1 The temperature ramp-up rate is the rate (in hours) at which the temperature changes in the chamber. Add 10 minutes to the total treatment time for every 10 minute increase in ramp-up time.

2 The core of the fruit must reach 110.3 °F (43.5 °C) within 2.25 hours.

T601-b

Apples

Pest: *Cydia pomonella* (Codling moth) and *Grapholita molesta* (Oriental fruit moth)

Treatment: T601-b—CATTS

Units	Ramp-Up Rate (per hour)[1]	Final Temperature	Internal fruit (core) Temperature within 2.5 hours[2]	Time at Core Temperature (minutes)	Total Treatment TIme (hours)
°F	53.6	114.8	112.3	15	3
°C	12.0	46.0	44.6	15	3

1 The temperature ramp-up rate is the rate (in hours) at which the temperature changes in the chamber. Add 10 minutes to the total treatment time for every 10 minute increase in ramp-up time.

2 The core of the fruit must reach 112.3 °F (44.6 °C) within 2.5 hours.

T601-c

Sweet Cherries

Two alternative treatments

Pest: *Cydia pomonella* (Codling moth) and *Rhagoletis indifferens* (Western Cherry Fruit Fly)

Treatment: T601-c-1—CATTS

Units	Ramp-Up Rate (per hour)	Final Chamber Temperature	Internal fruit (core) Temperature within (minutes):		Total Treatment Time (minutes)
			9[1]	22–24[2]	
°F	None	113.0	107.6	112.1	45
°C	None	45.0	42.0	44.5	45

1 The internal fruit temperature must reach the 107.6 °F (42.0 °C) within 9 minutes.

2 After the internal fruit temperature reaches 107.6 °F (42.0 °C) in 9 minutes, the internal fruit temperature must then continue to increase to 112.1 °F (44.5 °C) within 22-24 more minutes.

Treatment: T601-c-2—CATTS

Units	Ramp-Up Rate (per hour)	Final Chamber Temperature	Internal fruit (core) Temperature within (minutes):		Total Treatment Time (minutes)
			9[1]	12–14[2]	
°F	None	116.6	107.6	113.9	25
°C	None	47.0	42.0	45.5	25

1 The internal fruit temperature must reach the 107.6 °F (42.0 °C) within 9 minutes.

2 After the internal fruit temperature reaches 107.6 °F (42.0 °C) in 9 minutes, the internal fruit temperature must continue to increase to 113.9 °F (45.5 °C) within 12-14 more minutes.

Table 5-7-1 Summary of CATTS treatments

Treatment Schedule	Commodity	Pest	Ramp-up Rate (per hour)	Final Chamber Temperature	Total Treatment Time	Core Temperature	Time at Core Temperature
T601-a-1	Nectarine and Peach	*Cydia pomonella* (Codling moth) and *Grapholita molesta* (Oriental fruit moth)	53.6 °F (12 °C)	114.8 °F (46 °C)	3 hours	109.4 °F (43 °C) within 2.5 hours	30 minutes
T601-a-2	Nectarine and Peach	*Cydia pomonella* (Codling moth) and *Grapholita molesta* (Oriental fruit moth)	75.2 °F (24 °C)	114.8 °F (46 °C)	2.5 hours	110.3 °F (43.5 °C) within 2.25 hours	15 minutes
T601-b	Apple	*Cydia pomonella* (Codling moth) and *Grapholita molesta* (Oriental fruit moth)	53.6 °F (12 °C)	114.8 °F (46 °C)	3 hours	112.3 °F (44.6 °C) within 2.5 hours	15 minutes
T601-c-1	Cherry	*Cydia pomonella* (Codling moth) and *Rhagoletis indifferens* (Western Cherry Fruit Fly)	None	113 °F (45 °C)	45 minutes	107.6 °F (42 °C) within 9 minutes	112.1 °F (44.5 °C) within 22-24 minutes
T601-c-2	Cherry	*Cydia pomonella* (Codling moth) and *Rhagoletis indifferens* (Western Cherry Fruit Fly)	None	116.6 °F (47 °C)	25 minutes	107.6 °F (42 °C) within 9 minutes	113.9 °F (45.5 °C) within 12-14 minutes

Treatment Manual

Domestic Treatments

Contents

Pine Shoot Beetle (Tomicus piniperda) **5-8-1**
Citrus Canker (Xanthomonas axonopodis) **5-8-2**
Imported Fire Ant (Solenopsis invicta and S.richteri) **5-8-5**
Sugarcane Leaf Scald and Gummosis disease (Xanthomonas albilineans and X.vasculorum) **5-8-13**
Karnal Bunt (Tilletia indica) **5-8-14**
Phytophthora ramorum **5-8-15**

Introduction

The treatments listed in this section are to be used ONLY for domestic movement of regulated articles and are conducted in conjunction with a systems approach. State and local guidelines may apply.

D301.50-10 Pine Shoot Beetle (*Tomicus piniperda*)

NOTICE

Cut trees at least 2 weeks prior to treatment in order to reduce possible damage by the fumigant to the trees. APHIS assumes no responsibility for damage due to the phytotoxic effects of these treatments.

D301.50-10(a) Pine logs and pine lumber with bark attached, pine bark products, and pine stumps

Treatment: D301.50-10(a)—MB at NAP tarp or chamber
(equivalent to T404-b-1-1)

	Dosage Rate	Minimum Concentration Readings (ounces) At:			
Temperature	(lb/1,000 ft3)	0.5 hr	2 hrs	4 hrs	16 hrs
70 °F or above	3	36	30	27	25
40 - 69 °F	5	60	51	46	42

D301.50-10(b) Christmas trees, pine nursery stock, raw pine materials for pine wreaths and garlands

Treatment: D301.50-10(b)—Cold Treatment

Temperature	Exposure Period
-0.5 °F (-20.6 °C)	1 hour

Load the commodity into an APHIS-approved refrigeration unit. Do not start the treatment time until the refrigeration unit reaches the treatment temperature.

D301.50-10(c) Christmas trees, raw pine materials for pine wreaths and garlands

Treatment: D301.50-10(c)—MB at NAP tarp or chamber (equivalent to T313-b)

Temperature	Dosage Rate (lb/1,000 ft^3)	Minimum Concentration Readings (ounces) At:			
		2 hrs	3 hrs	3.5 hrs	4 hrs
60°F or above	3 lbs	43	—	—	36
60°F or above	4 lbs	57	48	—	—
50-59°F	3.5 lbs	50	—	—	42
50-59°F	4 lbs	57	—	48	—
40-49°F	4 lbs	57	—	—	48

D301.75-11 Citrus Canker (*Xanthomonas axonopodis*)

Conduct treatments at a commercial packinghouse operating under a compliance agreement.

Important

All personnel using these treatments must clean their hands using one of the following disinfectants:

- Gallex 1027 Antimicrobial Soap
- Hibiclens
- Hibistat
- Sani Clean Hand Soap
- Seventy Percent Isopropyl Alcohol

WARNING

Sodium hypochlorite , peroxyacetic acid, and soduim 0-phenyl phenate (SOPP) must be applied in accordance with label directions.

Regulated Fruit[1]

D301.75-11 (a-1)

Treatment: D301.75-11(a-1) — Chemical Treatment

Thoroughly wet the fruit for at least 2 minutes with a solution containing 200 parts per million sodium hypochlorite. Maintain the solution at a pH of 6.0 to 7.5.

D301.75-11 (a-2)

Treatment: D301.75-11(a-2)— Chemical Treatment

Thoroughly wet the fruit with a solution containing sodium o-phenyl phenate (SOPP) at a concentration of 1.86 to 2.0 percent of the total solution. If the solution has sufficient soap or detergent to cause a visible foaming action, wet for 45 seconds. If the solution does not contain sufficient soap to cause a visible foaming action. wet for 1 minute.

D301.75-11 (a-3)

Treatment: D301.75-11(a-3) — Chemical Treatment

Thoroughly wet the fruit with a solution of 85 parts per million peroxyacetic acid for at least 1 minute.

Regulated seed[2]

D301.75-11(b)

Treatment: D301.75-11(b) — Chemical and Heat Treatment
(equivalent to T511-1)

Following extraction from fruit treated as described in D301.75-11(a-1,2,3), the seed must be:

1. Cleaned free of pulp
2. Immersed for 10 minutes in water heated to 125 °F (51.6 °C) or higher

1 Regulated fruit is defined as any fruit, seed, plant, plant part, grass, or tree in all species, clones, cultivars, strains, varieties, and hybrids of the genera *Citrus* and *Fortunella*, and all clones, cultivars, strains, varieties, and hybrids of the species *Clausena lansium* and *Poncirus trifoliata*.
The most common of these are: lemon, pummelo, grapefruit, key lime, persian lime, tangerine, satsuma, tangor, citron, sweet orange, sour orange, mandarin, tangelo, ethrog, kumquat, limequat, calamondin, trifoliate orange, and wampi.

2 Regulated seed is defined as any seed in all species, clones, cultivars, strains, varieties, and hybrids of the genera *Citrus* and *Fortunella*, and all clones, cultivars, strains, varieties, and hybrids of the species *Clausena lansium* and *Poncirus trifoliata*.

3. Immersed for at least 2 minutes in a solution containing 200 parts per million sodium hypochlorite (0.525 percent), with the solution maintained at a pH of 6.0 to 7.5.

Important

Prepare the sodium hypochlorite solution by diluting 1 part Clorox (containing 5.25 percent sodium hypochlorite) in 9 parts of water. If using "Ultra strength" bleach, use only three-fourths as much bleach.

Adjust the pH using acetic acid (vinegar or any dilute acid) under a fume hood or in a well ventilated area.

Vehicles, equipment, and other inanimate articles

D301.75-11(d)

Treatment: D301.75-11(d) — Chemical or Heat Treatment

All vehicles, equipment, and other articles for which treatment is required must be cleaned and disinfected by removing all plants, leaves, twigs, fruit, and other plant parts from all areas of the equipment or vehicles, including in cracks, under chrome strips, and on the undercarriage of vehicles, by wetting all surfaces (including the inside of boxes and trailers), to the point of runoff, with one of the following disinfectants:

- 200-ppm solution of sodium hypochlorite with a pH of 6.0 to 7.5
- 0.2-percent solution of a quaternary ammonium chloride (QAC) compound
- Solution of hot water and detergent, under high pressure (at least 30 pounds per square inch), at a minimum temperature of 160 °F
- Steam, at a minimum temperature of 160 °F at the point of contact
- Solution containing 85 parts per million peroxyacetic acid (indoor use only)

D301-81-10

Imported Fire Ant (*Solenopsis invicta* and *S.richteri*)

Used Soil Moving Equipment

D301.81-10(1)

Treatment: D301.81-10(1) — Cleaning Treatment
Used soil moving equipment is eligible for movement when an inspector determines that **one** of the following procedures has been done:

- It has been brushed free of noncompacted soil
- It has been washed free of noncompacted soil
- Noncompacted soil has been removed with air pressure equipment using compressors designed specifically for this purpose. Such compressors must provide free air delivery of no less than 30 ft^3 per minute at 200 pounds per in^2.

Certification Period: The certification will be valid as long as the equipment remains free of noncompacted soil.

Limitations: Regardless of the type of cleaning equipment used, all debris and noncompacted soil must be removed unless it is steam-heated by a "steam jenny" to disinfest the articles. Used soil-moving equipment, such as bulldozers, dirt pans, motor graders, and draglines, are difficult to clean sufficiently to eliminate pest risk.

CAUTION

Steam may remove loose paint and usually is not recommended for use on equipment with conveyor belts and rubber parts.

D301.81-10(2)

Hay and Straw

Baled hay and straw stored in direct contact with the ground is ineligible for movement.

D301.81-10(3)

Nursery Stock—Balled or in Containers

There are four application methods for plants in containers or balled and burlaped. The methods are:

- Immersion
- Drench
- Topical
- Granular Incorporation

Method A—Immersion

***Equipment**:* You will need an open-top, watertight container sufficiently large to accommodate the treating solution and plants

***Procedure**:* Follow these steps to treat the plants:

Step 1 Choose an appropriate site.

Locate the immersion tank in a well-ventilated place. The location should be covered if possible. Do not remove burlap wrap or plastic containers with drain holes before immersion.

Step 2 Immerse the plants.

Immerse the soil balls and containers, singly or in groups, so that the soil is completely covered by the insecticidal solution. Allow the plants to remain in the solution until bubbling ceases.

Important

Thorough saturation of the plant balls or containers with the insecticide solution is essential!

Step 3 Remove the plants from the dip.

After removal from the dip, set the plants on a drainboard until adequately drained.

Step 4 Add treating mixture.

As treating progresses, add freshly prepared insecticide mixture to maintain the liquid at immersion depth.

Step 5 Dispose of solution.

Dispose of tank contents 8 hours after mixing. Disposal must comply with state and local regulations.

Important

Do not permit runoff of the solution from the treatment area! Dispose of excess and unused solution in accordance with state and local regulations.

Pesticide: Emulsifiable Chlorpyrifos

CAUTION

Wear rubber gloves, boots, and apron during this operation.

***Dosage*:**

Table 5-8-1 Emulsifiable Chlorpyrifos Dosage for Balled or Containerized Plants

Chlorpyrifos formulation	Amount of formulation to make 100 gallons of treating solution
1 EC	16 fl. oz. (472 ml)
2 EC	8 fl. oz. (236 ml)
4 EC	4 fl. oz. (118 ml)

Exposure Period: Plants certifiable immediately upon completion of treatment.

Certification period: 30 days

Important

Environmental factors significantly affect phytotoxicity. It is recommended that a small group of plants be treated at the recommended rate under the anticipated growing conditions and observed for phytotoxic symptoms for at least seven days before a large number of plants are treated. Dwarf yaupon, some varieties of azaleas, camellias, poinsettias, rose bushes, and variegated ivy may show phytotoxicity.

Method B—Drench

Equipment*:* You will need the following pieces of equipment to drench the plants:

- A large-capacity bulk mixing tank, either pressurized or gravity-flow for mixing and holding the insecticide solution
- Properly equipped hoses and watering nozzles that can be attached to the mixing tank and used to thoroughly saturate the plant balls with insecticide solution

Containerized Plants

Step 1 Prepare the solution

The volume of the treating solution must be at least 20 percent (1/5) of the volume of the container.

Insecticides and Dosages

Table 5-8-2 Insecticides and Dosages for Drenching Plants in Containers

Insecticide	Dosage
Chlorpyrifos (4EC)	4 fl. oz. per 100 gal water
Chlorpyrifos (2EC)	8 fl.oz. per 100 gal water
Bifenthrin (flowable)	25 parts per million (ppm)[1]

1 Dose rate for bifenthrin is 25 ppm based on dry weight bulk density of the potting media. Refer to **Table 5-8-3** for bulk density calculations.

Table 5-8-3 Bifenthrin calculations based on Bulk Density

Potting Media Bulk Density (lb/yd^3)	Oz. bifenthrin/100 gal water
200	2.4
400	4.8
600	7.2
800	9.6
1,000	12.0
1,200	14.4
1,400	16.8

Step 2 Apply the solution

Apply the bifenthrin or chlorpyrifos solution to the point of saturation one time only.

Important

Thorough saturation of the plant balls or containers with the insecticide solution is essential. Do not permit runoff of the solution from the treatment area! Dispose of excess and unused solution in accordance with state and local regulations.

Exposure Period: Plants are certifiable immediately upon completion of treatment.

Certification period

Table 5-8-4 Certification period for Plants in Containers

Insecticide	Certification Period (days)
Chlorpyrifos	30
Bifenthrin	10

Balled and Burlapped (B&B) Plants

Step 1 Select a site for the treatment

Move the plants to a well-ventilated place normally used to maintain plants prior to shipment. The treatment locations should be covered, if possible. The treatment will be enhanced by adding any agricultural wetting agent or surfactant.

Step 2 Apply the solution

Apply the chlorpyrifos solution as a substitute for plain water to the plants during the routine watering activities. Do not remove burlap wrap from plants prior to treatment. Treat plants singly or in groups with the chlorpyrifos solution to the point or runoff on a twice daily schedule for three consecutive days.

CAUTION

Wear rubber gloves, boots, and apron during this operation.

***Dosage*:**

Table 5-8-5 Emulsifiable Chlorpyrifos Dosage for Balled Plants

Chlorpyrifos formulation	Amount of formulation to make 100 gallons of treating solution
1 EC	16 fl. oz. (472 ml)
2 EC	8 fl. oz. (236 ml)
4 EC	4 fl. oz. (118 ml)

Exposure Period: Plants are certifiable immediately upon completion of treatment.

Certification period: 30 days.

Method C—Topical Application

Bifenthrin flowable is the only insecticide and formulation registered for topical application. Use this method only with nursery stock in 3- and 4-quart containers. Penetration of the pesticide in larger containers does not provide sufficient residual activity. Prepare a mix with the appropriate amount of bifenthrin in 1,000 oz. of water based on the container size and the bulk density of potting media. (Refer to **Table 5-8-6**) for the bulk density.

Table 5-8-6 Potting Media Bulk Density

	Oz. Bifenthrin flowable/1,000 fl. oz. water	
Potting Media Bulk Density (lb/yd^3)	3-quart Pots	4-quart Pots
200	3.6	5.2
400	7.2	10.4
600	10.8	15.6
800	14.4	20.8
1,000	18.0	26.0
1,200	21.6	31.2
1,400	25.2	36.4

Apply 1 fluid ounce of the mix to each container evenly distributed over the surface of the potting media.

Irrigate all treated containers with 1.5 inches of water following application.

Important

Do not permit runoff of the solution from the treatment area! Dispose of excess and unused solution in accordance with state and local regulations.

Certification period: 180 days.

Method D—Granular Incorporation

There are three granular insecticides registered and approved for incorporation into potting media:

- Granular bifenthrin
- Granular tefluthrin
- Granular fipronil

Use soil mixing equipment that will adequately mix and thoroughly blend the required dosage of pesticide throughout the potting media.

Dosage is based on the bulk density of the potting media and the desired certification period. Dosage is expressed as parts per million (ppm) and calculated by the following formula:

$$\frac{\text{Bulk density of media} \times \text{desired ppm}}{\text{concentration of pesticide}} = \text{lbs. insecticide needed per cubic yard of media}$$

Table 5-8-7 Application Rates for Incorporation of Granular Insecticides into Potting Media

Insecticide	Dosage (ppm)	Certification period (months after treatment)
Bifenthrin	10	0–6 months
	12	0–12 months
	15	0–24 months
	25	Continuous
Tefluthrin	10	0-18
	25	Continuous
Fipronil	10	0–6 months
	12	0–12 months
	15	0–24 months
	25	Continuous

D301.81-10(5)

In-Field Treatment For B&B Stock Prior to Harvest

This in-field treatment is based on a sequential application of fenoxycarb, hydramethylnon, methoprene, or pyriproxyfen bait followed by a broadcast application of chlorpyrifos. The combination treatment is necessary since broadcast application of chlorpyrifos (or other short-term residual insecticides) usually does not eliminate large, mature IFA colonies, and baits are not capable of providing a residual barrier against reinfestation by new queens. Therefore, the approved bait application will drastically reduce the IFA population while chlorpyrifos, applied approximately five days later, will destroy any remaining weakened colonies and also leave a residual barrier against reinfestation by new queens for at least 12 weeks.

Method: Apply approved bait only when ants are actively foraging using a granular applicator capable of applying the labeled rates (1.0–1.5 lb (0.45–0.68 kg)) of bait per acre. Three to five days after the approved bait application, apply chlorpyrifos broadcast at 6.0 lb (2.7 kg) active ingredient (a.i.) per acre. Treatment area must extend at least 10 feet beyond the base of all plants that are to be certified.

Dosage: Apply approved baits at 1.0–1.5 lb (0.45–0.68 kg) bait/acre. Apply granular chlorpyrifos at 6.0 lb (2.7 kg) a.i./acre.

Exposure Period: 30 days. Plants are certifiable 30 days after treatment.

Certification Period: 12 weeks; an additional 12 weeks of certification can be obtained with a second application of granular chlorpyrifos.

D301.81-10(6)

Blueberries and Other Fruit and Nut Nursery Stocks

Certain states have special local need labeling in accordance with section 24(c) of FIFRA for D-z-n Diazinon AG-500 and D-z-n Diazinon 50W, which APHIS will recognize as a regulatory treatment for containerized nonbearing blueberries and fruit and nut plants. Follow the label directions for use.

D301.81-10(7)

Greenhouse Grown Plants

Greenhouse grown plants are certifiable without treatment if the inspector determines that the greenhouse is constructed of fiberglass, glass, or plastic in such a way that IFA is physically excluded and cannot become established within the enclosure. No other treatment of the plants will be necessary if they are not exposed to infestation.

D301.81-10(8)

Grass—Sod

***Method*:**

Step 1 Apply the insecticide.

Apply a single broadcast application of chlorpyrifos with ground equipment or apply two sequential broadcast applications of granular fipronil.

Table 5-8-8 Chlorpyrifos Dosage for Grass Sod

Material	Amount and dosage of material	Certification period	Exposure Period
Chlorpyrifos	8.0 lb (3.6 kg) a.i./acre	6 weeks (after exposure period has been completed)	48 hours
Fipronil	0.0125[1]	20	30 days

1 Apply in two applications one week apart for a total of 0.025 lb a.i./acre.

Step 2 Water the treated areas.

Immediately after treatment, water the treated areas with at least ½ inch of water.

D301.81-10(9)

Soil—Bulk

Method: Bulk soil is eligible for movement when heated either by dry or steam heat after all parts of the mass have been brought to the required temperature.

Temperature: 150°F (65.5°C).

Certification Period: As long as protected from recontamination.

D301.81-10(10)

Soil Samples

Soil samples are eligible for movement when heated or frozen as follows:

Method: Soil samples are heated either by dry heat or steam heat. All parts of the mass must be brought to the required temperature.

Temperature: 150°F (65.5°C).

Certification Period: As long as protected from recontamination.

Method: Soil samples are frozen in any commercial cold storage, frozen food locker, or home freezer capable of rapidly reducing to and maintaining required temperature. Soil samples will be placed in containers, such as plastic bags—one sample per bag. The containers will be arranged in the freezer in a manner to allow the soil samples to freeze in the fastest possible time. If desired, the frozen samples may be shipped in one carton.

Temperature: -10° to -20°F (-23° to -29°C) for at least 24 hours.

Certification Period: As long as protected from recontamination.

D301.87-10 Sugarcane Leaf Scald and Gummosis disease (*Xanthomonas albilineans* and *X.vasculorum)*

Seed pieces

D301.87-10(a) Treatment: D301.87-10(a) Hot water (equivalent to T514-1)

Presoak in water at room temperature for 24 hours then immerse in water at 122 °F for 3 hours.

True seed (fuzz)

D301.87-10(b) Treatment: D301.87-10(b) Chemical Treatment (equivalent to T514-2)

Immerse in 0.525 percent sodium hypochlorite solution for 30 minutes followed by at least 8 hours air drying before packaging. (Dilute 1 part Clorox or similar solution containing 5.25 percent sodium hypochlorite; if using “ultra strength” chlorine bleach, use only 3/4 as much bleach).

Bagasse

D301.87-10(c) Treatment: D301.87-10(c)—Dry heat treatment (equivalent to T514-3)

Apply dry heat for 2 hours at 158 °F.

Field and processing equipment

D301.87-10(d) Treatment: D301.87-10(d)—High Pressure Wash (equivalent to T514-4)

Remove all debris and soil from equipment with water at high pressure (300 pounds per square inch minimum) or with steam.

Juice

D301.87-10(e) Treatment: D301.87-10(e)—Heat

Heat at 212 °F (100 °C) for 10 minutes or more.

D301.89

Karnal Bunt (*Tilletia indica*)

Equipment, grain elevators, conveyances, and other structures used for storing and handling wheat, durum wheat, or triticale

D301.89-13(a) Treatment: D301.89-13(a)—Chemical Treatment

1. Wet all surfaces to the point of runoff with **one** of the following 1.5 percent sodium hypochlorite solutions:

- One part Ultra Clorox brand regular bleach (6 percent sodium hypochlorite; EPA Reg. No. 5813-50) in 3 parts water
- One part CPPC Ultra Bleach 2 (6.15 percent sodium hypochlorite; EPA Reg. No. 67619-8) in 3.1 parts water

2. Let stand for 15 minutes.
3. Thoroughly wash down all surfaces after 15 minutes to minimize corrosion.

D301.89-13(b) Treatment: D301.89-13(b)—Steam

Apply steam to all surfaces until the point of runoff, and so that a temperature of 170 °F is reached at the point of contact.

D301.89-13(c) Treatment: D301.89-13(c)—Hot water and high pressure

Clean with a solution of detergent and water at a minimum temperature of 170 °F. Apply under pressure of at least 30 pounds per square inch.

D301.92

Phytophthora ramorum

Soil

D301.92-10(a)

Treatment: D301.92-10(a)—Heat Treatment

Heat to a temperature of at least 180 °F at the center of the load for 30 minutes in the presence of an inspector.

Wreaths, garlands, and greenery of host material

D301.92-10(b)

Treatment: D301.92-10(b)—Hot water

Dip for 1 hour in water that is held at a temperature of at least 160 °F.

Bay leaves

D301.92-10(c)

Treatment: D301.92-10(c)—Vacuum heat
(formerly T111-a-1)

1. Place bay leaves in a vacuum chamber.
2. Starting at 0 hour, gradually reduce to 0.133 Kpa vacuum at 8 hours.
3. Maintain the vacuum until the end of the treatment, 22 hours.
4. Gradually increase the temperature in the vacuum chamber from ambient temperature at 0 hour to 60C at 5 hours.
5. After 5 hours,gradually lower the temperature to 30C at 22 hours.

The total length of the treatment is 22 hours.

6

Treatment Manual

Certifying Facilities

Overview

Contents

Certification of Vacuum Fumigation Chambers **6-2-1**
Certifying Atmospheric Fumigation Chambers **6-3-1**
Certification of Cold Treatment **6-4-1**
Certification of Hot Water Immersion Facilities **6-5-1**
Certification of Niger seed Treatment Facilities **6-6-1**
Certification of Forced Hot Air and Vapor Heat Treatment Facilities **6-7-1**
Certifying Irradiation Treatment Facilities **6-8-1**
Certifying Facilities for the Heat Treatment of Firewood **6-9-1**

The Certification of Facilities section of this manual is organized by the following categories:

- Vacuum Fumigation Chambers
- Atmospheric Fumigation Chambers
- Cold Treatment Facilities
- Hot Water Immersion Facilities
- Niger seed Treatment Facilities
- Forced Hot Air and Vapor Heat Treatment Facilities
- Irradiation Treatment Facilities
- Firewood Heat Treatment Facilities

Domestic and foreign treatment facilities must be certified by APHIS before they can perform treatments to meet United States quarantine requirements. Specific requirements for each type of facility are included in this section.

After the Center for Plant Health Science and Technology (CPHST) has approved blueprints or drawings of a treatment facility, the treatment facility can request certification from Plant Protection and Quarantine at local ports or State Plant Health Directors.

Important

Send blueprints or drawings of **domestic** treatment facilities to:

USDA-APHIS-PPQ-CPHST
Treatment Quality Assurance Unit
1730 Varsity Drive, Suite 400
Raleigh, NC 27606
tel: 919-855-7450

Request for certification can be sent to State Plant Directors listed at the following URL:

http://www.aphis.usda.gov/services/report_pest_disease/report_pest_disease.shtml

Important

Send blueprints or drawings and request for certification of **foreign** treatment facilities to:

Director, Preclearance Programs
USDA, APHIS, PPQ
4700 River Road, Unit 60
Riverdale, MD 20737
tel: 301-734-8295
fax: 301-734-8318

For foreign treatment facilities, the company requesting certification is responsible for paying money into a trust fund account to pay the salary, travel costs, and per diem of a PPQ Officer to be sent on temporary duty.

Sea-going vessels that participate in the APHIS cold treatment program for fresh fruit may be certified at a port in the USA or at a foreign port. Also, if the certification is to be carried out overseas, a trust fund account will be needed to cover the costs. (For details call PPQ Quarantine Policy, Analysis and Support (QPAS), tel: 301-734-6404.

6

Treatment Manual

Certifying Facilities

Certification of Vacuum Fumigation Chambers

Contents

Construction and Performance Standards **6-2-1**
- Vacuum Chamber **6-2-1**
- Vacuum Pump **6-2-2**
- Fumigant Introduction Systems **6-2-2**
- Circulation and Exhaust System **6-2-2**
- Accessories **6-2-3**
- Certification Standards **6-2-3**

Construction and Performance Standards

Vacuum fumigation consists of placing the commodity in a gastight metal chamber, removing most of the air, and replacing a small portion of it with a gas which is lethal to insects and other pests. Vacuum fumigation provides a more rapid penetration of commodities undergoing treatment than is obtained in normal atmospheric fumigations.

Vacuum Chamber

Vacuum chambers are usually of welded steel construction. A rectangular chamber might be preferred for more effective use of space. Reinforcement of the chamber body by means of steel ribs, or other supports, is usually required to enable the chamber to withstand the difference in pressures when the vacuum is drawn. Doors can be provided at one or both ends of the chamber. In cylindrical chambers, the doors can be either concave or convex, but in rectangular chambers flat doors are commonly used with suitable reinforcements. The doors can be hinged at the side, or at the top and counterbalanced. Many doors are fitted with special mechanisms for rapid closing. Door gaskets should be durable and at the same time provide gastight seal. To a large extent, the efficiency of a chamber depends upon the tightness with which the door or doors will seal. All other chamber openings must be equally tight to sustain the prescribed vacuum over a specified period of time.

To permit circulation beneath the load, the chamber must be designed to enable the stacking of commodities on pallets, skids, or small trucks. Small chambers that are usually hand loaded have removable floors.

Vacuum Pump

Each installation requires a high quality, high capacity vacuum pump. The vacuum pump should have the capacity to reduce the chamber pressure to 1 to 2 inches (25 to 51 millimeters) of mercury (28 to 29 inches or 711 to 737 millimeters vacuum) in 15 minutes or less.

Fumigant Introduction Systems

The size of the chamber will determine the introduction system needed. For small chambers and for introducing fumigants in small quantities, measure the fumigant by volume using a graduated dispenser. For larger chambers place the gas supply cylinder on a platform scale and measure the amount of fumigant by weight.

For methyl bromide, a volatilizing unit is required to ensure fumigant introduction in a gaseous state. The volatilizer is located outside of the chamber between the gas cylinder or dispenser and the introduction port of the chamber. Essentially, the volatilizer consists of a metal coil submerged in water hot enough to vaporize the fumigant. The volatilizer must maintain the water temperature to at least 150 °F throughout the entire gas introduction period.

Within the chamber the gas introduction system should consist of tubing with multiple, graduated openings that will provide uniform distribution of the fumigant throughout the length of the chamber. Ensure that the fumigant enters the chamber from multiple points along the ceiling.

Circulation and Exhaust System

Adequate gas distribution is often hindered by the cargo placed in the chamber. To overcome this, equip vacuum chambers with a circulation system. If fans are employed, the number of fans required would depend upon the chamber design, volume, and loading arrangements. A minimum of 2 fans is normally required for chambers of over 1,000 cubic feet capacity (28.31 m^3). Place the fans at opposite ends of the chamber facing each other—one high, one low. Additional fans might be required for larger chambers. The fans should be capable of circulating air at the rate of at least one-third the volume of the chamber per minute. Some fumigants require nonsparking, explosion-proof-type circulation systems.

In most installations, the vacuum pump is used to remove the fumigant following the exposure period. The air-gas mixture is pumped out of the chamber through exhaust ducts or stacks installed for that purpose. The actual height of these stacks will vary with the location of the chamber, and may be regulated by local, state or federal safety ordinances.

Accessories

Equip chambers with a vacuum gauge and an instrument for measuring and recording the vacuum drawn and maintained during the exposure period. Install a temperature monitoring device in chambers used for quarantine treatments that are six or more hours in length. Combination temperature and vacuum recorders are available.

Certification Standards

To qualify for program approval, vacuum chambers must be able to meet or exceed specified vacuum leakage tests. There are four classification levels in which a chamber may be certified. The tests are listed in **Table 6-2-1** and determine the classification under which the chamber qualifies.

Important

There should be no commodity in the chamber during the certification procedure.

Table 6-2-1 Vacuum Chamber Classification Table

Classification	Initial vacuum (inches)	Allowable vacuum loss			
		4 hr	6 hr	16 hr	24 hr
Superior	28 1/2	—	1/2”	—	1"
A	28 1/2	1/2”	—	1"	2"
B	28 1/2	1"	—	2 1/2”	3"
C	26	1"	—	2 1/2”	3"

In addition to the classification tests in **Table 6-2-1**, ***ALL*** chambers must be capable of meeting the following requirement: A vacuum equivalent to 26 inches (660 mm) of mercury is drawn. The vacuum is then reduced to 5 inches (127 mm) and held for a period of 4 hours. A vacuum of 2 inches (55 mm) or more after 4 hours is considered adequate for this test.

- Chambers classified “Superior” or “A” are approved for all vacuum treatments. These chambers are to be tested annually.
- Chambers classified “B” are approved for all vacuum schedules up to and including 28-inch (711 mm) sustained vacuum. These chambers are to be tested semiannually.
- Chambers classified “C” are approved for all vacuum schedules up to and including 26-inch (711 mm) sustained vacuum. These chambers are to be tested semiannually.

During each certification, conduct a preventative maintenance inspection. The maintenance inspection will ensure the merit of each unit and correct any deficiencies proir to certification. Refer to **Table 6-2-2** for an inspection checklist.

CAUTION

Never use methyl bromide to check for leaks in the chamber. Use compressed air to check for leaks.

Once the chamber has met the requirements in **Table 6-2-1** and passes the preventative maintenance check, the approving APHIS official must complete PPQ Form 480, Treatment Facility Construction, Operation and Test Data, and PPQ Form 482, Certificate of Approval. A copy of each of the forms should be given to the owner/operator of the chamber and also mailed to:

USDA-APHIS-PPQ-CPHST
Treatment Quality Assurance Unit
1730 Varsity Drive, Suite 400
Raleigh, NC 27606

Approving a chamber for vacuum fumigation does **not** include approving atmospheric (NAP) fumigations. If the vacuum chamber will also be used as a normal atmospheric pressure chamber, it must also pass a pressure leakage test (see **page 6-3-4**).

Actual detailed instructions for constructing a vacuum chamber are **not** included in this discussion. The information presented is designed to list the component parts needed and the function of each. Instructions and additional information can be obtained from the following list of vacuum chamber manufacturers. In furnishing the names of these dealers, no discrimination is intended against any firm whose name may have been omitted. Neither does this program endorse the firms mentioned nor guarantee the reliability of their products. The list is furnished solely for information and convenience.

Partial List of Manufacturers of Vacuum Chambers

Slack Associates, Inc.
540 South Longwood Street
Baltimore, MD 21223

Vacudyne Altair
375 East Joe Orr Road
Chicago Heights, IL. 60411

CosMed Group
28 Narragansett Avenue
Jamestown, RI 02835
401-423-2003

The following three companies (SFS, ETO and BQA) are subsidiaries of the CosMed Group.

Sterilization and Fumigation Services, Inc. (SFS)
3500 Shiells Road
Newman, CA 95360
Plant Manager, Peter Baker
Phone: 209-862-4074
Bill Lanning
Phone: 208-880-0746

ETO Sterilization (ETO)
2500 Brunswick Avenue
Linden, NJ 07036-2432
Vice President of Operations, Karen Burns
Phone: 908-862-7077
FAX: 908-862-7168

Baltimore Quality Associates, Inc. (BQA)
4200 Boston Street
Baltimore, MD 21224
Ellen Heath
Phone: 410-327-0916

Table 6-2-2 Chamber Checklist

Chamber and Volatizer	Yes	No
Has chamber been measured and total volume calculated?		
Has chamber been checked for integrity?		
◆ Smoke test		
◆ Pressure test		
Have fans been tested to recirculate at least one third of the total volume per minute?		
Is gas monitoring required (by the workplan)?		
◆ If yes, are sampling leads properly placed (in commodity, if required)?		
◆ Are sampling leads one quarter inch inner diameter Tygon® and free from blockage?		
Will a scale be used to apply fumigant?		
◆ If yes, has the scale been calibrated and certified this year?		
◆ Is the graduated dispenser in good condition?		
Are the door seals and gaskets in good condition?		
Is the copper tubing in the volatizer intact? (check for holes)		
Are the vacuum and temperature gages accurate?		
Required Equipment		
Tape measure or electronic measuring device		
Calculator		
Stop watch		
Air (leaf) blower with appropriate fittings and adapters		
Manometer (including tubing and appropriate liquid)		
Digital anemometer		
Gas detection device (calibrated within one year)		
Dessicant (Drierite®) and Ascarite®		
Auxillary pump (for large chambers)		
Digital thermometer (accuracy 0.1 F) with probe		
Required Safety Equipment		
Gas leak detection device		
Self contained breathing apparatus		
First aid kit, including eye wash		
Emergency medical treatment facility map and phone number		
Required Documentation		
PPQ Form 480, Treatment Facility		
PPQ Form 482, Certificate of Approval		
Material safety data sheet		
Warning placard (English and Spanish)		
Special local need label and permit (if applicable)		

6

Treatment Manual

Certifying Facilities

Certifying Atmospheric Fumigation Chambers

Contents

Construction and Performance Standards **6-3-1**
- Basic Elements for Design and Construction of Chambers **6-3-2**
- Gastight Construction **6-3-3**
- Circulation and Exhaust Systems **6-3-3**
- Fumigant Dispensing System **6-3-4**
- Pressure-Leakage Test for NAP Fumigation Chambers **6-3-4**
- Other Auxiliary Equipment **6-3-6**

Construction and Performance Standards

The primary purpose of a program fumigation is to obtain quarantine control of the pests in all stages of development in or on the product being fumigated. A properly constructed fumigation chamber will provide an enclosure into which the product can be loaded and where the fumigant will be maintained at the prescribed concentration for the required exposure period.

When constructing an atmospheric fumigation chamber, the primary consideration is making it as gastight as possible. In addition, install circulation equipment to properly distribute the fumigant throughout the chamber. The chamber must retain these qualities of tightness and fumigant circulation during every fumigation.

Although chamber sizes are not restricted to specific dimensions, size chambers according to the volume of material to be fumigated. Experience has shown that two moderately sized chambers is preferable to one large chamber.

Select the construction material according to the type of product to be fumigated and the method of operation involved. Wood frame construction with light metal sheathing could be used if the products to be fumigated are lightweight and are to be hand loaded. Heavy products, often loaded by machinery or handtrucks, require heavy-gauge sheet metal, masonry, or metal plate construction. It is advisable to construct the chamber in the most durable manner consistent with its intended use.

Auxiliary equipment is required to measure, vaporize, circulate, and exhaust the fumigant. Size such equipment according to the volume of the chamber. When a relatively small amount of methyl bromide is used, it is often measured by volume in graduated dispensers. When larger amounts are used, the fumigant is most often measured by weight.

Equip chambers with heating or refrigeration units depending on the climatic environment and the products to be fumigated. Product injury or an ineffective fumigation can occur within certain temperature ranges. Although provisions for temperature control are not generally mandatory, in certain fumigation operations, temperature control is necessary and therefore must be considered in the design and construction of fumigation chambers.

While complete construction details for an atmospheric fumigation chamber are not contained in the following narrative, sufficient information is available to develop specifications for a proposed structure. Firms considering chambers for approval by the U.S. Department of Agriculture (USDA) should submit drawings to:

USDA-APHIS-PPQ-CPHST
1730 Varsity Drive, Suite 400
Raleigh, NC 27606

Basic Elements for Design and Construction of Chambers

- Equipped with removable, slatted floors unless all material placed in the chamber is on pallets or carts
- Gastight and remains so during every use
- Provides an efficient system for circulating and exhausting the fumigant
- Provides an efficient system of dispensing the fumigant
- Provides heating or refrigeration units when required for fumigation efficiency or to prevent product injury
- Provides a recording thermometer when product temperatures are critical or treatments are of such duration that temperature variations could affect the efficiency of the fumigation
- Provides suitable fittings to facilitate a pressure-leakage test and gas concentration sampling

The criteria listed above deal primarily with the efficiency of the fumigation chamber itself. In determining the ultimate design and construction, it is essential to give consideration to the safe and practical operation of the facility.

Gastight Construction

Interior surfaces must be impervious to the fumigant. Seal joints with proper compound, solders, or welds. Provide all doors and vents with proper gaskets. Make all openings for wiring, thermometer, tubing, and ports for pressure-leakage tests, etc. gastight.

Paint interior surfaces—whether metal (except for stainless steel), cement, concrete block, tile, or plywood—with epoxy resin, vinyl plastic, or asphalt base paints. Such paint coverings make the surfaces less sorptive, an important factor in maintaining gas concentrations.

Important

Aluminum base paints are **not** acceptable because of the corrosive effect caused by a reaction between such paints and the fumigant.

When wood or wood and sheet metal are used in construction, it is critical to seal all joints and seams with a nonhardening material. This makes a gastight seal and allows for expansion and contraction without leakage. In masonry construction, joint the mortar between all courses of cement blocks to produce a smooth, compact surface. Poured concrete structures should also have smooth, compact surfaces.

The construction and fastening of chamber doors is most critical. Hinge the doors from the top or side. A chamber door hinged at the top is less apt to sag. If the door is hinged at the side, use refrigerator hinges. Install a high-quality gasket around the entire perimeter of the chamber opening. To obtain maximum tightness, uniformly fasten the doors against the gaskets.

Circulation and Exhaust Systems

Fans or blowers delivering the prescribed minimum air movement are essential to proper fumigant distribution.

Various methods can be used to circulate the fumigant within the chamber. Equipment should be capable of circulating air at the rate of at least one-third the volume of the chamber per minute. For smaller chambers, a suitable circulating fan will usually provide the necessary air movement. For larger chambers, obtain effective gas distributions by using a circulating or squirrel cage fan that picks up the air/gas mixture from a duct reaching near the floor and blows it across the top of the load. A blower located outside the chamber can also be used, but this method considerably increases the possibilities of leakage.

Size exhaust blowers according to the volume of the chamber. Volume of enclosure (in cubic feet) divided by the sum of cubic feet per minute (cfm) of the exhaust fan(s) or exhaust blower equals the number of minutes required per complete gas volume exchange. Sixty minutes divided by the number of minutes per gas volume exchange equals the number of complete gas exchanges per hour. The result should be in the range of four to fifteen. The faster the rate of aeration, the better, particularly for perishable commodities. If the exhaust flow is connected to a MB recovery system, it must **not** impede the flow rate to less than four volumes per hour. Frequently, circulation and exhaust systems are designed to utilize the same blower. Extend the exhaust stack well above all nearby structures. Venting to the outside and complying with local safety ordinances are both essential.

Fumigant Dispensing System

The dispensing system needed will vary with the types of fumigants being used. The fumigant MB is usually introduced into the chamber through a tube extending from the volitizer. Within the chamber, provide this tube with properly spaced openings through which the fumigant is dispersed. Fumigants in small quantities are generally measured by volume using a graduated dispenser. Place the dispenser in the introduction line between the supply cylinder and the volatilizer. For larger quantities, place the supply cylinder on a platform scale and weigh the fumigant used. The measured amount of fumigant must pass through a volatilizer where it is converted from a liquid to a vapor. The volatilizer consists of a metal coil submerged in 150 °F degree water. The water temperature must remain at or above 150 °F throughout the entire gas introduction.

For the fumigant sulfuryl fluoride (SF), do **not** use a volatilizer or graduated dispenser. For the fumigant phosphine (PH), a chamber is generally **not** used because PH will corrode copper and brass (including tubing, fans, and electrical wiring).

Pressure-Leakage Test for NAP Fumigation Chambers

Before a chamber is used for fumigation, it must be checked for tightness using an open-arm manometer. **See "Open-Arm Manometer" on page-8-1-30** for a detailed description of this type of manometer. (If a digital manometer is used, contact CPHST for accurate conversion factors.)

The procedure for conducting a pressure leakage test is as follows:

1. Create an opening (usually 1-inch diameter) in the chamber for the use of a blower or other means for the introduction of air to create a positive pressure in the chamber.
2. Create an additional opening, such as a gas sampling line opening, for the manometer.

3. Close chamber as for fumigation.
4. Attach one end of the manometer to the chamber opening.
5. Use vacuum cleaner blower or similar apparatus to create pressure (as measured on an open arm manometer) of either 25 or 50 mm depending on chamber construction.

   For a chamber constructed of materials such as cement or cinder blocks, create a total pressure of 50 mm. The time lapse for the chamber pressure to recede from 25 mm to 2.5 mm in **each** arm must be:

   - 22 to 29 seconds; reinspect chambers every 6 months
   - 30 seconds or longer; reinspect chambers annually

   A **reduced** pressure test is acceptable for plywood chambers. Create a total pressure of 25 mm (12.5 in each arm of the manometer.) The time lapse for the chamber pressure to recede from 12.5 mm to 1.25 mm in **each** arm must be:

   - 60 seconds or longer; reinspect chambers annually
6. Discontinue blower and close its opening.
7. Observe time for pressure to recede.

The inability to develop or maintain adequate pressure indicates considerable leakage. In such cases, the chamber operator can use a smoke bomb or other device in an effort to determine the areas of leakage.

During each certification, conduct a preventative maintenance inspection. The maintenance inspection will ensure the merit of each unit and correct any deficiencies proir to certification. Refer to **Table 6-3-1** for an inspection checklist.

Once the chamber has passed the pressure leakage test and the preventative maintenance check, the approving APHIS official must complete PPQ Form 480, Treatment Facility Construction, Operation and Test Data, and PPQ Form 482, Certificate of Approval. A copy of each of the forms should be given to the owner/operator of the chamber and also mailed to:

USDA-APHIS-PPQ-CPHST
1730 Varsity Drive, Suite 400
Raleigh, NC 27606

Other Auxiliary Equipment

According to the needs of the operation, other auxiliary equipment may be necessary. When heat is required, steam pipes or low-temperature electric strip heaters are generally recommended. Do **not** use open flame or exposed electric coils as they tend to break down the gas and form undesirable compounds. Size refrigeration units to the volume of the chamber and the type and amount of commodity involved. Temperature recording thermometers are usually attached to the outside of the chamber with a remote sensing unit attached to the inside wall or inserted into the product.

Table 6-3-1 Chamber Checklist

Chamber and Volatizer	Yes	No
Has chamber been measured and total volume calculated?		
Has chamber been checked for integrity?		
◆ Smoke test		
◆ Pressure test		
Have fans been tested to recirculate at least one third of the total volume per minute?		
Is gas monitoring required (by the workplan)?		
◆ If yes, are sampling leads properly placed (in commodity, if required)?		
◆ Are sampling leads one quarter inch inner diameter Tygon® and free from blockage?		
Will a scale be used to apply fumigant?		
◆ If yes, has the scale been calibrated and certified this year?		
◆ Is the graduated dispenser in good condition?		
Are the door seals and gaskets in good condition?		
Is the copper tubing in the volatizer intact? (check for holes)		
Are the vacuum and temperature gages accurate?		
Required Equipment		
Tape measure or electronic measuring device		
Calculator		
Stop watch		
Air (leaf) blower with appropriate fittings and adapters		
Manometer (including tubing and appropriate liquid)		
Digital anemometer		
Gas detection device (calibrated within one year)		
Dessicant (Drierite®) and Ascarite®		
Auxillary pump (for large chambers)		
Digital thermometer (accuracy 0.1 F) with probe		
Required Safety Equipment		
Gas leak detection device		
Self contained breathing apparatus		
First aid kit, including eye wash		
Emergency medical treatment facility map and phone number		
Required Documentation		
PPQ Form 480, Treatment Facility		
PPQ Form 482, Certificate of Approval		
Material safety data sheet		
Warning placard (English and Spanish)		
Special local need label and permit (if applicable)		

6

Treatment Manual

Certifying Facilities

Certification of Cold Treatment

Contents

Introduction **6-4-1**
Standards for Temperature Recording Systems **6-4-2**
- Temperature Recording System **6-4-2**
- Temperature Sensors **6-4-3**

Certification of Vessels Used for Intransit Cold Treatment **6-4-4**
- Plan and Specification Approval **6-4-4**
- Certification Testing **6-4-5**
- Documentation **6-4-8**
- Certificate of Approval **6-4-8**
- Application for USDA Vessel Approval **6-4-9**

Certification of Self Refrigerated Containers Used for Intransit Cold Treatment **6-4-12**
- Certification Requirements **6-4-12**
- Letter of Certification **6-4-12**
- Application for USDA Container Certification **6-4-13**

Certification of Warehouses Used for Cold Treatment **6-4-15**
- Plan and Specification Approval **6-4-15**
- Certification Testing **6-4-15**
- Calibration of Temperature Sensors **6-4-16**
- Frequency of Certification Testing **6-4-18**
- Application for USDA Warehouse Approval **6-4-19**

Contact Information **6-4-22**

Introduction

Since the early 1900s, sustained cold temperature has been employed as an effective post-harvest method for the control of the Mediterranean and certain other tropical fruit flies. Exposing infested fruit to temperatures of 2.2 °C (36 °F) or below for specific periods of time results in the mortality of the various life stages of this group of notoriously injurious insects. Procedures were developed to effectively apply cold treatment (CT) to fruit while in transport in refrigerated holds of ships, in refrigerated containers, and in warehouses located in the country of origin or in the United States.

Self-refrigerated (Integral) containers, conventional vessels, and warehouses utilized for regulatory cold treatment are subject to approval by the USDA. Approval is needed only when treating fruit under USDA regulations and does **not** constitute an endorsement for the carrying or storage of refrigerated cargo.

Only officials authorized by APHIS have permission to conduct warehouse, vessel or container certification under the general guidance of TQAU. Refer to the following web site for a complete list of USDA-certified vessels and containers for intransit cold treatment:

https://treatments.cphst.org/vessels/

Standards for Temperature Recording Systems

Temperature recording systems may consist of various electronic components such as temperature sensors, computers, printers, and cables and are required for temperature recording installations in cold treatment vessels, refrigerated containers, or warehouses. Submit plans and specifications of the temperature recording system to **TQAU** for review and approval before installation.

Temperature Recording System

- **Accuracy**—The accuracy of the system must be within plus or minus 0.3 °C (0.5 °F) of the true temperature in the range of minus 3 °C (27 °F) to plus 3 °C (37 °F.)
  - Ensure the instrument is capable of repeatability in the range of minus 3 °C to plus 3 °C (27 °F to 37 °F.)
- **Automatic Operation**—The system must be capable of automatic operation whenever the treatment system is activated.
- **Long-Term Recording**—The system must be capable of continuous recording of date, time, sensor number, and temperature during all calibrations and for the duration of a voyage and/or treatment period.
- **Password Protection**—All approved temperature recording devices must be password protected and tamperproof.
- **Recording Frequency**—The time interval between prints will be no less than **once every hour**. For each sensor, the temperature value, location/identification, time and date must print **once per hour.**
- **Repeatability**—When used under treatment conditions over an extended period of time, the system must be capable of repeatability in the range of minus 3 °C to plus 3 °C (27 °F to 37 °F.) The design, construction and materials must be such that the typical environmental conditions (including vibration) will **not** affect performance.

- **Range**—The recorder must be programmed to cover the entire range between minus 3 °C to plus 3 °C (27 °F to 37 °F), with a resolution of 0.1 (°C or °F.)
- **Visual Display**—The system must have a visual display so the temperature can be reviewed manually during the treatment and calibrations.

Temperature Sensors

- **Construction Standards**—Sensors should have an outer sheath diameter of 0.25 inches (6.4 millimeters) or less. The sensing unit must be in the first inch of the sensor.
- **Identification**—Identify all sensors to distinguish the sensors in one compartment from those in other compartments.
  - Place an identifying number on the box where the sensor originates and on a permanent tag where the cable joins the sensor.
  - Identify the sensors for each compartment so the air sensors are numbered first (e.g., A1, A2—air; A3, A4,..., etc.,—fruit pulp.)
- **Location**—Post a diagram next to the recording instrument that shows the location and identification of each sensor by compartment.
  - Air sensors—Place sensors on the center line of the vessel, fore and aft, approximately 30 centimeters from the ceiling and connected to cables at least 3 meters in length
  - Fruit sensors—Distribute fruit sensors throughout the compartment so all areas of the compartment can be reached (5- to 15-meter cable lengths are usually sufficient.) The number and location is dependent upon cubic capacity of the compartment. Refer to **Figure 6-4-1 on page-6-4-6** for guidance for vessels and **Figure 6-4-7 on page-6-4-16** for guidance for warehouses. Three temperature sensors are required for refrigerated containers. These are labeled USDA1, USDA2, and USDA3.

Contact **TQAU** for a complete list of approved temperature recording systems.

Certification of Vessels Used for Intransit Cold Treatment

Vessels used in cold treatment must be certified by a qualified APHIS-PPQ employee or a designated representative before treating fruit under USDA regulations. Refrigeration (reefer) vessels presented for approval must be classified under the rules of the American Bureau of Shipping or a comparable internationally recognized ship classification society.

Submit plans, drawings and specifications to **TQAU** prior to the first vessel certification. Conduct certification tests prior to the vessel receiving final approval to conduct a cold treatment. Certification will be performed every **three** years or sooner if APHIS determines that a malfunction or alteration of the system warrants a recertification.

Plan and Specification Approval

Prior to the start of vessel construction, an application for vessel approval, detailed drawings of the vessel's physical characteristics and a written description of the all the equipment related to treatment must be reviewed and approved by **TQAU** (all plans and supporting materials must be submitted in Standard English.)

Plans and specifications must include the following information:

- Completed Application for Vessel Approval (an example of a completed Application is provided on **page 6-4-9**)
- Drawings showing the dimensions of the refrigerated compartments
- Example of an hourly printout from the recording system (must include date, time, temperature unit, vessel name)
- Number and location of air and pulp sensors in each compartment (see **Figure 6-4-1 on page-6-4-6**)
- Specifications of the recording system
- Specifications of refrigeration equipment (including air circulation)

The review of plans and process descriptions may take up to sixty days and subsequent requests for additional information may further extend this time.

Vessel owners will receive a letter granting plan approval or describing plan deficiencies and necessary remedial measures.

Following plan approval, the vessel should be built according to the plans. If deviations from the plans are necessary, TQAU must approve the changes (changes should be submitted in a manner similar to that described in "Plan and Specification Approval".)

Certification Testing

Make the vessel available for an on-site certification visit by a PPQ official when all documents and a completed Application have been submitted and approved by the **TQAU**.

Contact the State Plant Health Director or Officer-In-Charge at the port of call to arrange vessel certification at a US port.

Establish a cooperative agreement and other arrangements as needed with USDA for vessel certification inspections made at a foreign location. This will require a 60-day notification before the inspection can be scheduled. For specific information on the required procedure, contact:

Quarantine Policy, Analysis and Support (QPAS)
Preclearance Programs
USDA-APHIS-PPQ
4700 River Road, Unit 67
Riverdale, MD 20737
Phone: 301-734-4910

A representative from the temperature recorder company who is familiar with the installation, should be on hand to correct any deficiencies in the system.

Before requesting final inspection, the vessel's owner must complete all arrangements. Calibration and identification tests will be made during the inspection. Clean containers filled with crushed ice and fresh water must be made available for the immersion of the temperature sensors.

Determining the Number of Temperature Sensors

The number and location of temperature sensors is based on the cubic capacity of the compartment. Refer to **Figure 6-4-1** to determine the number and location of sensors. Always place the **air** sensors on the fore and aft bulkheads. Always distribute the **pulp** sensors throughout the compartment so that all areas can be reached.

Cubic Feet	Cubic Meters	Number of Air Sensors[1]	Number of Pulp Sensors	Total Number of Sensors
0 to 10,000	0 to 283	2 or 3	2	4 or 5
10,001 to 15,000	284 to 425	2 or 3	3	5 or 6
15,001 to 25,000	426 to 708	2 or 3	4	6 or 7
25,001 to 45,000	709 to 1,274	2 or 3	5	7 or 8
45,001 to 70,000	1,275 to 1,980	2 or 3	6	8 or 9
70,001 to 100,000	1,981 to 2,830	2 or 3	8	10 or 11
> 100,000	> 2,830	Contact TQAU		

Figure 6-4-1 Number of Temperature Sensors per compartment

1 In the case of twin deck compartments, two air sensors are required in the upper deck plus one air sensor in the lower compartment. This sensor should be located on the bulkhead farthest from the cooling unit.

Important

It is highly recommended that more temperature sensors be installed than the minimum number required for each refrigerated compartment. If a sensor malfunctions during a treatment, the Port Director has the option of disregarding it, providing that an additional working sensor is present, and the functional sensors were uniformly distributed. Otherwise, the entire treatment must be repeated for the fruit in that compartment.

Designate two of the sensors as air sensors, and the others as pulp sensors. Any sensors above the required minimum may be either pulp or air sensors.

For compartments exceeding 100,000 cubic feet, contact the **TQAU** for the minimum number of required sensors.

Calibration of Temperature Sensors

Calibrate all temperature sensors using a clean ice water slurry at 0 ºC (32 ºF).

NOTICE

It is APHIS policy to use the standard "rounding rule". In determining calibration factors, if the reading is .05 or higher, round to the next higher number in tenths. If it is .04 or lower, round to the lower number. For example: If the calibration factor was .15, round to .2. If it was .32, round to .3. Similar rounding can be used in actual treatment readings. If an actual reading was 34.04, round to 34.0, add or subtract the calibration factor, if necessary. If it was 34.07, round to 34.1, add or subtract the calibration factor, if necessary.

Use the following steps to make the ice water slurry:

1. Prepare a mixture of clean ice and fresh water in a clean insulated container.
2. Crush or chip the ice and completely fill the container.
3. Add enough water to stir the mixture.
4. Stir the ice and water for a minimum of 2 minutes to ensure the water is completely cooled and good mixing has occurred.
   - ❖ The percentage of ice is estimated at 80 to 85 percent while the water fills the air voids (15 to 20 percent).
5. Add more ice as the ice melts.
6. Prepare and stir the ice water slurry to maintain a temperature of 0 °C (32 °F).
7. Submerge the sensors in the ice water slurry without touching the sides or bottom of the container.
8. Stir the mixture.
9. Continue testing of each sensor in the ice water slurry until the temperature reading stabilizes.
10. Record two consecutive readings of the stabilized temperature on the temperature chart or logsheet.
    - ❖ The temperature recording device should be in manual mode to provide an instantaneous readout.
11. Allow at least a 1 minute interval between two consecutive readings for any one sensor; however, the interval should **not** exceed 5 minutes.
    - ❖ The variance between the two readings should **not** exceed 0.1°.
12. Contact an instrument company representative immediately if the time interval exceeds the normal amount of time required to verify the reading and accuracy of the sensor and recorder system
    - ❖ The recorder used with the sensors must be capable of printing or displaying on demand and **not** just at hourly intervals.
13. Correct any deficiencies in the equipment before certification.
14. Replace any sensor that reads more than plus or minus 0.3 °C (0.5 °F) from the standard 0 ºC (32 ºF).
15. Replace and recalibrate any sensors that malfunction.
16. Document the recalibration and replacement of the sensor(s).
17. Determine the calibrations to the nearest tenth of one degree.

Frequency of Certification Testing

A certification test is required every three years. No extensions to this three year requirement will be granted. Make requests for renewal at least 60 days before expiration to the TQAU or USDA PPQ Preclearance programs. Certification testing is also required anytime a malfunction, breakdown or other failure occurs (excluding temperature sensors) that requires modifications to the recording and monitoring system(s).

Documentation

The APHIS official will document all tests during certification. Send a copy of the signed PPQ Form 449-R, Temperature Recording Calibration Report, copies of all charts and/or printouts, and any other pertinent addenda or appendices to the **TQAU** for final approval.

Certificate of Approval

Upon meeting all requirements, the vessel will be designated as approved to conduct intransit cold treatments under the provisions of the PPQ's Fruit and Vegetable Quarantine 56. A PPQ Form 482, Certificate of Approval, listing the approved refrigerated compartments will be issued to the vessel. This approval is for equipment only, and each shipment of fruit must satisfy all requirements as described in Section 319.56 and 305.15 of the Code of Federal Regulations as a condition of entry into the United States.

Application for USDA Vessel Approval

Visit the Commodity Treatment Information System web site or contact **TQAU** for a fillable, electronic Vessel Approval Application.

APPLICATION FOR USDA VESSEL APPROVAL
FOR USE IN CONDUCTING QUARANTINE COLD TREATMENTS UNDER USDA REGULATIONS

Instructions:
(1) Use one application for each vessel.
(2) Review the regulatory requirements in Chapter 6 of the Plant Protection and Quarantine (PPQ) Treatment Manual. An electronic PDF document of the manual is available at the following website:
http://www.aphis.usda.gov/import_export/plants/manuals/ports/downloads/treatment.pdf
(3) A list of approved and certified vessels can be found at: https://treatments.cphst.org/vessels/
(4) Each application must include technical documents that support the information supplied.
(5) Fill in each field of the application completely. Review of the application will not begin until all information is received. If a field is not applicable, please put "N/A" in the space provided. In the column labeled "Reference", indicate the page number(s) or specific location where the information can be found in the supporting technical documents.
(6) Send the completed application and required additional information (manuals, technical sheets) to the following office:

Treatment Quality Assurance Unit
USDA-APHIS-PPQ-CPHST
1730 Varsity Drive, Suite 400
Raleigh, North Carolina 27606 USA
E-mail: **cphst.tqau@aphis.usda.gov** / Fax: (919) 855-7493 / Telephone: (919) 855-7450

1. **Contact Information (Please type or print)**	
Requestor Information: This information will be used by USDA as the official contact information for this vessel.	
Name of Company Golden Management	
Name and Title of Requestor Ben Charles, Owner	
Address of Requestor: 111 Executive Drive Washington, DC 30943	
Telephone: 444-123-1234	FAX: 444-123-1235
E-Mail Address: bcharles@goldenmanage.com	
Agent Responsible for the Vessel (if different from Requestor)	
Name of Agent N/A	
Address of Agent:	
Telephone:	Fax:
E-Mail Address:	
2. Vessel Information	
Shipyard: Shikoku	Hull number: 3456
IMO number: 99991111	Vessel name: Golden Swan

Form T-CT-V-A-124 Approved on 3/24/2009 Revision: 01 Page 1 of 3

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Figure 6-4-2 Example of a Completed Application for USDA Vessel Approval, page 1 of 3

Attach vessel schematic(s) to include the following:
All information must be clearly referenced in supporting technical documents.

Requirement	Reference Page or Section
(a) Sensor location	Page 6
(b) Sensor number	Page 2
(c) Sensor type (air or pulp)	Page 3
(d) Compartment identifiers	Page 4
(e) Airflow direction	Page 6
(f) Refrigeration Unit locations	Page 6
(g) Recorder location	Page 7

Ensure that a list of compartment identifiers with corresponding cubic capacity is attached to this application.

3. Refrigeration Unit

Make of Refrigeration Unit: Saab	Model of Refrigeration Unit: 687Vn123
Location of Refrigeration Unit: Power plant	Model Year: 2001
Airflow maximum rate (cfm): 3000	Airflow direction: aft

4. Temperature Recorder

Manufacturer: Mycom	Model: Marcs	Model Year: 2003
Serial number(s): 554987, 965896	Quantity of recorders: 2	**Is this a USDA approved recorder**: **Yes:** ☑ **No:** ☐

Accuracy:
Recorder (Must be accurate to within +/- 0.15 C in the range of +/- 3.0 C): yes
Recorder plus Sensor (Must be accurate to within +/- 0.30 C in the range of +/- 3.0 C): yes

5. Temperature Sensors

Accuracy (Must be accurate to within +/- 0.15 C in the range of +/- 3.0 C): yes

Are these USDA approved temperature sensors: Yes: ☑ **No:** ☐

Do sensors numbers match the numbers on the recorder: Yes: ☑ **No:** ☐

Description	Air Sensors	Pulp Sensors
Manufacturer	Mycom	Mycom
Model	RM105	RM115
Length of sensor cable	3 meters (Must extend from ceiling to floor)	15 meters (Must extend beyond centerline of the vessel compartment)

x _____ 8-16-2008
Requestor's Signature **Date *(mm-dd-yyyy)***

Form T-CT-V-A-124 Approved on 3/24/2009 Revision: 01
Page 2 of 3

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Figure 6-4-3 Example of a Completed Application for USDA Vessel Approval, page 2 of 3

**********DO NOT WRITE BELOW – FOR USDA PURPOSES ONLY – DO NOT WRITE BELOW**********

Date Application Received_____

Reviewer_____

Approved_____ **Not Approved**_____ **Date**_____

Reviewer's Signature_____

Comments

Form T-CT-V-A-124 Approved on 3/24/2009 Revision: 01
Page 3 of 3

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Figure 6-4-4 Example of a Completed Application for USDA Vessel Approval, page 3 of 3

Certification of Self Refrigerated Containers Used for Intransit Cold Treatment

Certify refrigerated containers used as cold treatment facilities before carrying treated fruit under USDA regulations. Classify refrigerated containers under the rules of the American Bureau of Shipping or a comparable internationally recognized classification society.

Certification Requirements

Complete an Application for Container Certification and submit to **TQAU**. All plans and supporting materials must be submitted in Standard English. Refer to **Figure 6-4-5 on page-6-4-13** for an example of a completed Application for Container Certification.

Include the following specifications in the application:

- Air flow rate
- Container size
- Make and model of refrigeration unit
- Make and model of temperature recorder/control unit
- Type of sensor
  - At least 3 sensors are necessary for each container and must be labeled USDA1, USDA2 and USDA3

Letter of Certification

Upon meeting all requirements, the container(s) will be certified to conduct intransit cold treatments under the provisions of the PPQ Fruit and Vegetable Quarantine 56. A Letter of Certification listing the refrigerated container(s) will be issued to the owner. This certification is for container(s) only, and each shipment of fruit must satisfy all requirements as described in Section 319.56 and 305.15 of the Code of Federal Regulations as a condition of entry for importation into the United States.

Application for USDA Container Certification

Visit the Commodity Treatment Information System web site or contact **TQAU** for a fillable, electronic Vessel Approval Application.

APPLICATION FOR USDA CONTAINER CERTIFICATION
TO CONDUCT COLD TREATMENT UNDER USDA REGULATIONS

Instructions:
(1) Prior to submitting your Application for USDA Container Certification please verify that the containers are **not** already approved by going to the USDA Certified Containers Website:
https://treatments.cphst.org/vessels/containers.cfm
(2) Review the regulatory requirements in Chapters 3-7 and 6-4 of the PPQ Treatment Manual. An electronic PDF document of the manual is available at the following website:
http://www.aphis.usda.gov/import_export/plants/manuals/ports/downloads/treatment.pdf
(3) Fill in each field on the application completely. Review for certification will not begin until all information is received. If a field is not applicable, please put "N/A" in the space provided.
(4) Send the completed application via electronic mail, fax, or postal mail to the following office:

USDA-APHIS-PPQ-CPHST-TQAU
1730 Varsity Drive, Suite 400
Raleigh, North Carolina 27606 USA
E-mail: **cphst.tqau@aphis.usda.gov** / Fax: (919) 855-7493

1. Name and Address of Requestor (Please type or print)	
(First) (Last) John Johnson	Company Name: Cold World
Job Title: Manager	
Company Address: 1356 Westshore Drive, Miami, Florida 60188	
Country: USA	E-Mail Address: jjohnson@coldworld.com
Telephone: 901-564-5555	FAX: 901-565-5556
2. Name and Address of Container Series Owner (Different from Leasing Company)	
Container Series Owner: Maersk LTD	
Owner Address: Kiel, New Jersey	
Country: USA	E-Mail Address: manage@maersk.com
Telephone: 605-545-8974	FAX: 605-545-8965
3. Name and Address of Container Manufacturer (Fill out ONLY if different from 1)	
Container Manufacturer: Belding Reefer Company	
Manufacturer Address: 2565 East River Drive, New York, NY	
Country: USA	E-Mail Address: bdrcompany@belding.com
Telephone: 565-509-5698	FAX: 565-509-5699

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Form T-CT-C-C-107 Approved 4/9/2009 Revision: 02
Page 1 of 2

Figure 6-4-5 Example of a Completed Application for USDA Container Certification, page 1 of 2

4. Container Information			
Container Code and Numbers:	BIC: APRU	Begin: 904954	End: 905154
Total Number of Containers in Series: 200		Date of Construction (mm/yyyy): 06/2009	
External Dimensions (feet):	Length: 40	Width: 8'	Height: 9'6"

5. Refrigeration Unit	
Make: Carrier	Model: 69NT40-551-509
Year of Manufacture: 2008	Location of the Unit: Inside the container ☑ Outside the container ☐
Airflow Maximum Rate (cubic feet per minute): 1400	Bottom Air Delivery? Yes ☑ No ☐

6. Temperature Controller	
Make: Carrier	Model: MicroLink 2
Year of Manufacture: 2008	
Is a modem connected to the controller / recorder? Yes ☐ No ☑	If Yes, specify model:

7. Temperature Sensors: Indicate which approved sensors will be used with the temperature monitoring and control system:			
Thermistor ☑	ST9702 ☐	PT100 ☐	NTC ☐

X John Johnson
Requestor's Name/Signature

06/01/2009
Date (mm/dd/yyyy)

*****************DO NOT WRITE BELOW – FOR USDA PURPOSES ONLY – DO NOT WRITE BELOW*****************

Reviewer_____

Date Application Received_____

Approved_____ **Not Approved**_____ **Date**_____

Reviewer's Signature_____

Container ID # _____**Document File Name** _____

Comments:

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Page 2 of 2

Figure 6-4-6 Example of a Completed Application for USDA Container Certification, page 2 of 2

Certification of Warehouses Used for Cold Treatment

The local APHIS-PPQ inspector will certify refrigerated warehouses for use as cold treatment facilities before treating fruit under USDA regulations. In addition to the general requirements, warehouse approval is subject to specific geographical pest-risk considerations as outlined in Title 7, Section 305.15 of the Code of Federal Regulations.

TQAU will approve plans and specifications prior to the initial warehouse certification. Conduct a performance survey prior to the warehouse receiving approval to conduct cold treatments under USDA regulations.

Plan and Specification Approval

Prior to the start of warehouse construction, submit a completed Application for Warehouse Approval, detailed drawings of the physical characteristics, and a written description of the all the treatment related equipment to **TQAU**. All plans and supporting materials must be submitted in Standard English. An example of a completed Application is provided in **Figure 6-4-8 on page-6-4-19**.

Include the following information in the Application:

- Address of the warehouse location
- Drawings showing the dimensions, cubic capacity and door locations

Important

Drawings may be hand-drawn, but must clearly show location of refrigeration units, circulation fans, temperature recorder, and sensors.

- Make and model of the refrigeration equipment
- Name and address of the firm owning the warehouse chamber
- Number and location of sensors (**Figure 6-4-7 on page-6-4-16**)
- Method for segregating fruit under treatment and securing it from other foreign or domestic articles
- Specification of the air circulation system; must indicate the number of air changes and direction of air flow
- Specifications of the recording system

Certification Testing

When all documents and a completed Application have been submitted and approved by the **TQAU**, the warehouse owner should make the warehouse available for an on-site certification visit by a local PPQ official. To arrange warehouse certification, contact the State Plant Health Director or

Officer-In-Charge for the port. Before requesting final inspection, the warehouse owner must complete all arrangements as directed by the PPQ officer. The PPQ official will conduct calibration and identification tests during the inspection.

Determining the Number of Temperature Sensors

The number and location of temperature sensors is based on the cubic capacity. Refer to **Figure 6-4-7** to determine the number and location of sensors. The minimum requirement is three sensors—one air sensor and two pulp sensors. Sensor cables must be long enough to reach all areas of the load.

Cubic Feet	Cubic Meters	Number of Air Sensors	Number of Pulp Sensors	Total Number of Sensors
0 to 10,000	0 to 283	1	2	3
10,001 to 20,000	284 to 566	1	3	4
20,001 to 30,000	567 to 849	1	4	5
30,001 to 40,000	850 to 1132	1	5	6
40,001 to 50,000	1133 to 1415	1	6	7
50,001 to 60,000	1416 to 1698	1	7	8
60,000 to 70,000	1699 to 1981	1	8	9
70,001 to 80,000	1982 to 2264	1	9	10
80,001 to 90,000	2265 to 2547	1	10	11
90,001 to 100,000	2548 to 2830	1	11	12
Over 100,000	>2830	Must be Approved by TQAU		

Figure 6-4-7 Number of Temperature Sensors

Important

If a refrigerated room is equipped according to the cubic capacity of the storage area (rather than of the load itself), the same criteria apply.

It is highly recommended that additional sensors beyond the required minimum be installed.

Calibration of Temperature Sensors

Calibrate all temperature sensors using a freshwater ice water slurry at 0 ºC (32 ºF).

NOTICE

It is APHIS policy to use the standard "rounding rule". In determining calibration factors, if the reading is .05 or higher, round to the next higher number in tenths. If it is .04 or lower, round to the lower number. For example: If the calibration factor was .15, round to .2. If it was .32, round to .3. Similar rounding can be used in actual treatment readings. If an actual reading was 34.04, round to 34.0, add or subtract the calibration factor, if necessary. If it was 34.07, round to 34.1, add or subtract the calibration factor, if necessary.

Use the following steps to make the ice water slurry:

1. Prepare a mixture of clean ice and fresh water in a clean insulated container.
2. Crush or chip the ice and completely fill the container.
3. Add enough water to stir the mixture.
4. Stir the ice and water for a minimum of 2 minutes to ensure the water is completely cooled and good mixing has occurred.
   - ❖ The percentage of ice is estimated at 80 to 85 percent while the water fills the air voids (15 to 20 percent).
5. Add more ice as the ice melts.
6. Prepare and stir the ice water slurry to maintain a temperature of 32 °F. (0 °C)
7. Submerge the sensors in the ice water slurry without touching the sides or bottom of the container.
8. Stir the mixture.
9. Continue testing of each sensor in the ice water slurry until the temperature reading stabilizes.
10. Record two consecutive readings of the stabilized temperature on the temperature chart or logsheet.
    - ❖ The temperature recording device should be in manual mode to provide an instantaneous readout.
11. Allow at least a 1 minute interval between two consecutive readings for any one sensor; however, the interval should **not** exceed 5 minutes.
    - ❖ The variance between the two readings should **not** exceed 0.1°.
12. Contact an instrument company representative immediately if the time interval exceeds the normal amount of time required to verify the reading and accuracy of the sensor and recorder system
    - ❖ The recorder used with the sensors must be capable of printing or displaying on demand and **not** just at hourly intervals.
13. Correct any deficiencies in the equipment before certification.
14. Replace any sensor that reads more than plus or minus 0.3 °C (0.5 °F) from the standard 0 ºC (32 ºF).
15. Replace and recalibrate any sensors that malfunction.
16. Document the recalibration and replacement of the sensor(s) on the PPQ Form 449-R, Temperature Recording Calibration Report.
17. Determine the calibrations to the nearest tenth of one degree.

Frequency of Certification Testing

A certification test is required every year. Sumit requests for recertification to the local PPQ office at least 60 days before expiration. Certification testing is also required anytime a malfunction, breakdown or other failure occurs (excluding temperature sensors) that requires modifications to the recording and monitoring system(s).

Application for USDA Warehouse Approval

Visit the Commodity Treatment Information System web site or contact **TQAU** for a fillable, electronic Vessel Approval Application.

APPLICATION FOR USDA WAREHOUSE APPROVAL
FOR USE IN CONDUCTING QUARANTINE COLD TREATMENTS UNDER USDA REGULATIONS

Instructions:
(1) Use one application for each warehouse.
(2) Review the regulatory requirements in Chapter 6 of the Plant Protection and Quarantine (PPQ) Treatment Manual. An electronic PDF document of the manual is available at the following website:
http://www.aphis.usda.gov/import_export/plants/manuals/ports/downloads/treatment.pdf
(3) Each application must include technical documents that support the information supplied.
(4) Fill in each field of the application completely. Review of the application will not begin until all information is received. If a field is not applicable, please put "N/A" in the space provided. In the column labeled "Reference", indicate the page number(s) or specific location where the information can be found in the supporting technical documents.
(5) Send the completed application and required additional information (manuals, technical sheets) to the following office:

Treatment Quality Assurance Unit
USDA-APHIS-PPQ-CPHST
1730 Varsity Drive, Suite 400
Raleigh, North Carolina 27606 USA
E-mail: **cphst.tqau@aphis.usda.gov**
Fax: (919) 855-7493 / Telephone: (919) 855-7450

1. Contact Information	
Requestor Information: This information will be used by USDA as the official contact information for this warehouse.	
Name (First) (Last): John Smith	Company Name: Bilco Cold Products
Job Title: Manager	E-Mail Address: jsmith@bcp.com
Company Address: 1700 Dock Street Philadelphia, PA 12345	
Telephone: 800-555-5555	FAX: 800-555-5556
Agent Responsible for the Warehouse (if different from Requestor)	
Name (First) (Last):	E-Mail Address:
Address of Agent:	
Telephone:	FAX:
2. Warehouse Information	
Name of Warehouse: Bilco Building 14	
Address: 123 Harbour Street Gloucester City, NJ 13456	
E-Mail Address: jsmith@bcp.com	Company Website: www.bcp.com
Telephone: 800-565-1234	FAX: 800-565-1236

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Page 1 of 3

Figure 6-4-8 Example of a Completed Application for USDA Warehouse Approval, page 1 of 3

Attach a warehouse schematic(s) that includes the following: ***All information must be clearly referenced in supporting technical documents.***	
Requirement	**Reference Page or Section**
(a) Delineations of treatment areas to be certified	See page 5
(b) Cubic capacity of each treatment area to be certified	See page 3
(c) Total cubic capacity of warehouse	See page 2
(d) Sensor location	See page 4
(e) Sensor number	See page 4
(f) Sensor type (air or pulp)	See page 1
(g) Treatment area identifiers	See page 2
(h) Airflow direction	See page 1
(i) Refrigeration unit location	See page 1
(j) Recorder location	See page 1
Also attach a description of the method used to segregate fruit under PPQ treatment from other foreign or domestic articles.	

3. Refrigeration Unit	
Make of Refrigeration Unit: Carrier	Model of Refrigeration Unit: GSE
Location of Refrigeration Unit: Equipment Room 1	Model Year: 1998
Airflow maximum rate (cfm): 1250	Airflow direction: East to West

4. Temperature Recorder		
Manufacturer: ACR	Model: Smart Recorder	Model Year: 2005
Serial number(s): 12513541111, 123569858, 125456852		Quantity of recorders: 3/25/2009
Location of unit(s): Portable		
Accuracy of Recorder (Must be accurate to within +/- 0.15 C in the range of +/- 3.0 C): 0.1		
Accuracy of Recorder plus Sensor (Must be accurate to within +/- 0.30 C in the range of +/- 3.0 C): 0.3		
Is this a USDA approved recorder? Yes		

5. Temperature Sensors		
Manufacturer: ACR	Model: 105	Model Year: 2005
Accuracy (Must be accurate to within +/- 0.15 C in the range of +/- 3.0 C): 0.1		
Length of sensor cable (must be long enough to reach fruit in all parts of the stack): 15 meters		
Do sensor numbers match the numbers on the recorder: Yes ☑ **No** ☐		

x _____ 03/23/2009
Requestor's Signature **Date *(mm-dd-yyyy)***

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Page 2 of 3

Figure 6-4-9 Example of a Completed Application for USDA Warehouse Approval, page 2 of 3

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Date Application Received_____

Reviewer_____

Approved_____ **Not Approved**_____ **Date**_____

Reviewer's Signature_____

Comments:

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Page 3 of 3

Figure 6-4-10 Example of a Completed Application for USDA Warehouse Approval, page 3 of 3

Contact Information

TQAU

USDA-APHIS-PPQ-CPHST
Treatment Quality Assurance Unit
1730 Varsity Drive
Suite 400
Raleigh, NC 27606
Phone: 919-855-7450
FAX: 919-855-7493
Email: cphst.tqau@aphis.usda.gov

6

Treatment Manual

Certifying Facilities

Certification of Hot Water Immersion Facilities

Contents

Introduction **6-5-1**
Preliminary Performance Testing **6-5-1**
New Procedures for Hot Water Facility Certification and Commercial Testing **6-5-2**
Procedures for Conducting the Annual APHIS Performance Test **6-5-4**
Protocols for Foreign Treatment Facilities **6-5-7**
Address for Technical Contact **6-5-7**

Introduction

Quarantine treatment by immersion in hot water is used primarily for fruits that are hosts of tropical fruit flies. Exposing the fruit to a temperature of at least 115 °F (46.1 °C) for specific periods of time (depending upon the specific pest, type of fruit, and size of fruit) constitutes a quarantine treatment. The U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS) incorporates this principle of insect control into its regulations to facilitate the importation or interstate movement of certain fruits from areas where tropical fruit flies are the significant pests of concern.

Commercial facilities using hot water immersion treatment are subject to USDA-APHIS, certification on an annual basis. More frequent tests may be required at the option of APHIS. APHIS certification is given solely in conjunction with quarantine treatment requirements.

Important

The certifying official shall check with the manager of the facility to be sure that he is aware of the requirement for using potable water. Whenever water comes into contact with fresh produce, the water's quality dictates the potential for pathogen contamination. To reduce the risk of food- borne illnesses, the water used for washing, treatments, and cooling must be fortified with sodium hypochlorite (household bleach), and constantly maintained at a chlorine level not to exceed 200 ppm.

Preliminary Performance Testing

If the facility has **not** been previously certified by APHIS, the operators should conduct preliminary, informal performance tests on their own (together with an engineer, if needed), to assure themselves that their equipment is in good working order.

By trial and error, the manager of the facility should decide on a tentative temperature set point for their tanks. This should be done by immersing one or more full baskets of fruit into each tank, to be certain that the water temperature (nearest the fruit) reaches at least 115.0 °F (46.1 °C) within 5 minutes. A thermostatic set point for each tank is typically in the range of 115.8 °F to 116.9 °F (46.6 °C to 47.2 °C).

As an option, some hot water immersion systems use an initial higher set point for the first several minutes, then automatically drop to a lower set point for the remainder of the treatment. (If this programming option is used, the change to the second set point must be done automatically, **not** manually.)

Data from the preliminary tests need **not** be recorded on official forms. These data, however, must be presented to APHIS, as evidence that the facility is ready for the official performance test.

Once the facility has been officially certified, APHIS does **not** require the facility to present preliminary performance test data in subsequent years, except when there have been major engineering changes to the equipment.

New Procedures for Hot Water Facility Certification and Commercial Testing

These guidelines have been issued to provide a more accurate reflection of the tank's coldest temperatures. They are **not** intended to replace existing procedures, but to be used in conjunction with the current operational framework. These guidelines are only needed for facilities **not** capturing interior probe temperatures with actual sensors and are **only** in place until each facility begins capturing interior temperatures with actual sensors. Futhermore, these guidelines will be in effect until each facility develops a procedure for placing probes in the coldest locations of the tank. Facilities already using temporary probes as a routine part of commercial testing can disregard the procedures outlined below. All new equipment and procedures must be approved by the Treatment Quality Assurance Unit (**TQAU**) before implementation.

Refer to **Figure 6-5-1** for information regarding adjusted temperatures and set points:

1 Tank Sensor (Lowest) (F)	2 Portable Sensor (Lowest) (F)	3 Adjusted Tank Sensor Temperature[1] (F)	4 Set Point (F)	5 Treatment Interval (minutes)	6 Pulp Temperature (F)
116.0	115.9	115.1	117.0	5	78
115.5	115.4	115.1	116.0	6 - 30	78
115.3	115.2	115.1	115.5	31 - 60	78
115.1	115.0	115.1	115.3	61 - 75	78
115.0	115.0	115.0	115.0	76 - 90	78

Figure 6-5-1 Hypothetical Certification Results: Treatment Tank with Multiple Set Points

1 Adjusted Tank Sensor Temperature Equation:

Take the amount of temperature exceeding 115.0 from Portable Sensor (Lowest) in column 2, and subtract it from Tank Sensor (Lowest) in column 1 (116.0 - 0.9 = 115.1).

1. Average minimum pulp temperatures must be taken from a minimum of 5 fruit extracted from the coldest fruit before treatment. On certification day, this average pulp temperature becomes the minimum commercial treatment pulp temperature permitted. All fruit must be at or above 70 °F to be hot water treated.
2. The "adjusted tank sensor temperature" is determined by taking the amount of temperature exceeding 115.0 from Portable Sensor (Lowest) in column 2, and subtract it from Tank Sensor (Lowest) in column 1.
3. During certification, establish the set point with its lowest corresponding charted temperature. Document these values on the PPQ Form 482, Certificate of Approval and an attachment in the format of **Figure 6-5-1**.
4. The **Figure 6-5-1** attachment and PPQ Form 482 must be displayed in a prominent location at the facility.
5. During commercial treatments, the "Adjusted Tank Sensor Temperature" is used as the lowest treatment temperature. The commercial treatment fails if the tank temperature is below the "Adjusted Tank Sensor Temperature"

Mango temperatures prior to treatment

During certification, determine and record an average pulp temperature (prior to treatment). Calculate this averaged pulp temperature by averaging pulp temperatures from the 5 "coldest" mangoes before treatment (mangoes extracted from the coldest locations). This temperature becomes the minimum

pretreatment pulp temperature allowable for commercial treatments. Therefore, during subsequent commercial treatments, mangoes must be at or above this minimum temperature before beginning treatment. (Any fruit below 70 °F cannot be treated per manual requirements).

Permanent probe temperatures

During certification, record from the printout/chart each set point with its lowest corresponding charted (permanent probe) temperature. A treatment tank may have one set point or multiple set points. If the tank has multiple set points, these set points are for a fixed length of treatment time. Refer to **Figure 6-5-1** for a detailed explanation. This "adjusted tank temperature sensor" (always above 115.0 °F) becomes the lowest temperature permitted for that set point, or the "standard" at that set point. Commercial temperatures (permanent probe temperatures from the chart/printout) must be equal to or greater than the set point standard for each length of time. Document each "adjusted tank sensor temperature" determined during certification, on the PPQ Form 482, Certificate of Approval and on the attachment to the Certificate.

Procedures for Conducting the Annual APHIS Performance Test

To approve the facility, the APHIS officer (or designated representative) shall take the following steps:

1. If the facility has **not** been previously certified, or if modifications have been made since the last performance test, compare the plans and drawings with the actual installation.

   Clearly show dimensions, water circulation, temperature sensing and recording systems, and safeguarding precautions in the plans and specifications.

2. Conduct a performance test (at least annually), during an actual treatment (as described below), to determine (or verify) a temperature “set point” for the system, and to determine the minimum duration of time required between the immersion of successive baskets of fruit within the same tank.

3. Inspect the heating, water circulation, and alarm systems, and check to see that all necessary safeguards (including screens, fans, locks, and air curtains) are secure and operational.

4. Calibrate the portable sensors, recording the results on APHIS form 205 (or a plain sheet of paper).

A. Using a factory-calibrated, mercury, non-mercury or digital thermometer as the standard, compare the reading of each portable sensor to the standard, and record any deviation.

B. To facilitate this process, a specially designed, portable temperature calibrator may be used, which uses either hot air or a swirling hot water bath, set at approximately the temperature at which treatments will take place; a treatment tank can also be used for this purpose, provided that the water is kept in motion.

5. Examine the calibration of the tank's permanent RTD sensors, and record the results on APHIS form 206.

6. Tape the cords of three or four portable "water temperature sensors" to the skins of three or four selected fruits in each basket. (Do **not** cover the end of the sensor with tape.)

7. Insert a portable "pulp temperature sensor" approximately one centimeter into the flesh of one or more fruits in the tank.

A. Hold the sensor in place with tape.

B. It is **not** necessary to have a pulp temperature sensor in each basket.

8. Set the fruit at ambient temperature (70 °F or above) immediately prior to the performance test.

If the fruit is pre-warmed by artificial means, note this routine as a condition of approval that should be followed for each commercial treatment.

9. On the location diagram (APHIS form 207), show the relative position of each portable sensor used in the test, and indicate whether it is a "water" or a "pulp" sensor. Number each sensor.

10. While the fruit are immersed in water, use an electronic thermometer to monitor the temperatures of each portable sensor at various times throughout the test. (record this information on APHIS form 208 for each tank.)

As a second option, a portable, automatic recording instrument can be used; it must, however, operate independently from the temperature recording system installed at the facility.

11. During the performance test, lower the baskets of fruit into the hot water immersion tank.

A. Closely monitor the "water temperature sensors" during the first five minutes of treatment.

APHIS requires that the temperatures of all "water temperature sensors" must reach at least 115 °F (46.1 °C) within 5 minutes; if **not**, in order to achieve the 5-minute temperature recovery requirement, repeat the test using other fruit, using a slightly higher water temperature set point, and/or a slightly longer time interval between subsequent basket immersions.

B. Run the test for the full duration (up to 90 minutes, depending upon fruit size).

During that time, all "water temperature sensors" must read at least 115 °F (46.1 °C) at the 5 minute point and beyond; in addition, the "pulp temperature sensor" (or sensors) must read at least 113 °F (45 °C) *by the end of the test.*

Important

It should be noted that APHIS standards for passing the official performance test are higher than the standards accepted for commercial treatments. This is intentional. *During commercial treatments* of mangoes, the water in the tank is allowed up to 5 minutes to reach the minimum treatment temperature of 115 °F after the fruit have been submerged.

Important

The mango hot water schedules also have a built-in tolerance for subnormal temperatures in the range of 113.7 °F to 114.9 °F for up to 10 minutes (in the case of 65 or 75-minute treatments), or 15 minutes (in the case of 90-minute treatments). This tolerance was designed to "save" an ongoing treatment during an emergency situation such as an electrical power outage. However, *for purposes of the official performance test*, all water temperature sensors are required to read at least 115.0 °F within the first 5 minutes, and to maintain temperatures at or above that threshold during the remainder of the treatment.

12. For issuance of a Certificate of Approval (PPQ form 482), submit all supporting documents to the APHIS-Regional Office (or to another APHIS office delegated by the Region).

13. APHIS will certify the facility only when all requirements are met, including *two* successful hot water immersion treatments in each tank, using standard fruit loads.

For annual recertification, however, only *one* successful performance test is required per tank, unless the Work Plan requires additional tests Submit a copy of PPQ Form 482, the corresponding attachment (**Figure 6-5-1**), all forms used in the certification or recertification and printouts from the temperature recorder to **TQAU**.

Protocols for Foreign Treatment Facilities

This section has been moved to the Commodity Preclearance Program Management Guidelines.

Address for Technical Contact

TQAU

Center for Plant Health Science & Technology
USDA, APHIS, PPQ, CHPST
Treatment Quality Assurance Unit
1730 Varsity Drive, Suite 400
Raleigh, NC 27606

Tel: 919-855-7450
Fax: 919-855-7493

6

Treatment Manual

Certifying Facilities

Certification of Niger seed Treatment Facilities

Contents

PPQ Regulation Policies Governing the Entry of Niger seeds into the United States **6-6-1**
The Certification Process **6-6-1**
Approval of engineering construction plan **6-6-1**
Requesting certification for a treatment plant. **6-6-2**
Performance test for a Niger seed treatment facility. **6-6-2**
Minimum standards and specifications **6-6-3**
Actions Required During Plant Certification **6-6-4**
Certification (approval) of a Treatment Facility. **6-6-4**
Quality Assurance **6-6-5**

PPQ Regulation Policies Governing the Entry of Niger seeds into the United States

Seeds of *Guizotia abyssinica* (Niger seed) from any foreign place, at or before the time of arrival at the port of first arrival, shall be heat treated for possible infestation with noxious weeds or prohibited pathogens in accordance with the applicable provisions of PPQ's Treatment Manual.

The Certification Process

Certification of a niger seed treatment facilities includes the following steps:

1. The facility submits an engineering construction plan
2. APHIS approves the engineering construction plan
3. The facility formally requests certification
4. APHIS conducts a performance test for certification
5. APHIS makes final approval for certification and issues a Certificate of Approval (PPQ Form 482)

Approval of engineering construction plan

Plans and specifications showing dimensions, capacity, heating units and temperature time recording system must be sent for approval through the appropriate State officials and through:

USDA-APHIS-PPQ-CPHST
Treatment Quality Assurance Unit (TQAU)
1730 Varsity Drive, Suite 400
Raleigh, NC 27606

Foreign treatment facilities must be constructed to meet foreign standards. The equipment must be designed in a manner to hold the temperature at or above temperatures prescribed in the treatment schedule for heat treatment of niger seed (T412-a). When the engineering plans are approved, the treatment plant will be constructed accordingly. Any modification of the original plans, will require advanced approval in writing from PPQ.

Requesting certification for a treatment plant.

To obtain certification from APHIS, a Niger seed treatment plant should submit a written request to the APHIS. The request should include the following:

- Listing of names, addresses and phone numbers of the facility, facility manager or supervisor and plant construction engineer,
- Assurance that the facility manager accepts responsibility for facility operations
- Assurance that required equipment is on-site
- Data from at least two preliminary performance tests indicating that the plant meets performance requirements for certification, including copies of completed treatment sheets and related temperature printout sheets for test treatments.

Important

The appropriate permits and approval to import niger seeds for tests must be approved by PPQ Permit Unit prior to shipment of the commodity to the United States.

Performance test for a Niger seed treatment facility.

Initial certification/performance testing will be conducted by CPHST-TQAU in conjunction with PPQ. CPHST may delegate this responsibility to others for the purpose recertification.

Equipment/materials needed by APHIS or its designee to conduct facility performance tests for certification.

The facility must supply the following equipment and materials to conduct a performance test for certification:

- Copy of plans and specifications showing dimensions and other details of heating and temperature recording systems.

- Certified calibrated thermometer (temperature range to at least 270° F (132.2° C))
- Stop watch and tape measure
- Temperature recording system to record temperature and processing time.

Minimum standards and specifications

To qualify for certification/recertification, the facility must meet the following minimum standards and specifications:

- Temperature probes (a minimum of 2) situated in the heat treating equipment in such a way as to determine when the niger seeds reaches the target temperature. Probes or sensors shall be placed in the commodity in order accurately record commodity temperature.
- Temperature recording chart shall be in increments of **not** less than 0.10 inch for each degree F. (or 5mm for each degree C)
- Temperature readings shall be recorded on a chart in time intervals **not** to exceed four minutes between each reading.
- Accuracy of the total temperature recording system shall be within plus or minus 0.5 degree F. (0.3 degree C.) of actual temperatures as measured with a certified calibrated thermometer.
- Speed indicator shall be present for continuous flow systems.
- All the valves and controls that affect heat flow to the treatment system shall be secured to avoid manipulation during the treatment process by unauthorized personnel.
- Heating controls shall be automatic and run continuously throughout the treatment process, manual adjustments are allowed.
- Gear systems used to control the niger seed conveyor (if applicable) shall be capable of being adjusted as needed to meet treatment requirements.
- An audible alarm or highly visible light shall be installed on burners or other equipment to indicate system failure and/or when **not** operating properly.
- A system shall be in place to divert any untreated niger seeds for treatment.
- An action plan shall be available to address any pests which may be associated with the storage, treatment and shipment of niger seeds.

- Proper sanitation measures shall be implemented to ensure that there are no potential breeding grounds for pests on the premises and therefore, little risk of re-infestation or cross-contamination.
- Treated seeds shall be stored in a location separate from the non-treated seeds. The treated and non-treated seeds shall be handled in a manner to prevent cross-contamination.
- Seed processing equipment shall have the capability to divert for re-treatment any non-treated, or treated seeds which do **not** meet treatment standards.

Actions Required During Plant Certification

Also, the facility must conform to the following operating procedures:

- Sufficient niger seeds for two (2) test runs at the maximum load for one (1) hour must be on hand for APHIS personnel overseeing the tests.
- All temperature sensing probes must be verified during the test runs or evidence provided that the probes have been calibrated by an official calibration company within a 12 month period.
- The temperature and conveyer speed must be verified to coincide with the readings taken during manual testing and calculation.
- Check the continuity of the system to verify the lack of any cross-contamination.
- Ensure that after treatment and cooling, the niger seeds are immediately bagged in new bags. The old bags must be treated or disposed of in a manner that will preclude regulated pests.

Certification (approval) of a Treatment Facility.

If treatment standards are **not** met during performance testing, APHIS will record the test as **not** acceptable for certification. A copy of the data sheet with explanation as to why the test was **not** acceptable, should be provided to the facility operator for corrective action.

Final approval of niger heat treating equipment will be given after two (2) consecutive successful runs of maximum capacity at the longest treating period consecutive successful runs of maximum capacity at the longest treating period (at least 15 minutes at 248 degrees F. minimum or 120 degrees C). Upon approval, APHIS will issue a Certificate of Approval (PPQ form 482).

Important

Any compliance agreement/workplans or standards developed be APHIS for the facility must be adhered to.

Quality Assurance

PPQ will monitor by sampling the treated seeds periodically to find actionable contaminants. Every 25th lot after treatment is to be sampled according PPQ sampling protocol.

6

Treatment Manual

Certifying Facilities

Certification of Forced Hot Air and Vapor Heat Treatment Facilities

Contents

Introduction **6-7-1**
Plan and Process Approval **6-7-2**
Preliminary Performance Testing **6-7-3**
Official Certification Testing **6-7-3**
- Calibrating the Portable Temperature Sensors **6-7-4**
- Calibrating the Permanent Temperature Sensors **6-7-4**
- Permanent Sensor Heat-up Test **6-7-5**
- Thermal Mapping **6-7-5**
- Conducting a Test Treatment **6-7-7**
- Frequency of Certification **6-7-7**
- Frequency of Permanent Temperature Sensor Calibration **6-7-7**

Documentation **6-7-8**
Contact Information **6-7-8**

Introduction

Forced hot air (FHA) and vapor heat (VH) treatment facilities must be certified by a qualified APHIS inspector. For brevity, "certification" and "re-certification" will both be referred to as "certification" in this chapter.

Prior to the first certification at a facility, the facility plan and process description must be approved by the Treatment Quality Assurance Unit (TQAU) (**TQAU** contact information can be found at the end of the chapter). Certification tests must be carried out prior to treatment at the beginning of the shipping season or whenever APHIS determines that a malfunction or alteration in the system warrants a certification test.

Certification will be granted on the basis of the ability of the chamber to meet treatment requirements, extent and condition of phytosanitary safeguards, sanitary (human health) conditions, and safety conditions. Facilities must be certified for each species (in some cases each variety or subspecies) of fruit, each chamber load configuration (half full, quarter full, etc.…), and, for some species, each size class of fruit treated.

Facilities should be aware that certification may **not** be the only condition under which they may treat fruit for shipment to or within the US. In addition to certification, there are other requirements such as agreeing to an operational workplan, signing compliance agreements, and obtaining import permits that must be satisfied prior to treatment. Treatment facility managers outside the US should contact APHIS International Services (IS) and managers of facilities in the US or its territories should contact their local PPQ office for a complete list of requirements.

Plan and Process Approval

Prior to the start of facility construction, a detailed plan of the facility's physical characteristics and a written, step by step, description of the all the processes related to treatment must be approved by **TQAU** (all plans and supporting materials must be submitted in Standard English). Plans and process descriptions for facilities within the US and its territories must be submitted through the local PPQ office, facilities outside the US should consult APHIS IS for the appropriate plan submission procedure.

At a minimum, plans must include the following information as diagrams and/ or written descriptions:

- Areas designated for fruit arrival
- Areas designated for loading of treated fruit
- Areas for storage of untreated fruit
- Crates, lugs, bins, etc., that will be used to hold fruit during treatment, including total volume and projected fruit capacity
- Delineations of area(s) for storage of treated and untreated fruit
- Description of all processes related to treatment of fruit. These descriptions should reference diagrams with numbers where appropriate
- Physical location of facility
- Post-treatment cooling system
- Post-treatment packing
- Pre-treatment sorting and grading areas
- Systems designed to ensure phytosanitary security of the treated fruit
- Systems designed to ensure water which comes into contact with fruit is free of microbial or any other contaminants that may adversely affect human health

- Treatment chamber including heating system, crate arrangement within the chamber, and air flow

The process of reviewing the plans and process descriptions may take as long as sixty days and subsequent requests for additional information may further extend this time. Facilities should take this time constraint into account when developing a project timeline. Facilities will receive a letter granting plan approval or describing plan deficiencies. Plan approvals expire one year from the approval date if the facility has **not** been certified.

Preliminary Performance Testing

Following plan approval, the facility should be built according to the plans. If deviations from the plans are necessary, **TQAU** must approve these changes (changes should be submitted in a manner similar to that described in "Plan and Process Approval"). After construction is completed, the facility must be tested to be sure it can meet all treatment requirements. These trials should test the ability of the treatment chambers to heat a full (maximum) load of fruit to according the treatment guidelines. Any problems or deficiencies found in the facility must be corrected and the preliminary tests must be re-run until all treatment requirements are met. After the facility representative is satisfied that the treatment system is running properly and can fully meet treatment requirements, they must submit results of the test to **TQAU** for review.

Facilities will be provided with specific requirements as part of the plan approval letter. General requirements for test result submission are as follows:

- Amount, type, and size of fruit in load and in each crate
- A diagram of chamber that shows location of each permanent sensor
- Time and temperature data from the test run(s)

The process of reviewing results from preliminary performance tests may take as long as 30 days. After **TQAU** reviews the results from the preliminary performance test, they will issue a letter either approving or rejecting the results. If approval is granted, the facility representative can then schedule an official certification test.

Official Certification Testing

The official certification test has four main components: (i) calibrating the portable and permanent sensors, (ii) permanent sensor heat up test (iii) thermal mapping (cold spot mapping), and (iv) conducting an actual test treatment.

These steps are discussed below in detail. A certification test must be completed for each combination of fruit species, chamber load configuration, and, in some cases, fruit size class.

Calibrating the Portable Temperature Sensors

If the facility is outside the US, it is the responsibility of the exporter to provide portable temperature sensors for the certification procedure. **Permanent sensors may not be substituted for portable sensors.**

NOTICE

Only portable sensors approved by **TQAU** may be used. Contact **TQAU** for a list of approved temperature sensors.

Portable temperature sensors must be calibrated in a swirling hot water bath with a factory calibrated certified mercury, non-mercury, or digital thermometer with 0.1 °C (0.2 °F) graduations as a standard. The temperature of the swirling hot water bath must consistently read the treatment temperature on the certified thermometer. Portable temperature sensors must be inserted into the hot water bath and must remain until the certified thermometer reads the treatment temperature for ten consecutive minutes. After the 10 minute calibration period, the portable sensors may be removed and their data read. Any sensor that deviates by more than +/- 0.3 °C (0.5 °F) from the treatment temperature may not be used. The greatest deviation for each portable sensor should be recorded as the correction factor for that portable sensor.

Important

If using a glass mercury thermometer, carefully inspect the calibrated certified glass mercury thermometers for bubbles in the mercury or other defects prior to each use.

Calibrating the Permanent Temperature Sensors

The permanent temperature recording system should be calibrated in the same manner described for portable sensors described in "Calibrating the Portable Temperature Sensors".

However, it should be noted that this calibration is not just for the sensor portion of the temperature recording system, but applies to the sensors, the wires that attach the sensors to the recording instruments, the recording instruments, and any other devices used to measure, transmit, or record the temperature. Failure of the permanent temperature recording system to read within +/- 0.3 °C (0.5 °F) of the treatment temperature may indicate that a portion of or the entire permanent temperature recording system needs to be

repaired or replaced. If any part or portion of the permanent temperature recording system is repaired or replaced, the entire permanent temperature recording system must be recalibrated.

NOTICE

Calibration of permanent and portable temperature sensors must be completed before the permanent sensor heat-up test, thermal mapping, and or test treatment is performed.

Permanent Sensor Heat-up Test

The permanent temperature sensor system must be tested against the portable temperature sensors to verify that the permanent temperature sensors correctly respond to changes in temperature within the chamber.

This test is performed by arranging permanent temperature sensors and portable temperature sensors in close proximity within the treatment chamber. A maximum ratio of 2 permanent sensors to one portable sensor is allowed for this test. Sensors should be placed in locations within the chamber that are expected to have relatively uniform heating patters. After all sensors are secured within the chamber, conduct the treatment as usual. When the test is complete, review the data. All data collected from the permanent temperature sensors must be within +/- 0.3 °C (0.5 °F) of the corresponding portable temperature sensor.

Thermal Mapping

Thermal mapping determines the placement of permanent temperature sensors in the chamber. Because the permanent temperature sensors will be placed in the coldest areas of the chamber, this process is also referred to as cold spot mapping or cold spot testing. The process of thermal mapping is relatively simple, portable temperature sensors are placed throughout the chamber and the treatment is conducted. The sensors that took the longest time to record treatment temperature represent colder areas of the chamber. Thermal mapping can be time consuming and resource intensive. The procedure is as follows:

1. Based on basic thermodynamics and data from the preliminary performance test, develop hypotheses about which regions of the chamber are most likely to have cold spots. This will be based primarily on the direction of the air flow in the chamber. Chambers in which air flows in a single vertical direction will generally have cold regions in portions of the load that come into contact with the heated air last. For example, if the chamber delivers hot air from the bottom, the top of the load is likely to take longer to heat up because the fruit at the bottom absorbs heat first. In chambers where the air flow changes direction or the air delivery is horizontal, it may be more difficult to form these types of hypotheses.

2. Inspect fruit to be used in test to be sure it is similar in size, ripeness, and variety to the fruit that will be routinely treated. Fruit should be sorted and a subset totaling the number of portable temperature sensors plus 20 percent should be selected. The difference between the heaviest and lightest fruit must not be more than 5 percent of the heaviest fruit's weight.
3. Each sensor must be placed in one of the fruit in the subset collected in #2 above. The most sensitive portion of the temperature sensor must be placed in the area of the fruit pulp most resistant to temperature change, usually the center of the fruit or close to the pit.
4. Based on the hypotheses formed in #1 above, place the majority of the portable temperature sensors in the areas thought to be cold regions. In order to verify the hypothesis, place a portion of the portable temperature sensors in the areas thought to be warmer. If no hypotheses were formed in #1 above, portable temperature sensors must be placed in a systematic pattern that can provide a complete thermal map of the entire load. If necessary, contact **TQAU** for assistance developing a thermal mapping sampling scheme.

NOTICE

Each chamber may require a different number of portable sensors depending on factors such as the chamber size, chamber dimensions, air flow patterns, and size and species of the fruit. Typically, a chamber approximately the size of a standard 40 ft. shipping container will require about 60 sensors. Contact **TQAU** for help in determining the number of sensors required.

5. Create a map of the chamber that shows the relative horizontal and vertical location of each portable temperature sensor.
6. Conduct the treatment.
7. Remove the portable temperature sensors and read their data.
8. Determine the amount of time each portable temperature sensor took to reach treatment temperature. The portable temperature sensors which required the longest time to reach treatment temperature indicate cold spots.

NOTICE

All portable temperature sensors must reach treatment temperature.

9. Create a map of the cold spots based on the map created in step #5 and the analysis completed in step #8.
10. Repeat this process at least twice for each load / volume configuration to ensure that correct and consistent cold spots are found.

11. Based on the thermal maps created in step #9, create a map showing the location of each permanent temperature sensor for each load/ volume configuration.

Important

If thermal mapping shows that difference in the time required to reach treatment temperature between any two sensors is greater than 2 hours, the chamber will **not** be certified.

Conducting a Test Treatment

A test treatment must be performed to verify that the chamber is capable of meeting treatment requirements. Test treatments are only required for the maximum load/volume configuration that the facility will be certified for and may be done in conjunction with the thermal mapping described above. The procedure for conducting a test treatment is as follows:

1. Place permanent temperature sensors in areas of the load that are thought to be cold spots (based on thermal mapping data).
2. Conduct the treatment.
3. During treatment, inspect the outside of the chamber to be sure it is free of leaks, is operating smoothly, and generally is in good working order.
4. After treatment is completed, review the temperature logs from the permanent temperature sensors. All permanent temperature sensors must have reached the treatment temperature.

Frequency of Certification

A certification test is required once a year, usually at the beginning of the shipping season, and whenever the system has a malfunction, breakdown, or other failure (excluding malfunction of temperature sensors) that require modifications that alter the manner in which the system functions.

Frequency of Permanent Temperature Sensor Calibration

Permanent temperature sensors must be calibrated using the process described in ***Calibrating the Permanent Temperature Sensors* on page 6-7-4**. Calibration of permanent temperature sensors must be performed every 14 days. However, calibration can also occur whenever any part of the permanent temperature recording system fails or is replaced, or at the discretion of the APHIS inspector.

Documentation

All tests performed during certification must be documented by the APHIS official. A copy of the signed APHIS Form 482, copies of all thermal maps, description of load size limitations, description of any other special limitations placed on the treatment, and any other pertinent addenda or appendices, must be sent to **TQAU** for final approval.

Contact Information

TQAU

Center for Plant Health Science & Technology
USDA, APHIS, PPQ, CHPST
Treatment Quality Assurance Unit
1730 Varsity Drive, Suite 400
Raleigh, NC 27606

Tel: 919-855-7450
Fax: 919-855-7493

6

Treatment Manual

Certifying Facilities

Certifying Irradiation Treatment Facilities

Contents

Introduction **6-8-1**
Certification Requirements **6-8-1**
Recertification **6-8-2**
Audits **6-8-3**
Certificate of Approval **6-8-3**

Introduction

In order to receive authorization to conduct approved phytosanitary irradiation treatments, an irradiation facility must obtain a PPQ Form 482, Certificate of Approval from the USDA-APHIS-PPQ Treatment Quality Assurance Unit (TQAU).

The purpose of this chapter is to provide basic guidelines for facility certification, recertification and audits. Approved facilities must be able to demonstrate that their equipment and personnel are able to safely, accurately, and consistently administer the minimum dose (Dmin) to all components of the commodity over the range of conditions expected for commodities treated.

Certification Requirements

The facility must be certified by the national nuclear regulatory authority of the country where the facility is located prior to involvement from USDA.

In order to receive a Certificate of Approval for treating commodities to mitigate regulated pests, a facility must complete the following in numerical order:

1. Operational Workplan (OWP)

An Operational Workplan (OWP) must be established prior to a Cooperative Agreement. The OWP provides general guidelines for safeguarding procedures.

2. Addenda to the Workplan

The addenda to the OWP identifies specific information **not** covered in the OWP, such as the commodity(ies) and pest(s) that will be irradiated and details pertinent to facility operation.

3. Cooperative Agreement

The Cooperative Agreement establishes a trust fund between the importing and exporting countries.

4. Plan Approval Application

The Plan Approval Application must be completed in it's entirety and submitted to:

USDA-APHIS-PPQ-CPHST
Treatment Quality Assurance Unit
1730 Varsity Drive
Raleigh, NC 27606-5202
Phone: 919-855-7450

5. On-site certification

When all documents have been approved, an official on-site visit will be scheduled. During this visit, the certifying official will verify the accuracy of the information submitted in the Plan Approval Application, review the Standard Operating Procedures (SOP), inspect the dosimetry equipment and verify that the personnel are proficient in its use. The on-site certification will also include inspection of the segregation structures to ensure misidentification or cross-contamination of treated and untreated commodities does **not** occur. Phytosanitary measures must be in place to guard against pest infestation from the perimeter of the facility. The certifying official will also review the dose mapping procedures and records and verify that data management procedures are acceptable.

6. Compliance Agreement

The Compliance Agreement serves as the legal notice to the treatment facility to follow the OWP. The Compliance Agreement defines what the facility must do before, during and after receipt of the fruit (i.e. segregation, inspection, safeguarding, record keeping, and labelling) and any additional requirements specific to the facility.

Recertification

Recertification will be conducted when at least one of the major non-compliances described below have been detected:

- A problem with the treatment process has been identified by APHIS or the NPPO (i.e. unmitigated pest interception)
- Change in management which substantially affects any aspect of the treatment process
- Operational or structural changes of the facility
- Replenishment, rearrangement or change of the radiation-producing source

Important

Annual recertification is **not** necessary.

Audits

Audits will be performed at the discretion of the Director of APHIS-PPQ-CPHST-TQAU. On-site audits will include review of the dosimetry, dose mapping, safeguarding measures, record keeping, and the treatment process and system integrity as a whole.

Electronic audits will also be performed by TQAU to review routine dosimetry data and dose mapping data.

Certificate of Approval

Upon facility approval, the USDA will issue a PPQ Form 482, Certificate of Approval, outlining the terms, conditions, and restrictions of the approval. The USDA approval status of all irradiation treatment facilities, both domestic and foreign, treating commodities to mitigate regulated agricultural pests will be tracked by USDA-APHIS-PPQ-CPHST-TQAU.

The Certificate of Approval can be revoked if major non-compliances are detected.

6

Treatment Manual

Certifying Facilities

Certifying Facilities for the Heat Treatment of Firewood

Contents

Introduction **6-9-1**
Plan and Process Approval **6-9-2**
Official Certification Testing **6-9-3**
Calibrating the Temperature Sensors **6-9-3**
Thermal Mapping **6-9-4**
Conducting a Test Treatment **6-9-5**
Frequency of Certification and Temperature Sensor Calibration **6-9-5**
Documentation **6-9-6**
Contact Information **6-9-6**

Introduction

Agrilus planipennis Fairmaire (Coleoptera: Buprestidae), commonly known as the Emerald Ash Borer (EAB,)is a wood-boring insect that infests firewood. This destructive beetle attacks all North American species of Ash trees and has been detected in Illinois, Indiana, Ohio, Pennsylvania, Maryland, Michigan, and Windsor, Ontario, Canada.

The European Gypsy moth (*Lymantria dispar* L.) feeds on over 500 species of trees and shrubs. Quarantined areas include the District of Columbia, the entire States of Connecticut, Delaware, Maryland, Massachusetts, Michigan, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont. Additionally these states, portions of the following states are quarantined: Indiana, Illinois, Maine, North Carolina, Ohio, Virginia, West Virginia, and Wisconsin.

Heat treatment is an approved treatment for these two common wood pests. The treatment must occur in a certified heat treatment facility. The purpose of this chapter is to provide guidelines for the certification of a heat treatment facility.

Heat treatment facilities must be certified by a qualified PPQ official. For brevity, “certification” and “re-certification” will both be referred to as “certification” in this chapter.

Certification tests must be carried out prior to treatment to allow movement of wood from the current quarantine areas, or whenever a malfunction or alteration in the system warrants a certification test.

Certification will be granted on the basis of the ability of the chamber to meet treatment requirements, extent and condition of phytosanitary safeguards, and safety conditions.

Facilities should be aware that certification may **not** be the only condition under which firewood for shipment can be moved from quarantine areas. In addition to certification, there are other requirements that must be satisfied prior to treatment:

- An operational workplan
- A compliance agreement
- Appropriate federal, state or local permits

Treatment facility managers should contact their local PPQ office and/or local state departments of agriculture for state-specific requirements.

Plan and Process Approval

Prior to the start of the certification process for a new or existing facility, a detailed plan of the facility's physical characteristics and a written, step by step, description of all the processes related to treatment must be approved by USDA-APHIS. Plans and process descriptions must be submitted through the local PPQ office.

At a minimum, plans must include a description of all processes related to the heat treatment of firewood. These descriptions should reference diagrams with numbers where appropriate. Submit the following information as diagrams and/or written descriptions:

- Areas designated for:
  - Arrival and storage of untreated firewood
  - Loading of untreated and treated firewood
  - Storage of untreated and treated firewood
- Crates, bins, racks etc. used to hold firewood during treatment, including total volume and projected capacity
- Physical location of facility
- Post-treatment cooling system

- Post-treatment packaging
- Pre-treatment sorting and grading areas
- Systems to ensure phytosanitary security of the treated wood
- Treatment chamber including heating system, arrangement within the chamber, and air flow

The process of reviewing the plans and process descriptions may take as long as sixty days and subsequent requests for additional information may further extend this time. Facilities should take this time constraint into account when developing a project timeline. Facilities will receive a letter granting plan approval or describing plan deficiencies. Plan approvals expire one year from the approval date if the facility has **not** been certified.

Official Certification Testing

Following plan approval, facilities seeking certification must be tested to ensure they can meet all treatment requirements. If deviations from the plans are necessary, PPQ must approve these changes prior to testing (changes should be submitted in a manner similar to that described in “Plan and Process Approval”).

The official certification test has three main components: (i) calibrating the temperature sensors, (ii) thermal mapping (cold spot mapping), and (iii) conducting an actual test treatment. These steps are discussed below in detail. A certification test must be completed for each chamber load configuration.

Calibrating the Temperature Sensors

Important

Only temperature sensors approved by USDA-APHIS may be used. Contact the PPQ personnel listed in ***Contact Information* on page 6-9-6**.

Calibrate all temperature sensors prior to facility certification tests and a minimum of once annually thereafter. In addition, if a permanent temperature recording system is used, the system must be recalibrated when any part or portion of the system is repaired or replaced. Calibrations must be performed by the temperature sensor manufacturer or by manufacturer trained technicians. All temperature sensors must read within +/-0.5 °C (0.9 °F) of the treatment temperature.

Thermal Mapping

Thermal mapping determines the placement of permanent temperature sensors in the chamber. Because the permanent temperature sensors will be placed in the coldest areas of the chamber, this process is also referred to as cold spot mapping or cold spot testing. The process of thermal mapping is relatively simple; portable temperature sensors are placed throughout the chamber and the treatment is conducted. The sensors that took the longest time to record treatment temperature represent colder areas of the chamber.

Important

Each facility may require a different number of portable sensors depending on factors such as the chamber size, chamber dimensions, and air flow patterns. A facility that is less than or equal to 10,000 ft^3 will require about 20 sensors for thorough temperature mapping. Contact the PPQ personnel listed at the end of this chapter for help in determining the number of sensors required for a facility larger than 10,000 ft^3.

The thermal mapping procedure is as follows:

1. Drill holes a minimum of 4 inches deep into the ends of the largest pieces of wood. The diameter of the hole should be equivalent to the outer diameter of the sensor.
2. Place the sensors in the wood and in various locations throughout the entire chamber.
3. Create a diagram of the chamber that shows the relative horizontal and vertical location of each temperature sensor.
4. Conduct the treatment.
5. Remove the temperature sensors and analyze the temperature data.
6. Determine the amount of time each temperature sensor took to reach the treatment temperature. The temperature sensors that required the longest time to reach treatment temperatures indicate cold spots.
7. Create a map of the cold spots based on the map created in step #3.
8. Repeat this process for each load and volume configuration to ensure that correct and consistent cold spots are found.
9. Based on the thermal maps created in step #7, create a map to indicate where temperature sensors should be placed for each load and volume configuration during daily operational treatments.

Conducting a Test Treatment

A test treatment must be performed to verify that the chamber is capable of meeting treatment requirements. Test treatments are only required for the maximum load/volume configuration that the facility will be certified for and may be done in conjunction with the thermal mapping described above. The procedure for conducting a test treatment is as follows:

1. Place permanent temperature sensors in areas of the load that are thought to be cold spots (based on thermal mapping data).
2. Conduct the treatment.
3. After treatment is completed, review the temperature data from the temperature sensors. All temperature sensors must have reached the treatment temperature.

These trials should test the ability of the treatment chambers to heat a full (maximum) load of wood according to the treatment guidelines. Any problems or deficiencies found in the facility or with the treatment must be corrected and the tests run again until all treatment requirements are met. After the facility representative is satisfied the treatment system is running properly and can fully meet treatment requirements, test results must be submitted to USDA-APHIS for review.

The process of reviewing results from preliminary performance tests may take as long as 30 days. After USDA-APHIS-PPQ reviews the results from the preliminary performance test, a letter will be issued either approving or rejecting the results. Once the facility is approved, treatment and shipment may begin.

Frequency of Certification and Temperature Sensor Calibration

A certification test is required once a year, and/or whenever the system has a malfunction, breakdown, or other failure that requires modifications that alter the manner in which the system functions. This excludes the replacement of a faulty temperature sensor.

All temperature sensors must be calibrated at the discretion of the PPQ official, annually, or whenever any part of the temperature recording system fails or is replaced. Use the process described in the “Calibrating the Permanent Temperature Sensors” section of this chapter.

Documentation

All tests performed during certification must be documented by the PPQ official. A copy of the signed APHIS Form 482, copies of all thermal maps, description of load size limitations, description of any other special limitations placed on the treatment, and any other pertinent addenda or appendices, must be sent to USDA-APHIS-PPQ for final approval.

Contact Information

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7 Emergency Aid and Safety

Treatment Manual

Fumigation Exposure

Contents

Emergency Action—DO NOT HESITATE **7-1-1**
- You **7-1-1**
- Coworker **7-1-1**

First Aid With Rescue Breathing **7-1-2**

Signs, Symptoms, Emergency Aid, and Medical Treatment for Poisoning by Some Fumigants Used by APHIS **7-1-3**
- Chloropicrin **7-1-3**
- Methyl Bromide **7-1-3**
- Phosphine (From Aluminum Phosphide) **7-1-3**
- Sulfuryl Fluoride **7-1-3**

Fumigant Safety **7-1-4**

Guidelines for Using Fumigants Safely **7-1-6**

Emergency Action—DO NOT HESITATE

You

If exposed to fumigant, immediately move well away from the contaminated area. Notify your coworkers of the danger and that you have been exposed. Onset of symptoms may be delayed in some fumigants. Promptly notify your supervisor of all details.

If liquid fumigants have spilled on skin or clothing—immediately remove contaminated clothing and gently wash the skin with large quantities of water and soap. Do **not** use abrasive cloths or brushes. Be sure to include areas under finger and toenails. Contaminated skin may also be rinsed with rubbing alcohol.

Contaminated clothing must **not** be used again until thoroughly aired, washed, and dried. Dangerous vapors will be produced by the liquid fumigant as it evaporates from skin or clothing.

Coworker

If chemical intoxication due to exposure is at any time suspected:

1. Immediately move the victim out of the area to fresh air.

CAUTION

Do **not** enter contaminated areas without a proper respirator, even to effect rescue.

2. If there is evidence of respiratory weakness, give artificial respiration. Oxygen can be beneficial. **Artificial respiration takes precedence over all other first aid.** (see next page.)
3. Call a physician when symptoms suggest immediate care is needed.
4. Keep patient warm, comfortable, and as quiet as possible.
5. If convulsions occur, use gentle restraint and prevent injury.

First Aid With Rescue Breathing

If you think a person has stopped breathing, don't delay. Give first aid immediately. Ask someone else to get medical help.

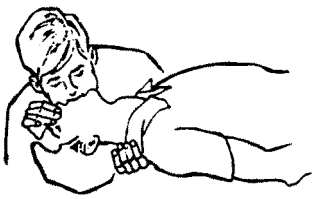
1. Is the person breathing?

To find out if the person is breathing, place him flat on his back and put your ear close to his mouth. If he is breathing, you will feel his breath and see his chest rise and fall.

2. Open the airway.

If the person has stopped breathing, lift up his neck with one hand and push down on his forehead with the other. This opens the airway and the person may start to breathe. If he doesn't, begin RESCUE BREATHING at once.

3. Rescue Breathing. Keep one hand under the person's neck so that his head is tilted backward with his chin up. Pinch his nostrils shut with the fingers of your other hand.



Take a deep breath and cover his mouth completely with yours. Blow air into his mouth. When his chest moves up, take your mouth away and let his chest go down by itself.

Repeat this procedure every 5 seconds. Do not stop until the person starts breathing or medical help comes.

Signs, Symptoms, Emergency Aid, and Medical Treatment for Poisoning by Some Fumigants Used by APHIS

Chloropicrin

Signs and Symptoms

Powerful irritant; affects all body surfaces, lacrimation, vomiting, bronchitis, pulmonary edema. Inhalation causes anemia, weak and irregular heart beat, recurrent asthmatic attacks.

Emergency Aid

Artificial respiration. Oxygen if available.

Medical Treatment

Symptomatic—oxygen. Sample analysis might be helpful in diagnosis and prognosis.

Methyl Bromide

Signs and Symptoms

Central nervous system depression, nausea, fever, dizziness, confusion, delirium, staggering, visual disturbances, abdominal pain, mania, tremors, pulmonary edema, convulsions, coma. ***Onset may be delayed 4-12 hours.*** On skin, severe irritations, skin blisters, dermatitis.

Emergency Aid

Artificial respiration. Oxygen if available. No mechanical resuscitation. If on skin, wash 15 minutes with large amounts of water. If on clothing, vapors may be released in toxic quantities.

Medical Treatment

Symptomatic—Artificial respiration, oxygen without mechanical resuscitator. Analysis of breath and blood may help in diagnosis and prognosis. Nausea, accompanied by vomiting. Give intravenous, glucose-bearing vehicles.

Phosphine (From Aluminum Phosphide)

Signs and Symptoms

2,000 ppm in air, rapidly fatal. Chest pain, headache, dyspnea, restlessness, vomiting, diarrhea, convulsions, coma, paralysis, low blood pressure, slow heart, death may be delayed several days.

Emergency Aid

Artificial respiration. Oxygen if available.

Medical Treatment

Symptomatic—oxygen; control convulsions with sedatives, restore fluid balance with glucose and saline.

Sulfuryl Fluoride

Signs and Symptoms

Central nervous system depression, excitation may follow.

Emergency Aid

Place patient in fresh air, face downward, with head slightly below level of lungs. Keep warm. If breathing stops, give artificial respiration.

Medical Treatment

First symptoms expected are those of respiratory irritation and central nervous system depression. Treat symptomatically.

Fumigant Safety

Specific precautions to be followed when using each of the fumigants are listed on the label and labelling. However, the following general safety procedures can be applied to most applications.

1. Hazards vary with:
   - **A.** Relative toxicity of each fumigant
   - **B.** Dosage rate (concentration)
   - **C.** Size of enclosure
   - **D.** Tightness of enclosure
   - **E.** Physical condition of employee (allergies, heart condition, respiratory ailments, etc.)
2. It is important to:
   - **A.** Know the characteristics of the fumigants you are working with
   - **B.** Have the proper equipment to carry out the fumigation
   - **C.** Be familiar with the emergency aid required should an accident occur
3. Wear protective equipment if there is a chance of exposure to highly toxic liquid fumigants.
   - **A.** Gloves should be impermeable to liquid fumigant being used
   - **B.** Rubber aprons should be long enough to prevent legs from being exposed
   - **C.** A face shield or respirator should be worn when liquids are being transferred and there is a possibility of splattering
4. Dispensers for measuring the amount of fumigant should have shatter-proof shields.
5. The area surrounding the fumigation enclosure should be well-aerated. Operators should be located upwind from treatment.
6. If it is necessary to stay in the area of a treatment, the air should be monitored to determine if harmful levels of the fumigant are present.

7. Under no circumstances should an inspector be exposed to concentrations above minimum safe standards. A self-contained breathing apparatus (SCBA) should always be readily available should an emergency develop.
8. A SCBA is required at all fumigation sites. Use of such respirators is mandatory for PPQ Officers when within 30 feet of tarpaulin fumigation or whenever TLV is exceeded (5 ppm for methyl bromide).. You must have a medical evaluation and clearance to use SCBA equipment. The evaluation must be performed by a physician or licensed health care professional. Also, you must follow OSHA standards for respirator use. (see APHIS Safety and Health Manual, Chapter 11, Section 3)
9. Wash hands and face after leaving area where toxic amounts of fumigants are being used.
10. Do **not** eat, drink, smoke, or carry tobacco in areas where fumigants are being used.
11. A first-aid kit equipped with the proper materials should be readily available at the treatment site.
12. Persons working regularly with toxic fumigants should have blood tests and physical examinations if warranted by supervisor's consultation with local medical authorities.
13. Have telephone numbers of local hospitals, doctors, and poison control centers prominently displayed.
14. Learn to recognize the signs and symptoms of fumigant poisoning. Training should be given to each inspector.
15. Supervisors should be aware of signs of fatigue. Risk of accidents increases in tired employees.

Guidelines for Using Fumigants Safely

Emergency-Rescue and respirator[1] for each of the fumigants is a SCBA.

Table 7-1-1 Fumigant Monitoring Devices and Sources of Exposure

Fumigant/Routes of Entry	Detector Unit or Monitoring Device	Sources of Exposure
Methyl bromide: Inhalation, skin	Gas detector tubes, Electronic detector, Thermal Conductivity Unit, Infrared spectroscopy	Cylinder connection, leaks in tarpaulin, applicators, aeration
Phosphine (from aluminum phosphide): Inhalation	Gas detector tubes, Electronic detector	Application of pellets, leakage from enclosure, aeration
Sulfuryl fluoride (Vikane®): Inhalation	Thermal Conductivity Unit, Electronic detector	Applicator and cylinder connections, leakage from enclosure, aeration

1 For use outside of enclosure only.

7 Emergency Aid and Safety

Treatment Manual

Pesticide Exposure

Contents

Emergency Action—DO NOT HESITATE **7-2-1**
- You **7-2-1**
- Coworker **7-2-1**

First Aid With Rescue Breathing **7-2-2**
General Symptoms **7-2-3**
- Mild Poisoning **7-2-3**
- Moderate Poisoning **7-2-3**
- Severe Poisoning **7-2-3**

Pesticide Safety **7-2-3**

Emergency Action—DO NOT HESITATE

You

If your clothing is soaked with pesticide, remove the contaminated articles quickly. Then gently wash the skin with large quantities of soap and water. Do **not** scrub the skin or use an abrasive cloth or brush. Include areas under your fingernails and toenails. Contaminated skin can also be rinsed with rubbing alcohol. Call or notify your supervisor or coworker immediately, giving full details of the incident.

Coworker

Move the victim well away from the contaminated area.

1. If there is respiratory weakness or **if breathing ceases, give artificial respiration immediately**. (see next page.)
2. Call a physician as quickly as possible. If you are alone, do **not** abandon the first-aid treatment.
3. Keep the patient as quiet as possible, warm, and comfortable.
4. When symptoms are moderate or severe and caused by organophosphate or carbamate poisoning, and if the patient is conscious, immediately give two atropine tablets (1/100 grain each). (see number 13 under Pesticide Safety, **page 7-2-3**). Then immediately contact the nearest medical help and request assistance, even if symptoms disappear.
5. If pesticide is splashed in the eyes, immediately wash with large volumes of clean water. Continue for at least 15 minutes.

6. If medical help cannot be obtained or is delayed, transport the patient to the nearest hospital, physician's office, or urgent medical clinic. If possible, use a radio or other means of communication to alert authorities and the hospital. Drive safely if you must transport a patient. Take the pesticide label or any available records of pesticides used and any other information which may aid in diagnosis and treatment.

First Aid With Rescue Breathing

If you think a person has stopped breathing, don't delay. Give first aid immediately. Ask someone else to get medical help.

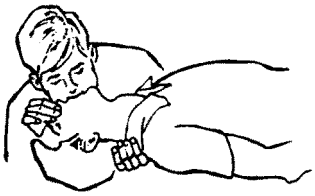
1. Is the person breathing?

To find out if the person is breathing, place him flat on his back and put your ear close to his mouth. If he is breathing, you will feel his breath and see his chest rise and fall.

2. Open the airway.

If the person has stopped breathing, lift up his neck with one hand and push down on his forehead with the other. This opens the airway and the person may start to breathe. If he doesn't, begin RESCUE BREATHING at once.

3. Rescue Breathing. Keep one hand under the person's neck so that his head is tilted backward with his chin up. Pinch his nostrils shut with the fingers of your other hand.



Take a deep breath and cover his mouth completely with yours. Blow air into his mouth. When his chest moves up, take your mouth away and let his chest go down by itself.

Repeat this procedure every 5 seconds. Do not stop until the person starts breathing or medical help comes.

General Symptoms

Mild Poisoning

Any discomfort can be an indication of mild poisoning or some other sickness. Individuals who are exposed to poison and who experience the following symptoms should be aware that more serious indications may follow.

Headache, fatigue, skin irritation, loss of appetite, dizziness, weakness, nervousness, nausea, perspiration, diarrhea, eye irritation, insomnia, thirst, restlessness, irritation of nose and throat, loss of weight, soreness of joints, changes of mood.

Moderate Poisoning

May be the beginning of severe symptoms. Nausea, trembling, muscular incoordination, excessive saliva, blurring of vision, feeling of constriction in the throat and chest, difficulty in breathing, flushed or yellow skin, abdominal cramps, vomiting, diarrhea, mental confusion, twitching of muscles, weeping, excessive perspiration, profound weakness, rapid pulse, cough.

Severe Poisoning

Vomiting, loss of reflexes, inability to breathe, uncontrollable muscular twitching, constriction of pupils (to pinpoint pupils), convulsions, unconsciousness, severe secretion from respiratory tract, fever, intense thirst, increased rate of breathing.

Pesticide Safety

1. Read the label before using any pesticide and follow precautions. If material is transferred to another container for application, a copy of the label should be kept near the dispersing point.
2. Use only proper tools for opening containers. Carefully open bags and use the proper tools to prevent pesticide from spilling onto your face or hands.
3. Pesticides should be opened in an area where any spills can be cleaned up properly. Mixing and pouring should be done in a well-ventilated place removed from other personnel. If there is a breeze, personnel should be upwind of any transfer of pesticides.
4. Pour pesticides properly. If an air vent is provided, use it.
5. A good supply of lime, coarse clay, sand, sawdust, or other absorbent material should be readily available.

6. Do **not** allow any person to work alone, especially when handling highly toxic materials.
7. Wear clean, dry, long-sleeved shirts and trousers made of cotton or any protective clothing as directed by the label.
8. Wear rubber gloves, well-fitted goggles, a rubber apron, and rubber boots when handling concentrates. Be certain the equipment is adequate for the task. Thin rubber gloves (disposable) should only be used once. An apron or gloves made of permeable material may be hazardous.
9. Be careful **not** to spill toxic chemicals on skin or clothing. If this happens, remove contaminated clothing at once and wash skin and clothing thoroughly. All operators should have available one change of clean clothes in case of accidental spillage.
10. Wash hands and face immediately after applying pesticide, before using toilet, and before eating, drinking, or smoking. Do **not** eat, drink, or carry tobacco in areas where pesticides are present.
11. Do **not** use mouth to siphon or to blow out nozzles or clogged lines, etc. on equipment. Do **not** put fingers in mouth or rub eyes while working with pesticides.
12. Never use arms to stir or to reach into a container of pesticides to retrieve tools or other accidentally dropped items.
13. When applying the more toxic organophosphates and carbamate insecticides, be prepared to contact a physician. In case of poisoning, the physician can prescribe atropine tablets. Also, read the label to learn what additional actions to take in case of poisoning—like giving liquids or inducing vomiting.

    A. If symptoms from poisoning include blurred vision, abdominal cramps, or tightness in the chest, and if a physician is **not** readily available, then immediately have the patient transported to the nearest doctor, hospital, posion control center, or urgent care clinic, even is symptoms subside.

    B. Further symptoms may include nausea, vomiting, diarrhea, pinpoint pupils, bronchial edema, muscle twitches, giddiness, drowsiness, confusion, difficulty in speech, and finally, coma.

    C. The acute emergency lasts 24 to 48 hours. The patient should be under the observation of a physician during this period. Illness caused by carbamate poisoning does **not** last as long as organophosphate poisoning symptoms.
14. A supply of detergent soap, clean water, rubbing alcohol, skin lotion, and a nail file (if possible) should be readily available.

15. Persons working regularly with or frequently exposed to the more toxic organophosphate pesticides should have periodic cholinesterase level checks and physical examinations if warranted by supervisor in consultation with local authorities, and Chapter 7, APHIS Safety and Health Manual.

16. Respirators or filter masks with proper canisters approved or the particular type exposure noted in the label directions should be used when such pesticides are handled. Rubber boots may be needed in an area drenched with pesticides.

17. Know the limitation of the protective clothing and equipment, especially respirators.

18. Learn to recognize the symptoms of pesticide poisoning and know the first-aid measure to be taken in case of accident. Training in emergency measures should be given to all employees who work with pesticides.

19. Have the telephone numbers of local hospitals, doctors, or poison control centers prominently displayed.

20. Fatigue lowers the standards of pesticide safety. Key personnel should be aware that risk increases after long hours of work.

21. If an employee feels any sign of illness suspected as being due to poisoning, he should contact a doctor immediately. However, certain circumstances such as consuming large amounts of liquids following excessive heat exposure may cause nausea, vomiting, dizziness, and cramps. Such signs mimic pesticide poisoning.

7

Treatment Manual

Emergency Aid and Safety

Guidelines for Managing Pesticide Spills

Contents

Guidelines for Managing Pesticide Spills **7-3-1**
Introduction **7-3-1**
Emergency Spill Procedures **7-3-2**
- Identify Contacts and Telephone Numbers **7-3-3**
- Evaluate the Situation (Take care of people first!!!) **7-3-3**
- Safety and First Aid **7-3-4**
- Crash Notification **7-3-6**
- Contamination Control **7-3-6**
- Notification **7-3-7**
- Site Security **7-3-8**
- Cleanup Techniques **7-3-9**
- Decontamination **7-3-10**

Post-Spill Procedures **7-3-11**
- Disposal of Contaminated Material **7-3-11**
- Environmental Monitoring **7-3-11**
- Reporting **7-3-11**

Planning for Pesticide Spills **7-3-12**
State Hazardous Waste Management Agencies **7-3-13**
Accident or Spill Emergency Kit **7-3-18**
- Safety **7-3-18**
- Cleanup **7-3-19**

Introduction

This document provides instructions for dealing with pesticide spills during program operations. “Pesticide spill” refers to any unplanned spill or leakage into the environment that occurs during storage, use, transport, or disposal of pesticide. Examples include aircraft and surface vehicular crashes, jettisoning pesticide cargoes from the air, and leaks or other equipment failures. After a pesticide spill, the responsible program person should evaluate the situation and begin appropriate corrective measures. (Use **Figure 7-3-2** to identify your responsible program contact.)

The Officer-in-Charge (OIC), Contracting Officer’s Representative (COR), or other responsible program official should prepare a site-specific plan based on the generic plan, **Emergency Spill Procedures**. (Refer to **Figure 7-3-1** for an abbreviated plan. Make a copy of this figure, and keep it for your pocket

reference.) Prepare the plan before program operations begin by filling in the names, telephone numbers, and other required information. Specific objectives of each plan include:

- Protecting people working in the spill area.
- Preventing or minimizing the risk of further pesticide exposure to people, animals, and the environment.
- Cleanup of the area and disposal or detoxification of residual material.
- Notifying Federal, State, and local government officials of the magnitude and details of the pesticide spill.
- Evaluation of the potential impact to the environment based on chemical residues found in environmental components.

Responsible Program Contact (Name)

(Work telephone number)

(Home telephone number)

IF A PESTICIDE SPILLS TAKE THE FOLLOWING STEPS:

1. **Evaluate**. (Take care of people first!!!)

2. **Safety and First Aid**. The most immediate concern is for the health and well-being of persons in and around the area.

3. **Call 911** for fire/rescue squad to obtain medical assistance for injured or contaminated persons.

4. **Contamination Control**. Consult pesticide label & MSDS for appropriate protective clothing and hazards (or **CHEMTREC Emergency Hotline (800) 424-9300**).

Figure 7-3-1 Abbreviated Spill Plan, Personal Reference Card (Wallet-size)

Emergency Spill Procedures

Use this section as your guide to prepare a site-specific plan for pesticide spills. (Please, complete the blanks for your specific program.) The following is a summary of factors you must consider when a pesticide spill occurs (details follow this summary):

- Identify Contacts and Telephone Numbers
- Evaluate the Situation
- Safety and First Aid
- Crash Notification

- Contamination Control
- Notification
- Site Security
- Cleanup Techniques
- Decontamination

Identify Contacts and Telephone Numbers

You must know who to contact and where to call if a pesticide spill occurs. **Figure 7-3-2** identifies preliminary information that you will need in case of an emergency. Fill in the blanks for your site-specific plan.

_____
(Program name)

_____
Responsible Program Contact (Name)

_____
(Work telephone number)

_____
(Home telephone number)

_____
Alternative Program Contact (Name)

_____
(Work telephone number)

_____
(Home telephone number)

Figure 7-3-2 Emergency Contacts for Pesticide Spills

Evaluate the Situation (Take care of people first!!!)

1. Injury/pesticide exposure. Refer to **Safety and First Aid**.
2. Vehicle or aircraft crash. Refer to **Crash Notification**.
3. Spill containment. Refer to **Contamination Control**.

Safety and First Aid

The most immediate concern is for the health and well-being of persons in and around the area.

1. Call **911** for fire/rescue squad to obtain medical assistance for injured or contaminated persons.

2. Evacuate the immediate area, if necessary get upwind.
3. Remove injured people from the area. (Do **not** move a seriously injured person unless absolutely essential because of the risk of further injury.)
4. Consult the pesticide label and/or MSDS for appropriate protective equipment and hazards.
5. Administer first aid as necessary. see the pesticide's MSDS or contact the nearest poison control center. **Figure 7-3-3** identifies information that you will need in case of an emergency. Fill in the blanks for your site-specific plan.

_____
(Center Name)

_____
(Telephone)

Figure 7-3-3 Poison Control Center

6. Remove contaminated clothing and wash affected area with soap and water. If eyes are contaminated, flush with clean water.
7. If individuals experience pesticide poisoning symptoms (blurred vision, trembling, nausea, etc.) then transport them to the nearest medical emergency facility. **Figure 7-3-4** identifies information that you will need in case of an emergency. Fill in the blanks for your site-specific plan.

_____

_____
(Address)

_____
(How to get there)

Figure 7-3-4 Medical Emergency Facility

8. Eliminate sources of ignition (e.g., pilot lights, electric motors, gasoline engines, or smoking) to prevent the threat of fire or explosion from flammable vapors.

Crash Notification

1. If the spill involved a vehicle or aircraft crash, contact the local police (911) as soon as possible.
2. If the spill involved an aircraft crash, notify the nearest Federal Aviation Administration (FAA) office. **Figure 7-3-5** identifies information that you will need in case of an emergency. Fill in the blank for your site-specific plan.

_____
(Telephone number)

Figure 7-3-5 Federal Aviation Administration (FFA) Office

Contamination Control

1. Consult the pesticide label and/or MSDS for appropriate protective clothing and hazards (**or call the CHEMTREC Emergency Hotline at (800) 424-9300**).
2. Try to contain the spilled pesticide at the original site, and prevent it from entering streams, rivers, ponds, storm drains, wells, and water systems as follows:
   - **A.** If possible, reposition the pesticide container to stop further leakage.
   - **B.** Prevent the spill from spreading by trenching or encircling the area with a dike of sand, sand snakes, absorbent material, soil or rags.
   - **C.** If a liquid formulation spills, cover it with absorbent material; however, use absorbent sparingly, since it also becomes hazardous waste. Use no more than necessary.
   - **D.** If a dry formulation spills, securely cover it with polyethylene or plastic tarpaulin to prevent tracking or airborne spreading of dust.

Notification

1. Notify by telephone state officials and the PPQ regional office. Headquarters management will be notified through normal channels.
2. Contact the local Community-Right-To-Know or Emergency Planning Coordinator (often the Fire Marshall). **Figure 7-3-6** identifies information that you will need in case of an emergency. Fill in the blanks for your site-specific plan.

_____
(Name)

_____
(Telephone number)

Figure 7-3-6 Community-Right-To-Know or Emergency Planning Coordinator (Fire Marshall)

3. Call the CHEMTREC Emergency Hotline at **(800) 424-9300**.
4. Notify by telephone the National Monitoring and Residue Analysis Laboratory (NMRAL) in Gulfport, Mississippi, Area Code (601) 863-8124 or (601) 863-1813. NMRAL will provide any supplies needed for sampling environmental components.
5. If the spill involves a large area (4 hectares (10 acres) or more) or you judge that it could affect a large area through runoff or other movement, notify the State Fish and Game Department or equivalent through appropriate channels. **Figure 7-3-7** identifies information that you will need in case of an emergency. Fill in the blank for your site-specific plan.

_____
(Telephone number)

Figure 7-3-7 Fish and Game Department

6. If animal poisoning may occur, notify the Regional Veterinary Services (RVS) Office. **Figure 7-3-8** identifies information that you will need in case of an emergency. Fill in the blank for your site-specific plan.

_____
(Telephone number)

Figure 7-3-8 Regional Veterinary Services (VS) Office

7. If the spilled product is a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) classified hazardous substance or a Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III classified extremely hazardous substance, spills of active ingredient exceeding the reportable quantities may be reportable (see Appendix 8 for information on determining whether to report).
8. If you are unsure as to reporting under CERCLA or SARA look at the product's MSDS or call the National Response Center **(800) 424-8802** for CERCLA, and for SARA call **(800) 535-0202**.
9. Notify your Regional Safety and Health Coordinator. **Figure 7-3-9** identifies information that you will need in case of an emergency. Fill in the blank for your site-specific plan.

_____
(Telephone number)

Figure 7-3-9 Regional Safety and Health Coordinator

Site Security

Secure the spill site from unauthorized entry by roping off the area and posting warning signs. If necessary, request assistance from local police. **Figure 7-3-10** identifies information that you will need in case of an emergency. Fill in the blank for your site-specific plan.

_____
(Telephone number)

Figure 7-3-10 Local Police

Cleanup Techniques

The following are general techniques. You should consult local hazardous waste officials, the pesticide's label, or its MSDS to determine specific cleanup and disposal techniques. (Refer to **State Hazardous Waste Management Agencies** for a list of local hazardous waste officials.) **Figure 7-3-11** identifies information that you will need in case of an emergency. Fill in the blanks for your site-specific plan.

_____
(Name)

_____
(Telephone)

Figure 7-3-11 Local Hazardous Waste Official

Adequate cleanup of spilled pesticides is essential to minimize health or environmental hazards. When cleaning pesticide spills, **NEVER WORK ALONE**. Be sure to ventilate the area and use appropriate protective equipment. Clean up dry spills (dusts, wettable powders, granular formulations) as follows:

- Immediately cover powders, dusts, or granular materials with polyethylene or plastic tarpaulin to prevent them from becoming airborne. If outside, weight the tarp ends, especially the end facing into the wind. Begin cleanup operations by rolling up the tarp while simultaneously sweeping up the spilled pesticide using a broom and shovel or dust pan. Avoid brisk movements to keep the dry pesticide from becoming airborne. When practical, lightly sprinkle the material with water to minimize dust. Always use an approved dust mask or respirator when working with dry pesticide materials.
- Collect the pesticide and place it in heavy-duty plastic bags. Secure and label the bags, properly identifying the pesticide and possible hazards. Set the bags aside in a secured area for disposal.
- Clean up liquid spills by placing an appropriate absorbent material (floor-sweeping compound, sawdust, sand, etc.) over the spilled pesticide. Work the absorbent into the spill using a broom or other tool to force the absorbent material into contact with the pesticide. Collect all spent absorbent material and place into a properly labeled metal drum for disposal.

Depending upon the pesticide, the size of the spill, and local conditions, you may need to remove the top 1-inch layer of contaminated soil with a shovel and dispose of it.

Decontamination

As soon as practical, decontaminate crashed aircraft, wrecked vehicles, and pavements. see the pesticide's MSDS or label for specific instructions. For aircraft, coordinate with investigating officials and FAA authorities. For automobile wrecks, coordinate with appropriate law enforcement agencies or investigative bodies.

Chlorine bleach, caustic soda (lye, sodium hydroxide) detergents, or burnt or hydrated lime effectively decontaminate most spill areas (see attached MSDS sheets for precautions when using these substances).

CAUTION

Use bleach or lye, but never both together since this combination may liberate poisonous chlorine gas. Lye or lime readily decomposes many pesticides, especially the organophosphates, and carbamates. Clean up and remove as much of the spilled pesticide as possible prior to applying any decontaminate. Allow 1 to 6 hours reaction with the decontaminate before using an absorbent material.

Spread decontaminates thinly and evenly over the spill area. Then, lightly sprinkle the area with water to activate the decontaminate. Repeat the cleanup procedures until all the spilled pesticide is removed.

Clean all equipment used for spill cleanup with detergent and appropriate decontaminates. Collect all used decontaminates and rinse water and place them in labeled metal drums. Place clothing and gloves that cannot be decontaminated in the drums for proper disposal.

It may also be necessary to completely remove and dispose of contaminated porous materials.

If pesticides have leaked or spilled on the soil, removal of the visibly contaminated soil (top 1-inch) may be required using a shovel. In such cases, place the contaminated soil in metal drums for disposal. Chemical analysis of monitoring samples may govern removal of additional soil.

Post-Spill Procedures

Disposal of Contaminated Material

You may contact the pesticide's manufacturers for specific instructions regarding their product. Also contact the State or Federal EPA office with jurisdiction over the pesticide spill location about disposal, and consult with the U.S. Department of Transportation (DOT) prior to shipping/transporting across state lines. Shipping by licensed transporters may be required.

In general, place contaminated materials in sealed leak-proof metal disposal drums. Label all drums properly and dispose of in an approved hazardous waste disposal facility (incinerator, landfill site, etc.) under current EPA or State permit. The pesticide's labeling and MSDS contain specific information concerning disposal.

Environmental Monitoring

After cleanup and disposal, if the pesticide spilled into the environment, collect environmental monitoring samples. see M390.1403, ***Collecting Environmental Monitoring Samples*** for specific instructions. Contact the Region and request an Environmental Monitoring Coordinator if you need help with sample collection.

Reporting

Report information regarding pesticide spills in accordance with the program's specific monitoring plan, and as required by state and federal law. In general, reports should include:

1. Detailed map with the site of the pesticide spill clearly marked.
2. Information on location, time, spill area, terrain, pesticide spilled, how spill occurred, and how managed.
3. Any other information the writer deems pertinent to the pesticide spill.

Upon completion of the chemical analyses NMRAL will report its findings to Technical and Scientific Services (TSS). TSS will include the spill residue data in its programmatic environmental monitoring report and distribute as appropriate.

Planning for Pesticide Spills

Pesticides vary in toxicity as described in the pesticide's labeling and MSDS. Actions taken following an accidental spill will depend upon the pesticide toxicity involved. Always consult the labeling and MSDS for your program's pesticides when planning for spills. Check the telephone book for the telephone number of the local poison control center and enter it on your plan.

The Environmental Protection Agency (EPA) under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA); Resource Conservation and Recovery Act (RCRA); and CERCLA or Superfund assigned the primary responsibility for enforcing safe pesticide use and disposal to most States. States may therefore acquire primary responsibility for determining pesticide spill, cleanup, and disposal procedures.

Not all States will perform or react to pesticide spills in the same way. Therefore the Port Director or COR should assist with cleanup, sample collection, sample analysis, securing affected area, etc. The Port Director or COR must monitor such activities to assure PPQ that the responsible parties take proper actions during and after a spill. Keep in mind that legal actions as a result of a pesticide spill may place liability on the cooperating Federal Agency.

Program Managers should inform the PPQ Assistant Regional Director's office of procedures to follow when pesticide spills occur within their jurisdictions so they may support field operations when needed. The Port Director, COR, or Senior Staff Officer for any given PPQ operation, is responsible for implementing pesticide spill procedures. These officers must be familiar with these guidelines and should make contingency plans for such pesticide spills in advance of field operations.

Useful information for completing your spill plan is found in the appendices to these guidelines. Copies of the MSDS (obtainable from the manufacturer) for your program's pesticides should be included in your spill plan.

State Hazardous Waste Management Agencies

When a pesticide spill occurs, you should consult local hazardous waste officials, the pesticide's label, and its MSDS to determine specific cleanup and disposal techniques. The following is a list of State Hazardous Waste Management Agencies:

ALABAMA
Land Division
Alabama Department of Environmental Management
P.O. Box 301463
Montgomery, AL 36130-1463
(334) 279-3050
Email: landmail@adem.state.al.us
http://www.adem.state.al.us/LandDivision/LandDivisionPP.htm

ALASKA
Division of Environmental Health
Pesticide Control
Alaska Department of Environmental Conservation
1700 E. Bogard Avenue
Building B, Suite 202
Wasilla, AK 99654
(907) 376-1870
(800) 478-2577 (toll free in-state)
http://www.dec.state.ak.us/divs_contacts/index.htm

AMERICAN SAMOA
No Listing Available

ARIZONA
Office of Waste and Water Quality Management
Arizona Department of Environmental Quality
1110 W. Washington Street
Phoenix, AZ 85007
(602) 771-4673
http://www.azdeq.gov/

ARKANSAS
Hazardous Waste Division
Arkansas Department of Environmental Quality
5301 Northshore Drive
North Little Rock, AR 72118-5317
(501) 682-0565
http://www.adeq.state.ar.us/hazwaste/

CALIFORNIA
Department of Toxic Substances Control
1001 I Street
Sacramento, CA 95814-2828 or
P.O. Box 806
Sacramento, CA 95812-0806
(916) 255-3618 (if calling from outside CA)
(800) 728-6942 (if calling from within CA)
http://www.dtsc.ca.gov/

COLORADO
Hazardous Materials and Waste Management Division
Colorado Department of Public Health and Environment
HMWMD-B2
4300 Cherry Creek Drive South
Denver, Colorado 80246-1530
(303) 692-3300
(888) 569-1831
Emergency Response: (877) 518-5608
Email: comments.hmwmd@state.co.us
http://www.cdphe.state.co.us/hm/

CONNECTICUT
Hazardous Material Management Unit
Department of Environmental Protection
79 Elm Street
Hartford, CT 06106-5127
(860) 424-3000
http://www.ct.gov/dep/site/default.asp

DELAWARE
Division of Air and Waste Management
Department of Natural Resources and Environmental Control
89 Kings Highway
Dover, DE 19901
(302) 739-9403
http://www.awm.delaware.gov/Pages/default.aspx

DISTRICT OF COLUMBIA
Hazardous Materials Division
District Department of the Environment
51 N Street, NE
Washington, DC 20002
(202) 535-2600
Email: ddoe@dc.gov
http://ddoe.dc.gov/ddoe/site/default.asp

FLORIDA
Division of Waste Management
Department of Environmental Protection
2600 Blair Stone Road, MS 4500
Tallahassee, FL 32399-2400
(850) 245-8705
http://www.dep.state.fl.us/waste/Default.htm

GEORGIA
Environmental Protection Division
Georgia Department of Natural Resources
2 Martin Luther King Jr. Drive
Suite 1152, East Tower
Atlanta, GA 30334
(404) 656-4863
(800) 241-4113
http://www.gaepd.org/

GUAM
Air and Land Programs Division
Guam Environmental Protection Agency
17-3304 Mariner Avenue
Tiyan, Guam 96913
1 - (671) 475-1658 or 1659
http://www.gepa.guam.gov/

HAWAII
Solid and Hazardous Waste Branch
Hawaii Department of Health
919 Ala Moana Boulevard, #212
Honolulu, HI 96814
(808) 586-4226
http://hawaii.gov/health/environmental/waste/index.html

IDAHO
Waste Management and Remediation
Department of Environmental Quality
1410 North Hilton
Boise, ID 83706
(208) 373-0502
http://www.deq.idaho.gov/waste/prog_issues.cfm

ILLINOIS
Bureau of Land
Illinois Environmental Protection Agency
1021 North Grand Avenue East
P. O. Box 19276
Springfield, IL 62794-9276
(217) 782-3397
http://www.epa.state.il.us/land/

INDIANA
Indiana Department of Environmental Management
Indiana Government Center North
100 N. Senate Avenue
Indianapolis, IN 46204
(317) 232-8603
(800) 451-6027
http://www.in.gov/idem/5217.htm

IOWA
Air Quality and Solid Waste Protection
Department of Natural Resources
Henry A. Wallace Bldg.
502 East 9th Street
Des Moines, IA 50319-0034
(515) 281-5918 (customer service)
(505) 281-8694 (24-hour number *only* for environmental spills)
Email: webmaster@dnr.iowa.gov
http://www.iowadnr.gov/index.html

KANSAS
Bureau of Waste Management
Department of Health and Environment
1000 SW Jackson, Suite 320
Topeka, KS 66612-1366
(785) 296-1500
Email: info@kdheks.gov
http://www.kdheks.gov/index.html

KENTUCKY
Division of Waste Management
Department of Environmental Protection
200 Fair Oaks Lane
Frankfort, KY 40601
(502) 564-6716
Email: waste@ky.gov
http://www.waste.ky.gov/

LOUISIANA
Louisiana Department of Environmental Quality
602 N. Fifth Street
Baton Rouge, LA 70802
(866) 896-LDEQ (5337)
Email: webmaster-deq@la.gov
http://www.deq.louisiana.gov/portal/tabid/36/Default.aspx

MAINE
Bureau of Remediation and Waste Management
Department of Environmental Protection
17 State House Station
Augusta, ME 04333-0017
(207) 287-7688
Spills, Toll Free: (800) 452-4664
http://www.maine.gov/dep/rwm/index.htm

MARYLAND
Land Management Administration
Maryland Department of the Environment
1800 Washington Boulevard
Baltimore, MD 21230
(410) 537-3000
Emergency Toll Free (866) 633-4686
Email: webmaster@mde.state.md.us
http://www.mde.state.md.us/

MASSACHUSETTS
Bureau of Waste Prevention
Department of Environmental Protection
One Winter Street
Boston, MA 02108
(617) 292-5500
http://www.mass.gov/dep/recycle/hazwaste.htm

MICHIGAN
Department of Environmental Quality
525 W. Allegan
Constitution Hall, 4th Floor, North
P.O. Box 30242
Lansing, MI 48909-7742
(517) 335-6010
Emergency Response:
(800) 292-4707 (within Michigan)
(517) 373-7660 (outside Michigan)
http://www.michigan.gov/deq/0,1607,7-135-3312---,00.html

MINNESOTA
Minnesota Pollution Control Agency
520 Lafayette Road
St. Paul, MN 55155-4194
(651) 296-6300
(800) 657-3864
24-hour Emergency Response:
(651) 649-5451
(800) 422-0798
http://www.pca.state.mn.us/index.cfm

MISSISSIPPI
Office of Polution Control
Environmental Enforcement & Compliance Division
Department of Environmental Quality
515 East Amite Street
P.O. Box 2261
Jackson, MS 39225
(601) 961-5068
http://www.deq.state.ms.us/MDEQ.nsf/page/Main_Home?OpenDocument

MISSOURI
Hazardous Waste Program
Division of Environmental Quality
Missouri Department of Natural Resources
P.O. Box 176
Jefferson City, MO 65102
(573) 751-3176
(800) 361-4827
Email: hazwaste@dnr.mo.gov
http://www.dnr.mo.gov/env/hwp/index.html

MONTANA
Hazardous Waste Program
Department of Environmental Quality
Lee Metcalf Building
1520 E. Sixth Avenue
P.0. Box 200901
Helena, MT 59620-0901
(406) 444-2544
http://www.deq.state.mt.us/HazWaste/index.asp

NEBRASKA
Department of Environmental Quality
1200 "N" Street, Suite 400
P.O. Box 98922
Lincoln, NE 68509
(402) 471-2186
Email: MoreInfo@NDEQ.state.NE.US
http://www.deq.state.ne.us/

NEVADA
Bureau of Waste Management
Division of Environmental Protection
901 South Stewart Street
Suite 4001
Carson City, NV 89701-5249
(775) 687-4670
http://ndep.nv.gov/bwm/bwm01.htm

NEW HAMPSHIRE
Waste Management Division
Department of Environmental Services
29 Hazen Drive
P.O. Box 95
Concord, NH 03302-0095
(603) 271-3503
Hazardous Materials Emergency Numbers:
(603) 271-3899 (M-F 8:00 am - 4:00 pm)
(800) 346-4009 (evenings and weekends)
http://des.nh.gov/organization/divisions/waste/index.htm

NEW JERSEY
Chemical & Pollution Control/Waste Management
Department of Environmental Conservation
401 East State Street
P.O. Box 414
Trenton, NJ 08625
(609) 633-1418
Environmental Emergency: 1-877-WARNDEP
(1-877-927-6337)
http://www.state.nj.us/dep/dshw/

NEW MEXICO
Hazardous Waste Bureau
New Mexico Environment Division
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505-6303
(505) 476-6000
http://www.nmenv.state.nm.us/hwb/index.htm

NEW YORK
Division of Hazardous Substance Regulation
Department of Environmental Conservation
625 Broadway
Albany, NY 12233-0001
(518) 402-8013
DEC 24-hour Spill Hotline (800) 457-7362
http://www.dec.ny.gov/chemical/292.html

NORTH CAROLINA
Division of Waste Management
Department of Environment and Natural Resources
1646 Mail Service Center
Raleigh, NC 27699-1646
(919) 508-8400
http://wastenotnc.org/

NORTH DAKOTA
Division of Waste Management
Department of Health
908 East Divide Avenue, 3rd Floor
Bismarck, ND 58501-5166
(701) 328-5166
http://www.ndhealth.gov/wm/index.htm

NORTHERN MARIANA ISLANDS, COMMONWEALTH OF
No listing available.

OHIO
Division of Hazardous Waste Management
Ohio Environmental Protection Agency
50 West Town Street, Suite 700
P.O. Box 1049
Columbus, Ohio 43215
(614) 644-2917
Emergency Response Hotline (800) 282-9378
http://www.epa.state.oh.us/Default.aspx?alias=www.epa.state.oh.us/dhwm

OKLAHOMA
Land Protection Division
Department of Environmental Quality
P.O. Box 1677
Oklahoma City, OK 73101-1677
(405) 702-5100
http://www.deq.state.ok.us/LPDnew/hwindex.html

OREGON
Land Quality/Hazardous Waste Management
Department of Environmental Quality
811 Sixth Avenue
Portland, OR 97204-1390
(503) 229-5696
Oregon Emergency Response System
Toll Free: (800) 452-0311
http://www.deq.state.or.us/lq/hw/hwmanagement.htm

PENNSYLVANIA
Division of Hazardous Waste Management
Pennsylvania Department of Environmental Protection
Rachel Carson State Office Building
400 Market Street
Harrisburg, PA 17101
(717) 787-2814
http://www.depweb.state.pa.us/landrecwaste/cwp/view.asp?a=1216&Q=442095&landrecwasteNav=|

PUERTO RICO
Environmental Quality Board
P.O. Box 11488
Santurce, PR 00910-1488
(809) 725-0439
—or—
U.S. EPA Region II
290 Broadway
New York, NY 10007
(212) 637-3660
Emergency Response: (787)-729-6826
http://www.epa.gov/epahome/violations.htm

RHODE ISLAND
Office of Waste Management
Bureau of Environmental Protection
Department of Environmental Management
235 Promenade Street
Providence, RI 02908-5767
(401) 222-2797
http://www.dem.ri.gov/programs/benviron/waste/index.htm

SOUTH CAROLINA
Land and Waste Management
Department of Health and Environmental Control
2600 Bull Street
Columbia, South Carolina 29201
(803) 898-3432
Emergency Response: (888) 481-0125
http://www.scdhec.gov/environment/lwm/

SOUTH DAKOTA
Division of Environmental Regulation
Department of Environment and Natural Resources
523 East Capitol
Joe Foss Building
Pierre, SD 57501
(605) 773-3151
http://denr.sd.gov/

TENNESSEE
Division of Solid and Hazardous Waste Management
Department of Environment and Conservation
5th Floor, L&C Tower
Nashville, TN 37243
(615) 532-0780
http://tennessee.gov/environment/swm/hazardous/

TEXAS
Hazardous and Solid Waste Division
Texas Commissionon Environmental Quality
P.O. Box 13087
Austin, TX 78711
(512) 463-7760
Spill Reporting (24-hr): (800) 832-8224
Email: ac@tceq.state.tx.us
http://www.tceq.state.tx.us/subject/subject_waste.html

UTAH
Division of Solid and Hazardous Waste
Department of Environmental Quality
P.O. Box 144880
Salt Lake City, UT 84114-4880
(801) 538-6170
http://www.hazardouswaste.utah.gov/

VERMONT
Waste Management Division
Department of Environmental Conservation
103 South Main Street, West Office Building
Waterbury, VT 05671-0404
(802) 241-3888
Emergency: (800) 641-5005
http://www.anr.state.vt.us/dec/wmd.htm

VIRGIN ISLANDS
Department of Conservation and Cultural Affairs
P.O. Box 4399, Charlotte Amalie
St. Thomas, Virgin Islands 00801
(809) 774-6420
—or—
U.S. EPA Region II
290 Broadway
New York, NY 10007
(212) 637-3660
Emergency Response: (787)-729-6826
http://www.epa.gov/epahome/violations.htm

VIRGINIA
Waste Management
Department of Environmental Quality
P.O. Box 1105
629 E. Main Street
Richmond, VA 23218
(804) 698-4000 or
Toll free in VA: (800) 592-5482
24-hour Emergency Hotline: (800) 468-8892
http://www.deq.state.va.us/waste/homepage.html

WASHINGTON
Waste Management Programs
Department of Ecology
P.O. Box 47600
300 Desmond Drive
Olympia, WA 98504-7600
(360) 407-6700
http://www.ecy.wa.gov/waste.html

WEST VIRGINIA
Environmental Enforcement
Division of Water and Waste Management
Department of Environmental Protection
601 57th Street
Charleston, WV 25304
(304) 926-0470
24 Hour Spill Hotline: (800) 642-3074
http://www.wvdep.org/item.cfm?ssid=13&ss1id=629

WISCONSIN
Waste and Materials Management
Department of Natural Resources
101 S. Webster Street
P.O. Box 7921
Madison, WI 53707-7921
(608) 266-2621
Hazardous Substances Hotline: (800) 943-0003
http://www.dnr.state.wi.us/org/aw/wm/index.htm

WYOMING
Division of Solid Waste
Department of Environmental Quality
122 West 25th Street, Herschler Building
Cheyenne, WY 82002
(307) 777-7937
Emergency: (307) 777-7781
http://deq.state.wy.us/shwd/

Accident or Spill Emergency Kit

The Port Director, COR, or their designee should have available a fully supplied pesticide emergency spill cleanup/decontamination kit with instructions for its use. The kit will have the label designation “For Use in Handling and Cleanup of Accident Pesticide Spills Only.”

Responsible officials should use their discretion as to what items will be stored in vehicles for immediate use. The following items should be immediately available for responding to a pesticide spill:

Safety

- First aid kit—bus and truck kit, (GSA #6545-00-664-5312, or equivalent)
- Fire extinguisher, 5-lb. size for class A, B, C fires

Cleanup

- One shovel, square-point, “D” handle (GSA 5120-00-224-9326, or equivalent)
- Twenty-five large, heavy-duty plastic bags with ties (GSA 8105-00-848-9631, or equivalent)
- Two pair, unlined vinyl rubber boots
- Four pair, disposable coveralls
- One 5-gallon water container
- Four pair, unlined vinyl rubber gloves
- Two approved respirators with approved pesticide canisters (Self-contained breathing apparatus must also be available in operations where methyl bromide is utilized.)
- One broom and dust pan
- One pint bottle of liquid detergent
- Two scrub brushes (GSA 7920-00-068-7903 or equivalent)
- One plastic cover or tarpaulin (to cover dry spills) (GSA 8135-00-529-6487, or equivalent)
- Twenty-five pound bag, absorbent material (GSA 7930-00-269-1272), or sweeping compound, sawdust, “kitty litter”, or other absorbent materials
- One large metal or heavy duty plastic garbage can with removable cover for storing contaminated materials for later disposal

Important

Use this can to store the spill kit materials during transport.

- Several sand snakes should be kept in storage areas

Obtain many of these items through the GSA Federal Supply System or from a local hardware store.

7

Treatment Manual

Emergency Aid and Safety

Hazard Communication and Material Safety Data Sheets

Contents

Overview **7-4-1**
OSHA Requirements **7-4-1**
Guidelines on Opening Containers Containing Commodities Under Controlled Atmosphere (CA) Storage **7-4-9**
Oxygen (O^2) **7-4-9**
Carbon dioxide (CO^2) **7-4-9**
Acronyms and Abbreviations Used in This Section **7-4-10**

Overview

Material safety data sheets (MSDS) provide information about hazardous chemicals that are used in the workplace. This information is necessary to safely handle hazardous chemicals.

OSHA Requirements

The Occupational Safety and Health Administration (OSHA) requires that the hazards of all chemicals produced or imported be evaluated, and information concerning chemical hazards is communicated to employers and employees by means of a comprehensive hazard communication program. A hazard communication program should include, but **not** be limited to, the following:

- Developing and maintaining a written hazard communication program for the workplace, including lists of hazardous chemicals present at the workplace.
- Labeling of containers of chemicals in the workplace, as well as containers of chemicals being shipped to other workplaces.
- Preparation and distribution of MSDS to employees and downstream employers.
- Development and implementation of employee training programs regarding hazards of chemicals and protective measures.

Employers who do **not** produce or import chemicals need only focus on those parts of 29CFR 1910.1200 that deal with establishing a workplace program and communicating information to their workers. Appendix E of 29CFR 1910.1200 is a general guide for such employers to help them determine the compliance obligations under this rule, and includes the following topics:

- Becoming Familiar With the Rule
- Identify Responsible Staff
- Identify Hazardous Chemicals in the Workplace
- Preparing and Implementing a Hazard Communication Program
  - Labels and Other Forms of Warning
  - Material Safety Data Sheets (MSDS's)
  - Employee Information and Training
  - Other Requirements
- Checklist for Compliance
- Further Assistance

A copy of Appendix E of 29CFR 1910.1200 is included in **Figure 7-4-1—Guidelines for Employer Compliance**.

The Hazard Communication Standard (HCS) is based on a simple concept—that employees have both a need and a right to know the hazards and identities of the chemicals they are exposed to when working. They also need to know what protective measures are available to prevent adverse effects from occurring. The HCS is designed to provide employees with the information they need.

Knowledge acquired under the HCS will help employers provide safer workplaces for their employees. When employers have information about the chemicals being used, they can take steps to reduce exposures, substitute less hazardous materials, and establish proper work practices. These efforts will help prevent the occurrence of work-related illnesses and injuries caused by chemicals.

The HCS addresses the issues of evaluating and communicating hazards to workers. Evaluation of chemical hazards involves a number of technical concepts, and is a process that requires the professional judgment of experienced experts. That's why the HCS is designed so that employers who simply use chemicals, rather than produce or import them, are not required to evaluate the hazards of those chemicals. Hazard determination is the responsibility of the producers and importers of the materials. Producers and importers of chemicals are then required to provide the hazard information to employers that purchase their products.

Employers that don't produce or import chemicals need only focus on those parts of the rule that deal with establishing a workplace program and communicating information to their workers. This appendix is a general guide for such employers to help them determine what's required under the rule. It does not supplant or substitute for the regulatory provisions, but rather provides a simplified outline of the steps an average employer would follow to meet those requirements.

1. Becoming Familiar With the Rule

OSHA has provided a simple summary of the HCS in a pamphlet entitled "Chemical Hazard Communication." OSHA Publication Number 3084. Some employers prefer to begin to become familiar with the rule's requirements by reading this pamphlet. A copy may be obtained from your local OSHA Area Office, or by contacting the OSHA Publications Office at (202) 523-9667.

Figure 7-4-1 Appendix E—Guidelines for Employer Compliance

The standard is long, and some parts of it are technical, but the basic concepts are simple. In fact, the requirements reflect what many employers have been doing for years. You may find that you are already largely in compliance with many of the provisions, and will simply have to modify your existing programs somewhat. If you are operating in an OSHA-approved State Plan State, you must comply with the State's requirements, which may be different than those of the Federal rule. Many of the State Plan States had hazard communication or "right-to-know" laws prior to promulgation of the Federal rule. Employers in State Plan States should contact their State OSHA offices for more information regarding applicable requirements.

The HCS requires information to be prepared and transmitted regarding all hazardous chemicals. The HCS covers both physical hazards (such as flammability), and health hazards (such as irritation, lung damage, and cancer). Most chemicals used in the workplace have some hazard potential, and thus will be covered by the rule.

One difference between this rule and many others adopted by OSHA is that this one is performance-oriented. That means that you have the flexibility to adapt the rule to the needs of your workplace, rather than having to follow specific, rigid requirements. It also means that you have to exercise more judgment to implement an appropriate and effective program.

The standard's design is simple. Chemical manufacturers and importers must evaluate the hazards of the chemicals they produce or import. Using that information, they must then prepare labels for containers, and more detailed technical bulletins called material safety data sheets (MSDS).

Chemical manufacturers, importers, and distributors of hazardous chemicals are all required to provide the appropriate labels and material safety data sheets to the employers to which they ship the chemicals. The information is to be provided automatically. Every container of hazardous chemicals you receive must be labeled, tagged, or marked with the required information. Your suppliers must also send you a properly completed material safety data sheet (MSDS) at the time of the first shipment of the chemical, and with the next shipment after the MSDS is updated with new and significant information about the hazards.

You can rely on the information received from your suppliers. You have no independent duty to analyze the chemical or evaluate the hazards of it.

Employers that "use" hazardous chemicals must have a program to ensure the information is provided to exposed employees. "Use" means to package, handle, react, or transfer. This is an intentionally broad scope, and includes any situation where a chemical is present in such a way that employees may be exposed under normal conditions of use or in a foreseeable emergency.

The requirements of the rule that deal specifically with the hazard communication program are found in this section in paragraph (e), written hazard communication program; (f), labels and other forms of warning; (g) material safety data sheets; and (h) employee information and training. The requirements of these paragraphs should be the focus of your attention. Concentrate on becoming familiar with them, using paragraphs (b) scope and application, and (c) definitions, as references when needed to help explain the provisions.

There are two types of work operations where the coverage of the rule is limited. These are laboratories and operations where chemicals are only handled in sealed containers (e.g., a warehouse). The limited provisions for these workplaces can be found in paragraph (b) of this section, scope and application. Basically, employers having these types of work operations need only keep labels on containers as they are received; maintain material safety data sheets that are received, and give employees access to them; and provide information and training for employees. Employers do not have to have written hazard communication programs and lists of chemicals for these types of operations.

The limited coverage of laboratories and sealed container operations addresses the obligation of an employer to the workers in the operations involved, and does not affect the employer's duties as a distributor of chemicals. For example, a distributor may have warehouse operations where employees would be protected under the limited sealed container provisions. In this situation, requirements for obtaining and maintaining MSDSs are limited to providing access to those received with containers while the substance is in the workplace, and requesting MSDSs when employees request access for those not received with the containers. However, as a distributor of hazardous chemicals, that employer will still have responsibilities for providing MSDSs to downstream customers at the time of the first shipment and when the MSDS is updated. Therefore, although they may not be required for the employees in the work operation, the distributor may, nevertheless, have to have MSDSs to satisfy other requirements of the rule.

Figure 7-4-1 Appendix E—Guidelines for Employer Compliance (continued)

2. Identify Responsible Staff
Hazard communication is going to be a continuing program in your facility. Compliance with the HCS is not a “one shot deal.” In order to have a successful program, it will be necessary to assign responsibility for both the initial and ongoing activities that have to be undertaken to comply with the rule. In some cases, these activities may already be part of current job assignments. For example, site supervisors are frequently responsible for on-the-job training sessions. Early identification of the responsible employees, and involvement of them in the development of your plan of action, will result in a more effective program design. Evaluation of the effectiveness of your program will also be enhanced by involvement of affected employees. For any safety and health program, success depends on commitment of every level of the organization. This is particularly true for hazard communication, where success requires a change in behavior. This will only occur if employers understand the program, and are committed to its success, and if employees are motivated by the people presenting the information to them.
3. Identify Hazardous Chemicals in the Workplace
The standard requires a list of hazardous chemicals in the workplace as part of the written hazard communication program. The list will eventually serve as an inventory of everything for which an MSDS must be maintained. At this point, however, preparing the list will help you complete the rest of the program since it will give you some idea of the scope of the program required for compliance in your facility. The best way to prepare a comprehensive list is to survey the workplace. Purchasing records may also help, and certainly employers should establish procedures to ensure that in the future purchasing procedures result in MSDSs being received before a material is used in the workplace. The broadest possible perspective should be taken when doing the survey. Sometimes people think of “chemicals” as being only liquids in containers. The HCS covers chemicals in all physical forms—liquids, solids, gases, vapors, fumes, and mists—whether they are “contained” or not. The hazardous nature of the chemical and the potential for exposure are the factors which determine whether a chemical is covered. If it’s not hazardous, it’s not covered. If there is no potential for exposure (e.g., the chemical is inextricably bound and cannot be released), the rule does not cover the chemical. Look around. Identify chemicals in containers, including pipes, but also think about chemicals generated in the work operations. For example, welding fumes, dusts, and exhaust fumes are all sources of chemical exposures. Read labels provided by suppliers for hazard information. Make a list of all chemicals in the workplace that are potentially hazardous. For your own information and planning, you may also want to note on the list the location(s) of the products within the workplace, and an indication of the hazards as found on the label. This will help you as you prepare the rest of your program. Paragraph (b) of this section, scope and application, includes exemptions for various chemicals or workplace situations. After compiling the complete list of chemicals, you should review paragraph (b) of this section to determine if any of the items can be eliminated from the list because they are exempted materials. For example, food, drugs, and cosmetics brought into the workplace for employee consumption are exempt. So rubbing alcohol in the first aid kit would not be covered. Once you have compiled as complete a list as possible of the potentially hazardous chemicals in the workplace, the next step is to determine if you have received material safety data sheets for all of them. Check your files against the inventory you have just compiled. If any are missing, contact your supplier and request one. It is a good idea to document these requests, either by copy of a letter or a note regarding telephone conversations. If you have MSDSs for chemicals that are not on your list, figure out why. Maybe you don’t use the chemical anymore. Or maybe you missed it in your survey. Some suppliers do provide MSDSs for products that are not hazardous. These do not have to be maintained by you. You should not allow employees to use any chemicals for which you have not received an MSDS. The MSDS provides information you need to ensure proper protective measures are implemented prior to exposure.

Figure 7-4-1 Appendix E—Guidelines for Employer Compliance (continued)

4. Preparing and Implementing a Hazard Communication Program

All workplaces where employees are exposed to hazardous chemicals must have a written plan which describes how the standard will be implemented in the facility. Preparation of a plan is not just a paper exercise—all of the elements must be implemented in the workplace in order to be in compliance with the rule. see paragraph (e) of this section for the specific requirements regarding written hazard communication programs. The only work operations which do not have to comply with the written plan requirements are laboratories and work operations where employees only handle chemicals in sealed containers. see paragraph (b) of this section, scope and application, for the specific requirements for these two types of workplaces.

The plan does not have to be lengthy or complicated. It is intended to be a blueprint for implementation of your program—an assurance that all aspects of the requirements have been addressed.

Many trade associations and other professional groups have provided sample programs and other assistance materials to affected employers. These have been very helpful to many employers since they tend to be tailored to the particular industry involved. You may wish to investigate whether your industry trade groups have developed such materials.

Although such general guidance may be helpful, you must remember that the written program has to reflect what you are doing in your workplace. Therefore, if you use a generic program it must be adapted to address the facility it covers. For example, the written plan must list the chemicals present at the site, indicate who is to be responsible for the various aspects of the program in your facility, and indicate where written materials will be made available to employees.

If OSHA inspects your workplace for compliance with the HCS, the OSHA compliance officer will ask to see your written plan at the outset of the inspection. In general, the following items will be considered in evaluating your program.

The written program must describe how the requirements for labels and other forms of warning, material safety data sheets, and employee information and training, are going to be met in your facility. The following discussion provides the type of information compliance officers will be looking for to decide whether these elements of the hazard communication program have been properly addressed.

In-plant containers of hazardous chemicals must be labeled, tagged, or marked with the identity of the material and appropriate hazard warnings. Chemical manufacturers, importers, and distributors are required to assure that every container of hazardous chemicals they ship is appropriately labeled with such information and with the name and address of the producer or other responsible party. Employers purchasing chemicals can rely on the labels provided by their suppliers. If the material is subsequently transferred by the employer from a labeled container to another container, the employer will have to label that container unless it is subject to the portable container exemption. see paragraph (f) of this section for specific labeling requirements.

The primary information to be obtained from an OSHA-required label is an identity for the material, and appropriate hazard warnings. The identity is any term which appears on the label, the MSDS, and the list of chemicals, and thus links these three sources of information. The identity used by the supplier may be a common or trade name (“Black Magic Formula”), or a chemical name (1,1,1,—trichloroethane). The hazard warning is a brief statement of the hazardous effects of the chemical (“flammable,” “causes lung damage”). Labels frequently contain other information, such as precautionary measures (“do not use near open flame”), but this information is provided voluntarily and is not required by the rule. Labels must be legible, and prominently displayed. There are no specific requirements for size or color, or any specified text.

With these requirements in mind, the compliance officer will be looking for the following types of information to ensure that labeling will be properly implemented in your facility.

1. Designation of person(s) responsible for ensuring labeling of in-plant containers;
2. Designation of person(s) responsible for ensuring labeling of any shipped containers;
3. Description of labeling system(s) used;
4. Description of written alternatives to labeling of in-plant containers (is used); and
5. Procedures to review and update label information when necessary.

Figure 7-4-1 Appendix E—Guidelines for Employer Compliance (continued)

Employers that are purchasing and using hazardous chemicals—rather than producing or distributing them—will primarily be concerned with ensuring that every purchased container is labeled. If materials are transferred into other containers, the employer must ensure that these are labeled as well, unless they fall under the portable container exemption (paragraph (f)(7) of this section). In terms of labeling systems, you can simply choose to use the labels provided by your suppliers on the containers. These will generally be verbal text labels, and do not usually include numerical rating systems or symbols that require special training. The most important thing to remember is that this is a continuing duty—all in-plant containers of hazardous chemicals must always be labeled. Therefore, it is important to designate someone to be responsible for ensuring that the labels are maintained as required on the containers in your facility, and that newly purchased materials are checked for labels prior to use.

Chemical manufacturers and importers are required to obtain or develop a material safety data sheet for each hazardous chemical they produce or import. Distributors are responsible for ensuring that their customers are provided a copy of these MSDSs. Employers must have an MSDS for each hazardous chemical which they use. Employers may rely on the information received from their suppliers. The specific requirements for material safety data sheets are in paragraph (g) of this section.

There is no specified format for the MSDS under the rule, although there are specific information requirements. OSHA has developed a non-mandatory format, OSHA Form 174, which may be used by chemical manufacturers and importers to comply with the rule. The MSDS must be in English. You are entitled to receive from your supplier a data sheet which includes all of the information required under the rule. If you do not receive one automatically, you should request one. If you receive one that is obviously inadequate, with, for example, blank spaces that are not completed, you should request an appropriately completed one. If your request for a data sheet or for a corrected data sheet does not produce the information needed, you should contact your local OSHA Area Office for assistance in obtaining the MSDS.

The role of MSDSs under the rule is to provide detailed information on each hazardous chemical, including its potential hazardous effects, its physical and chemical characteristics, and recommendations for appropriate protective measures. This information should be useful to you as the employer responsible for designing protective programs, as well as to the workers. If you are not familiar with material safety data sheets and with chemical terminology, you may need to learn to use them yourself. A glossary of MSDS terms may be helpful in this regard. Generally speaking, most employers using hazardous chemicals will primarily be concerned with MSDS information regarding hazardous effects and recommended protective measures. Focus on the sections of the MSDS that are applicable to your situation.

MSDSs must be readily accessible to employees when they are in their work areas during their workshifts. This may be accomplished in many different ways. You must decide what is appropriate for your particular workplace. Some employers keep the MSDSs in a binder in a central location (e.g., in the pick-up truck on a construction site). Others, particularly in workplaces with large numbers of chemicals, computerize the information and provide access through terminals. As long as employees can get the information when they need it, any approach may be used. The employees must have access to the MSDSs themselves—simply having a system where the information can be read to them over the phone is only permitted under the mobile worksite provision, paragraph (g)(9) of this section, when employees must travel between workplaces during the shift. In this situation, they have access to the MSDSs prior to leaving the primary worksite, and when they return, so the telephone system is simply an emergency arrangement.

In order to ensure that you have a current MSDS for each chemical in the plant as required, and that employee access is provided, the compliance officers will be looking for the following types of information in your written program:

1. Designation of person(s) responsible for obtaining and maintaining the MSDSs;
2. How such sheets are to be maintained in the workplace (e.g., in notebooks in the work area(s) or in a computer with terminal access), and how employees can obtain access to them when they are in their work area during the work shift;
3. Procedures to follow when the MSDS is not received at the time of the first shipment;
4. For producers, procedures to update the MSDS when new and significant health information is found; and
5. Description of alternatives to actual data sheets in the workplace, if used.

For employers using hazardous chemicals, the most important aspect of the written program in terms of MSDSs is to ensure that someone is responsible for obtaining and maintaining the MSDSs for every hazardous chemical in the workplace. The list of hazardous chemicals required to be maintained as part of the written program will serve as an inventory. As new chemicals are purchased, the list should be updated. Many companies have found it convenient to include on their purchase orders the name and address of the person designated in their company to receive MSDSs.

Figure 7-4-1 Appendix E—Guidelines for Employer Compliance (continued)

Each employee who may be “exposed” to hazardous chemicals when working must be provided information and trained prior to initial assignment to work with a hazardous chemical, and whenever the hazard changes. “Exposure” or “exposed” under the rule means that “an employee is subjected to a hazardous chemical in the course of employment through any route of entry (inhalation, ingestion, skin contact or absorption, etc.) and includes potential (e.g., accidental or possible) exposure.” see paragraph (h) of this section for specific requirements. Information and training may be done either by individual chemical, or by categories of hazards (such as flammability or carcinogenicity). If there are only a few chemicals in the workplace, then you may want to discuss each one individually. Where there are large numbers of chemicals, or the chemicals change frequently, you will probably want to train generally based on the hazard categories (e.g., flammable liquids, corrosive materials, carcinogens). Employees will have access to the substance-specific information on the labels and MSDSs.

Information and training is a critical part of the hazard communication program. Information regarding hazards and protective measures are provided to workers through written labels and material safety data sheets. However, through effective information and training, workers will learn to read and understand such information, determine how it can be obtained and used in their own workplaces, and understand the risks of exposure to the chemicals in their workplaces as well as the ways to protect themselves. A properly conducted training program will ensure comprehension and understanding. It is not sufficient to either just read material to the workers, or simply hand them material to read. You want to create a climate where workers feel free to ask questions. This will help you to ensure that the information is understood. You must always remember that the underlying purpose of the HCS is to reduce the incidence of chemical source illnesses and injuries. This will be accomplished by modifying behavior through the provision of hazard information and information about protective measures. If your program works, you and your workers will better understand the chemical hazards within the workplace. The procedures you establish regarding, for example, purchasing, storage, and handling of these chemicals will improve, and thereby reduce the risks posed to employees exposed to the chemical hazards involved. Furthermore, your workers’ comprehension will also be increased, and proper work practices will be followed to your workplace.

If you are going to do the training yourself, you will have to understand the material and be prepared to motivate the workers to learn. This is not always an easy task, but the benefits are worth the effort. More information regarding appropriate training can be found in OSHA Publication No. 2254 which contains voluntary training guidelines prepared by OSHA’s Training Institute. A copy of this document is available from OSHA’s Publications Office at (202) 219-4667.

In reviewing your written program with regard to information and training, the following items need to be considered:

1. Designation of person(s) responsible for conducting training;
2. Format of the program to be used (audiovisuals, classroom instruction, etc.);
3. Elements of the training program (should be consistent with the elements in paragraph (h) of this section); and
4. Procedure to train new employees at the time of their initial assignment to work with a hazardous chemical, and to train employees when a new hazard is introduced into the workplace.

The written program should provide enough details about the employer’s plans in this area to assess whether or not a good faith effort is being made to train employees. OSHA does not expect that every worker will be able to recite all of the information about each chemical in the workplace. In general, the most important aspects of training under the HCS are to ensure that employees are aware that they are exposed to hazardous chemicals, that they know how to read and use labels and material safety data sheets, and that, as a consequence of learning this information, they are following the appropriate protective measures established by the employer. OSHA compliance officers will be talking to employees to determine if they have received training. If they know they are exposed to hazardous chemicals, and if they know where to obtain substance-specific information on labels and MSDSs.

The rule does not require employers to maintain records of employee training, but many employers choose to do so. This may help employers choose to do so. This may help you monitor your own program to ensure that all employees are appropriately trained. If you already have a training program, you may simply have to supplement it with whatever additional information is required under the HCS. For example, construction employers that are already in compliance with the construction training standard (29CFR 1926.21) will have little extra training to do.

Figure 7-4-1 Appendix E—Guidelines for Employer Compliance (continued)

An employer can provide employees information and training through whatever means are found appropriate and protective. Although there would always have to be some training on-site (such as informing employees of the location and availability of the written program and MSDSs), employee training may be satisfied in part by general training about the requirements of the HCS and about chemical hazards on the job which is provided by, for example, trade associations, unions, colleges, and professional schools. In addition, previous training, education and experience of a worker may relieve the employer of some of the burdens of informing and training that worker. Regardless of the method relied upon, however, the employer is always ultimately responsible for ensuring that employees are adequately trained. If the compliance officer finds that the training is deficient, the employer will be cited for the deficiency regardless of who actually provided the training on behalf of the employer.

In addition to these specific items, compliance officers will also be asking the following questions in assessing the adequacy of the program:

Does a list of the hazardous chemicals exist in each work area or at a central location?

Are methods the employer will use to inform employees of the hazards of non-routine tasks outlined?

Are employees informed of the hazards associated with chemicals contained in unlabeled pipes in their work areas?

On multi-employer worksites, has the employer provided other employers with information about labeling systems and precautionary measures where the other employers have employees exposed to the initial employer's chemicals?

Is the written program made available to employees and their designated representatives?

If your program adequately addresses the means of communicating information to employees in your workplace, and provides answers to the basic questions outlined above, it will be found to be in compliance with the rule.

5. Checklist for Compliance

The following checklist will help to ensure you are in compliance with the rule:

- Obtained a copy of the rule.
- Read and understood the requirements.
- Assigned responsibility for tasks.
- Prepared an inventory of chemicals.
- Ensured containers are labeled.
- Obtained MSDS for each chemical.
- Prepared written program.
- Made MSDSs available to workers.
- Conducted training of workers.
- Established procedures to maintain current program.
- Established procedures to evaluate effectiveness.

6. Further Assistance

If you have a question regarding compliance with the HCS, you should contact your local OSHA Area Office for assistance. In addition, each OSHA Regional Office has a Hazard Communication Coordinator who can answer your questions. Free consultation services are also available to assist employers, and information regarding these services can be obtained through the Area and Regional offices as well.

The telephone number for the OSHA office closest to you should be listed in your local telephone directory. If you are not able to obtain this information, you may contact OSHA's Office of Information and Consumer Affairs at (202) 219-8151 for further assistance in identifying the appropriate contacts.

[59 FR 6170, Feb. 9, 1994, as amended at 59 FR 17479, Apr. 13, 1994; 59 FR 65948, Dec. 22, 1994; 61 FR 9245, Mar. 7, 1996]

Figure 7-4-1 Appendix E—Guidelines for Employer Compliance (continued)

Guidelines on Opening Containers Containing Commodities Under Controlled Atmosphere (CA) Storage

Controlled atmosphere (CA) is being used more and more commonly to preserve the quality of fresh produce during and shipment, especially during long voyages. It also has the advantage of reducing the number of many of the pests that may be present. In most cases, however, insufficient research has been done on enough pest species for APHIS to accept CA as a stand-alone quarantine treatment, although this could change in the future.

Opening and inspecting a container known or suspected to be under CA poses a safety risk to the inspector, and to others in the immediate vicinity. A placard is usually posted on the doors of the container prior to shipment, stating that the fresh produce is being shipped under CA. Also, a monitoring device, indicating the kinds and levels of gases in the mixture, should be present. If the monitor is **not** functioning properly, it is possible to use gas detector tubes specific for oxygen and carbon dioxide. If the nitrogen or carbon dioxide levels are high, or the oxygen level is low, the inspector must **not** enter the container immediately, because of the high risk of asphyxiation. This risk is very insidious, because the potential victim usually does **not** recognize the danger signs.

It should be noted that normal air contains 78 percent nitrogen, 21 percent oxygen, and 0.03 to 0.04 percent carbon dioxide (CO^2). Health risk to the inspector occurs when the oxygen level is too low, or the levels of nitrogen or CO^2 are too high.

Oxygen (O^2)

Gases within a CA space normally contain only 3 percent oxygen or less. The lowest oxygen level considered safe is 19.5 percent. A personal oxygen monitor (worn by the inspector) would set off an alarm at that level.

An oxygen level of 6 percent or less causes loss of consciousness within 45 seconds. Breathing is in gasps, followed by convulsive movements, then breathing stops. The heart may continue beating for a few minutes, then stops. If the person attempting to rescue is **not** equipped with a SCBA, there is a high probability that this person will also become a victim of asphyxiation.

Carbon dioxide (CO^2)

Gases within a CA space often contain high levels of CO2. Although this is a common compound, it can also be deadly—a fact often overlooked. Breathing pure CO2 will cause immediate death. Even at concentrations over 15 percent, death can be rapid. Above 10 percent, CO2 causes unconsciousness (coma). At 8 percent, CO2 causes headache, nausea, vomiting, and may lead to unconsciousness. Concentrations as low as 4 to 5 percent cause rapid, labored

breathing, slight choking, and headache. The threshold limit value (TLV), the highest level at which a person can work without adverse effect, is 0.05 percent or 5 ppm.

If dangerous gas levels are determined to be present, then the container must be aerated prior to inspection, preferably by using the container's own recirculation system, set in “exhaust” mode. Aeration may also be done passively, or by the use of fans, or by means of a fan-assisted aeration duct.

WARNING

Do **not** attempt to aerate while the container is parked at a loading dock, because the gases may asphyxiate workers in the area. Have the container moved to an open area. While opening doors and placing fans or a fan-assisted exhaust duct, wear SCBA for personal protection.

Aerate for at least one hour, then recheck gas levels. Proceed with cargo inspection only when safe levels have been reached. The safe waiting time (to achieve at least 19.5 percent oxygen in the accessible portion of the container) depends upon several factors:

- The type of produce and how it is packed
- The extent of holes in the boxes
- Packing density of the boxes
- Pallet spacing, and return-flow ribs in the floor of the container
- Amount of head-space above the load
- Whether the recirculation blower is on or off
- Percentage of oxygen in the controlled atmosphere

At ports receiving CA containers, periodic training/awareness sessions are needed, and policies clearly spelled out.

Acronyms and Abbreviations Used in This Section

a.i.	active ingredient
ACGIH	American Conference of Governmental Industrial Hygienists
ADI	Acceptable Daily Intake
APHIS	Animal and Plant Health Inspection Service
BBEP	Biotechnology, Biologics, and Environmental Protection
bw	body weight
CAS	Chemical Abstracts Service
cc	cubic centimeters
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
ChE	cholinesterase

CHEMTREC	24-hour emergency telephone service for spills
CNS	central nervous system
COR	Contracting Officer's Representative
CPK	creatine phosphokinase
cu.m	cubic meter
CWA	Clean Water Act
DHEW	U.S. Department of Health, Education, and Welfare
DNA	deoxyribonucleic acid
DOT	U.S. Department of Transportation
DW	drinking water
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
g	grams
GI	gastrointestinal
HDT	highest dose tested
Hgb	hemoglobin
HHS	U.S. Department of Health and Human Services
i.m.	intramuscular
i.p.	intraperitoneal
i.v.	intravenous
kg	kilogram
L	liter
LC50	Lethal Concentration 50; dose lethal to 50 percent of the animals
LCLO	Lethal Concentration Low; the lowest concentration causing death
LD50	Lethal Dose 50; dose lethal to 50 percent of the animals
LDLO	Lethal Dose Low; the lowest dose at which death occurred
LDT	lowest dose tested
LEL	lower exposure limit, or lowest-effect level
LOAEL	lowest-observed-adverse-effect-level
m	meter
MED	minimum effective dose
mg	milligram
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
mmHg	millimeters of mercury; a measure of pressure
MOE	Margin of Exposure
MOS	Margin of Safety
MSDS	Material Safety Data Sheet
MTD	maximum tolerated dose
MTL	median threshold limit
NFPA	National Fire Prevention Association

ng	nanogram
NIOSH	National Institute for Occupational Safety and Health
NMRAL	National Monitoring and Residue Analysis Laboratory
NOAEL	no-observed-adverse-effect level
NOEL	no-observed-effect level
NTP	National Toxicology Program
OIC	Officer-in-Charge
OSHA	U.S. Occupational Safety and Health Administration
PEL	permissible exposure limit
PHS	U.S. Public Health Service
p.o.	per os (by mouth)
ppb	parts per billion
ppm	parts per million
PPQ	Plant Protection and Quarantine
RBC	red blood cell(s)
RfD	Reference Dose
RfDi	Inhalation Reference Dose
RfDo	Oral Reference Dose
s.c.	subcutaneous
STEL	short-term exposure limit
TLV	threshold limit value
TSS	Technical and Scientific Services
TWA	time-weighted average
UCL	upper confidence limit
UEL	upper exposure limit
UF	uncertainty factor
ug	microgram
ug/cu.	micrograms per cubic meter
ug/L	micrograms per liter
USDA	United States Department of Agriculture

8

Treatment Manual

Equipment

Contents

Thermal Conductivity Gas Analyzers **8-1-2**
- Instrument Description **8-1-2**
- Instrument Standardization **8-1-5**
- Operation Procedures **8-1-6**
- Maintenance **8-1-8**

Infrared Spectroscopy Gas Monitoring Device **8-1-9**
- General Operation **8-1-10**
- Calibration and Service **8-1-12**

Respiratory Protection **8-1-13**
- Responsibility **8-1-13**
- Fumigants **8-1-14**
- Pesticides Other Than Fumigants **8-1-14**
- Air Purifying Respirators **8-1-14**
- Dust Masks **8-1-14**
- Employee Acceptance **8-1-14**
- Capabilities and Limitations **8-1-15**
- Respirator Protection Use **8-1-16**
- Use in Dangerous Atmospheres **8-1-17**
- Facepiece Fitting **8-1-17**
- Facepiece Fit Tests **8-1-18**
- Corrective Lenses With Full Facepiece **8-1-18**
- Eyeglasses With Half Facepiece **8-1-19**
- Use in Low Temperatures **8-1-19**
- Communications **8-1-19**
- Maintenance and Care **8-1-19**
- Cleaning and Disinfecting **8-1-20**
- Inspection for Defects (Including Leak Checks) **8-1-21**
- Repairs **8-1-22**
- Respirable Air for Self-Contained Breathing Apparatus **8-1-22**
- Storage **8-1-22**

Detector Kits or Gas Samples **8-1-23**
- Principles of Operations **8-1-23**

Volatilizer **8-1-25**

Air Velocity Measuring Instruments **8-1-27**
- Anemometer **8-1-27**
- Velometer® **8-1-27**

Auxiliary Pump **8-1-28**

Open-Arm Manometer **8-1-30**

Mityvac Hand-held Vacuum Pump **8-1-33**
Usage **8-1-33**
Phosphine Detector **8-1-33**
PortaSens Phosphine Detector **8-1-33**
Photo Ionization Detector **8-1-34**
Certified Precision Thermometers: Calibration Guidelines **8-1-35**
Charcoal Adsorber Recapture Standards **8-1-36**

Thermal Conductivity Gas Analyzers

The thermal conductivity gas analyzer (T/C) is a portable instrument specifically designed to determine the concentration of gases under a tarpaulin or within a chamber during a fumigation. These fumigation gases include methyl bromide (MB) and sulfuryl fluoride (SF).

Instrument Description

There are two instrument brands approved for use during a PPQ-supervised fumigation:

- Fumiscope® (**Figure 8-1-1**)
- Gow-Mac® (**Figure 8-1-2**)

These instruments are lightweight, portable, and completely contained in a compact metal case. They contain a thermal conductivity cell, scale, gas pump, range switch, and gas flow meter. A gas drying tube is also included. For large enclosures, an auxiliary pump may be needed.

Figure 8-1-1 Fumiscopes®

Figure 8-1-2 GowMac®

Inlet

The inlet tube connector is the gas inlet for the instrument. The sampling lines are 1/4" inner diameter (I.D.) and are connected to the inlet through the drying tube.

Flow Rate Meter

The flow rate meter indicates the gas flow rate in “simulated cubic feet per hour (SCFH).” Note: The flow rate should always be read at the middle of the ball.

Flow Rate Adjustment

The flow rate adjustment dial controls the air or gas flow rate by adjusting the pump. After connecting to the gas sampling line, adjust the flow rate upward until it reads exactly 1.0 SCFH.

Scale or Digital Display

The scale or digital display indicates the concentration of the fumigant in ounces per 1,000 cubic feet (milligrams per liter or grams per cubic meter). Record the gas concentration reading only after this meter stabilizes, which may take a minute or more (depending on the length of the tubing and whether an auxiliary pump is being used). Digital Fumiscope® models can indicate a range from 0 to 2999 ounces per 1,000 cubic feet. When using the GowMac® for sulfuryl fluoride, the concentration is calculated as the reading multiplied by a specific factor.

Zero Adjustment

The zero adjustment dial is used to adjust the display to zero after the instrument has warmed up.

Important

The instrument should be set to zero before taking concentration readings at each required time interval and reset to zero after each reading.

Line Switches

Line switches control the electrical supply to the pump and scale.

Fumigant Selector Switch

The fumigant selector switch (Fumiscope® only) changes the display to register either methyl bromide or sulfuryl fluoride (Vikane®.)

Range Switch

The range switch (GowMac® only) regulates the scale indicating the concentrations of fumigant measured, for example, 0 to 100 ounces per 1,000 cubic foot or 101 to 200 ounces per 1,000 cubic foot (some models).

Exhaust Outlet

Always connect an exhaust line to the exhaust outlet to carry gas away from the instrument and operator. When using the T/C unit in confined or poorly ventilated areas, recirculate the exhaust gas back to the fumigation space or exhaust it to the outside.

Drying Tube

Use drying tubes (filter tube) with a prepared chemical for removing certain contaminant gases or vapors that interfere with correct fumigant concentration readings. The tubes will contain a desiccant such as Drierite® (granules of anhydrous calcium sulfate), or Ascarite® (sodium hydroxide). Both are available from scientific supply houses. **Never mix Drierite® and Ascarite® in the same tube.**

When a drying tube is used, place a thin layer of glass wool or aquarium filter wool at the bottom and top of the tube to prevent small particles from sifting into the T/C unit. Using absorbent cotton or similar materials is **not** recommended. Cotton tends to pick up moisture and to become matted, and once matted, the cotton may restrict normal air flow, thus, adversely affecting the T/C unit's operation.

Mount the drying tube *vertically* so the gas mixture moves through the drying material and does **not** pass over the top. The gas mixture will pass over the top of the drying tube when the tube is mounted horizontally (lengthwise).

Drierite®

Always use anhydrous calcium sulfate (Drierite®) to remove moisture from the gas sample. Insert the drying tubes in the gas sampling line just before the inlet connection. Drierite® should be fresh and frequently changed to ensure correct readings. Drierite®, blue in color when dry, turns pink when moisture is absorbed. Replace the Drierite® when most of it has turned pink. In extremely high moisture conditions, two Drierite® tubes can be connected in tandem. Close drying tube openings when **not** in use.

Ascarite®

T/C gas analyzers are sensitive to a number of gases other than MB. For example, CO_2 may be troublesome when fumigating fruit where kerosene heaters are placed under the tarpaulin to raise pulp temperatures, or with plant material packed in peat moss or subsoil. Correct MB gas concentration readings may be obtained if a CO_2 absorbent is used in the gas sampling line

before the air-gas mixture enters the T/C unit. A CO_2 absorbent that can be used is Ascarite®. Observe the poison warning labels on the containers when using Ascarite®. **Tubes containing Ascarite® should be clearly labeled, "Warning—Avoid contact with skin, eyes, and clothing."**

WARNING

During a fumigation of living plant products, such as plants, plant material, logs, wood and wood products, tubes containing Ascarite® **must** be used to remove carbon dioxide from gas samples. Used Ascarite® should be discarded per label instructions. The Ascarite® tube should be connected between the Drierite® tube and the sample inlet. **Never mix Drierite® and Ascarite® in the same tube**. Ascarite® should be replaced when the granules begin to aggregate or become moist.

Because a chemical reaction will occur, ***never*** use Ascarite® when taking readings of SF.

Instrument Standardization

Instrument standardization is the first and basic operation. In order to standardize the instrument, do the following:

1. Connect the instrument to an electrical outlet with proper voltage and set the pump and meter switches to "on"; if inoperable, check fuse (replacements—Little Fuse or Buss #3AG 1/2 Amp.—should be kept on hand).
2. Attach the drying tube to the inlet port.
   - **A.** Give the instrument a tightness test.
   - **B.** A tightness test can be accomplished by placing a finger over the inlet of the drying tube; if the tubing and connections are tight, the flow ball in the flow meter should then fall to zero.
3. Warm up the instrument for 15 to 30 minutes.

Important

The manufacturer recommends that the analyzer be kept at the same temperature as the fumigated site. It may take up to two hours for the analyzer to acclimate if moved from extreme temperatures.

4. Adjust the gas flow rate to one SCFH by adjusting the flow rate knob.
   - **A.** If the flow rate knob is turned counterclockwise too far, the pump will emit noises and cease to operate properly.
   - **B.** When properly adjusted, the flow ball should float at the center mark, or slightly below it, on the calibrated glass cylinder.
   - **C.** The pump now draws dry, fresh air through the T/C cell; the air enters via the inlet on the face of the instrument, passes through the cell, and leaves through the exhaust outlet.

5. Turn the zero adjustment knob to obtain a zero reading on the meter.
   A. To obtain a stable zero reading, several additional adjustments during the first few minutes may be necessary.

Standardization is now complete and readings can be made of fumigant-air mixture drawn through the unit. At this point, it may be necessary to replace the desiccant.

The difference in the thermal conductivity of the fumigant-air mixture as compared with fresh air is measured electrically and indicated on the meter as concentration readings in ounces of gas per 1,000 cubic feet. T/C units used in PPQ must be calibrated for MB and/or SF by the manufacturer or an approved outside contractor prior to use. When fumigations are under even a small vacuum, readings will **not** be accurate.

Operation Procedures

Because of the variety of fumigation situations, some adjustments may be necessary to meet specific needs. Nevertheless, this outline should be helpful in establishing correct operational procedures.

The proper use of the T/C unit is discussed under two headings:

- Selecting operational site
- Measuring gas concentrations

Selecting Operational Site for T/C Unit

The T/C unit should be at least 30 feet upwind from the fumigation site to allow the operator to function without the fear of accidental exposure to gas and to allow for easy exit in an emergency. It should be close enough to the fumigation site to avoid using unreasonable lengths of sampling lines, to allow for constant surveillance of the fumigation during testing, and to avoid interference with other activities in the area. Avoid excessive wiring length. When T/C unit readings in multiple locations are necessary, see that each location is the best available.

The T/C unit should be supported on a sturdy, level surface, outside the traffic pattern, and protected from wind, rain, excessive cold, and, in hot weather, sun. In some cases, temporary shelter such as a tarpaulin cover may be adequate. The gas concentration readings indicated by the T/C unit may be inaccurate unless the unit is placed in an area that is approximately the same temperature as the gas mixture in the enclosure being fumigated. If the temperature of the gas mixture within the fumigated enclosure is approximately equal to that of the ambient air outside the enclosure, the gas concentration readings indicated by the T/C unit's meter will be generally more accurate. If there are great differences between the two temperatures, water vapor may condense inside the gas sampling leads. Such condensation, if desiccant is saturated, can result

in a lower than normal T/C meter reading, thus leading to the unnecessary addition of fumigant to compensate for the apparent shortage. Therefore, if vapor condensation appears inside the gas sampling leads, purge the line and move the T/C unit to a new location where the ambient temperature approximates that of the enclosure.

Most T/C units operate on 110 to 120 volts alternating current (AC). T/C units operating on 210 to 220 volts AC on direct current (DC) are available for overseas or other assignments as necessary. A converter is required to use DC. Keep extension wiring and gas sampling line length to a practical minimum and raise extension wiring above floor level when feasible.

Measuring Gas Concentrations With the Standardized Unit

As a protection for the cell and the pump of T/C units, **use a drying tube filled with Drierite® at all times.**

When taking gas concentration readings, first warm up the unit for at least 15 to 30 minutes depending on ambient temperatures. Then turn on the pump and adjust the gas flow meter to a 1.0 SCFH flow. Turn the zero adjustment knob to obtain a zero reading on the meter.

The unit is now ready to measure gas samples drawn through position tagged tubes from the area being treated. The meter will indicate gas concentrations in ounces per 1,000 cubic feet (grams per cubic meter).

Connect the gas sampling line to the Drierite tube using 1/4 inch ID polyethylene tubing. Allow sufficient time to draw a true sample. With 150 to 200 feet of 1/4 inch ID tubing and a temperature of 70 °F, a sufficient amount of time will be approximately 7 minutes. Stations equipped with small, auxiliary pumps can draw a sample through the same length of tubing in 12 to 15 seconds.

Wait until the analyzer reaches the maximum reading (at least thirty seconds) and does **not** move for thirty seconds. Ensure the flow meter still reads 1.0 SCFH. This is the gas reading. Record this reading on the PPQ Form 429.

Disconnect the sampling line and allow the pump to draw uncontaminated air through the T/C cell. The instrument should return to zero, however it may be necessary to re-zero the analyzer. Again, ensure that the flow meter reads 1.0 SCFH. **Always re-zero the analyzer before taking the next reading.**

After taking the final reading at the end of the fumigation, thoroughly purge the unit by disconnecting it from the gas sampling line and allowing the pump to draw fresh air through the instrument for several minutes.

Maintenance

If it is to function properly, the T/C unit requires the same attention as any other equipment. While the instrument is designed specifically for field use, the components, particularly the meter, may be damaged easily. To maintain an instrument capable of accurate gas concentration readings, careful handling is essential. If repairs are needed and are extensive, or the parts are **not** readily available, there will be a delay in returning the instrument. Should the need for a substitute T/C unit occur, the port should be prepared to obtain one from another source.

Repair and Calibration

Under normal service, the T/C unit will hold its calibration for a considerable length of time. To ensure all units are providing accurate gas concentration readings, recalibrate T/C units at least annually; calibrate more often if use is frequent.

Send the instrument by insured delivery service (ie. Federal Express, United Parcel Service, U.S. postal priority mail) to one of the contractors listed below. To prevent damage, the unit must be well-packed and shipped in a durable, tamper-proof box.

Prepare a memorandum to accompany each instrument explaining the need for sending the unit. Ensure all instruments are shipped with a proper return address, name of a contact person, and telephone number. The T/C unit will be calibrated for MB only, unless the PPQ office requests calibration for SF. **Notify the contractor if Ascarite® will be utilized during the readings, as the T/C must be calibrated using this type of absorbent.** All port locations will be responsible for payments to contractors.

Use one of the following contractors for repair and calibration:

Key Chemical and Equipment Co. (BPA# 45-6395-3-2872)
13195 49th St. North
Unit A
Clearwater, FL 33762
tel (727) 572-1159
fax (727) 572-4595
http://www.fumiscope.com/

Cardinal Professional Products (BPA# 45-6395-3-2871)
2641 W. Woodland Drive
Anaheim, CA 92801-2628
tel (714) 761-3292
fax (714) 761-2095
http://www.cardinalproproducts.com/

Infrared Spectroscopy Gas Monitoring Device

Infrared spectroscopy is an accurate and efficient method for measuring methyl bromide gas concentrations. There is one unit currently approved for use by PPQ. The MB-ContainIR™ is manufactured by Spectros Instruments Inc., Hopedale, MA, and will be referred to in this document as the "Spectros." The Spectros is light-weight (9 pounds; 4 kg) and battery operated.

Figure 8-1-3 Spectros Methyl Bromide Monitor

The Spectros uses a technology known as "non-dispersive infrared technology" (NDIR.) NDIR is based on Beer's Law (also known as Lambert-Beer Law or Beer-Lambert-Bouguer Law) that relates the absorption of light to the properties of the material through which the light is traveling. The Spectros is not affected by other volatile organic compounds such as carbon dioxide, eliminating the need for Ascarite™. Other benefits of the unit include:

- Audible and visible programmable alarm
- Battery powered and portable
- Measuring range for methyl bromide 0-240 oz./1000 ft^3 (g/m^3)
  - Sensitivity 0.16 oz./1000 ft^3 (g/m^3)
  - Accuracy 0.08 oz./1000 ft^3 (g/m^3)
- Operating temperature 32 °F - 122 °F (0 °C - 50 °C)
- Variable temperature compensation

The information and guidelines in this chapter are based on the Spectros Inc. Operation and Maintenance Guide. Contact **Spectros** for more detailed operating instructions or technical assistance.

Important points to remember:

Important

- This monitor **is not** and **should not** be used as a worker safety clearance device.
- This monitor is **not** set up to evaluate, test, or determine readings for other approved fumigants that PPQ uses, such as **phosphine** or **sulfuryl fluoride.**
- Do not operate the monitor in the presence of flammable liquids, vapors, or aerosols.
- Do not use soap and water to clean the monitor; use a dry cloth to clean the monitor.
- Maintain proper care and storage of the monitor when not in use.
- Use only batteries supplied by the factory.
- Operate the monitor at all times in a horizontal position. Operating the monitor in a vertical position may cause inaccurate measurements.
- Never operate this unit at or above 6,562 feet. (2,000 meters.)
- The monitor must be maintained free of moisture or other contaminants.
- Always place supplied filter on the gas sample line between the monitor and the sampling line.
- Always ensure that the direction of flow is correct for the supplied filter before using the monitor.
- Cap the ends of the gas sample lines to prevent the possibility of mists, aerosol, oil, water, dust, or other contaminants being drawn into the monitor.
- The maximum length of the gas sample line is 1000 feet.
- The monitor does not require Drierite if the measuring range is greater than 2 oz./1000 ft^3.
- Return the monitor to the manufacturer for calibration every 6 months.

General Operation

Prior to taking gas concentration readings, follow the guidelines in Chapter 2-4 Methyl Bromide Tarpaulin Fumigation, Conducting a Fumigation, to ensure proper installation of gas sampling lines and circulation fans.

If not using direct current, ensure that the battery for the Spectros is fully charged before the fumigation begins. When using the Spectros in battery mode, press the "test" button and observe the number of LEDs that light up.

- Four green LEDs on the battery indicate that the unit is fully charged and monitoring can begin. A fully charged battery pack will power the monitor for 8-10 hours.
- A red flashing LED on the battery indicates a low battery. Recharge the battery per manufacturer instructions before using for gas monitoring. Charging time is 3-4 hours for a fully discharged battery pack.

Gas Sample Line

Using 1/4-inch flex tubing, connect the gas sample line to the monitor by pushing the tubing onto the gas sample port on the front of the monitor. The gas sample line can be up to 50 feet in length and should be free of kinks or obstructions. If the gas sample line is longer than 300 feet, the instrument will display "FAULT" on the display screen. Ensure that the end of the line is positioned to prevent moisture or water intake, or utilize the filter element.

Purge Air Line

Connect the purge air line to the monitor by pushing the tubing onto the purge air port on the left side of the monitor. The purge line can be up to 100 feet maximum in length and should be in an area of fresh air. Ensure that the end of the line is positioned to prevent moisture or water intake, or utilize the filter element.

Exhaust Line

Connect the exhaust line to the monitor by pushing the tubing onto the exhaust port's barbed fitting. The exhaust line can be up to 50 feet in length and should terminate outside the building. Ensure that the end of the tube is positioned to prevent moisture or water intake.

Measuring Gas Concentration

To turn on the monitor lift the shield in front of the handle and press the red power ON/OFF toggle switch. Allow the monitor to warm up for 15 minutes.

The WARM UP screen is displayed and the ON light (green) will blink. After 15 minutes the ON light will stop blinking and glows steady.

The data display screen will show:

ZONETEMP - enter temperature of the area being monitored in °C. The zone is the area where the monitor is being operated, rather than the temperature of the commodity undergoing fumigation

The factory default temperature setting is 25 °C.

NOTICE

If the monitor is turned off at any time during operation, the monitor will run through an entire 15 minute WARM UP cycle, regardless of how long the monitor has been running.

After the warm up period, the Data Display Screen will read either MEASURE or PURGE in the upper left corner of the screen.

MEASURE indicates the monitor is actively measuring gas. The measurement is shown in the lower section of the screen. The monitor measures up to 240 g/m^3 with a sensitivity of 0.16g/m^3.

The measurement (reading) should stabilize (stop) before recording the reading. This may take one or more purge cycles depending on the length of the gas sample line.

The measurement cycle will run for 4 minutes before the purge cycle begins. When the display shows "PURGE", the monitor is resetting it's infrared detector to baseline. The PURGE cycle runs for 10 seconds.

A zero reading indicates the concentration measured is below the lower limit of detection of 0.77g/m^3 (200ppm approximately).

NOTICE

If kinks or obstructions occur in the line, the monitor may not function properly.

Check for crimped sampling lines. Make sure nothing is restricting the flow of either the inlet sample air, purge air, or the exhaust (return sample line).

Calibration and Service

Return the Spectros to the manufacturer every 6 months for a calibration check and service. Contact Spectros to obtain a Service Request Form and Return Materials Authorization Number (RMA). Ship the unit using an insured carrier.

Contact Information

Spectros

Spectros Instruments, Inc.
4 Evergreen Lane, #12A
Hopedale, MA 01747
Phone: 508-478-1648
FAX: 508-478-1652
Website: www. spectrosinstruments.com
Email: info@spectrosinstruments.com

Treatment Quality Assurance Unit

USDA-APHIS-PPQ-CPHST
Treatment Quality Assurance Unit
1730 Varsity Drive
Suite 400
Raleigh, NC 27606
Phone: 919-855-7450
FAX: 919-855-7493
Email: cphst.tqau@aphis.usda.gov

Respiratory Protection

Fumigation or other treatments conducted under the monitored conditions stated in this manual and other program manuals, are safe operations. The Occupational Safety and Health Administration (OSHA) has ruled that employees with possible exposure to pesticides (including fumigants) shall be provided adequate respiratory protection from such exposure. This section discusses the types, capabilities, limitations, and uses of different respiratory protection available.

Responsibility

Management's Responsibilities

1. Provide respiratory protective equipment when such equipment is necessary to protect the health of the individual.
2. Provide equipment that is applicable and suitable for the purpose intended.
3. Establish a maintenance program for respiratory devices used.
4. Initiate and maintain a regular training program to inform personnel of basic and current information.

Officer's Responsibilities

1. Use and maintain respiratory equipment in accordance with instructions written in this manual and other instructions issued.
   - **A.** Adherence or nonadherence to prescribed instructions for the proper use of protective devices and equipment will be a factor in evaluating the quality of an employee's performance.
   - **B.** Gross disregard for safety measures may result in disciplinary action.
   - **C.** Proper respiratory protection unit is required at the treatment site.
2. Report any damage or malfunction of the device to management.
3. Carry out routine cleaning and care in accordance with instructions in this manual or instructions provided by the manufacturer.

Table 8-1-1 Threshold Limit Values of Fumigants

Toxicity	Threshold limit value
Methyl bromide (MB)	5 ppm (skin)* STEL** and ceiling
Sulfuryl fluoride (SF)	10 ppm STEL**; 5 ppm TWA***
Phosphine (PH)	1 ppm STEL**; 0.3 ppm TWA***

*Skin means the potential overall exposure includes absorption through the skin and mucous membranes.
**Short term exposure limit
***Time-weighted average

Fumigants

Every effort will be made by management and workers to prevent exposing PPQ personnel to atmospheres containing dangerous concentrations of toxic fumigants or other pesticides, or to atmospheres where there is an oxygen deficiency. However, if an emergency situation develops in which personnel may be exposed, use only respiratory protective equipment with a pressure-demand regulator. This equipment includes self-contained breathing apparatus (SCBA), air-supplied respirators, and units combining these two types. (In this manual, the term, “SCBA” may be read to include all three of these types.) Because positive air pressure is maintained in the full face mask at all times, the pressure-demand respirator affords the best protection currently available.

Pesticides Other Than Fumigants

When there is doubt selecting proper respiratory protection in either of the following categories, use the device that offers the best protection. Consulting this manual, the pesticide label, and the supervisor can help determine the most effective respiratory protection.

Air Purifying Respirators

Air purifying respirators using either a full face mask or half face mask are acceptable in areas where concentrations below maximums designated on the canisters can be expected. They may also be used during pesticide application with a pesticide toxicity or concentration known to pose little or no danger when correctly applied.

Dust Masks

Dust masks may be used when particulate matter such as dust, insect scales, aerosol, spray, or other particles are a nuisance and are of low or moderate toxicity.

Employee Acceptance

The wearer’s acceptance of respiratory protection depends on facepiece comfort, clear and full vision, device weight, breathing resistance, individual physical condition, and personal preference. If more than one device with the proper facepiece seal is approved for the conditions, then the most comfortable device may be used by the individual. PPQ will use only respiratory protective equipment tested and certified by the National Institute for Occupational Safety and Health (NIOSH) and carrying an approval number prefixed by “TC.”

Capabilities and Limitations

Self-Contained Breathing Apparatus (SCBA)

Breathing air is carried in a tank by the user. When properly fitted and used according to instructions, the positive pressure-demand system will prevent harmful contaminants from entering and will provide breathing air in low oxygen areas. A warning device indicates when the air supply is low and allows adequate time to leave the area. The individual must know that only 5 to 7 minutes of air remain at the alarm and that a proper evacuation route must be planned in advance. Test each unit to determine the time remaining at the sound of the alarm.

Limitations

The time that the device will provide respiratory protection is limited by the amount of air in the tank. Rapid breathing due to stress will use the air supply more quickly. There is no protection against skin irritation from toxic gases with the self-contained breathing apparatus. Because some chemicals such as HCN or pesticide groups like the organo-phosphates can be absorbed through the skin, avoid splashes of liquid fumigants or other pesticides and wear protective clothing to protect against accidental exposure.

Gas- and Vapor-Removing Respirators

Canisters and cartridges can be used as protection from most pesticides *other than fumigants*. Select the type of canister for a specific gas or vapor or combinations of gases or vapors. Canisters and cartridges have the advantage of being small, light, and simple in operation.

Limitations

Canisters and cartridges are **not** effective in oxygen-deficient atmospheres. There is no protection from skin irritations or pesticide absorption through the skin. The capacity of the cartridge or canister determines the maximum contaminant concentration against which a purifying respirator will protect. The maximum concentration for which a canister is designed is printed on the label. Cartridges do **not** have this information. Unless specified on the canister or cartridge label, no protection is provided against particulate contaminants.

The unit will **not** provide full protection unless the facepiece is carefully fitted to the wearer's face. Protection is provided dependent on the canister- or cartridge-type concentration of the contaminant and the wearer's respiratory rate.

A rise in canister or cartridge temperature indicates that a gas or vapor is being removed from the inspired air. However, do **not** rely on this characteristic as an indicator of canister performance. An uncomfortably high canister temperature usually indicates a high concentration of gas or vapor and requires an immediate return to fresh air.

Particulate-Removing Respirators

Particulate-removing respirators can be used only to protect against nonvolatile particles. Unless a special combination filter and chemical cartridge (canister) system is used, no protection is afforded against gases and

vapors. When retained particles plug the filter or cartridge, breathing becomes difficult and the filter or cartridge must be replaced. Combination respirators using both chemical and mechanical filtering systems are used for dual or multiple exposures to dust and vapors. Normally, filters used for removing dust, mist, or other particulates plug up before the chemical cartridge is exhausted. Replace both filter and chemical cartridge at the same time.

Respiratory Protection Selection

Work time, including the time necessary to enter or leave a contaminated area, determines the length of time for which respiratory protection is needed. Selecting respirators must be based on all hazards to which the wearer may be exposed.

The only unit with an adequate warning device is the SCBA. The SCBA is equipped with a pressure gauge and audible alarm device. Canisters may have a window indicator that indicates only the presence of moisture. Because canister and cartridge respirators have no indication of remaining service life, replace used canisters and cartridges after each use.

The more active the wearer is, the more rapid his or her breathing. This rapid breathing shortens the usable working time of all types of respirators. High breathing resistance of air-purifying respirators under conditions of heavy work can result in distressed breathing.

Respirator Protection Use

Every effort will be made to avoid the need for respirators. The supervisor issuing respirators must be adequately trained to ensure the correct respirator is issued for each type of possible pesticide exposure. Unless more rigid standards are specified by PPQ, follow pesticide labels regarding respirator use.

If a PPQ Officer will use a respirator, the supervisor must ensure a physician or other licensed health care professional apply one or more of the following tests to determine the officer’s fitness to use a respirator:

- Chest x-ray
- EKG (Echocardiogram)
- Examination of nasal passages
- Pulmonary function test

Any such examination should be requested and reported as outlined in the Animal and Plant Health Inspection Service (APHIS) Safety and Health Manual. Use APHIS Form 29 for this purpose. Only a physician or other licensed health care professional can judge whether an officer is physically able to wear a respirator.

Supervisors must ensure employees who use respirators complete a medical review every two years, or more frequently if there is a significant change in the medical or physical condition of the officer. Procedures for conducting this review are outlined in the APHIS Safety and Health Manual,

Use in Dangerous Atmospheres

For situations in which employees may be overcome by a toxic or oxygen-deficient atmosphere, at least one additional person qualified in using respirators (such as the commercial applicator) must be present. The commercial applicator and the employee should cooperate to limit the likelihood of exposure to both individuals at one time. To prevent exposure to any individual at a treatment site, all precautions must be followed. Should exposure occur and an employee be overcome by a toxic atmosphere, do **not** attempt rescue without the SCBA.

Facepiece Fitting

All respirator or SCBA wearers must receive prior fitting instructions from their supervisors, fumigation trainers, or others experienced in these procedures. By demonstrations and practice, the wearer will know how to wear the respirator, how to make adjustments, and how to determine correct fit.

The same individual fit can vary over time due to weight loss or gain, hair, and scars. Supervisors will schedule periodic fittings to ensure officers are diligent in observing these conditions. With ideal wearing conditions, leakage may be as low as one percent. The wearer must check facepiece fit according to manufacturer’s facepiece fitting instructions each time respiratory protection is worn.

Inward leakage is one of the most important considerations in selecting a facepiece. Because conditions such as beard growth, sideburns, a skull cap that projects under the facepiece, temple pieces of eyeglasses, or the absence of one or both dentures can prevent obtaining an effective face seal, these conditions must be corrected so an effective seal can be obtained. Having a clean shaven area for an effective seal, removal or repositioning of a skull cap, using an eyeglass adapter kit (contact lenses cannot be worn during fumigations), or inserting dentures are some ways to correct these conditions. Long sideburns, beards, and other facial hair in the sealing area prevents an effective seal even for positive pressure masks, and is in violation of the Occupational Safety and Health Administration (OSHA) regulations. Because the presence of facial hair

in the sealing area is in direct violation of the OSHA regulations and also creates a significant safety hazard for the employees and their coworkers, cleanly shave the sealing area of the face to permit an effective seal. All supervisors and employees must be advised of this policy.

Important

The proper seal can also be attained with a hooded pressure demand SCBA designed to fit over beards and glasses, such as Survivair's Puma™, which is NIOSH-certified and OSHA-compliant.

All personnel assigned fumigation and/or pesticide duties wear SCBAs during critical portions of treatment procedures and must **not** have any condition(s) that prevent obtaining an effective face seal. Individual face masks, available in small, medium, and large sizes, will be assigned.

Facepiece Fit Tests

By following the manufacturer's facepiece-fitting instructions, examine the facepiece fit each time the respiratory protection is used. Two simple field tests are described below.

Negative Pressure Test

Close off the inlet opening of the facepiece or the canister or cartridges by covering with the palm of the hand(s). Gently inhale so the facepiece slightly collapses and hold your breath for 10 seconds. If the facepiece remains in a slightly collapsed condition and no inward air leakage is detected, the tightness of the respirator is probably satisfactory.

Also, detect leakage by crushing an ampoule of isoamyl acetate and passing it one to two inches around the seal area and exhalation valve. In this case, leakage will be noted by a "banana-like" odor in the facepiece. (See Isoamyl acetate in Appendix H, Reference Guide to Commercial Suppliers of Treatment and Related Safety Equipment.)

Positive Pressure Test

Close the exhalation valve and exhale gently into the facepiece. The face fit is considered satisfactory if a slightly positive pressure can be built up inside the facepiece without any evidence of outward air leakage along the seal. For most respirators, this method of leak testing requires that the wearer remove the exhalation valve cover, examine it, and then carefully replace it after the test. To prevent affecting the rubber valve, replace the exhalation valve cover the correct way.

Corrective Lenses With Full Facepiece

All facepieces will restrict, to some degree, the wearer's vision. This will increase accident potential. If the temple bars of eyeglasses extend through the sealing edge of the full facepiece, a proper seal cannot be established. A

prescription spectacle kit for respirators is available to correct this problem. All personnel who must wear prescription eyeglasses must use this kit when wearing equipment with a full facepiece.

It is APHIS policy to supply this adapter kit to all personnel requiring one.

WARNING

Wearing of contact lenses in contaminated atmospheres with a respiratory protection device is prohibited.

Eyeglasses With Half Facepiece

If corrective eyeglasses or goggles are required, they must be worn so as **not** to affect the fit of the facepiece. Proper equipment selection will minimize or avoid this problem.

Use in Low Temperatures

The use of full facepieces at low temperatures presents problems such as poor visibility and freezing exhalation valves. All full facepieces are designed so the incoming fresh air sweeps over the inside of the lens to reduce fogging. This makes it possible to wear a full facepiece in ordinary room temperatures without severe fogging. Antifog compounds can be used to coat the inside of the lens to prevent fogging at room temperatures and down to temperatures approaching 32 °F. However, below 0 °F, antifog compounds will **not** prevent severe fogging.

Although such instances are **not** usually encountered, the employee should be aware that it is dangerous to work at temperatures near and below freezing when using respirators **not** designed for such use.

When using air supplied respirators, the high-pressure connections may leak because of metal contraction at low temperatures. Because they may break when temperatures return to normal, it is important to remember that high-pressure connections should **not** be overtightened.

Communications

The conventional respirator exhalation valve will provide a pathway for some speech transmission over short distances in relatively quiet areas. Talking can induce facepiece or component leakage and, therefore, should be limited while wearing a respirator, especially those wearing half-facepieces.

Maintenance and Care

To retain its effectiveness, properly maintain equipment. A program for maintenance and care include the following basic services:

- Cleaning and disinfecting
- Inspection for defects (including leak checks)
- Repairs
- Respirable air for self-contained breathing apparatus
- Storage

Cleaning and Disinfecting

To ensure proper protection is provided for the wearer, routinely clean and disinfect used equipment after each use and those **not** routinely used as necessary. The following is recommended for cleaning and disinfecting respiratory protection devices.

1. Remove any filters, cartridges, or canisters.
2. Wash facepiece and breathing tube with a cleaner-disinfectant or detergent solution (see following paragraphs); use a hand brush to facilitate removal of dirt.
3. Rinse completely in clean, warm water.
4. Air dry in a clean area.
5. Clean other parts as recommended by manufacturer.
6. Inspect valves, headstraps, and other parts; replace with new parts when defective.
   A. Stretching and manipulating rubber elastomer parts with a massaging action will keep them pliable and flexible and prevent them from warping or sticking during storage.
7. Insert new filter, cartridge, or canister in the unit; ensure seal is tight.

Cleaner-disinfectant solutions containing a bactericidal agent (generally a quaternary ammonium compound) are available.

To obtain the proper solution, use commercial products according to the label. However, different concentrations of the quaternary ammonium salt are required for various hardness of water to obtain a satisfactory disinfectant solution. Dermatitis can occur if the quaternary ammonium compounds are **not** completely rinsed from the facepiece and associated parts.

Strong cleaning and disinfecting can damage parts. Avoid temperatures above 120 °F and vigorous mechanical agitation. Solvents that affect elastomer or rubber parts must be used with caution.

Respiratory protective equipment can be contaminated with toxic materials such as organo-phosphates or other pesticides. If the contamination is light, normal cleaning procedures should provide satisfactory decontamination. If

contamination is heavy, a separate decontamination step may be required before cleaning. For complete decontamination of phosphate pesticide residues, wash with alkaline soap, rinse with clean warm water, and then rinse with 50 percent alcohol (ethyl or isopropyl).

If commercial materials are **not** available, respiratory equipment may be washed in a liquid detergent solution, then immersed in one of the following:

- Sodium hypochlorite solution (50 parts per million of chlorine) for 2 minutes; **OR**
- Aqueous iodine solution (50 parts per million of iodine) for 2 minutes; **OR**
- Quaternary ammonium solution with 200 parts per million of quaternary ammonium compounds in water of less than 500 parts per million total hardness (see Quaternary Ammonium in Appendix H, Reference Guide to Commercial Suppliers of Treatment and Related Safety Equipment)

The sodium hypochlorite and iodine solutions are **not** stable. Prepare fresh solution for each use. These solutions age rubber parts and are corrosive to metallic parts, therefore, do **not** extend immersion times and thoroughly rinse the disinfectants from all parts with clean, warm water.

Inspection for Defects (Including Leak Checks)

The user must inspect the respiratory equipment before and after each use. Respiratory equipment that is **not** routinely used, but is kept ready for emergency use, must be inspected at least monthly to ensure it is in satisfactory working condition. SCBA air cylinders must be fully charged according to the manufacturer's instructions.

Inspection must include the following.

1. Examine the tightness of connections.
2. Examine the condition of the facepiece, headbands, valves, connecting tube, and any canisters or cartridges.
3. Examine rubber or other elastic parts for pliability and signs of deterioration.
4. Examine the regulator and the warning device to determine proper functioning before each use.
5. Examine for leaks.

Keep a record of inspection dates and findings in the unit carrying case.

Repairs

Only experienced persons should handle replacements or repairs using only those parts specifically designed for the equipment. Make no attempt to replace components or to make adjustments or repairs beyond the manufacturer's recommendations. Send reducing or inlet valves and regulators to the manufacturer or to a trained technician for adjustment or repair.

Respirable Air for Self-Contained Breathing Apparatus

Compressed air must be of high purity. Breathing air must meet the requirements for Grade D breathing air as described in Compressed Gas Association Commodity Specification G-7.1-1966. Air tanks can be refilled at most SCUBA diving stores or where local fire departments or rescue squads obtain air for their units. Test data denoting the quality of the compressed air should be available from the air supplier.

There is no need to change the air in the units, even after extended periods of time.

WARNING

Never use compressed oxygen! (Compressed air may contain a low concentration of oil. When high-pressure oxygen passes through an oil or grease-coated orifice, an explosion or fire may occur.)

Have breathing air cylinders inspected and hydrostatically tested as required by the type of cylinder being used. Refer to the manufacturer's recommendations and comply with the Department of Transportation (DOT) or Interstate Commerce Commission Specifications for shipping containers.

Breathing air cylinders must be marked in accordance with American National Standard Method of Marking Portable Compressed Gas Containers to Identify the Material Contained.

Storage

After inspection, cleaning, and necessary repair, store equipment to protect against dust, sunlight, heat, extreme cold, excessive moisture, or damaging chemicals. Store respiratory equipment located at stations and work areas for emergency use in compartments built for that purpose. The compartments should be clearly marked and quickly accessible at all times. Under no circumstances shall a motor vehicle be used for respiratory protective equipment storage. The excessive and uncontrollable changes in temperature are bad for this equipment.

Routinely used respirators, such as dust respirators, may be placed in resealable plastic bags or heat-sealed plastic. Do **not** store respirators in such places as lockers or toolboxes unless they are in carrying cases or cartons and

plainly marked. To prevent function impairment by the elastomer taking a permanent set in an abnormal position, pack or store respirators so the facepiece and exhalation valve will rest in a normal position. It is advisable to rotate the respirator face up, or face down at monthly inspections. Instructions for proper emergency respirators, or self-contained breathing apparatus storage are found in “use and care” instructions usually mounted inside the carrying case lid. Should the case **not** have such instructions, obtain them from the manufacturer and place in the case cover.

Detector Kits or Gas Samples

Although thermal conductivity (T/C) units such as the Gow-Mac® and the Fumiscope® are used to measure concentrations of MB and SF in ounces per 1,000 cubic feet (milligrams per liter), concentrations of phosphine and some other fumigants cannot be measured with a T/C unit. However, they may be measured with detector tubes. Residual gas concentrations during commodities or enclosures aeration can also be determined for most fumigants with detector tubes.

Principles of Operations

Special pumps are used to draw a measured sample (usually 100 milliliters) of an air-gas mixture. The sample is drawn through 1 or 2 detector tubes where a chemical reaction with the tube reagent takes place, creating a stain. The length of the stain is proportional to the concentration of the gas. Measure the length of the stain by using a calibrated chart or by simply reading the number from a scale printed on the glass tube.

Gas detector tubes are manufactured with a constant reagent weight with corrections for variations in the diameter of each tube. Detailed operational instructions accompany the equipment.

The detector tubes are specific for each fumigant and are usually available from several manufacturers. However, it is advisable to use the pump supplied by the manufacturer of the tube used. In an emergency, detector tubes available under the trade names Auer, Draeger, Gastec, Kitagawa, and Mine Safety Appliances can be used with pumps manufactured by any of these companies provided they draw 100 milliliters. Because of the different diameters of the tubes sold by each manufacturer, adapters may be necessary. The Kitagawa pump uses a removable, stainless-steel micro-orifice to reduce the rate of air flow through many of its detector tubes. This provides greater accuracy in the chemical reaction within the tube. Remove the orifice when using tubes manufactured by other companies.

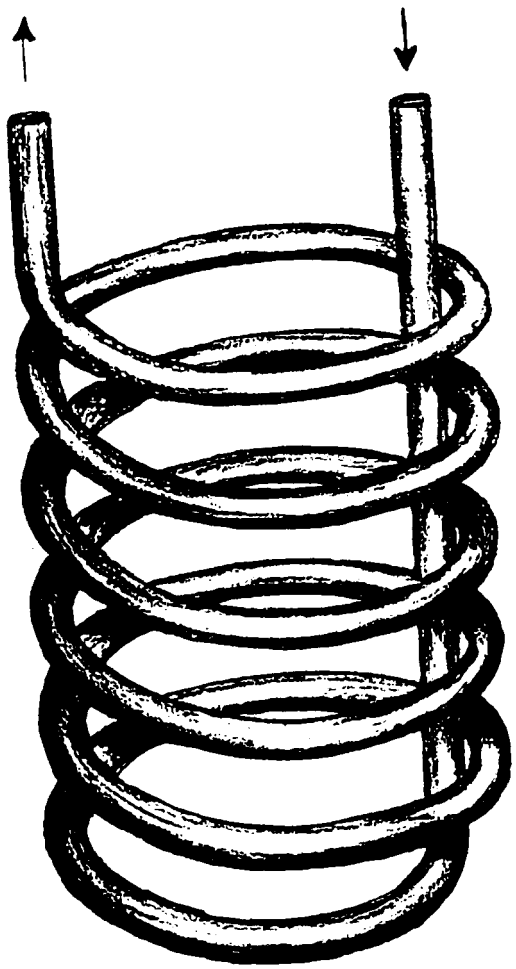
To increase shelf life, store tubes under refrigeration. Before each day's use, test pumps as provided by instructions with each kit and make repairs as necessary. Keep spare parts and operational instructions with each kit for use as needed.

When many samples must be drawn to a common point during a large fumigation, an auxiliary pump can be used. If only one sample lead is involved, it may be necessary to pull the fumigant through the line by pumping several times. A used tube can be inserted in the pump to determine when the fumigant has reached the pump.

Volatilizer

Methyl bromide must pass through a volatilizer (vaporizer) to ensure adequate conversion of liquid MB to gaseous MB. The volatilized fumigant should be introduced into or near to the air flow of the gas introduction fan. When 5 pounds or less of MB are used, a simple volatilizer can be made with a 25-foot coil of 3/8 inch O.D. (outer diameter) coiled copper tubing immersed in a container of hot water.

When amounts greater than 5 pounds are to be used, the copper tubing used in the volatilizer must consist of a minimum of 50 feet of 1/2 inch O.D. coiled copper tubing immersed in a container of hot water.



The volatilizer should be made of semihard copper tubing. It is important that gas be introduced and discharged as shown by arrows. If applied in reverse order, it may move so rapidly that some liquid will pass into the chamber.

Figure 8-1-4 Methyl Bromide Volatilizer Coil

The water in all sizes of volatilizers must be heated to temperatures of 200 °F or above with a minimum of 150 °F during the gas introduction process. A calibrated thermometer must be used to determine the water temperature. The thermometer must be calibrated once per year by an approved calibration company or by the fumigator under the supervision of PPQ. Written documentation of calibration must be present at the time of fumigation.

The line that runs from the from MB cylinder to the copper tubing in the volatilizer must be a 3000 PSI hydraulic high pressure hose with a 3/8 inch diameter ID (inner diameter) or larger. The line that exits the volatizer and runs into the enclosure must be a 350 PSI tubing with a 1/2 inch diameter ID or greater.

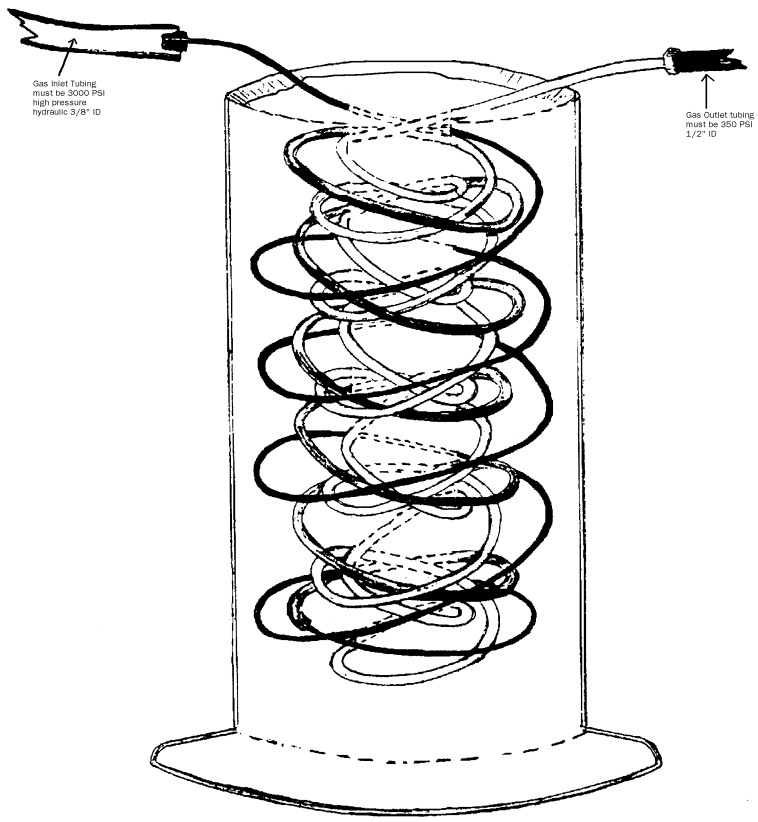


Figure 8-1-5 Tubing Specifications

The fumigant should be introduced through the tubing at the rate of 3 to 4 pounds of gas per minute. The gas introduction tube should feel hot to the touch as a good measure of satisfactory vaporization.

Air Velocity Measuring Instruments

Anemometer

Anemometers (wind meters) are used for measuring the air velocity of circulation fans and air curtains. Wind meters must be approved by the Treatment Quality Assurance Unit (TQAU). Submit specifications of unapproved wind meters to TQAU for approval.

Fan Velocity

The cubic feet per minute (cfm) of a fan can be measured by placing the anemometer 12 inches from the face of the fan to be tested. Take a minimum of three readings; one from the center and the others from points toward the outside of the fan. Average the readings. If an anemometer is used, each measurement should be for 1 minute, thereby giving the result in feet per minute. If a wind speed indicator is used, the reading in miles per hour should be converted to feet per minute by multiplying the miles per hour by 5,280 and dividing by 60.

Area of the fan is calculated by first measuring the radius (R)—distance from the center of the fan to the end of a blade. Formula for area is Pi* R^2 where Pi is equivalent to 3.1416 (22/7). The final answer should be given in cfm. Therefore, if the radius of the blade is given in inches and **not** feet, the factor 1/144 must be multiplied in to convert square inches to square feet. The full formula would be: Feet per minute × R^2 (in inches) × 3.14 × 1/144 = cfm.

EXAMPLE: If average air movement is 1,600 feet for 1 minute from a fan having a 7 inch radius (14 inch diameter), the calculations are as follows:

$$1{,}600 \times 7^2 \times 3.1416 \times 1/144 = 1{,}700 \text{ cfm (approximate)}$$

Velometer®

The Velometer® is one approved anemometer that can be used to measure fan velocity. It is manufactured by TSI Inc., Alnor Products. Take readings by either holding the instrument itself or jets (probes) in front of the air stream. Velocities are rapidly determined in units of feet per minute without timing or calculations.

Air Curtain Velocity

The velocity of air curtains is also measured with an anemometer. Anemometers used in this capacity must meet the following specifications:

- Hand held
- Digital
- +/- 3 percent accuracy

- Minimum operating speed of .04 m/s
- Record in at least one of the following units with the resolution in parenthesis:
  - m/s (0.1)
  - ft/min (1)
  - km/h (0.1)
  - mph (1)
  - knots (0.1)
  - Beaufort (0.1)
- CE certified with a certificate of conformity
- Tested to NIST-Traceable standards with a written certificate of tests
- Calibrated once a year to NIST calibration and certification

Kestrel® Pock Wind Meter

All Models of Kestrel® Pocket Wind Meters are approved for use by TQAU. Refer to Appendix H for ordering information.

Auxiliary Pump

During large-enclosure fumigations, it is necessary to take numerous gas concentration readings from various locations throughout the enclosure. Thus, some sample leads may be over 200 feet long. Pump the fumigant to the sampling point before making an accurate concentration reading using an auxiliary pump. If the inspector must rely on the pump provided with the gas sampler or T/C unit to pull the fumigant, a great deal of time will be needed between readings.

Because it pumps the fumigant from many areas and keeps a constant pull, the auxiliary pump will reduce sampling time to only the reading time. Constructing a unit is relatively simple. Petcocks capable of accepting sample leads are tapped and soldered to a short length of pipe. This pipe is connected to the suction side of the pump. The pipe acts as a manifold. Opening or closing the petcocks allows the gas samples to be drawn as required. Connect an exhaust line of sufficient length to the pump to ensure the fumigant is removed from the sample area.

It is important that all soldering be done in such a manner as to provide gastight construction of the petcocks. The pump should be of sufficient size to pull one cubic foot per minute through all of the leads on the manifold.

Therefore, the more leads, the higher the required capacity of the pump. Mount the whole unit on a board large enough to keep vibration to a minimum. Keep the unit weight down to allow easy transport.

Disconnect each sampling line from the auxiliary pump in turn, and close the petcock. Attach the line to the T/C unit or gas detector. Obtain a reading and reconnect the line to the auxiliary pump and open the petcock.

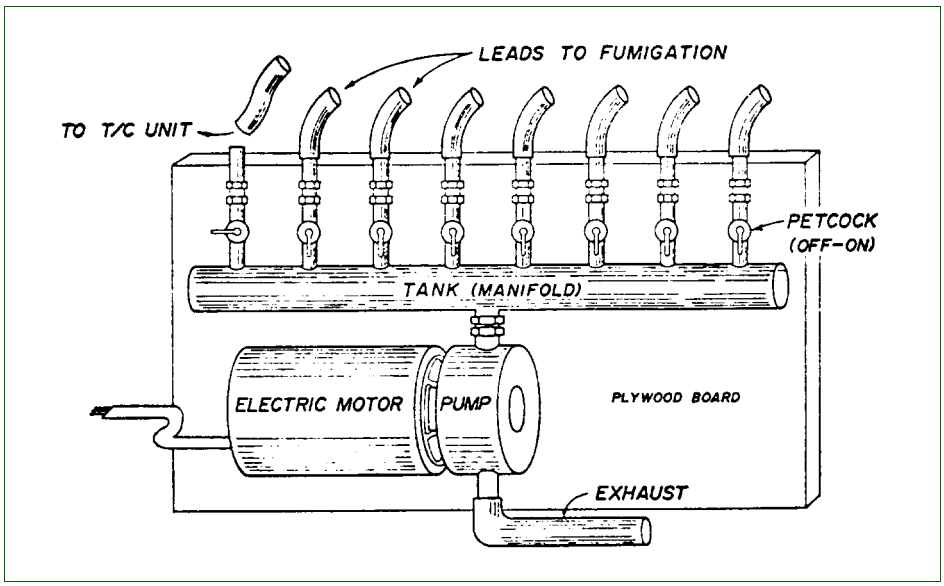


Figure 8-1-6 Auxiliary Pump

Open-Arm Manometer

This information has been extracted from the following web site http://www.dwyer-inst.com/htdocs/pressure/ManometerIntroduction.cfm

A manometer is used during a leakage test of a fumigation chamber and is a device used to measure pressure. Pressure is defined as a force per unit area. The most accurate way to measure low air pressure is to balance a column of liquid of known weight against it and measure the height of the liquid column so balanced. The units of measure commonly used are inches of mercury (in. Hg), using mercury as the fluid and inches of water (in. w.c.), using water or oil as the fluid.

A simple manometer is typically a U-shaped tube partially filled with liquid. The tube may be of glass or transparent plastic tubing. A ruler calibrated in millimeter (mm) divisions or carefully measured lines on a background is used to measure the difference in level of the liquid in the two arms (or the level in one arm).

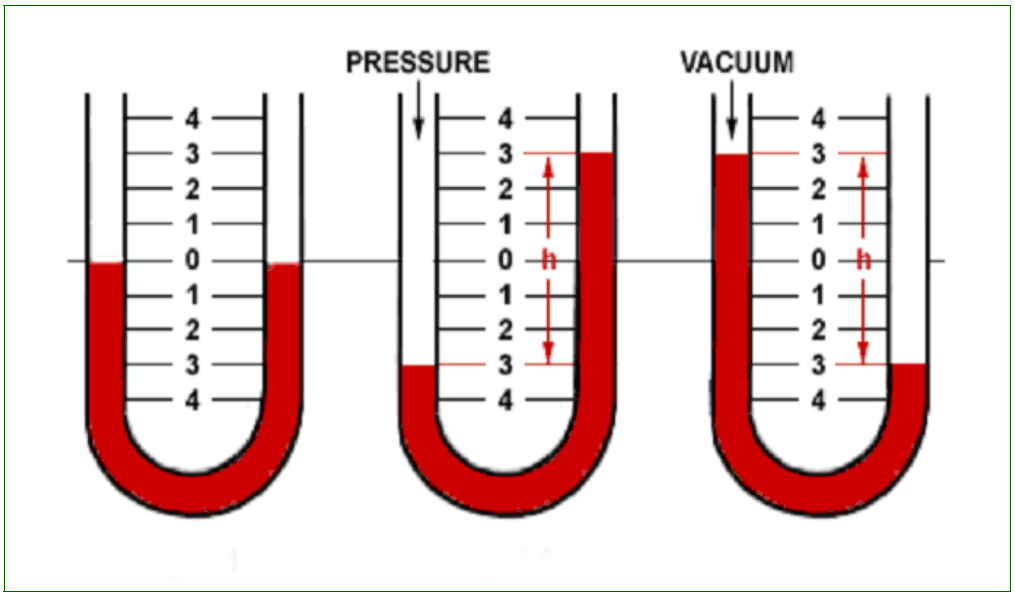


Figure 8-1-7 Example of Pressure Measurement in an Open-arm Manometer

As displayed by the middle picture in Figure 8-1-5, when positive pressure is applied to one arm, the liquid is forced down in that arm and up in the other. The difference in height, "h," which is the sum of the readings above and below zero, indicates the pressure.

The picture of the manometer on the right in Figure 8-1-5 shows that when a vacuum is applied to one arm, the liquid rises in that arm and falls in the other. The difference in height, "h," which is the sum of the readings above and below zero, indicates the amount of vacuum.

No manometer can be read more accurately than the accuracy with which the specific gravity of the liquid inside the manometer is known. The liquid must also have good "wetting" characteristics and be capable of forming a consistent, well shaped meniscus in the indicating tube to facilitate accurate, repeatable readings.

The liquid used also affects the operating range of the manometer. Mercury being 13.6 times the weight of water will move 1/13.6th the distance water will move in response to a given pressure. Red gage oil, having a specific gravity of .826. which is lighter than water, will move about 1.2 times farther than water in response to a given pressure. This, obviously, expands the scale for easier, more precise reading.

Red gage oil is a stable petroleum base oil with carefully controlled specific gravity which gives an excellent, consistent high visibility meniscus. Manometers for use with water are furnished with a fluorescent green concentrate which when added to water serves as a setting agent and a dye to improve the consistency and visibility of the meniscus for easier more accurate readability. Because of increased accuracy and consistency, CPHST recommends the use of red gage oil manometers.

Operating Procedures

When a fumigant is volatilized in a chamber at atmospheric pressure, a positive pressure is created, which may then be continuously reduced by leakage of the air-fumigant mixture. PPQ-approved chambers must be sufficiently tight to retain the fumigant during the exposure period. The manometer is used during the pressure leakage test for NAP chamber certification and the vacuum leakage test for vacuum chamber certification. (**See "Pressure-Leakage Test for NAP Fumigation Chambers" on page-6-3-4** and ***Certification Standards* on page 6-2-3** for detailed descriptions of the certification processes.)

Use the following example for the most accurate way to determine the pressure measurement from a manometer.

EXAMPLE: Referencing Figure 8-1-6, the left arm of the open-arm manometer measures 8 mm below zero. The right arm measures 7 above zero. The sum of the two measurements equals 15 mm. Therefore, in this example, 15 mm is the actual reading.

Photo by PPQ Specialist John Loyd

Figure 8-1-8 Example of U Tube Manometer

Mityvac Hand-held Vacuum Pump

Detect detect blocked monitoring leads by using a Mityvac hand-held vacuum pump (for supplier, see ***Vacuum Pump* on page H-1-72**).

Usage

1. Prior to introducing fumigant, connect the Mityvac hand-held vacuum pump to a monitoring lead.
2. Squeeze the handle on the Mityvac Unit; if the lead is blocked, a vacuum will be indicated on the vacuum gauge of the Mityvac unit (squeeze the handle 2 or 3 times for monitoring leads longer than 25 feet; the Mityvac hand-held pump has the capacity to attain and hold 25 inches of Hg vacuum and a minimum of 7 psi pressure).
3. Disconnect the Mityvac hand-held pump from the monitoring lead, and repeat this procedure for each monitoring lead (connect monitoring leads to the gas analyzer prior to fumigant introduction).

Phosphine Detector

PortaSens Phosphine Detector

Description

Historically, measuring phosphine has been done using detector tubes specific for phosphine (see ***Detector Kits or Gas Samples* on page 8-1-23**). The high cost associated with these tubes has been a deterrent for many ports.

A more accurate, portable unit has been recommended for use during phosphine fumigations. The Series B16 PortaSens is a portable, battery-operated instrument for measuring various gas concentrations in ambient air. The instrument can be ordered specifically for phosphine in the 0 to 1,000 ppm range. Ranges from 0 to 1 ppm are available also, along with other configurations. The PortaSens is a complete measuring instrument containing an electrochemical sensor, sampling pump, flow cell assembly, microprocessor electronics, and a two-line, backlit LCD display. The unit is powered by a rechargeable NiCad battery located in the handle, with the charger connection located at the bottom of the handle.

Operation

The PortaSens needs to be calibrated by the Center for Plant Health Science & Technology (CPHST) before use. After calibration, the instrument is ready to use directly out of the box. Simply remove the instrument from the storage case and press and release the button (instrument switch) on the front of the handle. The LCD display on the front will immediately be activated and the internal pump will begin to pull sample into the flow cell.

The unit comes with a flexible extension wand that screws into the standard inlet fitting. Connect the extension wand and a length of flexible tubing that will reach safely from the item(s) being fumigated to the PortaSens.

Response Time

Response time will vary depending on the gas concentration and ambient temperature. The LCD readout will stabilize when maximum concentration is reached. Readings will be more timely when the monitoring leads are purged using the Mityvac hand-held vacuum pump (refer to ***Mityvac Hand-held Vacuum Pump* on page 8-1-33**).

Alarm Function

The PortaSens contains both visual and audible gas concentration alarm functions that are preset at the factory. Refer to B16 PortaSens Operation and Maintenance Manual for specific instructions. For instruments in the 0 to 1,000 ppm range, the alarm has been disabled to allow for more efficient use.

Battery Power Supply

The instrument is powered by a rechargeable NiCad battery. With a fully charged battery, the unit will continuously operate for 12 hours at 20 °C. Battery capacity will drop with decreasing temperature. Should the battery become weak during operation, the lower line of the LCD display will indicate “LOW BATT.” An audible beeper will begin to sound. At this point, there will be 1 hour of operating time left. When the voltage reaches a level where reliable measurements are no longer possible, the unit will turn itself off. If emergency use is anticipated, it is good practice to leave the instrument on charge at all times.

Flow Verification

Verify proper flow before using the PortaSens for leak detection. When the unit is turned on, a pump continuously delivers an air sample to the flow cell. In normal operation, the flow rate is approximately 300 cc/min. In order to allow quick verification of proper flow, a flowmeter is included in the PortaSens kit. Turn the instrument on and connect the sampling wand. Place the tip of the sampling wand into the tubing adapter attached to the flowmeter. Hold the flowmeter in the vertical position and verify that the flow rate is above 150 cc/min.

Power Down

In order to turn the unit off, press and hold the switch for approximately three seconds, until the “POWER DOWN” message appears on the display and then release.

Photo Ionization Detector

The Photo Ionization Detector (PID) is a portable vapor and gas detector that detects a variety of organic compounds. For methyl bromide, the PID has been used both as a leak detector to locate fumigant leakage around chambers, application equipment, temporary enclosures, and as a safety device around fumigation sites.

Principles of Operations

The PID is used to indicate the presence and approximate concentration of methyl bromide or other volatile organic compounds (VOCs) present. This is accomplished by photo ionization that occurs when an atom or molecule absorbs light of sufficient energy to cause an electron to leave and create a positive ion. Because PIDs measure all VOCs, careful attention must be paid to the presence of other VOCs in the air. Other VOCs include but are **not** limited to cigarette smoke, perfume, soap, and exhaust fumes from vehicles.

Description

All PIDs have the same basic construction, differing only in detail by the various manufacturers. Each has an ultraviolet lamp that emits photons that are absorbed by the compound in an ionization chamber. Electrodes collect the ions that are produced. The current that is generated provides a measure of the concentration.

Calibration

PIDs are typically calibrated using isobutylene, a stable gas with a slightly pungent odor. This gas is easy to handle and can be stored at high pressure, allowing calibration bottles to be used for calibrations many times. The PID manufacturer supplies a reference manual that describes calibration procedures and provides a list of correction factors.

For a partial list of manufacturers refer to ***Reference Guide to Commercial Suppliers of Treatment and Related Safety Equipment* on page H-1-1**.

Certified Precision Thermometers: Calibration Guidelines

Before a thermometer can be used as a calibration standard, it must meet the following requirements from an approved facilities. All calibration facilities must be approved by TQAU, 1730 Varsity Drive, Suite 400, Raleigh, NC 27606 USA.

A list of current approved facilities can be accessed in Appendix H, **Thermometers, Certified Precision, Approved Calibration Companies**.

- Accuracy must be 0.1 °C or less for Centigrade thermometer or 0.1 °F or less for Fahrenheit thermometer.
- Thermometer must be calibrated against standards that are approved by National Institute of Standards and Technology (NIST).

- The calibration certificate issued by calibration facility lists one to five calibration points, tabulated corrections for each calibration point, serial and test identification number of the NIST standard, and explanatory notes defining the conditions under which the test results were made.
- The thermometer must be calibrated annually. Thermometers with expired calibration certificates cannot be used in quarantine treatments.
- ASTM thermometers must have 5 or more calibration points. Non-ASTM (precision thermometers must have calibration points at the treatment temperature.

Charcoal Adsorber Recapture Standards

The USDA APHIS uses methyl bromide (MB) fumigant for quarantine fumigations at ports of entry and domestic facilities. The Agency also supervises quarantine fumigations conducted internationally as part of preclearance programs. Since the negotiation of the Montreal Protocol in 1987, the USDA APHIS has been actively pursuing MB alternatives and recapturing techniques.

The purpose for charcoal adsorber recapture technology is to trap most of the MB gas, preventing its release into the atmosphere and reducing impacts on the ozone layer. In order for a recapturing unit to be considered for use by USDA APHIS, it must meet the specifications outlined in this section.

The system will:

- Accommodate a variety of enclosure types (portable chamber and fixed chamber)
- Accommodate MB monitoring sensors in the air flow (number and placement of sensors will depend upon the size of the equipment)
- Accommodate the fumigant concentrations and temperature conditions listed in this (Treatment) manual
- Ensure that all untreated ventilation air is under negative pressure (in the event of a leak, ambient air will leak into the system instead of contaminated air escaping from the system)
- Leak-tight (includes valves, ducts, canisters)
- Provide a minimum adsorptive capacity of 1 pound of MB per 10 pounds of carbon (The quality of the carbon will determine the adsorptive capacity. A lower quality carbon could cause a ration of 1 pound of MB per 20-25 pounds of carbon.)
- Provide between 4 and 15 complete gas exchanges per hour

- Provide flow and pressure system monitoring
- Provide on site installation, training, and continual technical support
- Reduce emissions of MB by at least 80%
- Retain approved fumigation and aeration times as mandated by this (Treatment) manual
- Will not exceed 500 ppm (2 ounces per 1000 ft^3) MB gas released to the atmosphere and provide the ability to document MB concentration levels

Any recapturing system used in tandem with a PPQ-supervised fumigation must be approved by CPHST-TQAU. Submit equipment specifications to CPHST-TQAU for review.

List of Approved Recapturing Equipment

TIGG Corporation
1 Willow Avenue
Oakdale, PA 15071
P: 724-703-3020
F: 724-703-3026
Toll Free: 800-925-0011

For a detailed description of the Chemtura Methyl Bromide Recapture system, visit the following web site: Chemtura Recapturing System.

9 Glossary

Treatment Manual

Acronyms, Abbreviations, and Terms

a.i.	active ingredient
ACGIH	American Conference of Governmental Industrial Hygienists
ADI	Acceptable Daily Intake
APHIS	Animal and Plant Health Inspection Service
BBEP	Biotechnology, Biologics, and Environmental Protection
bw	body weight
CAS	Chemical Abstracts Service
cc	cubic centimeters
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
ChE	cholinesterase
CHEMTREC	24-hour emergency telephone service for spills
CNS	central nervous system
copra	dried coconuts and whole coconuts without the husk
COR	Contracting Officer's Representative
CPK	creatine phosphokinase
cu.m	cubic meter
CWA	Clean Water Act
DHEW	U.S. Department of Health, Education, and Welfare
DNA	deoxyribonucleic acid
DOT	U.S. Department of Transportation
DW	drinking water
EPA	Environmental Protection Agency
External Feeder	A pest that normally inhabits the outside or outer part of its host. Contrast with hitchhiker and internal feeder.
FAA	Federal Aviation Administration
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
g	grams
GI	gastrointestinal
HDT	highest dose tested
Hgb	hemoglobin
HHS	U.S. Department of Health and Human Services

Hitchhiker	A pest transported by chance and **not** found inhabiting its host. Contrast with external feeder.
i.m.	intramuscular
Internal Feeder	A pest that normally inhabits the inside or inner part of its host. Contrast with external feeder.
i.p.	intraperitoneal
i.v.	intravenous
kg	kilogram
L	liter
LC50	Lethal Concentration 50; dose lethal to 50 percent of the animals
LCLO	Lethal Concentration Low; the lowest concentration causing death
LD50	Lethal Dose 50; dose lethal to 50 percent of the animals
LDLO	Lethal Dose Low; the lowest dose at which death occurred
LDT	lowest dose tested
LEL	lower exposure limit, or lowest-effect level
LOAEL	lowest-observed-adverse-effect-level
m	meter
MED	minimum effective dose
mg	milligram
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
mmHg	millimeters of mercury; a measure of pressure
MOE	Margin of Exposure
MOS	Margin of Safety
MSDS	Material Safety Data Sheet
MTD	maximum tolerated dose
MTL	median threshold limit
NFPA	National Fire Prevention Association
ng	nanogram
NIOSH	National Institute for Occupational Safety and Health
NMRAL	National Monitoring and Residue Analysis Laboratory
NOAEL	no-observed-adverse-effect level
NOEL	no-observed-effect level
NTP	National Toxicology Program
OIC	Officer-in-Charge
OSHA	U.S. Occupational Safety and Health Administration
p.o.	per os (by mouth)

PEL	permissible exposure limit
PHS	U.S. Public Health Service
ppb	parts per billion
ppm	parts per million
PPQ	Plant Protection and Quarantine
RBC	red blood cell(s)
RfD	Reference Dose
RfDi	Inhalation Reference Dose
RfDo	Oral Reference Dose
s.c.	subcutaneous
STEL	short-term exposure limit
TLV	threshold limit value
TSS	Technical and Scientific Services
TWA	time-weighted average
UCL	upper confidence limit
UEL	upper exposure limit
UF	uncertainty factor
ug	microgram
ug/cu.	micrograms per cubic meter
ug/L	micrograms per liter
USDA	United States Department of Agriculture

A

Treatment Manual

Appendix A

Forms

Contents

APHIS Form 2061 (Residue Sample for Food or Feed Product) **A-2**
APHIS Form 205-R, Instructions and Worksheet for Calibrating Portable Temperature Sensors **A-3**
APHIS Form 206-R, Test of the Accuracy of the Permanent RTD Sensors Installed in Hot Water Tanks **A-4**
APHIS Form 207-R, Sensor Location Diagram Fruit Weights and Pulp Temperatures **A-5**
APHIS Form 208, Performance Test for Mango Hot Water Immersion Tank **A-6**
Calibration of Temperature Probes (Cold Treatment) **A-7**
Location of Temperature Sensors in Containerized Cargo (Cold Treatment) **A-8**
PPQ Form 429, Fumigation Record **A-9**
PPQ Form 519, Compliance Agreement **A-13**
PPQ Form 523, Emergency Action Notification **A-16**
PPQ Form 449-R, Temperature Recording Calibration Report **A-27**
PPQ Form 203, Foreign Site Certificate of Inspection and/or Treatment **A-29**
PPQ Form 556, Intransit Cold Treatment Clearance Report **A-32**

This Appendix contains example forms and instructions for completing the forms you may need when conducting or monitoring a fumigation.

APHIS Form 2061 (Residue Sample for Food or Feed Product)

The APHIS Form 2061 has been removed from this manual. Contact the Manuals Unit to obtain a copy and instructions for use.

APHIS Form 205-R, Instructions and Worksheet for Calibrating Portable Temperature Sensors

INSTRUCTIONS AND WORKSHEET FOR CALIBRATING PORTABLE TEMPERATURE SENSORS

USDA - APHIS

1. DATE		
2. NAME OF FACILITY	3. SIGNATURE OF PERSON CALIBRATING SENSORS	4. NAME OF PERSON CALIBRATING SENSORS *(Type or Print)*

INSTRUCTIONS

These instructions are for calibrating the portable temperature sensors that will be used in performance tests of hot water tanks.

(A) Assign each portable sensor a number. *(Write sensor numbers on pieces of duct tape or tag, and attach them near the "dry" end of each sensor.)*

(B) Submerge the "wet" end of the sensors into a circulating hot water bath in a temperature range of 115° to 120°F *(46.1° to 48.9°C)*, in close proximity to the bulb of a submersible certified glass mercury thermometer. Both must be submerged to the same depth. The mercury thermometer *(with demarcations readable to the nearest tenth of a degree)* shall be used as the standard against which the portable sensors are to be compared.

(C) Record the temperatures obtained from each portable sensor and the mercury thermometer, in succession. Compute the difference in the two temperatures, if any, and record this also.

(D) If the temperature shown by the portable sensor falls within five-tenths of a degree *(F) (or +/- 0.3°C)* of the true temperature shown on the certified mercury thermometer, then this sensor is considered to be within the tolerance, and may be used in the performance test. Any sensors reading outside of this range do not meet APHIS standards for accuracy, and should not be used. Recommend that they be destroyed.

TEMPERATURE *(Specify °C or °F)*

5. PORTABLE SENSOR NO.	6. SENSOR READING	7. MERCURY READING	8. DIFFERENCE *(Add/Subtract)*	9. REMARKS

RETURN COMPLETED FORM TO THE METHODS DEVELOPMENT CENTER THAT WILL ISSUE A CERTIFICATE.

APHIS FORM 205-R
(NOV 93)

Figure A-1 APHIS Form 205-R, Instructions and Worksheet for Calibrating Portable Temperature Sensors

APHIS Form 206-R, Test of the Accuracy of the Permanent RTD Sensors Installed in Hot Water Tanks

TEST OF THE ACCURACY OF THE PERMANENT RTD SENSORS INSTALLED IN HOT WATER TANKS

USDA - APHIS

1. DATE		
2. NAME OF FACILITY	3. SIGNATURE OF PERSON TESTING SENSORS	4. NAME OF PERSON TESTING SENSORS *(Type or Print)*

INSTRUCTIONS

These instructions describe the procedure for testing the accuracy of the permanent RTD temperature sensors installed in the hot water tanks, which are wired to a recorder located in the Control Room.

(A) First, calibrate all available portable sensors against the certified glass mercury thermometer standard. *(See separate instructions and worksheet for performing this procedure - APHIS FORM 205.)*

(B) Select the portable sensor that shows the least deviation from the certified mercury standard. This particular sensor will now be used as a tool for testing the accuracy of each of the permanent RTD sensors installed on the tanks.

(C) Using a 6-foot rod *(such as a broom handle or PVC pipe)* and duct tape, fasten the "wet" end of the portable sensor wire to one end of the rod, being careful not to cover the metal sensor tip with tape. *(The use of a metal rod should be avoided because if it comes in direct contact with the portable sensor, it may cause false readings.)* Tape the sensor wire also to the center, and to the opposite end of the rod, to remove the slack.

(D) Raise the water temperature in the tanks to 115°F to 120°F *(46.1° to 48.9°C)*, and run the pump to ensure uniform distribution of heat. Inspect the sides of the tank to locate the exact position of each permanent RTD sensor. Using the portable sensor and rod assembly, dip it into the hot water until the portable sensor comes in close proximity to the tank's sensor. ***(NOTE:** Each basket position should have its own sensor.)* Plug the portable sensor into a hand-held digital thermometer, and read the display. Compare this number with the display on the data logger or strip chart recorder in the control room. *(You may need an assistant for this purpose.)* Record the results from the chart on this form. Repeat the procedure for each permanent sensor in the tank.

(E) Decision: If the temperature shown on the display in the control room matches the temperature shown on the hand-held digital thermometer *(as calibrated)*, then the permanent sensor in the tank is acceptable. If the two temperatures do not match exactly, but are within five-tenths of a degree *(F)* of each other *(+/- 0.3°C)*, then this small amount of deviation is considered to be within tolerance. Any permanent sensors that fail this standard must be repaired or replaced.

5. HAND-HELD DIGITAL THERMOMETER USED FOR THE STANDARD *(Portable Sensor Number Used: _____.)*				6. MAKE & MODEL OF THE RECORDER USED IN CONTROL ROOM FOR TEMPERATURE DISPLAY		
7. TANK NO. AND PERMANENT RTD SENSOR NO. *(Basket Position)*	8. READING OBTAINED *(°F or °C) (Hand-held)*	9. CORRECTION FACTOR *(Determined Previously)* (+/-)	10. TRUE READING (°F or °C)	11. READING OBTAINED *(°F or °C) (In Control Room)*	12. DIFFERENCE BETWEEN COLUMN 10. AND COLUMN 11. (°F or °C)	13. REMARKS

RETURN COMPLETED FORM TO THE METHODS DEVELOPMENT CENTER THAT WILL ISSUE A CERTIFICATE.

APHIS FORM 206-R (NOV 93)

Figure A-2 APHIS Form 206-R, Test of the Accuracy of the Permanent RTD Sensors Installed in Hot Water Tanks

APHIS Form 207-R, Sensor Location Diagram Fruit Weights and Pulp Temperatures

SENSOR LOCATION DIAGRAM FRUIT WEIGHTS AND PULP TEMPERATURES

USDA-APHIS

1. DATE		
2. NAME OF FACILITY	3. TANK NUMBER	4. TEST NUMBER

INSTRUCTIONS

Show sensor numbers, and their approximate location within each basket. *(Use three or four sensors per basket.)* Place an asterisk (*) beside fruit pulp sensors. *(Use one or two per test.)* Indicate, by arrow, the direction of water flow in the tank. *(If the tank is of an unusual shape (e.g., round) please use the reverse side of this form to draw a diagram, showing position of baskets and sensors.)*

BASKET NO. 1	BASKET NO. 2	BASKET NO. 3	BASKET NO. 4	BASKET NO. 5

5. WEIGHT (g) OF 10 FRUITS SELECTED AT RANDOM		6. WEIGHT (g) OF 5 LARGEST FRUITS	7. FRUIT PULP TEMPERATURES (Taken at random)	8. NET WEIGHT OF A TYPICAL FIELD CRATE OF MANGOES
				9. NUMBER OF FIELD CRATES PER LOADED BASKET
MEAN WT. =	(g)	MEAN WT. =	MEAN TEMP. =	

10. REMARKS

APHIS FORM 207-R (OCT 95) (Previous edition is obsolete)

Figure A-3 APHIS Form 207-R, Sensor Location Diagram Fruit Weights and Pulp Temperatures

APHIS Form 208, Performance Test for Mango Hot Water Immersion Tank

USDA-APHIS

PERFORMANCE TEST FOR MANGO HOT WATER IMMERSION TANK

1. DATE OF TEST	
2. NAME OF FACILITY	3. LOCATION
4. NAME OF FACILITY MANAGER (Type or print)	
5. TELEPHONE NUMBER ( )	6. FAX NUMBER ( )
7. FRUIT VARIETY	8. STAGE OF RIPENESS

9. TEMPERATURES AT START OF TEST

9A. THERMOSTATIC SET POINT	9B. WATER IN THE TANK	9C. FRUIT PULP (Average)	9D. AMBIENT AIR

10. SIGNATURE OF INSPECTOR	11. NAME OF INSPECTOR (Type or print)

12. NOTES

BASKET NO.: _____ TANK NO.: _____ TEST NO.: _____

Readings taken at specific times (minutes) before calibration adjustment (if any). Use 1 or 2 pulp sensors per tank. Indicate pulp sensors with an asterisk (*)

PORTABLE SENSOR NO. (Use at least 3)	CALLIBRATION ADJUSTMENT		0-1	1-2	2-3	3-4	5	30	60	75	90
		TIME									
		TEMP.									
		TIME									
		TIME									
		TIME									
		TEMP.									
		TIME									
		TEMP.									

APHIS FORM 208 (OCT 95) (Previous edition is obsolete) Page 1 of 2

Calibration of Temperature Probes (Cold Treatment)

CALIBRATION OF TEMPERATURE PROBES

Vessel: _____

Date of Calibration: _____ Date Loaded: _____

Hatch & Compartment	Temperature Probe No.	Calibration at 0.0°C			Probe Temperature of Fruit at Completion of Loading
		Test #1	Test #2	Correction °C/°F	

Signature: _____

Figure A-4 Calibration of Temperature Probes (Cold Treatment)

Location of Temperature Sensors in Containerized Cargo (Cold Treatment)

LOCATION OF TEMPERATURE SENSORS IN CONTAINERIZED CARGO

NAME OF VESSEL _____

CONTAINER NUMBER _____

PROBE 1 _____

_____

_____

PROBE 2 _____

_____

_____

PROBE 3 _____

_____

_____

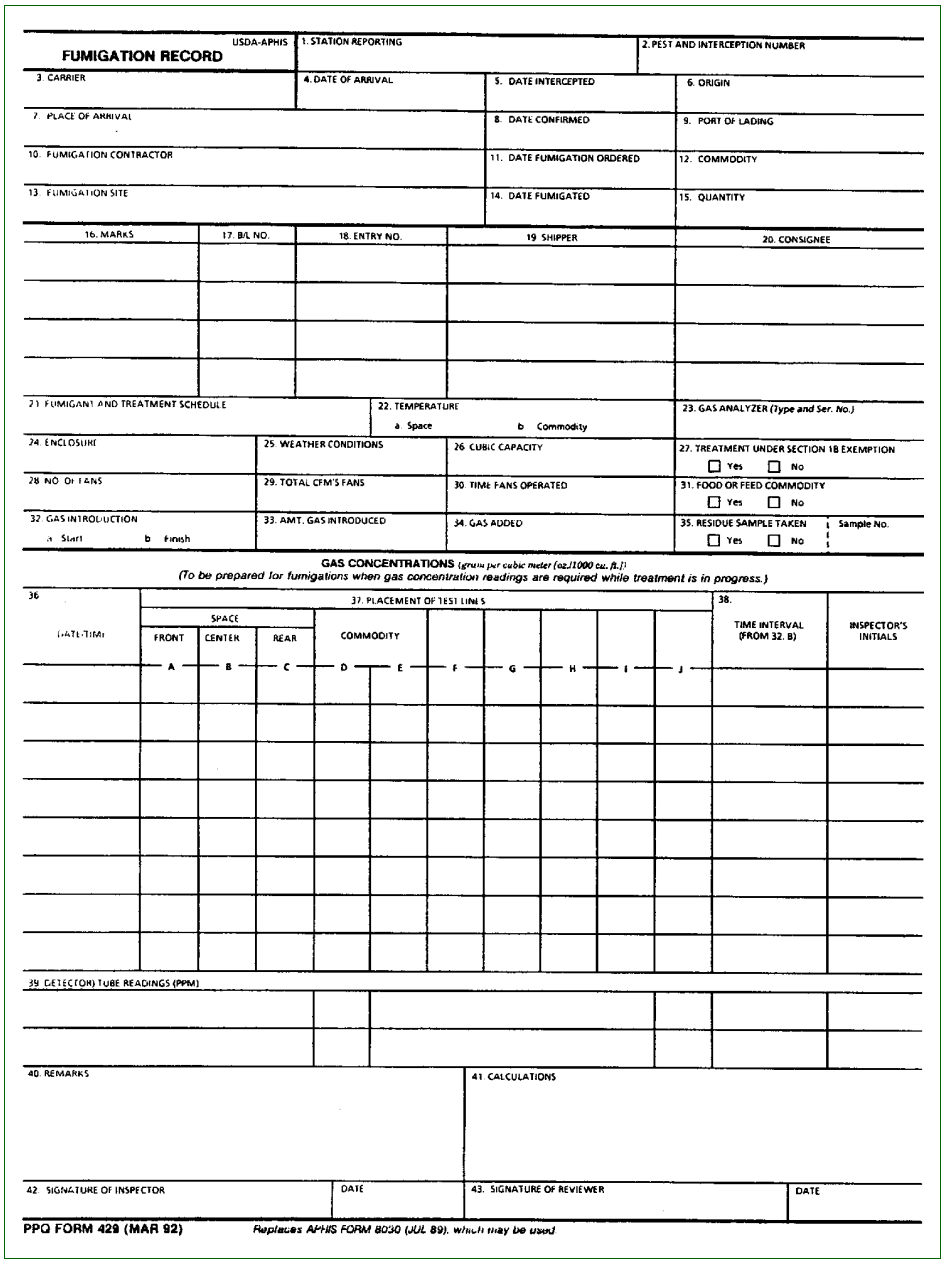
SIGNATURE: _____ DATE: _____

TITLE: _____

Figure A-5 Location of Temperature Sensors in Containerized Cargo (Cold Treatment)

PPQ Form 429, Fumigation Record

The PPQ Form 429 is to be used as a station record for all treatments conducted in approved chambers or in temporary enclosures (tarpaulin, in containers, truck vans, railroad cars, ships, warehouses, or other enclosures). Treatments conducted under temporary enclosures require minimum gas concentration readings be reported. CPHST TQAU tracks MB fumigant usage in an electronic 429 database. Contact CPHST TQAU for username and password.



USDA-APHIS
FUMIGATION RECORD

1. STATION REPORTING			2. PEST AND INTERCEPTION NUMBER
3. CARRIER	4. DATE OF ARRIVAL	5. DATE INTERCEPTED	6. ORIGIN
7. PLACE OF ARRIVAL		8. DATE CONFIRMED	9. PORT OF LADING
10. FUMIGATION CONTRACTOR		11. DATE FUMIGATION ORDERED	12. COMMODITY
13. FUMIGATION SITE		14. DATE FUMIGATED	15. QUANTITY

16. MARKS	17. B/L NO.	18. ENTRY NO.	19. SHIPPER	20. CONSIGNEE

21. FUMIGANT AND TREATMENT SCHEDULE	22. TEMPERATURE a. Space b. Commodity		23. GAS ANALYZER (Type and Ser. No.)
24. ENCLOSURE	25. WEATHER CONDITIONS	26. CUBIC CAPACITY	27. TREATMENT UNDER SECTION 18 EXEMPTION ☐ Yes ☐ No
28. NO. OF FANS	29. TOTAL CFM'S FANS	30. TIME FANS OPERATED	31. FOOD OR FEED COMMODITY ☐ Yes ☐ No
32. GAS INTRODUCTION a. Start b. Finish	33. AMT. GAS INTRODUCED	34. GAS ADDED	35. RESIDUE SAMPLE TAKEN ☐ Yes ☐ No Sample No.

GAS CONCENTRATIONS (grams per cubic meter (oz./1000 cu. ft.))
(To be prepared for fumigations when gas concentration readings are required while treatment is in progress.)

36. DATE-TIME	37. PLACEMENT OF TEST LINES: SPACE FRONT A	SPACE CENTER B	SPACE REAR C	COMMODITY D	E	F	G	H	I	J	38. TIME INTERVAL (FROM 32. B)	INSPECTOR'S INITIALS

39. DETECTOR TUBE READINGS (PPM)					

40. REMARKS		41. CALCULATIONS	
42. SIGNATURE OF INSPECTOR	DATE	43. SIGNATURE OF REVIEWER	DATE

PPQ FORM 429 (MAR 92) *Replaces APHIS FORM 8030 (JUL 89), which may be used*

Figure A-6 Example of PPQ Form 429, Fumigation Record (Front)

TARPAULIN FUMIGATION

NOTE: ***In preparation for the fumigation and prior to site selection the officer should have determined (1) the immediate pest risk associated with the infested commodity, (2) the temperature requirements for the fumigation, and (3) the permeability of the packaging.***

CHECKLIST OF MATERIALS AND PROCEDURES *(Consider each of the listed items when performing a fumigation.)*

MATERIALS

FUMIGATOR						PPQ
	Tarpaulin		Tarpaulin Supports		Volatilizer	Gas Analazer
	Sand Snakes		Fans		Heat Supply	Drierite
	Water Snakes		Extension Cords		Exhaust Fans	
	Loose Sand		2-3 Prong Plug Adapters		Sampling Tubes	Self Contained (SCBA) Breathing Apparatus
	Burlap / Padding		Fumigant		Scale	Halide Detector
	Masking Tape		Gas Introduction Line		Fumigation Placards	Tape Measure
	Pesticide & Spray Equipment		T/C Gas Analyzer		SCBA - Self Contained Breathing Apparatus	Thermometer
						Gas Detector Kit and Detector Tubes

PROCEDURES *(SECTION III TREATMENT MANUAL)*

PREPARATION				FUMIGATION			
1.	**SITE SELECTION**	3.	**TARPAULIN ENCLOSURE**	4.	**TREATMENT SCHEDULE DETERMINATION**		Introduction Rate
	Ventilated Area	A.	**COVER**		Plant Pest		Check for Leaks
	Sheltered Area		Condition		Commodity Temperature	6.	**SAFETY**
	Impervious Surface		Air Space, Above Load		Space Temperature		Gas Detection Tests
	Non-work Area		Floor Area 30 cm (12") Space Around Load		Volume Determination	7.	**CONCENTRATION READINGS**
	Proximity to Electrical Source		Overlap 45 cm (18") Border		Sorptive Commodity		T/C Gas Analyzer Standardization
	Proximity to Commodity	B.	**SNAKES**		Amount of Fumigant		Time Intervals
2.	**ARRANGEMENT OF COMMODITY & EQUIPMENT**		Contact Along Sides	5.	**FUMIGANT INTRODUCTION**		Gas Distribution
	Stack Size Limitation		Contact Around Corners		Area Clear of Unauthroized Personnel		Maximum / Minimum
	Air Space, Below and Between Load		Overlap 15 cm (6") Minimum		Cover condition	8.	**AERATION (MULTIPLE STACKS)**
	Placement of Tarp. Supports	C.	**SAND**		Fan Operation		Exhaust Fan(s)
	Placement of Padding		Perimeter		Contaminant Gases		Exhaust Tube(s)
	Placement of Fans	D.	**ADHESIVE**		Fumigant Cylinder Weight		Exhausted in a Non-fumigation Area
	Placement of Gas Introdution Line(s)		Perimeter		Gas Line Connections		Negligible Gas Readings Before Tarpaulin Removal
	Placement of Sampling Lines				Volatilizer Heated		Halide or Other Detector Tests

PPQ FORM 429 (Reverse) ☆ U.S. GOVERNMENT PRINTING OFFICE: 1997 417-294/60024

Figure A-7 Example of PPQ Form 429, Fumigation Record (Back)

Block	Instruction
1	Fill in.
2	Fill in scientific name(s) of pest or simply “precautionary” when fumigation is mandatory as a condition of entry or movement. Include station interception number(s) if fumigation is based on pest findings.
3-20	Fill in. In completing Block 12, if the commodity is a fruit or vegetable, enter the common name. The common name is more descriptive. If available, include the variety. By using common names and names of varieties, tolerances to the fumigant can be better predicted.
21	Fill in fumigant (for example, MB, CB, PH, EO, or SF), schedule number, dosage rate, and exposure period (4 lbs/1,000 ft^3 for 12 hours).
22	Fill in beginning temperatures in space under enclosure (a) and commodity temperature (b). Specify Centigrade or Fahrenheit.
23	Fill in type of thermal conductivity unit used (Fumiscope® or Gow-Mac®) and the serial number of the conductivity unit.
24	Fill in chamber, tarpaulin, structure, or type of carrier such as truck van, railroad car, or ship. If a container was used, indicate if covered by tarpaulin. Fill in type of tarpaulin used—single or multiple-use and the thickness (4 mil or 6 mil).
25	If treatment is conducted outside, fill in the weather conditions.
26	Fill in.
27	If commodity is treated under APHIS Section 18 Exemption, check “yes.” If commodity is treated at label dosage or less, check “no.”
28-30	Fill in.
31	If food or feed, check “yes.” If nonfood/nonfeed, check “no.”
32	Record time gas introduction started (a) and finished (b). Treatment does **not** start until gas is completely introduced in the chamber or enclosure.
33	When the fumigant dosage is calculated by weight, fill in the dosage to the nearest quarter pound. If liquid measures are needed, convert from weight to volume by using the conversion table in Appendix D.
34	If additional gas is required, note under Remarks (Block 40) and show calculations (Block 41).
35	Check appropriate box. Sample number refers to Block 7 on APHIS Form 2061 (Residue Sample for Food or Feed Product).
36	Record the date and time you take concentration readings. Treatment schedules specify when to take concentration readings.
37	Fumigants such as methyl bromide may be read and recorded directly from the gas analyzer. However, readings for fumigants such as sulfuryl fluoride must be corrected to get the true concentration reading. Each gas analyzer used for fumigants other than methyl bromide is calibrated with a correction factor. The factor is multiplied times the dial reading, to give the actual concentration. Record phosphine gas concentrations as ppm as determined by detector tubes or APHIS-approved detection device. Specify where the gas sampling line was placed: space or commodity. Use at least three lines. Use additional lines as needed.
38	Fill in.
39	Fill in time as well as the reading. Refer to the section in the manual that is tabbed “Aeration” for guidelines.

Block	Instruction
40	Note any unusual events that occurred during the treatment. When it is necessary to abort a fumigation, details concerning the termination of the treatment should be reported in this block.
41	Show all calculations used in determining the volume of temporary enclosures. Also show calculations when additional gas is added.
42-43	Sign and date.
Reverse Side	Use as a check list.

Distribution

Give the original and one copy to your supervisor for review. The supervisor should keep the original for port files and send one copy to:

USDA, APHIS, PPQ, CPHST
Treatment Quality Assurance Unit
1730 Varsity Drive, Suite 400
Raleigh, NC 27606

PPQ Form 519, Compliance Agreement

FORM APPROVED
OMB NUMBER 0579-0064

UNITED STATES DEPARTMENT OF AGRICULTURE
ANIMAL AND PLANT HEALTH INSPECTION SERVICE
PLANT PROTECTION AND QUARANTINE

COMPLIANCE AGREEMENT

According to the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0579-0064. The time required to complete this information collection is estimated to average 1.25 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

1. NAME AND MAILING ADDRESS OF PERSON OR FIRM

2. LOCATION

3. REGULATED ARTICLE(S)

4. APPLICABLE FEDERAL QUARANTINE(S) OR REGULATIONS

5. *I/We agree to the following:*

6. SIGNATURE

7. TITLE

8. DATE SIGNED

9. AGREEMENT NO.

The affixing of the signatures below will validate this agreement which shall remain in effect until canceled, but may be revised as necessary or revoked for noncompliance.

10. DATE OF AGREEMENT

11. PPQ OFFICIAL *(Name and Title)*

12. ADDRESS

13. SIGNATURE

14. STATE AGENCY OFFICIAL *(Name and Title)*

15. ADDRESS

16. SIGNATURE

PPQ FORM 519
(FEB 2002)

Figure A-8 Example of PPQ Form 519, Compliance Agreement

Purpose

The PPQ Form 519 is a form that provides a signed, written agreement with fumigators to indicate their understanding of methods, conditions, and procedures necessary for compliance with regulations.

The PPQ Form 519 is also available as an electronic form. Click on the following link to access a fillable version of the form:

PPQ Form 519

Instructions

Many PPQ ports maintain Compliance Agreements with commercial pesticide applicators. PPQ may maintain compliance agreements, however if they cancel an agreement, PPQ should not ban an exterminator from doing business, or applying regulatory treatments. PPQ may however, discontinue certification of a particular treatment that did **not** meet the required time, temperature, and concentration levels indicated in the treatment schedule. Similarly, PPQ may not want to begin monitoring a fumigation if the tarp appears inadequate and excessive leakage may lead to a safety problem.

Review compliance agreements at least annually, but preferably twice a year. Amend compliance agreements as appropriate.

If the establishment fails to abide by the conditions of the agreement, then the Port Director may cancel that agreement orally or in writing.

If you make an oral cancellation, confirm it in writing as soon as possible. The establishment has 10 days to appeal the cancellation. Appeals must be made to the Deputy Administrator.

Table A-1 Instructions for Completing PPQ Form 519, Compliance Agreement

Block	Instructions
1,8,9, 10-12	Fill in.
2	Fill in the location of the specific property(s) for which the agreement is signed.
3	Fill in the specific regulated articles to which the agreement applies.
4	Fill in the titles, parts, and subparts.
5	Outline stipulations which apply to the fumigator for each quarantine or regulation affecting the fumigator. Make clear to the fumigator that stipulations in the compliance agreement do **not** preclude compliance with other sections of the quarantine or regulations. If space in Block 6 is inadequate for listing the stipulations, then write “see Attached Sheets.”
6	Have a responsible official of the fumigator’s sign.

Table A-1 Instructions for Completing PPQ Form 519, Compliance Agreement

Block	Instructions
9	Assign a compliance agreement number.
13	Have the PPQ Port Director sign.
14-16	Complete only when State is involved in cooperating with enforcing Federal quarantines.

Distribution

If:	Then:
Compliance agreement affects one work unit	GIVE original to the fumigator, and KEEP a copy for port files in the area where the fumigator is located
Compliance agreement affects more than one work unit	GIVE original to the fumigator, and GIVE copies to all work units affected by the compliance agreement, and KEEP a copy for port files in the area where the fumigator is located

PPQ Form 523, Emergency Action Notification

According to the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information is 0579-0102. The time required to complete this information collection is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

FORM APPROVED - OMB NO. 0579-0102

U.S. DEPARTMENT OF AGRICULTURE
ANIMAL AND PLANT HEALTH INSPECTION SERVICE
PLANT PROTECTION AND QUARANTINE

EMERGENCY ACTION NOTIFICATION

SERIAL NO.

1. PPQ LOCATION
2. DATE ISSUED
3. NAME AND QUANTITY OF ARTICLE(S)
4. LOCATION OF ARTICLES
5. DESTINATION OF ARTICLES
6. SHIPPER
7. NAME OF CARRIER
8. SHIPMENT ID NO.(S)
9. OWNER/CONSIGNEE OF ARTICLES

Name:

Address:

PHONE NO. FAX NO.

SS NO. TAX ID NO.

10. PORT OF LADING
11. DATE OF ARRIVAL
12. ID OF PEST(S), NOXIOUS WEEDS, OR ARTICLE(S)
12a. PEST ID NO.
12b. DATE INTERCEPTED
13. COUNTRY OF ORIGIN
14. GROWER NO.
15. FOREIGN CERTIFICATE NO.
15a. PLACE ISSUED
15b. DATE

Under Sections 411, 412, and 414 of the Plant Protection Act (7 USC 7711, 7712, and 7714) and Sections 10404 through 10407 of the Animal Health Protection Act (7 USC 8303 through 8306), you are hereby notified, as owner or agent of the owner of said carrier, premises, and/or articles, to apply remedial measures for the pest(s), noxious weeds, and or article(s) specified in Item 12, in a manner satisfactory to and under the supervision of an Agriculture Officer. Remedial measures shall be in accordance with the action specified in Item 16 and shall be completed within the time specified in Item 17.

AFTER RECEIPT OF THIS NOTIFICATION, ARTICLES AND/OR CARRIERS HEREIN DESIGNATED MUST NOT BE MOVED EXCEPT AS DIRECTED BY AN AGRICULTURE OFFICER. THE LOCAL OFFICER MAY BE CONTACTED AT:

16. ACTION REQUIRED

☐ TREATMENT:

☐ RE-EXPORTATION:

☐ DESTRUCTION:

☐ OTHER:

Should the owner or owner's agent fail to comply with this order within the time specified below, USDA is authorized to recover from the owner or agent cost of any care, handling, application of remedial measures, disposal, or other action incurred in connection with the remedial action, destruction, or removal.

17. AFTER RECEIPT OF THIS NOTIFICATION COMPLETE SPECIFIED ACTION WITHIN (Specify No. Hours or No. Days):
18. SIGNATURE OF OFFICER:

ACKNOWLEDGMENT OF RECEIPT OF EMERGENCY ACTION NOTIFICATION

I hereby acknowledge receipt of the foregoing notification.

SIGNATURE AND TITLE: DATE AND TIME:

19. REVOCATION OF NOTIFICATION

ACTION TAKEN:

SIGNATURE OF OFFICER: DATE:

PPQ FORM 523 (JULY 2002) Previous editions are obsolete.

Figure A-9 Example of PPQ Form 523, Emergency Action Notification

Purpose

The Emergency Action Notification (EAN) is a document that serves purposes for APHIS regulations. When an emergency action must be taken on a shipment, this form allows Customs and Border Protection - Agriculture Inspection (CBPAI) and/or Plant Protection and Quarantine (PPQ) to communicate the need for a specific action on a shipment to the interested parties. The EAN specifies to the broker, shipper, market owner, or other stakeholder the reason(s) why the shipment is being refused and basic explanation(s) as to what action is necessary.

The document also serves other critical needs. Use of the EAN information assists in determining risks and identifying trends. Through data compilation and analysis PPQ will use the information to update regulations, inform trade partners of areas of concern in foreign countries, and help with domestic emergencies. Targeting is another use for the information. CBPAI will be better able to determine which shipments may need closer inspection.

An EAN **must be issued from the National AQAS EAN Database** every time an emergency action is ordered for an agricultural purpose in the cargo or express courier environment. Agricultural purposes would be those that relate back to a violation of a regulation within the 7 CFR or 9 CFR chapters.

Important

EANs may **not** be issued as a hand written document, typed on a manual typewriter, from any local database, or any means of issuance other than the **National** AQAS system.[1]

1 The only acceptable reason for issuing an EAN from a source other than the AQAS National EAN Database is if the AQAS system is **not** in operation. In this instance, the EAN issued in another format must be entered into the AQAS National EAN Database within 24 hours.

Issue an EAN when:

- The Agriculture Specialist finds an actionable pest, potential quarantine pest, a contaminant, or prohibited product
- The Agriculture Specialist needs to record a commercial seizure
- The shipment lacks proper documentation
- The shipment contains non-compliant WPM
- The shipment is in the express courier environment (i.e. FedEx, UPS, DHL, etc.).

An EAN must **not** be issued for the following reasons:

- Condition of Entry/Precautionary Treatments - An EAN is **not** to be issued for a shipment requiring treatment as a condition of entry.
- Holding a Shipment - An EAN is only for taking immediate action. Do **not** use an EAN as a hold or supplemental hold for a shipment for any other reason than immediate treatment.
- Quality Issues - An EAN is **not** to be issued for the quality of a shipment. If the shipment does **not** pose a pest risk do **not** write an EAN.
- No inspection - An EAN is only to be issued if a shipment has been inspected (either a physical inspection of the goods or a paperwork inspection when that is the requirement) and an agricultural problem has been found. Do **not** write an EAN in lieu of inspection.
- Mail - Do **not** issue an EAN for any USPS mail. A Mail Interception Notification (PPQ 287) must be used for these shipments.
- Selected Animal Products - EANs are **not** to be issued on shipments of live animals or live animal products. Refer to the Animal Products Manual for instructions on these products.
- Other Agencies' regulations - EANs are **not** to be issued for a violation of other agencies regulations. The only regulations that may be cited on an EAN are chapters 7 CFR and 9 CFR.

Instructions

The instructions in **Table A-2** are for initiating an EAN. The electronic version of PPQ Form 523 which is located in the National Agricultural Quarantine Activity System (AQAS) at https://mokcs14.aphis.usda.gov/aqas/login.jsp is the only method by which an Emergency Action Notification may be initiated. **Emergency Action Notifications MAY NOT be issued in any other format, either manual or electronic.**

Table A-2 Instructions for Initiating an EAN

Block Number	Field Name	Instructions
1	Issuing Port	Select the port in which the EAN is being issued. Please note that some users will have multiple locations. If the user is assigned to multiple locations, be sure to select the correct location. If the user is **not** assigned to a port to which he/she requires access, contact the help desk.
2	Date Issued	Enter the date that the EAN was issued.

Table A-2 Instructions for Initiating an EAN

Block Number	Field Name	Instructions
3 Name and Quantity of Manifested Article	Article Category* Article Name*	This block is to determine the commodity of the shipment. **Only one commodity is allowed to be listed per EAN.** Do **not** list pallets, crates, dunnage, etc. as the Name of Article unless they are the actual **commodity** being shipped. **Article Category** - Select a category (Animal Product, Plant Product, or Miscellaneous). The user must select the appropriate category as the other fields in this block are dependent upon it. **Animal Products** Animal Classification - Select the classification of the shipment. The classification selected will determine the drop down list for the classification category in the next field. See the Animal Products Manual (APM) contents page for further clarification. Classification Category - Select the classification category. The classification category will determine if a classification subcategory is required. To decide on a classification category see the APM classification selected in the previous field. Classification Subcategory - Select the classification subcategory. This information can be found in shipment documentation. * The drop down lists in this category have come directly from the Animal Products manual. If you need assistance with this menu, see the APM. **Plant Products** This selection is for fresh cut flowers, fresh fruits and vegetables, logs, lumber, and propagative materials only. Any processed plant products (mulch, handicrafts, potpourri, Chinese Teas, etc.) will be found in the Miscellaneous Category. **Miscellaneous Products** This category is for all products that do **not** fit into either Animal Products or Plant products as defined above. Select the category that best fits the commodity. If there is **not** a category that fits your item please contact the help desk, National Coordinator, or Regional Coordinators before continuing. If the user selects miscellaneous, a description of the article must be entered. The description should be as accurate as the information available. For example, brake pads, bolt screws, linen fabric, stuffed toys, etc. If the product is agricultural but processed, the user must give an exact description of the article. For example, wooden birdhouses with grass roofs, dried whole apricots, wood carvings with bark edging, etc. **Article Name** - This drop down list has been determined by the user's previous selections. If the user does **not** find the article name in the drop down list please contact the help desk.

Table A-2 Instructions for Initiating an EAN

Block Number	Field Name	Instructions
3 Name and Quantity of Manifested Article (continued)	Quantity* Unit of Measure*	Enter the numerical quantity of the shipment. When determining the article quantity, use the most specific number. For example, kilograms is a better selection than box count when dealing with most produce or meat products, but square meter is a better selection for veneer. **"Boxes/Crates" may not be used if another option is available.**
	APHIS Permit Number	**APHIS Permit Number** - If the shipment has any kind of APHIS permit, enter the number here.
	Wood Packing Material*	Check the appropriate boxes. If the user selects none or non-compliant only one box may be selected, but if the wood is non-compliant the user may chose both non-compliant for timber pest and no markings. **If wood is not marked with an acceptable symbol, then it is considered unmarked.**
4	Location of Articles*	The location of articles is the place where the shipment is located when it is inspected. For example, US Air Warehouse, 123 Airplane Way, Butte, MT 12345. Each port will have a local drop down list so that users will **not** have to type addresses that have already been added to the system. If using the drop down list, ensure that the correct location has been selected. If the location that the user needs to select is **not** on the default list, it may be added by port users and supervisors by selecting "Set Defaults". All locations must contain the name of the facility, the physical address, city, state, and zip code.
5 Delivery Address of Articles	Name*	Enter the name of the company/individual accepting the goods as destination of the articles (delivery address). Do **not** use the broker as destination. Do **not** automatically assume that the consignee address and delivery address is the same.
	Address where the articles will be delivered*	Enter the address where the goods are intended to be delivered including street address, city, state (within the US), country, and zip/postal code. If the shipment has multiple destinations, the officer should include the destination to which the majority of the shipment is being delivered. If the shipments will be distributed evenly then choose the location to which the product could potentially cause the greatest risk. When determining the address to select the officer should use his/her best judgment. Additional delivery addresses should be entered into the "Comments" field on page 4 of the data entry screens. Questions regarding this should be directed to the officer's first line supervisor.
6 Shipper	Name*	Enter the name of the shipper.
	Address of Shipper*	Enter the address of the shipper including street address, city, and country. Enter state/province and postal code if known. **This must be a foreign address.**

Table A-2 Instructions for Initiating an EAN

Block Number	Field Name	Instructions
7 Name of Carrier	Name*	Enter the name of the carrier company. For example, Northwest Airlines, M/V Panama, Canadian Pacific, Yellow Freight. On the land borders independent trucks frequently cross. If the truck is independent use the name of the owner of the tractor. Do **not** enter vehicle numbers in this field. **Do not enter abbreviations for the name of carrier including airline codes.**
	Flight/ Voyage/ Trip Number*	Enter the appropriate number based on pathway. For trucks use the trailer license number.
8 Shipment Identification Numbers	Airway Bill, Bill of Lading, PAPS Code*	Enter the bill of lading number. If the cargo is border cargo and does **not** have a bill number, use the PAPS code. **This is a mandatory field. Every shipment will have this number at the time that shipment is presented for inspection.**
	Tariff Number*	Enter the 10 character tariff number as provided in ACS or ATS. This is indicated in ATS as the HTS number. Do **not** add any punctuation, numbers only. If the user cannot find the tariff number in ATS or ACS then use this link to look up the number: http://dataweb.usitc.gov/scripts/tariff_current.asp
	Customs Entry Number*	Enter the Customs Entry Number. Do **not** add any punctuation, numbers only. *If the entry has **not** yet been filed at the time of inspection, enter "**Not** Yet Filed" *If the shipment is of low value (under $2000 as of 09/2006) it is considered informal and no entry number will ever be processed, enter "Informal" **Do not enter N/A or Not Available. If the user doesn't have an entry number other than listed above, describe why.**
	Container Number	Enter the complete container number. This is usually a 4-letter code followed by 5 or 6 numbers. Include the check digit.
	ISPM Markings	Enter the complete information from the ISPM Marking (IPPC wood marking). If the officer finds a pest in **marked** wood, this is a required field.
	Other Identifying Number	This field is available to include another number that there is either **not** a field for or can be used for a number collected for port policy. Examples include invoice number, shipment number, etc. **If the pathway is air cargo, the House Airway Bill must be entered here.**
	Other Identifying Number Descriptio n	If the user enters an “Other Identifying Number” then this field must be completed. The entry should clearly identify what the “Other Identifying Number” is. Do **not** use abbreviations in the description other than HAWB for “House Airway Bill.”

Table A-2 Instructions for Initiating an EAN

Block Number	Field Name	Instructions
9 Consignee of Articles	Name*	Enter the name of the Consignee. This will be a company name most of the time. If the shipment owner is an individual, enter the name of the individual. The Consignee is the owner of the shipment. The broker is usually **not** the consignee.
	Address of Consignee*	Enter the street address of the consignee. Street address, city, and country must be entered. Enter the state/province and postal code if known.
	Phone and Fax Numbers	Enter the phone and fax numbers of consignee if known
10 Port of Lading	City*	Enter the foreign city where the shipment was last loaded onto a vessel, plane, railcar, or vehicle.
	Country*	Enter the foreign country where the shipment was last loaded onto a vessel, plane, railcar, or vehicle.
11	Date of Arrival*	Enter the date that the shipment entered the port.
12	Reason for EAN*	Select the reason(s) that the EAN is being issued. The following is a guideline to help determine the reason. **Pest** - If a pest or disease is found on, in, or with a shipment. Do **not** to enter a tentative ID. A national AQAS Pest ID number will be required. **Lacks Documentation or Certification** - Shipment is missing documentation or the documentation is **not** acceptable. Documents may include but are **not** limited to health certificates, FSIS paperwork, permits, phytosanitary certificates, etc. **Contaminant- Seed** - Shipment is found to have seed or seed heads that are contaminants, but **not** part of the manifested commodity. A national AQAS Pest ID number is required. **Contaminant-Other** - Shipment is found to have any contaminant that does **not** need to be sent to an identifier. Examples include blood, soil, manure, etc. **Lacking ISPM15 Marking** - Shipment was found to have unmarked or improperly marked WPM. **Prohibited Animal Product** - Shipment was found to be prohibited by a 9 CFR. **Prohibited Product** - Shipment was found to be prohibited by 7 CFR regulation.

Table A-2 Instructions for Initiating an EAN

Block Number	Field Name	Instructions
12a	Pest ID Number*	Enter the Pest ID number generated by the Pest ID system. This number must be provided by the identifier or an APHIS employee acting on behalf of an identifier. If pest or seed contaminant is selected as the reason for the EAN then the user will have to enter the 17 digit Pest ID number. If the user does **not** have the Pest ID number the EAN may be saved and printed, however the EAN cannot be closed in the system until this information has been added. The system will **not** accept local pest ID numbers in any form.
12b	Date Intercept-ed*	Enter the date that the reason for writing the EAN was found. This date must match the date that is entered on the Pest ID record (309A).
13	Country of Origin	Enter country of origin. The country of origin is **not** necessarily the country from which it is being shipped. The country of origin is the location where the commodity was grown, manufactured, or produced. For example, a shipment of handicrafts might be shipped from Canada, but were made in China. China is the country of origin. Canada is the country of lading.
14	Grower/ Facility Number	Enter the number of the foreign facility in which the product was processed or the foreign grower number. This number is frequently found on the invoice. It may also be available in ATS.
15	Foreign Sanitary Certificate Status*	Select the status of the certificate. If a certificate is **not** required continue to Block 16.
15a	Foreign Sanitary Certificate Number	Enter the certificate number.
15b	Place Issued	Enter City/Country where the certificate was issued. This will be a foreign address.
	Date Issued	Enter the date on which the certificate was issued.
Contact Number	Phone Number*	Enter the phone number at which the user issuing the EAN can be reached.

Table A-2 Instructions for Initiating an EAN

Block Number	Field Name	Instructions
16	Treatment Schedule	Using the drop down menu, **if treatment is available,** select the appropriate treatment schedule. The treatment schedule **MUST** be provided by a PPQ Identifier or PPQ Employee acting on behalf of an Identifier. CBP AI should **not** select a treatment schedule that has **not** been approved by a PPQ Identifier or PPQ Employee acting on behalf of an Identifier.
	Explanation Text*	Select the explanation text that best matches the scenario for this EAN. This explanation tells the acceptor of the EAN two things: 1) what the problem is and 2) how to correct the situation. **This is where the options are given. DO NOT use the "check boxes" printed on the form.**
	Phyto-Fumigation Disclaimer	If fumigation is an option, the phyto disclaimer must be selected.
16 (continued)	CFR Regulation*	Select the CFR under which the shipment is being regulated. More than one CFR can be selected. To look up a CFR use this link: http://ecfr.gpoaccess.gov
	Seal Text	If the shipment must be transferred to another location under seal, select the text that is appropriate to scenario. If the shipment is being sent for treatment by PPQ the quantity of the shipment being transferred (preferably in box count) **must** be included. **NOTE:** If the PPQ Officer supervising the treatment does **not** know the quantity to be treated the shipment will **not** be treated until that information is provided from CBP.
	Comments	If the user has any additional comments to make, they should be recorded in the Comment field. Do **not** repeat information that has previously been provided. Do **not** enter any pest name in this location. It may be helpful on a local level to enter a local ID number or broker information here. **NOTE:** These comments will print on the paper EAN.
17	After Receipt of Notification Complete Specified Action Within:	The user should select the amount of time allowed before treatment begins. For example, if the shipment is to be re-exported then the user should select the amount of time before the shipment must be on the conveyance back to country of origin.
18	Name of Inspecting Officer	Enter the name of the officer that inspected the shipment. Do **not** enter the name of the data enterer unless it is the same individual.

Table A-2 Instructions for Initiating an EAN

Block Number	Field Name	Instructions
Acknowledg e-ment of Receipt of Notification	Name of Recipient	Enter the first and last name of the person accepting the EAN. The user **MUST** have this person print their name next to the signature. The only acceptable entry in this field is the first and last name of the person accepting the EAN. Do **not** enter "On File."
	Title of Recipient	Enter the title of the person accepting and signing the EAN. Preferably enter name of their company as well. Example: Dispatcher, American Shipping
	Date Signed	Enter the date the EAN was signed and accepted.
19 Revocation Notification	Reason for Action Taken*	Enter the reason that the EAN was written. **This should match the data entered in block 12.**
19 Revocation Notification (continued)	Action Taken*	Enter the action that was actually taken. **Do not enter an action unless that action was taken.** If the action was "Treatment," select the treatment type. If the action was "Other," enter what action was taken in the "Additional Remarks" section. Be descriptive in the narrative. Example: The WPM was separated from the shipment. The WPM was re-exported. The commodity entered commerce.
	Was the Article Mislabeled, Misrepre-sented, or Conceal-ed?*	Select yes or no.
	Form 518 Reference Number	If the above answer is yes, then a 518 number must be entered.
	Additional Remarks	If the user has additional information that was **not** previously recorded, it should be entered here. This field is required if Action Taken-Treatment Type is equal to "Other." This field will **not** print at any time. These are private comments visible only to system users.
	Signature of Officer*	Enter the name of the officer that completed or supervised the treatment, received confirmation of destruction, or received confirmation of re-exportation. Do **not** enter the data entry clerk's name unless it is the same officer as described above. This may be a different user than originally opened the EAN.
	Date Action was Completed*	Date - Enter the date that the final action was completed.

Special Instructions for Infested Vessels Sailing Foreign Without Treatment

When an infested vessel is allowed to sail foreign without treatment, type the following statement in the "Comments" field on the EAN.

The requirements of the Emergency Action Notification are suspended upon condition that this vessel shall leave the territorial limits of the United States within *[list number]* of hours after receipt of this notice. This vessel shall **not** re-enter any port in the United States unless it has been treated in accordance with the notification and certified by the person who applied the treatment. If the certificate is **not** presented to the CBP officer when arriving at a port in the United States, or if the CBP officer for any other reason is **not** satisfied that the infestation has been eliminated, the notification shall immediately become effective and treatment required.

PPQ Form 449-R, Temperature Recording Calibration Report

Use the PPQ Form 449-R to document the calibration of temperature sensors for intransit cold treatment in vessels.

TEMPERATURE RECORDING CALIBRATION REPORT
(IN-TRANSIT COLD TREATMENT)

1. NAME OF VESSEL: Crown Emerald			
2. PPQ DUTY STATION: Houston	3. DATE OF INSPECTION: 8-5-2008	4. POINT OF INSPECTION: Bremerhaven, Germany	5. HULL NUMBER AND DOCKYARD: 164 - Imabari
6. IMO NUMBER: 9128037	7. FLAG (3-LETTER CODE): PAN	8. SHIP'S OFFICER: ENS Smith	9. OWNER/OPERATOR: Wallem Management

10. RECORDING INSTRUMENT 1	11. RECORDING INSTRUMENT 2
Recorder(s) must match CPHST website – see instructions.	
10a. MAKE: Mycom	11a. MAKE:
10b. MODEL: Marcs	11b. MODEL:

TEMPERATURE SENSORS
(If unsatisfactory, explain in item 17.)

12. LOCATIONS MATCH DIAGRAM	13. LABELING OF SENSORS/BOXES	14. CABLE LENGTH	15. REACTION TIME
Satisfactory ☒ Unsatisfactory ☐	Satisfactory ☒ Unsatisfactory ☐	Satisfactory ☒ Unsatisfactory ☐	Satisfactory ☒ Unsatisfactory ☐

16. TEMPERATURE READINGS AT 0 C (32 F)

BULB NO.	TEST I	TEST II	TEST III	BULB NO.	TEST I	TEST II	TEST III	BULB NO.	TEST I	TEST II	TEST III	BULB NO.	TEST I	TEST II	TEST III
1A1	0.1	0.1		1C3	0.0	0.0		2A4	0.1	0.1		2C4	0.1	0.1	
1A2	0.0	0.0		1C7	0.0	0.0		2A5	0.1	0.1		2C5	0.1	0.1	
1A3	0.1	0.1		1C8	0.0	0.1	0.0	2A6	0.1	0.1		2D1	0.1	0.1	
1A4	0.1	0.1		1C9	0.0	0.0		2A7	0.1	0.1		2D2	0.1	0.1	
1A5	0.1	0.1		1D1	0.1	0.1		2B3	0.1	0.1		2D3	0.1	0.1	
1A6	0.1	0.1		1D2	0.1	0.1		2B8	0.1	0.1		2D4	0.1	0.1	
1A7	0.1	0.1		1D3	0.1	0.1		2B9	0.1	0.1		2D5	0.1	0.1	
1B1	0.1	0.1		1D4	0.1	0.1		2B10	0.1	0.1		3A1	0.1	0.1	
1B2	0.1	0.1		1D5	-0.2	-0.2		2B11	0.1	0.1		3A2	0.1	0.1	
1B4	0.2	0.2		1D6	-0.1	-0.1		2C1	0.1	0.1		3A3	0.1	0.1	
1B5	0.0	0.0		2A1	0.2	0.2		2C2	0.1	0.1		3A4	0.1	0.1	
1B6	0.0	0.0		2A2	0.3	0.3		2C3	0.1	0.1		3A5	-0.1	-0.1	

17. REMARKS (List names of all USDA officials participating in the calibration.)
D. Jones, S. Wood

18. COMPANY NAME AND ADDRESS TO SEND CERTIFICATE OF APPROVAL Wallem Ship Management 1799 West Street New York, NY	19. COMPANY EMAIL: WSM@gmail.com 20. COMPANY PHONE NUMBER: 800-879-4659
21. SIGNATURE OF LEAD INSPECTOR	22. DATE: 5-August-2008

PPQ FORM 449-R (Local Reproduction Authorized)
(JAN 2007)

Figure A-10 Example of PPQ Form 449-R, Temperature Recording Calibration Report

Instructions for Completing PPQ Form 449-R

Block	Instructions
1	Verify that the vessel name agrees with the name on the CPHST web site: https://treatments.cphst.org/vessels/.
2	PPQ officer's duty station.
3	Date of Inspection
4	Place of Inspection
5	Verify that the hull number and dockyard agrees with the CPHST web site: https://treatments.cphst.org/vessels/.
6	The IMO number is a unique identification number for every vessel engaged in commerce and provides a complete history of the vessel. Verify that the IMO number agrees with the CPHST web site: https://treatments.cphst.org/vessels/. If this information is not on the CPHST web site, collect the number from the ship's officer and record in this block.
7	Verify that the flag (country of registry) agrees with the 3-letter code on the CPHST web site: https://treatments.cphst.org/vessels/.
8	Name of Captain, Chief Engineer, Reefer Engineer, or First Officer
9	Name of the shipping line owner or agent. Verify with CPHST web site: https://treatments.cphst.org/vessels/.
10a, b	Verify the make and model agree with the information on the web site. If the information differs from that listed on the website, gather as much information as possible from the vessels crew regarding when (date) instrument was changed, and whether or not they have any documentation from CPHST approving the changes. Record this additional information in the remarks section.
11a, b	Multiple recorders may be used. Record the make and model.
12	Verify that the sensor and cable locations match the diagram on the CPHST web site.
13	Verify that the sensors and cables are labeled correctly and in accordance with the sensor diagram.
14	Confirm that air sensors are capable of reaching the floor and fruit sensors are capable of reaching all areas of the compartment from their location along the walls (each should reach past the center line of the compartment).
15	Do the sensors respond appropriately when hand-warmed?
16	TEST ALL AIR AND PULP SENSORS. If officer suspects a compartment to be a hanging deck, test any sensors located in the space and make a notation in this block and in the narrative.
17	Record names of all USDA officials participating in the inspection, indicating lead officer for the report. Include any other information deemed appropriate.
18	Include as much information as possible.
19	Company email.
20	Company phone number.
21	Signature of Lead Inspector.
22	Date the report is completed.

PPQ Form 203, Foreign Site Certificate of Inspection and/ or Treatment

According to the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control num ber. The valid OMB control numbers for this information collection are 0579-0190 and 017 3. The time required to complete this information collection is estimated to a verage .5 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completi ng and reviewing the collection of information.

OMB APPROVED
0579-0190 and 0173

U.S DEPARTMENT OF AGRICULTURE
ANIMAL AND PLANT HEALTH INSPECTION SERVICE
PLANT PROTECTION AND QUARANTINE

FOREIGN SITE CERTIFICATE OF INSPECTION AND/OR TREATMENT

1. CERTIFICATE NO.
2. COUNTRY OF ORIGIN
3. DATE LOADED
4. FOREIGN PORT OF EXPORT
5. CARRIER IDENTIFICATION
6. U.S. PORT OF ENTRY
7. SHIPPER (Name and Address - Include Zip Code)
8. CONSIGNEE (Name and Address - Include Zip Code)

9. COMMODITY	10. NO. CONTAINERS (Identify as box, sack, 1/2 Bruce box, flat, cardboard box, etc.)	11. CONTAINER IDENTIFICATION MARKS

12. LOCATION OF INSPECTION AND/OR TREATMENT
13. DATE

This certifies that the shipment described above has been inspected and/or treated in accordance with agricultural requirements for entry into the United States.

14. SIGNATURE OF PLANT PROTECTION AND QUARANTINE OFFICER
15. DATE ISSUED

PPQ FORM 203
(JUL 2007)

Figure A-11 PPQ Form 203, Foreign Site Certificate of Inspection and/or Treatment

Purpose

PPQ Form 203 verifies that PPQ has precleared the commodity it accompanies (either through inspection or treatment) at the foreign site.

An electronic copy of this form is available in the APHIS forms library at:

http://www.aphis.usda.gov/library/forms/#ppq

Instructions

The Agriculture Specialist at Port of Entry (POE) examines this form when a precleared commodity arrives at the port.

The APHIS officer completes this form at the foreign site where the commodity is inspected or treated. The form may either be handwritten in ink or typed. Use **Table A-3** to decide what paperwork should be presented upon the arrival of a precleared commodity.

Table A-3 Determine Paperwork to Be Presented upon Arrival of a Precleared Commodity

If arriving from:	And by:	Then the exporter or the exporter's agent must provide the following paperwork:
Australia, Japan, Korea, or the Republic of South Africa	→	◆ Original (yellow) PPQ Form 203 for the commodity ◆ Copy of the master PPQ Form 203 or original Phytosanitary Certificate, specifying the number of units shipped or remaining in cold storage from the master PPQ Form 203
Chile	Vessel	◆ Original Chilean Phytosanitary Certificate ◆ E-mail notification of the cargo on board and its status from the IS Region II office to the POE **NOTE:** No PPQ Form 203 will accompany the commodity
	Air	◆ Original (yellow) PPQ Form 203 for the commodity ◆ Original Chilean Phytosanitary Certificate
New Zealand	→	◆ Original (yellow) PPQ Form 203 for the commodity, **or** a copy of the master 203 ◆ Original New Zealand Ministry of Agriculture forms specifying the number of units shipped or remaining in cold storage from the master PPQ Form 203, Final Balances-Balance Sheet for USA-Passed Product in Coolstore and Details of Loading Certificate
Other than a country listed in the three cells above	→	◆ Original (yellow) PPQ Form 203 for the commodity

Verify that any seals listed on the form are still intact. Also, confirm that the information and conditions described on the form agree with the cargo manifest, invoice, or other CBP entry documents. Contact QPAS at 301/734-8295 if **any** of the following occurs:

- PPQ Form 203 is missing
- Seals are broken
- Information on the PPQ Form 203 does **not** match the entry documents

Important

Refer to the Fruits and Vegetables Import Requirement database (FAVIR) for the commodity being shipped. The commodity may be undergoing in-transit cold treatment. If it is, you need to ensure that the commodity meets the time and temperature requirements.

Instructions for Issuing Officer

The APHIS Issuing Officer will complete PPQ Form 203, as follows:

1. Type the form or write in ink.
2. Number the certificate using the numbering system assigned by the Area Office with responsibility for the program.
3. If the commodity was treated, mark the form with the plant's approved stamp.
4. Fill in the remaining, self-explanatory information.

Distribution

Issuing Officer

The APHIS Issuing Officer will distribute PPQ Form 203 using **Table A-4** as a guide.

Table A-4 Distribution of PPQ Form 203, Foreign Site Certificate of Inspection and/or Treatment

If:	Then:
Original and first copy	GIVE to the exporter (the original must be presented at the first POE)
Copy	SEND to the Area Office, IS, with responsibility for the program
Copy	RETAIN by the certifying APHIS officer
Copy (through the office of cooperator)[1]	FAX a copy to the U.S. Port of Arrival
Copy	ATTACH to trip report

1 This does **not** apply to all programs. Check the technical packet or with the IS Field Office in Charge.

PPQ Form 556, Intransit Cold Treatment Clearance Report

U. S. DEPARTMENT OF AGRICULTURE
Animal and Plant Health Inspection Service
Plant Protection and Quarantine Programs

IN TRANSIT COLD TREATMENT CLEARANCE REPORT

INSTRUCTIONS: Refer to PPQ Treatment Manual Sec. III part 10 and CFR 319.56-2d.

1. NAME OF CARRIER	2. PORT OF LOADING	3. PAGE NO. of
4. PORT REPORTING	5. DATE	6. TIME
7. PORT REPORTING	8. DATE	9. TIME

10. CONTENTS OF COMPARTMENTS

COMMODITY	NO. CASES	COMMODITY	NO. CASES	COMMODITY	NO. CASES	COMMODITY	NO. CASES
Apples		Nectarines		Pears		Plums	
Cherries		Oranges		OTHER (Specify)		OTHER (Specify)	
Grapes		Peaches					

INSTRUMENT EXAMINATION		INSTRUMENT EXAMINATION	
11. INSTRUMENT NO.	12. WAS INSTRUMENT LOCKED? YES ☐ NO ☐	17. INSTRUMENT NO.	18. WAS INSTRUMENT LOCKED? YES ☐ NO ☐
13. PRINTING INTERVAL	14. CHART SPEED (in. or cm/24 hours)	19. PRINTING INTERVAL	20. CHART SPEED (in. or cm/24 hours)
15. ACTUAL LENGTH OF RECORD	16. CALCULATED LENGTH OF RECORD	21. ACTUAL LENGTH OF RECORD	22. CALCULATED LENGTH OF RECORD

23. CALIBRATION RECORD SATISFACTORY ☐ | IF NOT SATISFACTORY - WHY | SIGNED BY

TEMPERATURE RECORD

24. IDENTIFY COMPARTMENTS													
25. Initial fruit temp. recorded		MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.
26. Loading completed		DATE	TIME	DATE	TIME	DATE	TIME	DATE	TIME	DATE	TIME	DATE	TIME
27. TREATMENT COMMENCED	2.2°C(36°F)												
	1.7°C(35°F)												
	1.1°C(34°F)												
	0.6°F(33°F)												
	0°C(32°F)												
28. Total No. days treatment to time of clearance		TEMP.	DAYS	TEMP.	DAYS	TEMP.	DAYS	TEMP.	DAYS	TEMP.	DAYS	TEMP.	DAYS
29. Pulp temperatures *(manual check by PPQ officer)*		MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.
30. Recorded temperatures		BULB NO.	TEMP.	BULB NO.	TEMP.	BULB NO.	TEMP.	BULB NO.	TEMP.	BULB NO.	TEMP.	BULB NO.	TEMP.

31. CARGO STOWAGE SATISFACTORY ☐ | IF NOT, SPECIFY WHY | 32. SIGNATURE OF OFFICER

PPQ FORM 556
AUG. 1977

REPLACES PPQ FORM 556(9/74) WHICH MAY BE USED

Figure A-12 PPQ Form 556, In Transit Cold Treatment Clearance Report

B

Treatment Manual

Appendix B

Coast Guard Regulations

This Appendix contains information reprinted from 46CFR, October 1, 1997.

Title 46—Shipping
Chapter 1—Coast Guard, Dept. of Transportation

Part 147A—Interim Regulations For Shipboard Fumigation

MINIMUM REQUIREMENTS
General
Sec. 147A.1 Purpose.
Sec. 147A.3 Applicability..
Sec. 147A.5 General requirement.
Sec. 147A.7 Definitions..
Sec. 147A.9 Persons in charge of fumigation and the vessel; designation..
Sec. 147A.10 Notice to Captain of the Port.

Before Fumigation
Sec. 147A.11 Person in charge of fumigation; before fumigation..
Sec. 147A.13 Person in charge of the vessel; before fumigation..

During Fumigation
Sec. 147A.21 Person in charge of fumigation; during fumigation.
Sec. 147A.23 Person in charge of vessel; during fumigation..
Sec. 147A.25 Entry.

After Ventilation
Sec. 147A.31 Removal of fumigation material and warning signs..

SPECIAL REQUIREMENTS FOR FLAMMABLE FUMIGANTS
Sec. 147A.41 Person in charge of fumigation; flammable fumigants..
Sec. 147A.43 Other sources of ignition; flammable fumigants..

AUTHORITY: 46U.S.C. 170; (49 U.S.C. 1655(b)(1)); 49CFR 1.46(b).
SOURCE: CGD 74-144, 39 FR 32998, Sept. 13, 1974, unless otherwise noted.

General

Sec. 147A.1 Purpose.

The purpose of this part is to prescribe the requirements for shipboard fumigation that are critical for the health and safety of the crew and any other person who is on board a vessel during fumigation. These are interim rules pending further study and promulgation of comprehensive regulations on shipboard fumigation.

Sec. 147A.3 Applicability.

This part prescribes the rules for shipboard fumigation on vessels to which 49 CFR parts 171-179 apply under 49 CFR 176.5.

Sec. 147A.5 General requirement.

No person may cause or authorize shipboard fumigation contrary to the rules in this part.

Sec. 147A.7 Definitions.

As used in this part:

(a) Qualified person means a person who has experience with the particular fumigant or knowledge of its properties and is familiar with fumigant detection equipment and procedures, or an applicator who is certified by the Environmental Protection Agency if his certification covers the fumigant that is used.

(b) Fumigant means a substance or mixture of substances that is a gas or is rapidly or progressively transformed to the gaseous state though some nongaseous or particulate matter may remain in the space that is fumigated.

(c) Fumigation means the application of a fumigant on board a vessel to a specific treatment space.

Sec. 147A.9 Persons in charge of fumigation and the vessel; designation.

(a) The person, including any individual, firm, association, partnership, or corporation, that is conducting a fumigation operation shall designate a person in charge of fumigation for each operation.

(b) The operator of each vessel shall designate a person in charge of the vessel for each fumigation operation.

Sec. 147A.10 Notice to Captain of the Port.

Unless otherwise authorized by the Captain of the Port, at least 24 hours before fumigation the operator of the vessel shall notify the Coast Guard Captain of the Port, for the area where the vessel is to be fumigated, of the time and place of the fumigation, and the name of the vessel that is to be fumigated.

Before Fumigation

Sec. 147A.11 Person in charge of fumigation; before fumigation.

(a) The person in charge of fumigation shall notify the person in charge of the vessel of:

(1) The space that is to be fumigated;

(2) The name, address, and emergency telephone number of the fumigation company;

(3) The dates and times of fumigation;

(4) The characteristics of the fumigant;

(5) The spaces that are determined to be safe for occupancy paragraph (b)(1)(i) of this section;

(6) The maximum allowable concentration of fumigant in spaces, if any, that are determined to be safe for occupancy under paragraph (b)(1)(i) of this section;

(7) The symptoms of exposure to the fumigant; and

(8) Emergency first aid treatment for exposure to the fumigant.

(b) The person in charge of fumigation shall ensure that:

(1) A marine chemist or other qualified person who has knowledge of and experience in shipboard fumigation evaluates the vessel's construction and configuration and determines:

(i) Which spaces, if any, are safe for occupancy during fumigation; and

(ii) The intervals that inspections must be made under Sec. 147A.21(a)(1);

(2) No persons or domestic animals are in the space that is to be fumigated or the spaces that are designated as unsafe for occupancy under paragraph (b)(1)(i) of this section;

(3) There is proper and secure sealing to confine the fumigant to the space that is to be fumigated, including blanking off and sealing any ventilation ducts and smoke detectors;

(4) The personal protection and fumigation detection equipment for the fumigant that is to be used is on board the vessel;

(5) Warning signs are:

(i) Posted upon all gangplanks, ladders, and other points of access to the vessel;

(ii) Posted on all entrances to the spaces that are designated as unsafe for occupancy under paragraph (b)(1)(i) of this section; and

(iii) In accordance with 49 CFR 173.9(c) or section 8.10 of the General Introduction of the International Maritime Dangerous Goods Code. The word “unit" on the warning sign may be replaced with “vessel,” “barge,” “hold,” or “space,” as appropriate.

(6) Watchmen are stationed at all entrances to:

(i) Spaces that are not determined to be safe for occupancy under paragraph (b)(1)(i) of this section; or

(ii) The vessel, if no spaces are determined to be safe for occupancy under paragraph (b)(1)(i) of this section.

Sec. 147A.13 Person in charge of the vessel; before fumigation.

(a) After notice under Sec. 147A.11 (a)(5), the person in charge of the vessel shall notify the crew and all other persons on board the vessel who are **not** participating in the fumigation of the spaces that are determined to be safe for occupancy under Sec. 147A.11(b)(1)(i).

(b) If no spaces are determined to be safe for occupancy under Sec. 147A.11 (b)(1)(i), the person in charge of the vessel shall ensure that the crew and all persons who are **not** participating in the fumigation leave the vessel and remain away during fumigation.

During Fumigation

Sec. 147A.21 Person in charge of fumigation; during fumigation.

(a) Until ventilation begins, or until the vessel leaves port, the person in charge of fumigation shall ensure that a qualified person inspects the vessel as follows:

(1) He must use detection equipment for the fumigant that is used to ensure that the fumigant is confined to:

(i) The space that is fumigated, if partial occupancy is allowed under Sec. 147A.11(b)(1)(i); or

(ii) The vessel, if no space is determined to be safe for occupancy under Sec. 147A.11(b)(1)(i).

(2) He must make inspections at the intervals that are determined to be necessary by the marine chemist or qualified person under Sec. 147A.11 (b)(1)(ii).

(b) If leakage occurs, the person in charge of fumigation shall:

(1) Notify the person in charge of the vessel that there is leakage;

(2) Ensure that all necessary measures are taken for the health and safety of any person; and

(3) Notify the person in charge of the vessel when there is no danger to the health and safety of any person.

(c) After the exposure period, if the vessel is in port, the person in charge of fumigation shall ensure that fumigators or other qualified persons ventilate the space that is fumigated as follows:

(1) Hatch covers and vent seals must be removed, other routes of access to the atmosphere must be opened, and if necessary, mechanical ventilation must be used.

(2) Personal protection equipment that is appropriate for the fumigant that is used must be worn.

(d) If ventilation is completed before the vessel leaves port, the person in charge of fumigation shall:

(1) Ensure that a qualified person, who is wearing the personal protection equipment for the fumigant that is used if remote detection equipment is **not** used, tests the space that is fumigated and determines if there is any danger to the health and safety of any person, including a danger from fumigant that may be retained in bagged, baled, or other absorbent cargo;

(2) Notify the person in charge of the vessel of this determination; and

(3) If it is determined that there is a danger:

(i) Ensure that all measures are taken that are necessary for the health and safety of all persons; and

(ii) Notify the person in charge of the vessel when there is no danger to the health and safety of any person.

Sec. 147A.23 Person in charge of vessel; during fumigation.

(a) The person in charge of the vessel shall ensure that the crew and all other persons on board the vessel who are **not** participating in the fumigation restrict their movement during fumigation to the spaces that are determined to be safe for occupancy under Sec. 147A.11(b)(1)(i).

(b) The person in charge of the vessel shall ensure that the crew and all other persons who are **not** participating in the fumigation follow any instructions of the person in charge of fumigation that are issued under Sec. 147A.21(b)(2) or (d)(3)(i) and that the vessel does **not** leave port if he is notified under:

(1) Section 147A.21(b)(1) that there is leakage, unless the person in charge of fumigation notifies him under Sec. 147A.21(b)(3) of this subpart that there is no danger; or

(2) Section 147A.21(d)(2) that there is a danger after ventilation, unless the person in charge of the fumigation notifies him under Sec. 147A.21(d)(3)(ii) that there is no danger.

(c) If fumigation is **not** completed before the vessel leaves port, the person in charge of the vessel shall ensure that personal protection and fumigant detection equipment for the fumigant that is used is on board the vessel.

(d) If the vessel leaves port before fumigation is completed, the person in charge of the vessel shall ensure that a qualified person makes periodic inspections until ventilation is completed and this person shall use detection equipment for the fumigant that is used to determine if:

(1) There is leakage of fumigant; or

(2) There is a concentration of fumigant that is a danger to the health and safety of any person.

(e) If the qualified person determines under paragraph (d) of this section that there is leakage or a concentration of fumigant that is a danger to the health and safety of any person, the person in charge of the vessel shall take all measures that are, in his discretion, necessary to ensure health and safety of all persons who are on board the vessel. If the danger is due to leakage, he shall also ensure that qualified persons immediately ventilate in accordance with paragraphs (c)(1) and (2) of Sec. 147A.21.

(f) If the vessel leaves port during the exposure period, the person in charge of the vessel shall ensure that the space that is fumigated is ventilated by qualified persons after the exposure period in accordance with paragraphs (c) (1) and (2) of Sec. 147A.21.

(g) If ventilation is completed after the vessel leaves port, the person in charge of the vessel shall ensure that a qualified person, who is wearing the personal protection equipment for the fumigant that is used if remote detection equipment is **not** used, tests the space that is fumigated to determine if there is a danger to the health and safety of any person, including a danger from fumigant that may be retained in bagged, baled, or other absorbent cargo. If the qualified person determines that there is a danger, the person in charge of the vessel shall take all measures that are, in his discretion, necessary to ensure the health and safety of all persons who are on board the vessel.

Sec. 147A.25 Entry.

(a) No person may enter the spaces that immediately adjoin the space that is fumigated during fumigation unless entry is for emergency purposes or the space is tested and declared safe for human occupancy by a marine chemist or other qualified person and is inspected under Sec. 147A.21(a)(2) or Sec. 147A.23(d).

(b) If entry is made for emergency purposes:

(1) No person may enter the space that is fumigated or any adjoining spaces during fumigation unless he wears the personal protection equipment for the fumigant that is in use;

(2) No person may enter the space that is fumigated unless the entry is made by a two person team; and

(3) No person may enter the space that is fumigated unless he wears a lifeline and safety harness and each life-line is tended by a person who is outside the space and who is wearing the personal protection equipment for the fumigant that is in use.

After Ventilation

Sec. 147A.31 Removal of fumigation material and warning signs.

After ventilation is completed and a marine chemist or other qualified person determines that there is no danger to the health and safety of any person under Sec. 147A.21(d) or Sec. 147A.23(g), the person in charge of fumigation, or, if the vessel has left port, the person in charge of the vessel, shall ensure that all

warning signs are removed and fumigation containers and materials are removed and disposed of in accordance with the manufacturer's recommendations.

Special Requirements for Flammable Fumigants

Sec. 147A.41 Person in charge of fumigation; flammable fumigants.

(a) The person in charge of fumigation shall ensure that:

(1) Before the space that is to be fumigated is sealed, it is thoroughly cleaned, and all refuse, oily waste, and other combustible material is removed;

(2) Before fumigation, all fire fighting equipment, including sprinklers and fire pumps, is in operating condition; and

(3) Before and during fumigation, electrical circuits that are in the space that is fumigated are de-energized.

(b) [Reserved]

Sec. 147A.43 Other sources of ignition; flammable fumigants.

While the space that is fumigated is being sealed or during fumigation, no person may use matches, smoking materials, fires, open flames, or any other source of ignition in any spaces that are **not** determined to be safe for occupancy under Sec. 147A.11(b)(1)(i).

C

Treatment Manual

Appendix C

Maintenance: Supporting and Updating Manuals

Contents

Introduction **page-C-C-1**
Keeping Manuals Current **page-C-C-1**
Ordering Manuals **page-C-C-2**
Correcting Errors and Suggesting Improvements **page-C-C-2**

Introduction

This appendix contains the procedures for maintaining the **paper** version of the *Treatment Manual*. The PPQ Manuals Unit issues and maintains manuals electronically on the Manuals Unit Web site. The on-line manuals contain the most up-to-date information.

Keeping Manuals Current

The PPQ Manuals Unit issues announcements for immediate manual updates by e-mail. The email is distributed to all PPQ employees. The e-mail contains the following information:

- Instructions to access the Manuals Unit Web site to download the entire manual
- List of the updated pages by number (for paper copies of the manuals)
- Purpose of the revision
- Transmittal number (used to track revisions). Besides having numbered transmittals, each page in the manual has control data. This is positioned at the bottom of the page. The revised pages' control data alerts you to whether you have the most up-to-date version. The control data looks like this:

03/2009-25

month, year and transmittal number

All manual revisions are marked with a solid black bar in the left margin of the page.

New editions of manuals always start with a transmittal number of -01 and increase by one for each revision to the manual for the life of the edition. A new edition of a manual is generally scheduled when the percentage of revised pages exceeds 30 percent of the entire manual.

Ordering Manuals

APHIS employees can order hard copies of manuals from the APHIS Printing, Distribution, and Mail Services Center in Riverdale, Maryland. Visit the Riverdale Print Shop web site for detailed information.

Correcting Errors and Suggesting Improvements

If you detect an error, report it using a comment sheet that is included with this manual. Or, if it is easier, call, send an E-mail message, or transmit a facsimile to Josie Cooley or anyone else in the manuals unit:

Office number: (240) 529-0358

Facsimile number: (240) 529-0399

E-mail address: josie.cooley@aphis.usda.gov

Do the same if you want to suggest an improvement or question a procedural change. If your improvement is substantive, you might want to submit a formal suggestion, using the required form.

D

Treatment Manual

Appendix D

Conversion Tables

Table D-1 Conversion Tables

To convert from:	To:	Multiply by:
Acres (a)	Hectares (ha)	0.4047
Acres (a)	Square meters (m^2)	4,047.0
Celsius	Fahrenheit	9/5 (then add 32)
Centimeters, cu. (cm^3)	Cubic inches (in^3)	0.061
Centimeters, sq. (cm^2)	Square inches (in^2)	0.155
Centimeters (cm)	Inches (in)	0.3937
Fahrenheit	Celsius	First, subtract 32, then multiply by $^5/_9$
Feet, cubic (ft^3)	Liters (L)	28.32
Feet, cubic (ft^3)	Cubic meters (m^3)	0.0283
Feet, square (ft^2)	Square meters (m^2)	0.0929
Feet, square (ft^2)	Sq. centimeters (cm^2)	929.0
Feet (ft)	Centimeters (cm)	30.48
Feet (ft)	Meters (m)	0.3048
Gallons (gal)	Liters (L)	3.785
Grams (g)	Ounces (oz)	0.0353
Hectares (ha)	Acres (a)	2.471
Inches (in)	Centimeters (cm)	2.54
Inches, square (in^2)	Sq. centimeters (cm^2)	6.4516
Inches, cubic (in^3)	Cu. centimeters (cm^3)	16.387
Kilograms (kg)	Pounds (lb)	2.205
Kilograms (kg)	Ounces (oz)	35.27
Kilometers, sq. (km^2)	Square miles (mi^2)	0.3861
Kilometers, sq. (km^2)	Acres (a)	247.1
Kilometers (km)	Miles (mi)	0.6214
Liters (L)	Gallons (gal)	0.2642
Liters (L)	Quarts (qt)	1.0567
Meters, cubic (m^3)	Cubic feet (ft^3)	35.314
Meters, cubic (m^3)	Cubic yards (yd^3)	1.308
Meters (m)	Feet (ft)	3.281
Meters (m)	Yards (yd)	1.0936
Meters, sq. (m^2)	Square inches (in^2)	1,550.00
Meters (m)	Inches (in)	39.37
Meters, sq. (m^2)	Square feet (ft^2)	10.764

Table D-1 Conversion Tables

To convert from:	To:	Multiply by:
Miles, square (mi^2)	Hectares (ha)	258.99
Miles, square (mi^2)	Sq. kilometers (km^2)	2.5899
Miles, statute (mi)	Meters (m)	1,609.347
Miles, statute (mi)	Kilometers (km)	1.609
Milliliters (ml)	Liquid ounces (lq oz)	0.0338
Nautical miles	Meters (m)	1,852.00
Ounces, fluid (fl oz)	Milliliters (ml)	29.57
Ounces (oz)	Kilograms (kg)	0.0284
Ounces (oz)	Grams (g)	28.35
Pounds (lb)	Kilograms (kg)	0.4536
Pounds (lb)	Grams (g)	453.6
Quarts (qt)	Liters (L)	0.9464
Tons, short (2000 lb)	Metric tons (t)	0.9072
Tons, Metric (t)	Tons, short	1.102
Yards, cubic (yd^3)	Liters (L)	764.6
Yards, cubic (yd^3)	Cubic meters (m^3)	0.765
Yards (yd)	Meters (m)	0.9144
Yards (yd)	Centimeters (cm)	91.44

Miscellaneous:

Ounces (weight) per 1,000 cu. ft. = grams per cu. meter (g/m3)
Pounds per acre (lb/a) × 1.1206 = kg/ha
Ounces (liquid) per acre × 73.14 = ml/ha
Gallons per acre (gal/a) × 9.3527 = liters per hectare (L/ha)
Pressure per square inch (PSI) × 6.894757 = kilopascals (kPa)
Inches mercury × 3.38 = kilopascals (kPa)
Grams per cu. meter (g/m^3) = ounces per 1,000 cu. ft. (oz/1,000 ft^3)
Kilogram per hectare (kg/ha) × 0.8924 = pounds per acre
Milliliters per hectare × 0.01367 = ounces (lq.) per acre
Liters per hectare (L/ha) × 0.1069 = gallons per acre
Kilopascals (kPa) × 0.145038 = pounds per square inch (PSI)
Grams per liter × 0.008345 = pounds per gallon
Kilopascals (kPa) × 0.29586 = inches mercury

E

Treatment Manual

Appendix E

Directory of Treatment Facilities

There are two lists of approved treatment facilities available for public viewing. They are separated by region and include facilities that are used for the treatment of **imported** commodities.

Click on the following address to access the Manuals Unit complete list of electronic manuals. Scroll down to the end of the page where *"Treatment Manual"* appears. Select either Eastern Region Facility List or Western Region Facility List.

http://www.aphis.usda.gov/import_export/plants/manuals/online_manuals.shtml

In addition, a complete list of approved treatment facilities for both exported and imported commodities can be viewed on the PPQ Intranet site by government agencies only. Government personnel may access the list at http://inside.aphis.usda.gov/ppq/php/manuals.shtml

NOTICE

These lists are updated semi-annually. If you have any questions regarding the status of a treatment facility, contact the Regional Treatment Program Manager in your region.

F

Treatment Manual

Appendix F

List of Integral Containers Approved for Intransit Cold Treatment

A database of approved containers is maintained by the PPQ Center for Plant Health Science & Technology (CPHST) Treatment Quality Assurance Unit (TQAU). To search for an approved container, consult the TQAU database:

https://treatments.cphst.org/vessels/

NOTICE

If you have any questions regarding the status of a self-refrigerated container, contact the Center for Plant Health Science and Technology (CPHST) at (919) 855-7450 or fax (919) 855-7493.

G

Treatment Manual

Appendix G

List of Vessels Equipped for Intransit Cold Treatment

A database of approved vessels is maintained by the PPQ Center for Plant Health Science & Technology (CPHST) Treatment Quality Assurance Unit (TQAU). To search for an approved vessel, consult the TQAU database:

https://treatments.cphst.org/vessels/

NOTICE

If you have questions regarding the status of vessels, contact CPHST at (919)855-7450 or fax (919) 855-7493 for the current status of the vessel

H

Treatment Manual

Appendix H

Reference Guide to Commercial Suppliers of Treatment and Related Safety Equipment

This list is not intended to be all inclusive; only domestic suppliers are shown. Many large companies have branch offices. This list is intended to be a reference guide to the availability of fumigation equipment and supplies and is furnished solely for the convenience of potential users, particularly PPQ plant inspection stations. No endorsement is intended of the particular items listed, and no discrimination is intended toward those products or companies that may not be listed.

Products

Aeration Duct, Flexible H-10
- Biesterfeld U.S. Inc. H-10
- Fumigation Service & Supply, Inc. H-10

Aerosol Insecticides H-10
- Gilmore Marketing and Development, Inc. H-10
- Otis Laboratory H-10
- Prentiss Drug & Chemical Co., Inc. H-10
- Southern Agricultural Insecticides, Inc. H-11
- Southern Mill Creek Products Co., Inc. H-11

Air Pump, Auxiliary H-11
- 3M Corporate Headquarters H-11
- Barnant H-11
- Cole-Parmer H-11
- McMaster-Carr Supply Co. H-12

Air-Purifying Respirator H-13
- AVOX Systems (Aviation Oxygen Products and Services) H-13
- Mine Safety Appliances Co. (MSA) H-13

Air Velocity Measuring (Anemometer) H-12
- NK Nielson-Kellerman H-12
- TSI, Inc. Alnor Products H-12

Aluminum Phosphide H-13
- Degesch America, Inc. H-13
- Fumigation Service & Supply, Inc. H-14
- Gilmore Marketing and Development, Inc. H-14
- Helena Chemical Co. H-14
- ICD Group Metals, LLC H-14

INCHEMA, Inc. H-14
Loveland Products, Inc. H-14
Marman USA, Inc. H-15
Pest Fog, Inc. H-15
Pestcon Systems, Inc. H-15
United Suppliers, Inc. H-15
Applicator (Dispenser) for Methyl Bromide H-15
Pest Fog, Inc. H-15
Vuscamante North H-16
Ascarite II H-16
Sigma-Aldrich Chemical Company, Inc. H-16
Fisher Scientific H-16
Thomas Scientific H-16
Balances, Portable (for weighing individual fruit) H-17
Ohaus Corporation H-17
Batch Systems (complete installations, hot water immersion treatments) H-17
Agri Machinery, Inc. H-17
Agroindustrias Integradas, S.A. de C.V. H-17
Calderas Astro, S.A. de C.V. H-17
Construcciones Pyrsa H-18
Consultecnia H-18
Dica de Mexico, S.A. H-18
Diseños y Maquinaria Jer, S.A. de C.V. (“Jersa”) H-18
Equipos Agroindustriales de Occidente, S.A. de C. V. H-18
Frutico International H-18
Guiar Industrial, S.A. de C.V. H-19
Industria de Maquinas Agricolas GB Ltda. H-19
Industrial Equipment & Engineering Co. H-19
Produce Sorters International H-19
Proyect Asesoria Industrial H-19
Pyrsa de Celaya H-19
Silsa, S.A. de C.V. H-20
William B. Cresse, Inc. H-20
Blower H-20
W. W. Grainger, Inc. H-20
William W. Meyer & Sons, Inc. H-20
Bubble Fumigation System H-20
B&G Equipment Company H-20
Power Plastics H-21
Cascade Air Tank Recharging System (for SCBA) H-21
AVOX Systems (Aviation Oxygen Products and Services) H-21
Mine Safety Appliance Co. (MSA) H-21
Chain Hoist (Electronic) (For hot water immersion treatments) H-21
Chemonics H-21

Columbus McKinnon Corp. H-22
Consultants (For hot water immersion treatments) H-22
C.C. Coutinho Consulting H-22
Center for Plant Health Science and Technology H-22
Consultecnia H-22
Dica de Mexico, S.A. H-22
Frutico International H-23
GEC Instruments H-23
Nojoxten H-23
North Bay Produce, Inc. H-23
Societe d'Entretien & d'Installation (SODEIN) H-23
Curtains (air, safeguarding) H-24
W.W. Granger, Inc. H-24
Digital Thermister Instrument (hand-held for hot water immersion treatments) and Portable Sensors (used in Performance Test) H-24
Allied Electronics H-24
Cooper Instrument Corp. H-24
Drierite® (anhydrous calcium sulfate) H-24
Sigma-Aldrich Chemical Company, Inc. H-24
Fisher Scientific H-25
W. A. Hammond Drierite Co. (Manufacturer) H-25
Exhaust Duct (Tube), Flexible H-25
Gaskets, Inc. H-25
Super Vacuum Manufacturing Company, Inc. H-25
Fans H-26
Pest Fog, Inc. H-26
Super Vacuum Manufacturing Company, Inc. H-26
Fruit Crates (Plastic for hot water immersion treatments) H-26
Fruit Sizing Equipment (Automatic) H-26
Hortagro International, b.v. H-26
Kerian Machines, Inc. H-27
Fumigation Chamber, NAP H-27
Fruit Technologies H-27
Fumigation Chamber, Vacuum H-27
CosMed Group H-27
Baltimore Quality Associates (BQA) H-27
ETO Sterilization (ETO) H-27
Sterilization and Fumigation Services (SFS) H-28
Slack Associates, Inc. H-28
Vacudyne, Inc. H-28
Fumigators, Commercial H-28
Fungicides H-28
Chemtura Corporation H-28
Crystal Chemical Inter-America H-28
Drexel Chemical Co. H-29

Syngenta H-29
Cytec Industries, Inc. H-29
FMC Agricultural Products H-29
Arkema, Inc. H-29
Rohm and Haas H-30
Bayer CropScience LP H-30
Cytec Industries, Inc. H-30
Gas Analyzers H-30
Analytical Technology, Inc. H-30
Interscan Corporation H-31
Key Chemical and Equipment Co., Inc. H-31
Neal Systems, Inc. H-31
Pest Fog, Inc. H-31
Spectros Instruments, Inc. H-31
Gas Detector Tube (colorimetric) and Apparatus H-32
APHIS/NOAA Centralized Warehouse H-32
Draeger Safety, Inc. H-32
Lab Safety Supply H-32
Matheson Tri-Gas H-32
Pest Fog, Inc. H-32
Protech Safety Equipment H-33
Sensidyne, LP H-33
SKC, Inc. H-33
Union Carbide Corp, Linde Div. H-33
Gas Drying Tube (for Drierite®) H-33
Wilmad-LabGlass H-33
Germicides/Disinfectants H-34
Georgia-Pacific Corp. H-34
Halide Gas Leak Detector (removed) H-34
Incinerators H-34
Whitton Technology, Inc. H-34
Magnesium Phosphide H-35
Degesch America, Inc. H-35
Fumigation Service & Supply, Inc. H-35
Helena Chemical Co. H-35
Marman USA, Inc. H-35
Manometer (used in pressure leakage test) H-35
Alnor Instruments H-35
Davis Calibration H-36
Dwyer Instruments, Inc. H-36
Fisher Scientific H-36
Zellweger Analytics H-36
Metam-sodium H-36
Amvac Chemical Corp. H-36
Methyl Bromide, 100% H-37

Ameribrom, Inc. H-37
Biesterfeld U.S., Inc. H-37
Chemtura Corp. H-37
Degesch America, Inc. H-37
Fumigation Service & Supply, Inc. H-37
Helena Chemical Co. H-37
ICD Metals Group, LLC H-38
Marman USA Inc. H-38
Pest Fog, Inc. H-38
Pestcon Systems, Inc. H-38
Southern Agricultural Insecticides Inc. H-38
Southern Mill Creek Products Co., Inc. H-38
Methyl Bromide—Recapture H-39
TIGG Corporation H-39
Moisture Meter (for wood) H-39
Delmhorst Instrument Company H-39
Lignomat USA Ltd. H-39
Newsletters and Trade Journals H-40
Fumigants and Pheromones H-40
Pest Control Technology H-40
Pest Management Professional H-40
Personal Air Sample Pump H-41
Anatole J. Sipin Co., Inc. H-41
Georgia Steel & Chemical Company, Inc. H-41
Mine Safety Appliances Company (MSA) H-41
Spectrex Corp. H-41
Photo Ionization Detector H-42
Mine Safety and Appliance H-42
Rae Systems H-42
Safety Equipment H-42
United States Plastic Corporation H-42
Scale (portable platform type) H-43
Arlington Scale Co., Inc. H-43
Atlantic Scale Co., Inc. H-43
Eastern Scale of NJ H-43
Phifer Incorporated H-43
Sealing Tape H-43
Degesch America, Inc. H-43
Fumigation Service & Supply, Inc. H-44
Self-Contained Breathing Apparatus (SCBA) H-44
AVOX Systems (Aviation Oxygen Products and Services) H-44
Cesco H-44
Draeger Safety, Inc. H-44
Georgia Steel & Chemical Company, Inc. H-45
Lab Safety Supply H-45

Mine Safety Appliances Co. (MSA) H-45
Pest Fog, Inc. H-45
Survivair H-45
Smoking Candle H-45
Davis Calibration H-46
Superior Signal Co., Inc. H-46
Snakes (sand snakes, watersnakes) H-46
Fumigation Service & Supply, Inc. H-46
Pest Fog, Inc. H-46
Soil Fumigants H-47
Buckman Laboratories International Inc. H-47
Cytec Industries, Inc. H-47
OR-CAL, Inc. H-47
Syngenta H-47
Spill Recovery Materials H-48
Ansul H-48
Fumigation Service & Supply, Inc. H-48
New Pig Corp. H-48
WYK Sorbents, LLC H-48
Steam Boilers (For hot water immersion treatment) H-49
Fulton Boiler Works, Inc. H-49
Steam Generators H-49
Sioux Corporation H-49
Steam Sterilizers/Autoclaves H-49
Environmental Tectonics Corporation H-49
Sulfuryl Fluoride (Vikane) H-49
Dow AgroSciences LLC H-49
Marman USA, Inc. H-50
Pest Fog, Inc. H-50
Southern Agricultural Insecticides Inc. H-50
Southern Mill Creek Products, Co., Inc. H-50
Supplied-Air Respirators H-50
AVOX Systems (Aviation Oxygen Products and Services) H-50
Draeger Safety, Inc. H-51
Mine Safety Appliances Co (MSA). H-51
3M Occupational Health & Environmental Safety H-51
Tarpaulins (made to order) H-52
Elastec/American Marine H-52
Poly-Flex, Inc. H-52
Raven Industries H-52
Reef Industries, Inc. (Griffolyn Division) H-52
Temperature Recorders and Sensors - General Use H-53
Cole-Parmer H-53
GEC Instruments H-53
MadgeTech, Inc. H-53

Mesa Laboratories, Inc. H-53
Nanmac Corporation H-54
National Instruments H-54
Nordic Sensors Industrial, Inc. (NSI) H-54
Omega Engineering Inc. H-54
Temperature Recorders (Portable Type) for Cold Treatment in Self-regulated Containers H-54
Controlyne, Inc. H-54
DeltaTRAK, Inc. H-55
GE Sensing (formerly Kaye Instruments) H-55
International Reactor Corporation H-55
Metrosonics, Inc. H-55
Remonsys Limited H-55
Sensitech, Inc. H-56
Wescor Environmental H-56
Temperature Recorders (Built-in Type) for Cold Treatment in Self-Regulated Containers H-56
Carrier Transicold Division H-56
Daikin Industries Ltd. H-56
Klinge Corporation H-57
Matrix Dynamics H-57
Mitsubishi Heavy Industries H-57
Thermo King Corporation H-57
Temperature Recorders (Portable Type) for Cold Treatment in Warehouses H-58
Evidencia LLP H-58
Temperature Recorders for Hot Water Immersion Treatment H-58
Agri Machinery, Inc. H-58
Conax Technologies H-58
Contech H-58
Electro Scientific Industries, Inc. H-59
Enterprise S.A. de C.V. H-59
Equipos Industriales Guadalajara H-59
Eurotherm Chessell H-59
Guiar Industrial, S.A. de C.V. H-59
Honeywell International, Inc. H-60
Instrumentacion y Control Industrial H-60
Laboratorios Jael H-60
Nanmac Corporation H-60
National Instruments H-60
Neuberger Messinstrumente Gmbh H-61
NZ Automacao Ltda-ME H-61
Process Technologies, Inc. H-61
Vacuum Research Corp. H-61
William B. Cresse, Inc. H-61

Thermocouple Wire H-62
Omega Engineering, Inc. H-62
Thermometers H-62
Cole-Parmer H-62
Cooper Atkins H-62
Omega Engineering, Inc. H-62
Thermo Electric Company, Inc. H-63
Thermometers, Glass-Mercury, Certified Precision H-63
DC Scientific Glass H-63
Fisher Scientific H-64
VWR H-64
Thermometers, Glass Non-Mercury, Certified Precision H-65
Cole-Parmer H-65
Thermometers, Digital, Certified Precision H-66
EUTECH Instruments H-67
OpticsPlanet, Inc. H-68
Tech Instrumentation, Inc. H-68
Thermco Products, Inc. H-69
ThermoWorks H-69
Thermometers, Certified Precision, Approved Calibration Companies H-69
DC Scientific Glass H-70
ERTCO H-70
ICL Calibration Laboratories, Inc. H-70
INNOCAL H-70
Instrumentation Technical Services H-70
Measurement Assurance Technology H-71
Phoenix Calibration DR H-71
VWR H-71
Tubing, Gas-Sampling H-71
Cole-Parmer H-71
Consolidated Plastics Co. Inc. H-71
Fisher Scientific H-72
Pest Fog, Inc. H-72
Thomas Scientific H-72
Vacuum Pump H-72
Neward Enterprises, Inc. H-72
Sargent Welch H-73
Vapam H-73
Volatilizer H-73
Degesch America, Inc. H-73
Pest Fog, Inc. H-73
Vacudyne, Inc. H-73
Warning Signs and Placards H-74
Carlton Industries, L.P. H-74
Champion America H-74

Pest Fog, Inc. H-74

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Fax: (52) 810-7422

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Equipos Agroindustriales de Occidente, S.A. de C. V.
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email: info@powerplastics.co.uk
www.powerplastics.co.uk

Cascade Air Tank Recharging System (for SCBA)

AVOX Systems (Aviation Oxygen Products and Services)
(formerly Scott Aviation)
225 Erie Street
Lancaster, NY 14086-9502
Phone: (716) 683-5100
Fax: (716) 681-1089
email: customerservice.avox@zodiacaerospace.com
www.avoxsys.com

Mine Safety Appliance Co. (MSA)
P.O. Box 426
600 Penn Center Boulevard
Pittsburgh, PA 15230
www.msanorthamerica.com/overview.html

Chain Hoist (Electronic) (For hot water immersion treatments)

Chemonics
1717 H Street, NW
Washington, DC 20006
Phone: (202) 955-3300
Fax: (202) 955-3400
email: info@chemonics.com
www.chemonics.com
(Post-harvest advice; international consulting)

Columbus McKinnon Corp.
Industrial Products Division
140 John James Audubon Parkway
Amherst, NY 14228
Phone: (716) 689-5400
Fax: (716) 689-5644
email: sales@cmworks.com
www.cmworks.com
(Lodestar electronic chain hoist, capacity to 3 tons)

Consultants (For hot water immersion treatments)

C.C. Coutinho Consulting
Av. Princess Leopddina, 238
Ap. 101 D
Graca - Ed Olga Pontes
Cep 40150-080 Salvador, Bahia
Brazil
Phone: (55-81) 99-98-42-84
Fax: (55-81) 8-62-29-93
e-mail: cosam@uol.com.br

Center for Plant Health Science and Technology
USDA-APHIS-PPQ-CPHST
Treatment Quality Assurance Unit
1730 Varsity Drive, Suite 400
Raleigh, NC 27606
Phone: (919) 855-7450
Fax: (919) 513-1995
(APHIS technical contact; approval of plans and drawings)

Consultecnia
3a Calle 28-70, Zona 1
Quetzaltenango
Apartado Postal 537-1
Guatamala
Phone: (502) 02-781-496

Dica de Mexico, S.A.
Carretera a Navolato, Km 8
Culiacan, Sinaloa
Mexico
Phone: (52) 4-32-23

Frutico International
P.O. Box 35-A
Avenida Vallarta 2095
Culiacan, Sinaloa
Mexico
Phone: (52) 671-490-30
Phone: (52) 671-490-80

GEC Instruments
5530 NW 97th Street
Gainesville, FL 32653
Phone: (352) 373-7955
email: info@gecinstruments.com
www.gecinstruments.com
(Engineering consulting)

Nojoxten
Sta. Martha No.276-A Col. Sta.
Margarita C.P.45140
Zapopan, Jalisco, Mexico
Phone (33)3833-1999
Fax (33)3633-9380
www.nojoxten.com.mx

North Bay Produce, Inc.
10a Calle 1-4, Zona 9
Guatemala, Guat.
Phone: (502-2) 342-295 or 6
Fax: (502-2) 344-974
email: marketing@northbayproduce.com
www.northbayproduce.com
(Legal and technical advice)

Societe d'Entretien & d'Installation (SODEIN)
Route de Carrefour #83
(P.O. Box 995)
Port-au-Prince, Haiti
(Installation of temperature recording equipment, especially the Chessel 346)

Curtains (air, safeguarding)

W.W. Granger, Inc.
Branch offices in many cities.
www.grainger.com

Digital Thermister Instrument (hand-held for hot water immersion treatments) and Portable Sensors (used in Performance Test)

Allied Electronics
15721 NW 60th Avenue
Miami Lakes, FL 33014
Phone: (305) 558-2511
Fax: (305) 558-1130
(Additional sales outlets in other cities) (Instruments include Cooper Instrument Corp's Model TM99A, and. Thermister sensors with submersible 10 or 20 ft. cord,
Catalog No. 2010.)

Cooper Instrument Corp.
33 Reeds Gap Road
Middlefield, CT 06455
Phone: (860) 347-2256
Fax: (860) 347-5135
www.cooperinstrument.com
(Note: This company manufactures the Cooper instruments sold by Allied Electronics, but does not sell directly to retail customers.)

Drierite® (anhydrous calcium sulfate)

Sigma-Aldrich Chemical Company, Inc.
6000 North Teutonia Avenue
Milwaukee, WI 53209
Phone: (800) 771-6737 or (414) 438-3850
Fax: (800) 962-9591
www.sigmaaldrich.com

Fisher Scientific
2000 Park Lane Drive
Pittsburgh, PA 15275
Phone: (800) 766- 7000
Fax: (800) 926-1166
www.fishersci.com

W. A. Hammond Drierite Co. (Manufacturer)
138 Dayton Avenue
Xenia, OH 45385
Phone: (937) 376-2927
Fax: (937) 376-1977
email: drierite@aol.com
www.drierite.com

Exhaust Duct (Tube), Flexible

Stock sizes available in diameters of 12, 16, and 24 inches. Available in 10 and 20 feet lengths, which may be attached by a ring coupling.

Gaskets, Inc.
301 W. Highway 16
Rio, WI 53960
Phone: (800) 558-1833 or (920) 992-3137
Fax: (920) 992-3124
email: info@gasketsinc.com
www.gasketsinc.com

Super Vacuum Manufacturing Company, Inc.
P.O. Box 87
Loveland, CO 80539-0087
Phone: (800) 525-5224
Fax: (970) 667-4296
email: info@supervac.com
www.supervac.com

Fans

Pest Fog, Inc.
1424 Bonita
P.O. Box 3703
Corpus Christi, TX 78463
Phone: (800) 395-2345 or (361) 884-8214
Fax: (361) 884-5903
email: info@pestfog.com
www.pestfog.com
(18-inch fumigation fan)

Super Vacuum Manufacturing Company, Inc.
P.O. Box 87
Loveland, CO 80539-0087
Phone: (800) 525-5224
Fax: (970) 667-4296
email: info@supervac.com
www.supervac.com
For use in a chamber or under tarpaulin, or during exhaust. Specify blade size, horsepower, and CFM.

Fruit Crates (Plastic for hot water immersion treatments)

No listings

Fruit Sizing Equipment (Automatic)

Hortagro International, b.v.
P.O. Box: 4050
8901 EB Leeuwarden
Holland
Phone: 31-58-21-23-795
Fax: 31-58-21-25-344
www.hortagro.nl
(Mechanical weight sizer with conveyor belt)

Kerian Machines, Inc.
1709 Highway 81 South
P.O. Box 311
Grafton, ND 58237
Phone: (701) 352-0480
Fax: (701) 352-3776
email: sales@kerianmachines.com
www.kerianmachines.com
(Roller type of sizing equipment)

Fumigation Chamber, NAP

(large fumigation chambers must be custom built by engineering contractors)

Fruit Technologies
Walla Walla & Wenatchee, WA
Phone: (509) 662-0700
Fax: (509) 664-3743

Fumigation Chamber, Vacuum

CosMed Group
28 Narragansett Avenue
Jamestown, RI 02835
Phone: (401) 423-2003
www.cosmedgroup.com

The following three companies (BQA, ETO, and SFS) are subsidiaries of the CosMed Group and are listed as treatment facilities on .www.cosmedgroup.com.

Baltimore Quality Associates (BQA)
4200 Boston Street
Baltimore, MD 21224
Phone: (410) 327-0916
www.cosmedgroup.com

ETO Sterilization (ETO)
2500 Brunswick Avenue
Linden, NJ 07036-2432
Phone: (908) 862-7077
www.cosmedgroup.com

Sterilization and Fumigation Services (SFS)
3500 Shiells Road
Newman, CA 95360
Phone: (209) 862-4074
www.cosmedgroup.com

Slack Associates, Inc.
540 South Longwood Street
Baltimore, MD 21223
Phone: (410) 566-2520
email: slackinc@us.net or slackinc@comcast.net

Vacudyne, Inc.
375 East Joe Orr Road
Chicago Heights, IL 60411
Phone: (800) 459-9591 or (708) 757-5200
www.vacudyne.com

Fumigators, Commercial

See listings in local telephone directories (yellow pages) under the heading "Pest Control Services."

Fungicides

(Bordeaux Mixture (hydrated lime + copper sulfate)

Chemtura Corporation
199 Benson Road
Middlebury, CT 06749
Phone: (203) 573-2000
www.chemtura.com
Product name: Nutra-Spray
Captan

Crystal Chemical Inter-America
6800 SW. 40th Street, Suite 499
Miami, FL 33155-3708
Phone: (305) 971-4753
Product name: Captanex

Drexel Chemical Co.
P.O. Box 13327
Memphis, TN 38113-0327
Phone: (901) 774-4370
Fax: (901) 774-4666
email: mstewart@drexchem.com
www.drexchem.com
Product name: Drexel Captan

Syngenta
1800 Concord Pike
P.O. Box 8353
Wilmington, DE 19803
Phone: (800) 759-4500 or (302) 425-2000
www.syngenta-us.com

Ferbam

Cytec Industries, Inc.
5 Garrett Mountain Plaza
West Patterson, NJ 07424
Phone: (800) 652-6013 or (973) 357-3100
email: custinfo@cytec.com
www.cytec.com
Product names: Carbamate WDG, Ferbam 76 WDG, Ferbam Granuflo

FMC Agricultural Products
Chemical Group
1735 Market Street
Philadelphia, PA 19103
Phone: (800) 845-0187 or (215) 299-6000
Fax: (215) 299-5998
www.fmccrop.com
Product Name: Carbamate

Mancozeb

Arkema, Inc.
2000 Market Street
Philadelphia, PA 19103-3222
Phone: (215) 419-7000
www.arkema-inc.com
Product name: Penncozeb 80 WP

Rohm and Haas
100 Independence Mall West
Philadelphia, PA 19106
Phone: (877) 288-5881
www.rohmhaas.com
Product name; Dithane

Thiram

Bayer CropScience LP
P.O. Box 12014
2 T.W. Alexander Drive
Research Triangle Park, NC 27709
Phone: (919) 549-2000
Fax: (919)949-3959
www.bayercropscience.com
Product Names: Cuprothex Super Mix

Cytec Industries, Inc.
5 Garrett Mountain Plaza
West Patterson, NJ 07424
Phone: (800) 652-6013 or (973) 357-3100
email: custinfo@cytec.com
www.cytec.com
Product Names: Tech TMTD, Thianosan, THiLor, Thipel, Thiram
Granuflo, Thiram 65, Thiram 75-WDG
Zineb

Gas Analyzers

Analytical Technology, Inc.
6 Iron Bridge Drive
Collegeville, PA 19426
Phone: (800) 959-0299 or (610) 917-0991
Fax: (610) 917-0992
email: sales@analyticaltechnology.com
www.analyticaltechnology.com
(Porta-Sens Phosphine Detector)

Interscan Corporation
P.O. Box 2496
Chatsworth, CA 91313
Phone: (800) 458-6153 or (818) 882-2331
Fax: (818) 341-0642
email: info@gasdetection.com
www.gasdetection.com
(Interscan Model GF 1900 pyrolysis unit, sensitive to SF at 0–50 ppm.)

Key Chemical and Equipment Co., Inc.
13195 49th Street North, Unit A
Clearwater, FL 33762
Phone: (727) 572-1159
Fax: (727) 572-4595
www.fumiscope.com
(Fumiscope, Model D)

Neal Systems, Inc.
122 Terry Drive
Newtown, PA 18940
Phone: (215) 968-7577
Fax: (215) 968-6480
email: sales@nealsystems.com
www.nealsystems.com
(Porta-Sens Phosphine Detector)

Pest Fog, Inc.
1424 Bonita
P.O. Box 3703
Corpus Christi, TX 78463
Phone: (800) 395-2345 or (361) 884-8214
Fax: (361) 884-5903
email: info@pestfog.com
www.pestfog.com

Spectros Instruments, Inc.
4 Evergreen Lane
Hopedale, MA 01747
Phone: (508) 478-1648
FAX: (508) 590-0262
www.spectrosinstruments.com

Gas Detector Tube (colorimetric) and Apparatus

APHIS/NOAA Centralized Warehouse
(must order by Fedstrip procedure)
FTS: 758-6222 (Draeger tubes)

Draeger Safety, Inc.
101 Technology Drive
Pittsburgh, PA 15275-1057
Phone: (800) 858-1737 or (412) 787-8383
Fax: (412) 787-2207
email: prodinfo@draeger.com
www.draeger.com
(Draeger tubes)

Lab Safety Supply
P.O. Box 1368
Janesville, WI 53547-1368
Phone: (800) 356-0783
Fax: (800) 543-9910
www.labsafety.com
(Draeger tubes)

Matheson Tri-Gas
603 Heron Drive
Bridgeport, NJ 08014
Phone: (201) 933-2401
Fax: (856) 467-3415
email: tbriggs@matheson-trigas.com
www.matheson-trigas.com
(Kitagawa tubes)

Pest Fog, Inc.
1424 Bonita
P.O. Box 3703
Corpus Christi, TX 78463
Phone: (800) 395-2345 or (361) 884-8214
Fax: (361) 884-5903
email: info@pestfog.com
www.pestfog.com

Protech Safety Equipment
37 East 21st Street
P.O. Box 455
Linden, NJ 07036
Phone: (908) 862-1550
Fax: (908) 862-4436
(Draeger tubes)

Sensidyne, LP
16333 Bay Vista Drive
Clearwater, FL 33760
Phone: (800) 451-9444 or (727) 530-3602
Fax: (727) 539-0550
email: info@sensidyne.com
www.sensidyne.com
(Sensidyne/Gastec tubes and apparatus)

SKC, Inc.
863 Valley View Road
Eighty Four, PA 15330
Phone: (800) 752-8472 or (724) 941-9701
Fax: (724) 941-1369
email: skcinc@skcinc.com
www.skcinc.com

Union Carbide Corp, Linde Div.
National Specialty Gases Office
40 Veronica Avenue
Somerset, NJ 08873-3498
tel (732) 937-4900
(Sensidyne/Gastec tubes and apparatus)

Gas Drying Tube (for Drierite®)

Wilmad-LabGlass
1002 Harding Hwy.
P.O. Box 688
Buena, NJ 08310
Phone: (800) 220-5171 or (856) 697-3000
Fax: (856) 697-0536
www.wilmad-labglass.com
(glass tube) – Catalog # 301-7501

Germicides/Disinfectants

Georgia-Pacific Corp.
300 W. Laurel Street
Bellingham, WA 98225
Phone: (360) 733-4410
Fax: (206) 676-7247
www.gp.com
Product: Formaldehyde
Order from GSA
(NSN 6810-00-664-7121 or
NSN 6810-00-664-0402)
Product: Soda Ash
Order from GSA
(NSN 6810-00-270-8177)
Product: Sodium Hydroxide
Order from GSA (NSN 6810-00-281-254 or NSN 6810-00-240-2121)
Product: Sodium Hypochlorite
Available from APHIS-VS
Product: Sodium Orthophenate
(Also available as bleach in almost all grocery stores. Trade names include Clorox and others.)

Halide Gas Leak Detector (removed)

Incinerators

Whitton Technology, Inc.
Air Burners Products Div.
4390 Cargo Way
Palm City, FL 34990
Phone: (561) 220-7303
Fax: (561) 220-7302
e-mail: info@airburners.com
www.airburners.com
(Air Curtain Incinerators)

Magnesium Phosphide

Degesch America, Inc.
P.O. Box 116
Weyers Cave, VA 24486
Phone: (800) 330-2525 or (540) 234-9281
Fax: (540) 234-8225
www.degeschamerica.com

Fumigation Service & Supply, Inc.
16950 Westfield Park Road
Westfield, IN 46074
Phone: (800) 992-1991 or (317) 896-9300
FAX: (317) 867-5757
email: info@fumigationzone.com
www.fumigationzone.com

Helena Chemical Co.
225 Schilling Blvd., Suite 300
Collierville, TN 38017
Phone: (901) 761-0050
www.helenachemical.com

Marman USA, Inc.
500 Bayshore Blvd.
Tampa, FL 33601
Phone: (813) 286-2503
email: tmg@marmanusa.com
www.marmanusa.com

Manometer (used in pressure leakage test)

Alnor Instruments
500 Cardigan Road
Shoreview, MN 55126
Phone: (800) 874-2811 or (651) 490-2811
Fax: (651) 490-3824
www.tsi.com/en-1033/categories/alnor_instruments.aspx
Model 530 (1–10 inches of water) (electronic)

Davis Calibration
1946 Greenspring Drive, Suite A
Timonium, MD 21093
Phone: (410) 842-1000
Fax: (410) 842-1003
email: tthompson@daviscalibration.com
www.daviscalibration.com
(U-tube or electronic)

Dwyer Instruments, Inc.
102 Indiana Highway 212
Michigan City, IN 46360
Phone: (800) 872-9141 or (219) 879-8000
Fax: (219) 872-9057
www.dwyer-inst.com
(flex-tube type)

Fisher Scientific
2000 Park Lane Drive
Pittsburgh, PA 15275
Phone: (800) 766- 7000
Fax: (800) 926-1166
www.fishersci.com
(tube or electronic)

Zellweger Analytics
Neotronics Sieger Solomat Division
4331 Thurmond Tanner Road
P.O. Box 2100
Flowery Branch, GA 30542
Phone: (770) 967-2196
Fax: (770) 967-1854
www.zelana.com
Model No. 530 (0–19.99 inches of water)

Metam-sodium

Amvac Chemical Corp.
4100 East Washington Blvd.
Los Angeles, CA 90023
Phone: (888) 462-6822 or (323) 264-3910
Fax: (323) 728-7863
www.american-vanguard.com

Methyl Bromide, 100%

Ameribrom, Inc.
622 Emerson Road, Suite 500
St. Louis, MO 63141
Phone: (877) 661-4272
Fax: (314) 983-7610
www.ameribrom.com

Biesterfeld U.S., Inc.
200 Madison Avenue
New York, NY 10016
Phone: (212) 689-6610
(resmethrin)
http://www.biesterfeld.com/index.php?lang=EN&area=home&page=root

Chemtura Corp.
1801 Hwy. 52 W.
West Lafayette, IN 47906
Phone: (800) 428-7947 or (765) 497-6100)
www.chemtura.com

Degesch America, Inc.
Houston Division
P.O. Box 451036
Houston, TX 77245
Phone: (713) 433-4777
Fax: (713) 433-0877
www.degeschamerica.com

Fumigation Service & Supply, Inc.
16950 Westfield Park Road
Westfield, IN 46074
Phone: (800) 992-1991 or (317) 896-9300
FAX: (317) 867-5757
email: info@fumigationzone.com
www.fumigationzone.com

Helena Chemical Co.
225 Schilling Blvd., Suite 300
Collierville, TN 38017
Phone: (901) 761-0050
www.helenachemical.com

ICD Metals Group, LLC
600 Madison Avenue
New York, NY 10022
Phone: (212) 644-1500
Fax: (212) 644-1480
email: info@icdmetals.com
www.icdmetals.com

Marman USA Inc.
500 Bayshore Blvd.
Tampa, FL 33601
Phone: (813) 286-2503
email: tmg@marmanusa.com
www.marmanusa.com

Pest Fog, Inc.
1424 Bonita
P.O. Box 3703
Corpus Christi, TX 78463
Phone: (800) 395-2345 or (361) 884-8214
Fax: (361) 884-5903
email: info@pestfog.com
www.pestfog.com

Pestcon Systems, Inc.
1808 Firestone Parkway
Wilson, NC 27893-7991
Phone: (800) 548-2778
Fax: (252) 243-1832
email: info@pestcon.com
www.pestcon.com

Southern Agricultural Insecticides Inc.
P.O. Box 218
Palmetto, FL 34220
Phone: (941) 722-3285
Fax: (941) 723-2974
e-mail: sales@southernag.com
www.southernag.com

Southern Mill Creek Products Co., Inc.
5441 N. 59th Street
Tampa, FL 33610
Phone: (800) 422-9557
www.smcpoh.com

Methyl Bromide—Recapture

TIGG Corporation
1 Willow Avenue
Oakdale, PA 15071
tel (724) 703-3020
fax (724)703-3026
Toll Free: 800-925-0011
web site: Chemtura Recapturing System.

Moisture Meter (for wood)

Delmhorst Instrument Company
51 Indian Lane East
Towaco, NJ 07082
Phone: (877)-DELMHORST or (973) 334-2557
Fax: (973) 334-2657
e-mail: info@delmhorst.com
www.delmhorst.com
Order: Moisture Meter G30
Electrode 26ES
Type 496 pin
Above comes as package in carrying case.

Lignomat USA Ltd.
14345 NE Morris Court
Portland, OR 97230
Phone: (800) 227-2105
email: sales@lignomat.com
www.lignomat.com

Newsletters and Trade Journals

(containing articles on fumigation)

Fumigants and Pheromones
(free newsletter)
Fumigation Service & Supply, Inc.
16950 Westfield Park Road
Westfield, IN 46074-9374
Phone: (317) 896-9300
email: insectslimited@aol.com
www.fumigationzone.com
www.insectslimited.com

Pest Control Technology
(monthly for professional pest control operators)
4020 Kinross Lakes Parkway, Suite 201
Richfield, OH 44286
Phone: (800) 456-0707
Fax: (330) 659-0823
www.pctonline.com

Pest Management Professional
(monthly for professional pest control operators)
Questex Media Group, Inc.
600 Superior Avenue East, Suite 1100
Cleveland, OH 44114
Customer Service Mailing Address:
Pest Management Monthly
P.O. Box 1268
Skokie, IL 60076-8268
Phone: (847) 763-9594
email: pestmanagement@halldata.com
www.mypmp.net

Personal Air Sample Pump

Important

This equipment is not for routine use at ports.

Anatole J. Sipin Co., Inc.
505 8th Avenue
New York, NY 10018-6505
Phone: (212) 695-5916
Fax: (212) 695-5706
(Model SP-15 wide range personal sampler, pump, with charcoal tube inserts)

Georgia Steel & Chemical Company, Inc.
10810 Guilford Road, Suite 205
Annapolis Junction, MD 20701
Phone: (800) 296-0351 or (301) 317-5502
Fax: (301) 470-6313
email: info@georgiasteelco.com
www.georgiasteelco.com
(Clean-Gear, Breathing Mask Cleaning Towelette

Mine Safety Appliances Company (MSA)
P.O. Box 426
600 Penn Center Boulevard
Pittsburgh, PA 15230
www.msanorthamerica.com/overview.html
(Cleaner-Sanitizer II, part no. 34337)

Spectrex Corp.
3580 Haven Avenue
Redwood City, CA 94063
Phone: (800) 822-3940 or (650) 365-6567
Fax: (650) 365-5845
email: info@spectrex.com
www.spectrex.com
Quaternary Ammonium

Photo Ionization Detector

Mine Safety and Appliance
MSA World Headquarters
Customer Service Center
P.O. Box 426
Pittsburg, PA 15230
1-800-MSA-2222

Sirius Multigas Detector

http://www.msanorthamerica.com/

Rae Systems
3775 North First Street
San Jose, CA 95134
408-952-8200

MiniRAE 2000

http://www.raesystems.com/products/minirae_2000

Safety Equipment

United States Plastic Corporation
1390 Neubrecht Road
Lima, OH 45801-3196
Phone: (800) 809-4217
Fax: (800) 854-5498
email: usp@usplastic.com
www.usplastic.com
(Safety guards for belt and chain drives; fan guards; fire extinguishers; safety equipment in general).

Scale (portable platform type)

(for weighing gas cylinders) (in addition to the following, also see Yellow Pages)

Arlington Scale Co., Inc.
38 Davey Street
Bloomfield, NJ 07003
Phone: (978) 748-8000
Fax: (978) 748-8035
www.arlingtonscale.com

Atlantic Scale Co., Inc.
136 Washington Avenue
Nutley, NJ 07110
Phone: (973) 661-7090
Fax: (973) 661-3651
www.atlanticscale.com
(see website for other locations in Hicksville, NY and Yonkers, NY)

Eastern Scale of NJ
1053 Pennsylvania Avenue
Linden, NJ 07036-2240
Phone: (732) 381-8007

Phifer Incorporated
P.O. Box 1700
Tuscaloosa, AL 35403-1700
Phone: (205) 345-2120
Fax: (205) 759-4450
email: info@phifer.com
www.phifer.com
(Fiberglass insect screening of various mesh sizes and colors)

Sealing Tape

Degesch America, Inc.
Houston Division
P.O. Box 451036
Houston, TX 77245
Phone: (713) 433-4777
Fax: (713) 433-0877
www.degeschamerica.com

Fumigation Service & Supply, Inc.
16950 Westfield Park Road
Westfield, IN 46074
Phone: (800) 992-1991 or (317) 896-9300
FAX: (317) 867-5757
email: info@fumigationzone.com
www.fumigationzone.com
(ARMAK sealing tape)

Self-Contained Breathing Apparatus (SCBA)

AVOX Systems (Aviation Oxygen Products and Services)
(formerly Scott Aviation)
225 Erie Street
Lancaster, NY 14086-9502
Phone: (716) 683-5100
Fax: (716) 681-1089
email: customerservice.avox@zodiacaerospace.com
www.avoxsys.com
Scott Air-Pak 11a (#900,000)
Presur-Pak 11a (#900,014)
Scott Air-Pak 4.5 (#900,450)
Presur-Pak (#900,455)

Cesco
PO Box 970
35 Grace Drive
Powell, OH 43065
Phone: (800) 642-7698 or (614) 846-4733
Fax: (614) 846-0864
email: sales@cesco1.com
www.cesco1.com

Draeger Safety, Inc.
101 Technology Drive
Pittsburgh, PA 15275-1057
Phone: (800) 858-1737 or (412) 787-8383
Fax: (412) 787-2207
email: prodinfo@draeger.com
www.draeger.com

Georgia Steel & Chemical Company, Inc.
10810 Guilford Road
Annapolis Junction, MD 20701
Phone: (800) 296-0351 or (301) 317-5502
Fax: (301) 470-6313
email: info@georgiasteelco.com
www.georgiasteelco.com
(CLEAN-GEAR, Breathing mask cleaning towelette)

Lab Safety Supply
P.O. Box 1368
Janesville, WI 53547-1368
Phone: (800) 356-0783
Fax: (800) 543-9910
www.labsafety.com

Mine Safety Appliances Co. (MSA)
P.O. Box 426
600 Penn Center Boulevard
Pittsburgh, PA 15230
www.msanorthamerica.com/overview.html

Pest Fog, Inc.
1424 Bonita
P.O. Box 3703
Corpus Christi, TX 78463
Phone: (800) 395-2345 or (361) 884-8214
Fax: (361) 884-5903
email: info@pestfog.com
www.pestfog.com

Survivair
3001 South Susan Street
Santa Ana, CA 92704
Phone: (800) 821-7236
Fax: (800) 201-4407
www.survivair.com

Smoking Candle

(Used in pressure leakage test. Candles of various sizes.)

Purchase only candles that emit white smoke. If candles that emit colored smoke are used, their residue will stain the interior walls of the fumigation chamber, skin, and clothing. Store candles in a dry, cool place.

Davis Calibration
1946 Greenspring Drive, Suite A
Timonium, MD 21093
Phone: (410) 842-1000
Fax: (410) 842-1003
email: tthompson@daviscalibration.com
www.daviscalibration.com

Superior Signal Co., Inc.
P.O. Box 96
Spotswood, NJ 08884
Phone: (800) 345-8378 or (732) 251-0800
Fax: (732) 251-9442
www.superiorsignal.com

Snakes (sand snakes, watersnakes)

Fumigation Service & Supply, Inc.
16950 Westfield Park Road
Westfield, IN 46074
Phone: (800) 992-1991 or (317) 896-9300
FAX: (317) 867-5757
email: info@fumigationzone.com
www.fumigationzone.com

Pest Fog, Inc.
1424 Bonita
P.O. Box 3703
Corpus Christi, TX 78463
Phone: (800) 395-2345 or (361) 884-8214
Fax: (361) 884-5903
email: info@pestfog.com
www.pestfog.com

Soil Fumigants

(Metam-sodium, Vapam, etc.)

Buckman Laboratories International Inc.
1256 North McLean Boulevard
Memphis, TN 38108-1241
Phone: (901) 278-0330
Fax: (901) 276-5343
email: knetix@buckman.com
www.buckman.com
Product name: Busan 1020

Cytec Industries, Inc.
5 Garrett Mountain Plaza
West Patterson, NJ 07424
Phone: (800) 652-6013 or (973) 357-3100
email: custinfo@cytec.com
www.cytec.com
Products: Metam 32.7, Metam 42, Ucetam

OR-CAL, Inc.
29454 Meadowview Road
Junction City, OR 97448
Phone: (800) 237-2367 or (541) 689-4413
Fax: (541) 689-5026
email: orcal@orcalinc.com
www.orcalinc.com
Product name: Sectagon

Syngenta
1800 Concord Pike
P.O. Box 8353
Wilmington, DE 19803
Phone: (800) 759-4500 or (302) 425-2000
www.syngenta-us.com
Product name: Vapam

Spill Recovery Materials

(products to absorb spills of hazardous materials)

Ansul
One Stanton Street
Marinette, WI 54143
Phone: (715) 735-7411
Fax: (800) 543-9822
www.ansul.com
(Product: Spill-X)

Fumigation Service & Supply, Inc.
16950 Westfield Park Road
Westfield, IN 46074
Phone: (800) 992-1991 or (317) 896-9300
FAX: (317) 867-5757
email: info@fumigationzone.com
www.fumigationzone.com

New Pig Corp.
One Pork Avenue
P.O. Box 304
Tipton, PA 16684-0304
Phone: (800) 468-4647
Fax: (800) 621-7447
email: hothogs@newpig.com
www.newpig.com

WYK Sorbents, LLC
10715 Kahlmeyer Drive
St. Louis, MO 63132
Phone: (800) 248-7007 or (314) 426-3336
Fax: (314) 426-0145
email: sales@wyksorbents.com
www.uprightinc.com
(Product: absorbant pillows and socks) (Free samples available)

Steam Boilers (For hot water immersion treatment)

Fulton Boiler Works, Inc.
3981 Port Street
Pulaski, NY 13142
Phone: (315) 298-5121
Fax: (315) 298-6390
www.fulton.com
(oil-fired, gas-fired, or combination)

Steam Generators

Sioux Corporation
One Sioux Plaza
Beresford, SD 57004
Phone: (888) 763-8833 or (605) 763-3333
Fax: (605) 763-3334
e-mail: email@sioux.com
www.sioux.com

Steam Sterilizers/Autoclaves

Environmental Tectonics Corporation
125 James Way
Southhampton, PA 18966
Phone: (215) 355-9100
www.etcusa.com

Sulfuryl Fluoride (Vikane)

Dow AgroSciences LLC
9330 Zionsville Road
Indianapolis, IN 46268
Phone: (800) 992-5994 or (317) 337-3000
www.dowagro.com

Marman USA, Inc.
500 Bayshore Blvd.
Tampa, FL 33601
Phone: (813) 286-2503
email: tmg@marmanusa.com
www.marmanusa.com

Pest Fog, Inc.
1424 Bonita
P.O. Box 3703
Corpus Christi, TX 78463
Phone: (800) 395-2345 or (361) 884-8214
Fax: (361) 884-5903
email: info@pestfog.com
www.pestfog.com

Southern Agricultural Insecticides Inc.
P.O. Box 218
Palmetto, FL 34221
Phone: (941) 722-3285
Fax: (941) 723-2974
email: sales@southernag.com
www.sothernag.com

Southern Mill Creek Products, Co., Inc.
5441 North 59th Street
Tampa, FL 33610
Phone: (800) 422-9557 or (813) 635-0707
Fax: (813) 630-9536
email: SMCTampa@smcpoh.com
www.smcpoh.com

Supplied-Air Respirators

AVOX Systems (Aviation Oxygen Products and Services)
(formerly Scott Aviation)
225 Erie Street
Lancaster, NY 14086-9502
Phone: (716) 683-5100
Fax: (716) 681-1089
email: customerservice.avox@zodiacaerospace.com
www.avoxsys.com
Scott #900,034 Supplied Airline respirator with self-contained air supply
Scott #801, 548 Type C Supplied-air pressure demand respirator

Draeger Safety, Inc.
101 Technology Drive
Pittsburgh, PA 15275-1057
Phone: (800) 858-1737 or (412) 787-8383
Fax: (412) 787-2207
email: prodinfo@draeger.com
www.draeger.com
(Airline respirator)

Mine Safety Appliances Co (MSA).
P.O. Box 426
600 Penn Center Boulevard
Pittsburgh, PA 15230
www.msanorthamerica.com/overview.html
(Airline respirator)

3M Occupational Health & Environmental Safety
3M Corporate Headquarters
3M Center
St. Paul, MN 55144-1000
Phone: (888) 364-3577
http://solutions.3m.com/en_US/
3M #W-2804 pesticide helmet and other Whitecap systems

Tarpaulins (made to order)

Tarpaulins for fumigation are made by many companies. Consult the Yellow Pages.

Elastec/American Marine
1309 West Main
Carmi, IL 62821
Phone: (618) 382-2525
Fax: (618) 382-3610
also located at:
401 Shearer Blvd
Cocoa, FL 32922
Phone: (321) 636-5783
email: elastec@elastec.com
www.elastec.com

Poly-Flex, Inc.
2000 West Marshall Drive
Grand Prairie, TX 75051
Phone: (888) 765-9359
Fax: (972) 337-8269
www.poly-flex.com

Raven Industries
P.O. Box 5107
Sioux Falls, SD 57117-5107
Phone: (605) 336-2750
email: raveninfo@ravenind.com
www.ravenind.com

Reef Industries, Inc. (Griffolyn Division)
9209 Almeda Genoa
Houston, TX 77075
Phone: (800) 231-6074 or (713) 507-4250
Fax: (713) 507-4295
email: ri@reefindustries.com
http://www.reefindustries.com/division.php?div=1
Inflatable tarpaulin: see “Bubble Fumigation System”

Temperature Recorders and Sensors - General Use

Cole-Parmer
625 East Bunker Court
Vernon Hills, IL 60061
Phone: (800) 323-4340
Fax: (847) 247-2929
email: info@coleparmer.com
www.coleparmer.com

GEC Instruments
5530 NW 97th Street
Gainesville, FL 32653
Phone: (352) 373-7955
email: info@gecinstruments.com
www.gecinstruments.com
(Model S16TC Type T Thermocouple)
(Model S4TC Type T Thermocouple)

MadgeTech, Inc.
879 Maple Street
Contoocook, NH 03229 or
P.O. Box 50
Warner, NH 03278
Phone: (603) 456-2011
FAX: (603) 456-2012
email: info@madgetech.com
www.madgetech.com
(Model: HITEMP 150A)

Mesa Laboratories, Inc.
Data Trace Division
12100 West 6th Avenue
Lakewood, CO 80228
Phone: (800) 525-1215 or (303) 987-8000
FAX: (303) 987-8989
email: Technical Support and Service: datatracetechnical@mesalabs.com
datatraceservice@mesalabs.com
email: Product Sales and Customer Service: datatracesales@mesalabs.com
www.mesalabs.com
Models: Data Tracers, STO, LTO, and Micropack III

Nanmac Corporation
9-11 Mayhew Street
Framingham, MA 01702-2400
Phone: (800) 786-4669
Fax: (508) 879-5450
www.nanmac.com

National Instruments
11500 N. Mopac Expressway
Austin, TX 78759-3504
Phone: (800) 531-5066
Fax: (512) 68-8411
www.ni.com

Nordic Sensors Industrial, Inc. (NSI)
6860 Louis-Sicard
Montreal, Quebec
Canada H1P 1T7
Phone: (888) 667-3421
Fax: (888) 867-9986
email: info@nordicsensors.com
www.nordicsensors.com

Omega Engineering Inc.
P.O. Box 4047
One Omega Drive
Stamford, CT 06907-0047
Phone: (800) 848-4286 or (203) 359-1660
Fax: (203) 359-7700
email: info@omega.com
www.omega.com

Temperature Recorders (Portable Type) for Cold Treatment in Self-regulated Containers

Controlyne, Inc.
14 Highpoint
Cedar Grove, NJ 07009
Phone: (800) 766-5737 or (973) 819-7816
Fax: (973) 857-3014
email: m.degan@verizon.net
(ACR SmartReader 8 Logger)

DeltaTRAK, Inc.
P.O. Box 398
Pleasanton, CA 94566
Phone: (800) 962-6776 or (925) 249-2250
Fax: (925) 249-2251
email: salesinfo@deltatrak.com
www.deltatrak.com
(DeltaTrak T-8, DeltaTrak CDX-100, CDX-300, CDX-22000)

GE Sensing (formerly Kaye Instruments)
1100 Technology Park Drive
Billerica, MA 01821
Phone: (978) 437-1000
Fax: (978) 437-1021
email: sensing@ge.com
www.kayeinstruments.com
(Model DR-2B Digistrip II

International Reactor Corporation
521 Kiser Street
Dayton, OH 45404-1641
Tel. (937) 224-4444
Fax (937) 224-4434
email: sales@irc-reactors.com
www.ifs-frp.com/irc-web
(Grant Squirrel Meter/Logger)

Metrosonics, Inc.
1060 Corporate Center Drive
Oconomowoc, WI 53066
Phone: (800) 245-0779 or (262) 567-9157
Fax (262) 567-4047
email: quest.mail@mmm.com
www.metrosonics.com
(DocuTemp 714A)

Remonsys Limited
The Stables, Church Hanborough
Witney, Oxfordshire OX29 8AB
United Kingdom
Phone and Fax: +44 (0)1993 886996
email: info@remonsys.com
www.remonsys.com
(Autolog Time/Temperature Monitor,
AUTOLOG 2000 Data Logger)

Sensitech, Inc.
800 Cummings Center, Suite 258X
Beverly, MA 01915-6197
Phone: (800) 843-8367 or (978) 927-7033
Fax: (978) 921-2112
www.sensitech.com
(Data Mentor, RTM 2000 CTU)

Wescor Environmental
P. 0. Box 361
Logan, UT 84323-0361
Phone: (435) 752-6011 ext. 1310
Fax: (435) 753-6756
email: enviro@wescor.com
www.wescor.com
(Datapod)

Temperature Recorders (Built-in Type) for Cold Treatment in Self-Regulated Containers

Carrier Transicold Division
Carrier Corporation
United Technologies
P. 0. Box 4808, Carrier Parkway
Syracuse, NY 13221-4808
Phone: (800) 227-7437
Fax: (315) 432-6620
http://www.corp.carrier.com/www/v/index.jsp?vgnextoid=76a61d6b31c08010VgnVCM100000cb890b80RCRD
(Micro Link 2 DataCorder, Micro Link 2i Controller/DataCorder, Micro Link 3 DataCorder, 69NT40-541, 69NT40-551, and 69NT20-551)

Daikin Industries Ltd.
Umeda Center Building, 2-4-12
Nakazaki-Nishi, Kita-ku, Osaka,
530-8323, Japan
Phone: 81-6-6373-4312
Fax: 81-6-6373-4380
www.daikin.com
(Decos III Microproc. Temp Controller, Decos III A, Decos III B, Decos III C, and Decos IIID)

Klinge Corporation
4075 E. Market Street
York, PA 17402
Phone: (717) 840-4500
Fax: (717) 840-4501
email: info@klingecorp.com
www.klingecorp.com
(ThermLogger II)

Matrix Dynamics
501 Doylestown Road
Lansdale, PA 19446
tel (215) 393-9780
fax (215) 393-9783
(Road Warrior 1, HACCP Warrior)

Mitsubishi Heavy Industries
3-1, Asahi, Nishi-biwajima-cho, kiyosu,
Aichi Prefecture, 452-8561, Japan
Phone: 81-52-503-9200
Fax: 81-52-503-3533
www.mhi.co.jp
(MMCCIII & MMCC IIIA, MMCC IIIA-47B)

Thermo King Corporation
314 West 90th Street
Minneapolis, MN 55420
Phone: (888) 887-2202 or (952) 887-2200
Fax: (952) 887-2615
www.thermoking.com
(Thermoguard PA Microprocessor Temperature Controller,
MP-D Microprocessor Controller, Thermoguard PA+ Microprocessor
Controllers)(MP-2000, MP-3000)

Temperature Recorders (Portable Type) for Cold Treatment in Warehouses

Evidencia LLP
505 Tennessee St., Ste. 502
Memphis, Tennessee 38103
Phone: (901)529-9163
Fax: (901)529-9197
www.evidencia.biz

ThermAssureRF, ThermProbeRF

Temperature Recorders for Hot Water Immersion Treatment

Agri Machinery, Inc.
3489 All American Boulevard
Orlando, FL 32810
Phone: (407) 299-1592
Fax: (407) 299-1489
email: info@agrimachinery.com
www.agrimachinery.com
(Honeywell strip chart recorders)

Conax Technologies
2300 Walden Avenue
Buffalo, NY 14225
Phone: (800) 223-2389 or (716) 684-4500
Fax: (716) 684-7433
e-mail: conax@conaxtechnologies.com
www.conaxtechnologies.com

Contech
Avenida Circunvalacion #1590
Jardines del Country, C.P. 44210
Guadalajara, Jalisco
Mexico
tel (523) 823-2831
fax (523) 823-2831
(contech data logger)

Electro Scientific Industries, Inc.
13900 Science Park Drive
Portland, OR 97229
Phone: (503) 641-4141
www.elcsci.com
(Dekabox Delade Resister instrument, Model No. DB62, which may be used in the calibration of RTD sensors)

Enterprise S.A. de C.V.
Rodriguez Saro 424
Colonia del Valle
03100 Mexico D.F.
Mexico
tel (905) 534-6028
fax (905) 524-6426
(Honeywell and Molytek 2702 temperature recorders)

Equipos Industriales Guadalajara
Aguador No. 3959-A
Int. 5 Fracc. La Calma
C.P. 45070, Zapopan, Jalisco
Mexico
tel (52-3) 634-52-64
fax (52-3) 632-35-20
(Honeywell instruments)

Eurotherm Chessell
741-F Miller Drive
Leesburg, VA 20175-8993
Phone: (703) 443-0000
Fax: (703) 669-1300
www.chessel.com
(Chessel strip-unit recorder,
Model 346)

Guiar Industrial, S.A. de C.V.
Rayon No. 989
Colonia Moderna
Sector Juarez
Guadalajara, C.P. 44190, Jalisco
Mexico
tel (91-36) 10-10-06
tel (91-36) 10-19-49
fax (91-36) 10-10-52
(Honeywell instruments)

Honeywell International, Inc.
101 Columbia Road
Morristown, NJ 07962
Phone: (800) 328-5111 or (973) 455-2000
Fax: (973) 455-4807
www51.honeywell.com/honeywell/
(Honeywell instruments)

Instrumentacion y Control Industrial
Santa Martha No. 269
Zapopan, Jalisco
Mexico
tel/fax (52-3) 636-5145
(National and Honeywell Instruments)

Laboratorios Jael
Automation Division
Calle 2 Norte #7
Parque Industrila Francisco I. Madero
Puerto Chiapas,Tapachula, Chiapas
Mexico
Phone: (962) 620-4147 or (962) 620-4146
Fax: (962) 620-4148
email: fjsanchez@labjael.com
www.labjael.com
(HyThsoft v 2)

Nanmac Corporation
9-11 Mayhew Street
Framingham, MA 01702-2400
Phone: (800) 786-4669
Fax: (508) 879-5450
www.nanmac.com
(Nanmac data logger, Model H30-1)

National Instruments
11500 N. Mopac Expressway
Austin, TX 78759-3504
Phone: (800) 531-5066
Fax: (512) 68-8411
www.ni.com
(National Instruments)

Neuberger Messinstrumente Gmbh
Steinerstr 16, D-8000
Munchen, Germany
Phone: (089) 72402-0
(Neuberger strip chart recorder)

NZ Automacao Ltda-ME
R. Areal
99 - Bom Retiro 01125-020
Sao Paulo SP
Phone: 0 xx 11 223-6596
email: nz@ig.com.br
www.mercosulbordados.com.br/mercosulbordados/placas.htm

Process Technologies, Inc.
154 Whitaker Road
Tampa, FL 33549
Phone: (800) 889-5699 or (813) 949-9553
Fax: (877) 569-0775 or (813) 949-8108
email: info@process-technologies.com
www.process-technologies.com

Vacuum Research Corp.
2419 Smallman Street
Pittsburgh, PA 15222
Phone: (800) 426-9340 or (412) 261-7630
Fax: (412) 261-7220
email: VRC@vacuumresearch.com
www.vacuumresearchcorp.com
(Molytek temperature recorder, Model 2702)

William B. Cresse, Inc.
117 Commerce Avenue
Lake Placid, FL 33852
Phone: (305) 633-0977
Fax: (863) 465-0016
email: cressecan@aol.com
www.equip2go.com
(Honeywell strip chart recorder)
Temperature Sensors (RTD, 100 ohm)

Thermocouple Wire

Omega Engineering, Inc.
P.O. Box 4047
One Omega Drive
Stamford, CT 06907-0047
Phone: (800) 848-4286 or (203) 359-1660
Fax: (203) 359-7700
email: info@omega.com
www.omega.com
(Type "T" thermocouple wire)
Catalog No. PR-T-24

Thermometers

Cole-Parmer
625 East Bunker Court
Vernon Hills, IL 60061
Phone: (800) 323-4340
Fax: (847) 247-2929
email: info@coleparmer.com
www.coleparmer.com
(digital thermometers, hand-held)

Cooper Atkins
33 Reeds Gap Road
Middlefield, CT 06455-0450
Phone: (860) 347-2256
Fax: (860) 347-5135
www.cooper-atkins.com
Electro-Therm hand-held digital thermometer. Instrument model Tm-99a (Electro Therm), general purpose air/surface probes, 12 feet in length, cat # 20-10, puncture probe #1075

Omega Engineering, Inc.
P.O. Box 4047
One Omega Drive
Stamford, CT 06907-0047
Phone: (800) 848-4286 or (203) 359-1660
Fax: (203) 359-7700
email: info@omega.com
www.omega.com

Thermo Electric Company, Inc.
60-A Commerce Way
Totowa, NJ 07512
Phone: (800) 766-4020 or (201) 843-5800
Fax: (201) 843-4568
email: info@te-direct.com
www.te-direct.com
Micromite indicator/calibrator;
Model 3115-1-T-0-1-0-0
Probe for Micromite;
Model T-18-G-304-0-36-4M1

Thermometers, Glass-Mercury, Certified Precision

These thermometers are used as calibration standards in cold treatment, hot water dip treatment and hot air treatment.

Thermometers from other sources may be considered as long as they meet the specifications outlined in **Chapter 8: Certified Precision Thermometers: Calibration Guidelines**.

Request approval for thermometers from:

USDA-APHIS-PPQ-CPHST-TQAU
1730 Varsity Drive, Suite 400
Raleigh, NC 27606

DC Scientific Glass
Mail: P.O. Box 1099
Pasadena, MD 21123
Physical Location: 510 McCormick Drive, Suite D
Hanover, Maryland 21076
Phone: (800) 379-8493 or (410) 863-1700
Fax: (410) 863-1704
email: sales@dcglass.com
www.dcglass.com

Catalog Number	Type	Range	Scale Division	Calibration Points	Length (mm)	Immersion
210-624	Extreme Precisio n	30 to 124 °F	0.1 °F	Minimum of one at the treatment temperature	610	Total
210-626	Extreme Precisio n	30 to 124 °F	0.1 °F	Minimum of one at the treatment temperature	610	3 inches
10064F-C	ASTM	77 to 131 °F	0.2 °F	5 calibration points (32, 80, 05, 115, 130 °F)	379	Total
10064C-C	ASTM	25 to 55 °C	0.1 °C	5 calibration points (0, 25, 35, 45, 55 °C)	379	Total
67C-100MM-C	ASTM	95 to 155 °C	0.2 °C	5 calibration points (0, 100, 110, 130, 150 °C)	379	100 mm

Figure H-1 DC Scientific Glass - Approved Thermometers

Fisher Scientific
2000 Park Lane Drive
Pittsburgh, PA 15275
Phone: (800) 766- 7000
Fax: (800) 926-1166
www.fishersci.com

Catalog Number	Type	Range	Scale Division	Calibration Points	Length (mm)	Immersion
15-142C	ASTM Mercury	77 to 131 °F	0.2 °F	5 calibration points (32, 80, 95, 115, 130 °F)	379	Total
15-140C	ASTM Mercury	25 to 55 °C	0.1 °C	5 calibration points (0, 25, 35, 45, 55 °C)	379	Total
15-169-120	ASTM Mercury	95 to 155 °C	0.2 °C	5 calibration points (0, 100, 110, 130, 150 °C)	379	Total

Figure H-2 Fisher Scientific - Approved Thermometers

VWR
1310 Goshen Parkway
West Chester, PA 19380
Phone: (800) 932-5000
www.VWR.com

Catalog Number	Type	Range	Scale Division	Calibration Points	Length (mm)	Immersion
61099-068	ASTM Mercury	77 to 131 °F	0.2 °F	5 calibration points (32, 80, 95, 115, 130 °F)	379	Total
15-61099-057	ASTM Mercury	25 to 55 °C	0.1 °C	5 calibration points (0, 25, 35, 45, 55 °C)	379	Total

Figure H-3 VWR - Approved Thermometers

Thermometers, Glass Non-Mercury, Certified Precision

These thermometers are used as a calibration standard in cold treatment, hot water dip treatment and hot air treatment.

Thermometers from other sources may be considered as long as they meet the specifications outlined in **Chapter 8:** .

Request approval for thermometers from:

USDA-APHIS-PPQ-CPHST-TQAU
1730 Varsity Drive, Suite 400
Raleigh, NC 27606

Cole-Parmer
625 East Bunker Court
Veron Hills, IL 60061
Phone: (800) 323-4340
Fax: (847) 247-2929
e-mail: info@coleparmer.com
www.coleparmer.com

Catalog Number	Type	Range	Scale Division	Calibration Points	Length (mm)	Immersion
K-08007-15	Thermo Scientific ERTCO®	77 to 131 °F	0.2 °F	5 calibration points (32, 80, 95, 115, 130 °F)	379	Total
K-08007-14	Thermo Scientific ERTCO®	25 to 55 °C	0.1 °C	5 calibration points (0, 25, 35, 45, 55 °C)	379	Total
EW-08007-20	Thermo Scientific ERTCO®	95 to 155 °C	0.2 °C	5 calibration points (0, 100, 110, 130, 150 °C)	379	100 mm

Figure H-4 Cole Parmer - Approved Thermometers

Thermometers, Digital, Certified Precision

These thermometers are used as a calibration standard and can be substituted for mercury and non-mercury thermometers in cold treatment, hot water dip treatment and hot air treatment.

Thermometers from other sources may be considered as long as they meet the specifications outlined in **Chapter 8: Certified Precision Thermometers: Calibration Guidelines**.

Request approval for thermometers from:

USDA-APHIS-PPQ-CPHST-TQAU
1730 Varsity Drive, Suite 400
Raleigh, NC 27606

EUTECH Instruments

For Africa, Asia, Middle East and Pacific Rim:
Eutech Instruments Pte Ltd
Blk 55, Ayer Rajah Crescent, #04-16/24, Singapore 139949
Phone: (65) 6778-6876
Fax: (65) 6773-0836
e-mail: eutech@thermofisher.com
www.eutechinst.com

For Europe:
Eutech Instruments Europe B.V.
P.O. Box 254, 3860 AG Nijkerk
The Netherlands
Phone: (31) 033-2463887
Fax: (31) 033-2460832
e-mail: info@eutech.nl
www.eutech.nl/

For North and South America:
OAKTON Instruments
P.O. Box 5136, Vernon Hills, IL 60061
Phone: (888) 4OAKTON (888)-462-5866
Fax: (847) 247-2984
e-mail: info@4oakton.com
www.4oakton.com

Cole-Parmer
625 East Bunker Court
Vernon Hills, Illinois 60061
Phone: (800) 323-4340
Fax: (847) 247-2929
e-mail: info@coleparmer.com
www.coleparmer.com

For China:
Thermo Fisher Scientific
Building 6, No.27 Xin Jinqiao Rd.,
Shanghai 201206, China
Phone: (86) 021 6865 4588
Fax: (86) 021 6445 7909
e-mail: candy.tian@thermofisher.com
www.eutech.cn

For India:
Thermo Fisher Scientific
102, 104 Delphi 'C' wing
Hiranandani Business Park
Powai, Mumbai - 400 076
Phone: 022-6742 94 94 (Board No.)
Fax: 022-6742 94 95
e-mail: prasanna.pandit@thermofisher.com
www.eutechinst.com

Catalog # 60010-85: Digital thermometer with range -330 to 2210 °F or -201 to 1210 °C; Resolution 0.1 °C/°F at 100.0 to 999.9 C/F; Accuracy +/- 0.1 °C/°F at 100 to 999.9 °C/°F; various probe lengths; Request NIST traceable calibration with 5 temperature points or more and a certificate.

OpticsPlanet, Inc.
Phone: (800) 504-5897 or (847) 513-6201
Fax: (847) 919-3003
e-mail: sales@opticsplanet.com
www.opticsplanet.net/
control-company-vwr-digital-data-logger-thermometers-4000.html

Catalog # C1-LB-4000: Control Company Digital Data Logger Thermometer with Probe 4000/61220-601; Accuracy- +/-0.05 °C; Request NIST calibration and certificate with 5 or more temperature points in treatment range.

Palmer Wahl
234 Old Weaverville Road
Asheville, North Carolina 28804-1228
Phone: 800 421 2853; 828 658 3131
Fax: 828 658 0728
Email: info@palmerwahl.com
www.palmerwahl.com

Model DST600 series: Precision handheld reference thermometer: Range;-50 to 500 °F; Accuracy +/-0.1F/ °C over 1 year period; w/certificate of calibration. Request NIST calibration and certificate with temperature points in treatment range; choice of temperature sensors.

Tech Instrumentation, Inc.
160 W. Kiowa Avenue
P.O. Box 2029
Elizabeth, CO 80107
Phone: (800) 390-0004 or (303) 841-7567
Fax: (303) 840-8568
e-mail: sales@techinstrument.com
www.techinstrument.com

Catalog #TL-1W: Digital thermometer with range -44 to 600 °F and -43 to 315 °C; Resolution 0.01 degrees; Accuracy -/+0.1 F below 300 °F; Various stem lengths; 4 point NIST traceable calibration included (request 5 or more calibration points and a certificate);1 year warranty.

Thermco Products, Inc.
10 Millpond Drive, Unit #2
Lafayette, NJ 07848
Phone: (973) 300-9100
Fax: (973) 255-1000
e-mail: info@thermcoproductsinc.com
www.thermcoproductsinc.com

Catalog #ACCD650P: High Precision Digital Pt100 Platinum Thermometer; Range- Pt100: -200 °C to +850 °C: Accuracy- Pt 100 +/- 0.03 from -50 °C to + 199.99 °C; with Certificate of calibration. Request NIST calibration and certificate with 5 or more temperature points in treatment range; ACCD1019 High Precision Probe Pt100 Platinum 12" (405mm)

ThermoWorks
165 N. 1330 W., #A1
Orem, UT 84057
Phone: (801) 756-7705
Fax: (801) 756-8948
e-mail: info@thermoworks.com
www.thermoworks.com

Model P600 series; Precision handheld reference thermometer: Range; -328 F to 842 F; Accuracy 0.05 F from -148 to 302 F: w/Certificate of calibration. Request NIST calibration and certificate with temperature points in treatment range; choice of temperature sensors.

Thermometers, Certified Precision, Approved Calibration Companies

Conduct thermometer calibration by USDA-approved calibration companies. Follow the procedures for calibration summarized in **Chapter 8**, **Certified Precision Thermometers: Calibration Guidelines** .

DC Scientific Glass
Mail: P.O. Box 1099
Pasadena, MD 21123
Physical Location: 510 McCormick Drive, Suite D
Hanover, MD 21076
Phone: (800) 379-8493 or (410) 863-1700
Fax: (410) 863-1704
email: sales@dcglass.com
www.dcglass.com

ERTCO
2555 Kerper Blvd.
Dubuque, IA 52001
Phone: (800) 553-0039 or (563) 556-2241
Fax: (563) 589-0516
e-mail: ertco@thermofisher.com
www.ertco.com

ICL Calibration Laboratories, Inc.
1501 Decker Avenue, Suite 118
Stuart, FL 34994
Phone: (800) 713-6647 or (772) 286-7710
Fax: (772) 286-8737
e-mail: sales@iclcalibration.com
www.icllabs.com

INNOCAL
625 East Bunker Court M/S 14
Vernon Hills, IL 60061-1844
Phone: (866) 466-6225
Fax: (847) 247-2984
e-mail: info@innocalsolutions.com
www.innocalsolutions.com

Instrumentation Technical Services
20 Hagerty Blvd., Suite 1
West Chester, PA 19382
Phone: (610) 436-9703
Fax: (610) 436-9097
e-mail: general@calservice.net
www.calservice.net

Measurement Assurance Technology
2109 Luna Road, Suite 240
Carrollton, TX 75006
Phone: (877) 871-TEST or (972) 241-2165
Fax: (972) 241-2167
e-mail: sales@mattestusa.com
www.mattestusa.com

Phoenix Calibration DR
Parque Industrial de Zona Franca Excel Boca Chica
Los Tanquecitos, Boca Chica
Santo Domingo, RD
Phone: (809) 563-0457
Fax: (809) 540-2320
e-mail: dweil@phoenixcalibrationdr.com
www.phoenixcalibrationdr.com

VWR
1310 Goshen Parkway
West Chester, PA 19380
Phone: (800) 932-5000
www.VWR.com

Tubing, Gas-Sampling

(polyethylene or polypropylene)

Cole-Parmer
625 East Bunker Court
Vernon Hills, IL 60061
Phone: (800) 323-4340
Fax: (847) 247-2929
email: info@coleparmer.com
www.coleparmer.com

Consolidated Plastics Co. Inc.
4700 Prosper Drive
Stow, OH 44224
Phone: (800) 362-1000
Fax: (800) 858-5001
www.consolidatedplastics.com

Fisher Scientific
2000 Park Lane Drive
Pittsburgh, PA 15275
Phone: (800) 766- 7000
Fax: (800) 926-1166
www.fishersci.com

Pest Fog, Inc.
1424 Bonita
P.O. Box 3703
Corpus Christi, TX 78463
Phone: (800) 395-2345 or (361) 884-8214
Fax: (361) 884-5903
email: info@pestfog.com
www.pestfog.com

Thomas Scientific
P.O. Box 99
99 High Hill Road at I 295
Swedesboro, NJ 08085-0099
Phone: (800) 345-2100 or (800) 345-2000
Fax: (800) 345-5232 or (856) 467-3087
www.thomassci.com

Vacuum Pump

Air compressor for use with vacuum fumigation chambers.

Neward Enterprises, Inc.
Distributor: McMaster-Carr
P.O. Box 740100
Atlanta, GA 30374-0100
Phone: (404) 346-7000
Fax: (404) 349-9091
email: atlsales@mcmaster.com
www.mcmaster.com
(Mityvac hand-held vacuum pump)
Cost: $69 (zinc-alloy pump #9963K12)

Sargent Welch
P.O. Box 4130
Buffalo, NY 14217
Phone: (800) 727-4368
Fax: (800) 676-2540
email: customerservice@sargentwelch.com
www.sargentwelch.com

Vapam

(see Metam-sodium)

Volatilizer

(for volatilizing liquid methyl bromide into a fumigant gas)

Degesch America, Inc.
Houston Division
P.O. Box 451036
Houston, TX 77245
Phone: (713) 433-4777
Fax: (713) 433-0877
www.degeschamerica.com

Pest Fog, Inc.
1424 Bonita
P.O. Box 3703
Corpus Christi, TX 78463
Phone: (800) 395-2345 or (361) 884-8214
Fax: (361) 884-5903
email: info@pestfog.com
www.pestfog.com

Vacudyne, Inc.
375 East Joe Orr Road
Chicago Heights, IL 60411
Phone: (800) 459-9591 or (708) 757-5200
www.vacudyne.com

Warning Signs and Placards

Carlton Industries, L.P.
P.O. Box 280
La Grange, TX 78945
Phone: (800) 231-5934 or (979) 242-5055
Fax: (979) 242-5058
email: sales@carltonusa.com
www.carltonusa.com

Champion America
P.O. Box 3092
Stoney Creek, CT 06405
Phone: (877) 242-6709
Fax: (800) 336-3707
www.champion-america.com

Pest Fog, Inc.
1424 Bonita
P.O. Box 3703
Corpus Christi, TX 78463
Phone: (800) 395-2345 or (361) 884-8214
Fax: (361) 884-5903
email: info@pestfog.com
www.pestfog.com

Treatment Manual

Comment Sheet

Directions: Use this sheet to suggest an improvement or to identify a problem in the content of the manual. **Do not use this sheet to order manuals and manual parts—see Appendix C for ordering manuals and manual parts, or for changing the number of manuals you receive.** To mail, please follow the directions on the next page.

Description of problem (error, inconsistency, missing or insufficient information, etc.)

Description of improvement or recommended change (add attachments if necessary)

Reason for improvement or change

After completion:

1. Fold on the dotted lines with the address side outward.
2. Staple or tape to close.
3. Affix postage.
4. Drop in the mail.

USDA-APHIS-PPQ
Manuals Unit
92 Thomas Johnson Drive, Suite 200
Frederick, MD 21702-4301

Attn: Josie Cooley

Index

Symbols

"L" Fume 5-4-39, 5-5-48

Numerics

2-hour reading
methyl bromide 2-4-22
30-minute reading
methyl bromide 2-4-22

A

A. fraterculus
MB at NAP treatment 5-2-7
vapor heat treatment 5-2-73
A. ludens
cold treatment 5-2-76
forced hot air treatment 5-2-60
hot water treatment 5-2-56
A. obliqua
forced hot air treatment 5-2-60
A. serpentina
forced hot air treatment 5-2-60
a.i. 7-4-10
ability to heat area
methyl bromide 2-4-5
abiu
from Hawaii 5-2-68
absorbed dose 3-8-6
Acalypha 5-6-20
treatment options 5-6-20
acceptable daily intake (ADI) 7-4-10
ACGIH 7-4-10
Achatina
cold treatment 5-5-10
MB at NAP treatment 5-5-5
other treatment options 5-5-7
Achatinidae
cold treatment 5-5-10
achimenes 5-6-15
Aconitum 5-6-20
treatment options 5-6-20
acorn
nonpropagative 5-4-8
propagative 5-3-29
actinidia 5-6-15
actionable pests 5-3-21
active ingredient (a.i.) 7-4-10
adding gas and time
oak logs T312a 2-4-29, 2-4-30
oak logs T312a-Alternate 2-4-29, 2-4-33
other than T101 or equivalent 2-4-24, 2-4-25
T101 or equivalent schedules 2-4-26
additional readings
methyl bromide 2-4-22
ADI 7-4-10
aerating
fresh fruit, vegetables, and cut flowers 2-4-41
nonsorptive, containerized cargo 2-4-37
nonsorptive, noncontainerized cargo 2-4-39
sorptive, containerized cargo 2-4-44
sorptive, noncontainerized cargo 2-4-42
Aeration Duct, Flexible H-1-10
aeration requirements
methyl bromide 2-4-6
phosphine 2-10-35
sulfuryl fluoride 2-9-5
Aerosol Insecticides H-1-10
aerosols 2-11-1
aerosols and micronized dusts
cargo aircraft treatment 2-11-2
containerized or palletized cargo treatment 2-11-3
passenger compartment treatment 2-11-2
precautions 2-11-4
separate cargo compartment treatment 2-11-3
Aerospatiale 5-5-31
African couchgrass
dry heat treatment 5-5-42
Africanized honeybee swarms
residual insect spray treatment 5-5-4
Afromomum melgueta 5-2-30
Agapanthus 5-6-15
Agrilus planipennis
heat treatment 5-4-38
Agriolimacidae
MB at NAP treatment 5-3-6, 5-5-8
Agriolimax
MB at NAP treatment 5-3-6, 5-5-8
Air Pump, Auxiliary H-1-11
Airbus Industries of North America, Inc. 5-5-30
aircraft 5-5-29
treatment options 5-5-29
Air-Purifying Respirator H-1-13
Alabama

state hazardous waste management agencies 7-3-12
Alaska
state hazardous waste management agencies 7-3-12
Aleurocanthus woglumi
MB at NAP treatment 5-2-28, 5-3-13
Aleurocanthus woglumi host plants
treatment options 5-3-13
alfalfa seeds
from Europe 5-6-14
Allium 5-6-14
Allium schoenoprasum 5-2-30
Allium tuberosum 5-2-30
allspice 5-2-30
aloe 5-6-15
alpha grass and handicrafts 5-4-16
treatment options 5-4-16
Alphelenchoides fragariae 5-6-15
Aluminum Phosphide H-1-13
Amaryllis 5-6-14, 5-6-18
ambrosia/timber beetles
kiln sterilization treatment 5-5-17
American Bureau of Shipping 6-4-4
American Conference of Governmental Industrial Hygienists (ACGIH) 7-4-10
American Samoa
state hazardous waste management agencies 7-3-12
Amorphophallus 5-6-15
Ampelodesma mauritanicus 5-4-16
Ampelopsis 5-6-15
Amphulariidae
hot water treatment 5-3-3
Anastrepha spp.
cold treatment 5-2-75, 5-2-76
forced hot air treatment 5-2-59
hot water treatment 5-2-56
MB at NAP/chamber only treatment 5-2-20, 5-2-28, 5-2-40
vapor heat treatment 5-2-70
Anchusa 5-6-15
anemometer 8-1-27
Anemone 5-6-15
angelica 5-2-30
Angelica archangelica 5-2-30
Animal and Plant Health Inspection Service
preclearance program for vessels used for intransit cold treatment 6-4-2–??
Animal and Plant Health Inspection Service (APHIS) 7-4-10
anise 5-2-30
anise star 5-2-30
annatto 5-2-30
ant
kiln sterilization treatment 5-5-17
MB at NAP treatment 5-2-63, 5-5-42
residual insecticidal spray treatment 5-5-4
Anthemis nobilis 5-2-30
Anthemum graveolens 5-2-30
Anthonomus grandis 5-4-5
MB at NAP/tarpaulin only treatment 5-4-5
Anthriscus cerefolium 5-2-30
AP 2-10-9
Aphelenchoides besseyi 5-6-17
hot water treatment 5-6-17, 5-6-18
Aphelenchoides fragariae spp.
hot water treatment 5-6-19, 5-6-20
Aphelenchoides subtenuis
hot water treatment 5-6-18
aphids 5-3-6
MB at NAP treatment 5-2-63, 5-3-5
APHIS 7-4-10
APHIS Form 205-R, Instructions and Worksheet for Calibrating Portable Temperature Sensors A-A-3
APHIS Form 2061, Residue Sample for Food or Feed Product A-A-2
APHIS Form 206-R, Test of the Accuracy of the Permanent RTD Sensors Installed in Hot Water Tanks A-A-4
APHIS Form 207-R, Sensor Location Diagram Fruit Weights and Pulp Temperatures A-A-5
APHIS Form 208, Performance Test for Mango Hot Water Immersion Tank A-A-6
Apium graveolens 5-2-30
apple 5-2-3, 5-2-63, 5-2-64, 5-2-75, 5-2-76, 5-2-80, 5-2-82, 5-7-3
from Australia 5-2-83
Fuji from Japan and Korea 5-2-84
apple maggot
irradiation treatment 5-2-66
Applicator (Dispenser) for Methyl Bromide H-1-15
Approved Calibration Companies (ther-

mometers) H-1-69
apricot 5-2-3, 5-2-63, 5-2-64, 5-2-75, 5-2-76, 5-2-77, 5-2-80
aquatic plants infested with freshwater snails
hot water treatment 5-3-3
Araucaria spp.
MB at NAP treatment 5-3-10
Archachatina 5-5-7
cold treatment 5-5-10
MB at NAP treatment 5-5-5
Arion
MB at NAP treatment 5-3-6, 5-5-8
Arionidae
MB at NAP treatment 5-3-6, 5-5-8
Arizona
state hazardous waste management agencies 7-3-12
Arkansas
state hazardous waste management agencies 7-3-12
Armoracea 5-6-15
Artemisia absinthium 5-2-30
Artemisia dracunculus 5-2-30
Ascarite 8-1-4
Ascarite II H-1-16
Ascochyta spp. 5-6-10
ash logs 5-4-38
asparagus 5-2-3, 5-2-63, 5-2-64
from Thailand, Australia, New Zealand 5-2-4
asphalt surfaces 5-5-3
Asphodelus fistulosus 5-5-42
astilbe 5-6-15, 5-6-18
root 5-3-23
atemoya 5-2-68
atmospheric fumigation chambers
basic design elements 6-3-2
certification of 6-3-1
circulation and exhaust systems 6-3-3
construction and performance standards 6-3-1
fumigant dispensing system 6-3-4
gastight construction 6-3-3
other auxiliary equipment 6-3-6
Austrotortrix spp.
cold treatment followed by MB at NAP 5-2-83
MB at NAP followed by cold treatment 5-2-82
Autoclaves H-1-49
Autographa gamma
MB at NAP treatment 5-2-36
automobiles 5-5-22
restricted MB fumigation item 2-3-8
auxiliary pump 8-1-28
avocado 5-2-63, 5-2-75, 5-2-80
FIFRA section 18 exemption 2-3-3
from Hawaii, Israel, Philippines 5-2-4
seeds only, without pulp 5-3-29
avocado seed moth
MB in 26" vacuum treatment 5-3-29
avocado seed weevil
MB in 26" vacuum treatment 5-3-29
avodaco stem weevil
MB in 26"vacuum treatment 5-3-29
Azalea 5-3-10
azalea 5-6-3
Azalea indica 5-3-10
azaleodendron 5-6-3, 5-6-6

B

Bactrocera cucurbitae
cold treatment 5-2-78
forced hot air treatment 5-2-59, 5-2-61
fumigation plus cold treatment 5-2-80
irradiation treatment 5-2-66
MB at NAP treatment 5-2-4
vapor heat treatment 5-2-70, 5-2-71, 5-2-72
Bactrocera dorsalis
cold treatment 5-2-78
forced hot air treatment 5-2-59, 5-2-61
fumigation plus cold treatment 5-2-80
hot water immersion treatment 5-2-55
irradiation treatment 5-2-66
MB at NAP treatment 5-2-4
vapor heat treatment 5-2-70, 5-2-71, 5-2-72, 5-2-73
Bactrocera jarvisi
irradiation treatment 5-2-66
Bactrocera occipitalis
vapor heat treatment 5-2-71
Bactrocera philippinensis
vapor heat treatment 5-2-71
Bactrocera tryoni
cold treatment 5-2-76
cold treatment followed by MB at NAP 5-2-83
fumigation plus cold treatment 5-2-80
irradiation treatment 5-2-66
MB at NAP followed by cold treatment 5-2-82

bags and bagging material 5-4-19
for cotton only 5-4-18
for small grains 5-6-5
for soil-grown commodities 5-6-4
for unroasted coffee beans 5-4-20
to contain root crops 5-4-18
treatment schedules for 5-4-18, 5-5-21
baking powder
restricted MB fumigation item 2-3-8
Balances (portable) for weighing individual fruit H-1-17
baled hay 5-4-28
treatment options 5-4-28
baled lint 5-4-2
Baltimore Quality Associates, Inc. (BQA)
vacuum chamber manufacturers 6-2-5
banana 5-2-5, 5-2-63, 5-2-64
FIFRA section 18 exemption 2-3-3
from Hawaii 5-2-68, 5-2-69
root 5-3-23
barges 5-5-22
Baris lepidii
MB in 15" vacuum treatment 5-2-32
bark/engraver beetle
kiln sterilization treatment 5-5-17
bark-gnawing beetle
kiln sterilization treatment 5-5-17
basil 5-2-30
batch system 3-3-4
Batch Systems H-1-17
bay leaf 5-2-30
bean 5-2-63, 5-2-64
dry 5-2-5
bee
kiln sterilization treatment 5-5-17
beet 5-2-6, 5-2-63, 5-2-64
Begonia 5-6-15, 5-6-17
bell pepper 5-2-70
Berberis 5-3-10
bess beetle
kiln sterilization treatment 5-5-17
black curaway 5-2-30
black fruit fly
forced hot air treatment 5-2-60
black pepper 5-2-30
blackberry 5-2-7, 5-2-63, 5-2-64
FIFRA section 18 exemption 2-3-3
blended strip tobacco for export 5-4-22
Bletilla hyacinthina 5-6-15, 5-6-18
Blower H-1-20
blueberry 5-2-7, 5-2-63, 5-2-75
blueprints
restricted MB fumigation item 2-3-8
body weight (bw) 7-4-10
Boeing Commericial Aeroplane Group 5-5-30
boilers and thermostatic controls 3-3-6
adequate water heating capacity 3-3-6
multiple set point option 3-3-6
thermostatic controls 3-3-6
boll weevil
MB at NAP/tarpaulin only treatment 5-4-5
phosphine at NAP treatment 5-4-5
bone meal
restricted MB fumigation item 2-3-8
Bootanomyia spp.
MB in 26" vacuum treatment 5-3-35
borage 5-2-30
Borago officinalis 5-2-30
borer
Chlorpyrifos spray treatment 5-5-13
dry heat treatment 5-4-9
MB at NAP treatment 5-5-19
MB at NAP/chamber only treatment 5-4-9
MB in 15" vacuum treatment 5-3-5, 5-3-12, 5-3-15, 5-4-17
MB in 26" vacuum treatment 5-3-8
SF at NAP treatment 5-5-16
Bostrichidae
kiln sterilization treatment 5-5-17
box and package
aeration 2-3-5
penetration 2-3-5
Brachycerus spp.
MB in 15" vacuum treatment 5-3-24
MB in 15" vacuum/chamber only treatment 5-2-25
Brachyrhinus larvae
MB in 26" vacuum treatment 5-3-23
Bradybaena
cold treatment 5-5-10
MB at NAP treatment 5-5-9
Bradybaenidae
cold treatment 5-5-10
MB at NAP treatment 5-5-9
branch borer
kiln sterilization treatment 5-5-17
Brassica albogiabra 5-2-8

Brassica campestris 5-2-9, 5-2-12
Brassica chinensis 5-2-11
Brassica juncea 5-2-30, 5-2-38
Brassica napus 5-2-46
Brassica oleracea 5-2-10
Brassica oleracea var. acephala 5-2-22, 5-2-32
Brassica oleracea var. botrytis 5-2-8, 5-2-14, 5-2-15
Brassica oleracea var. gemmifera 5-2-9
Brassica oleracea var. gongyiodes 5-2-34
Brassica pekinensis 5-2-11
Brassica rapa Japonica group 5-2-38
Brassica rapa Perviridis group 5-2-39
brassware
    from Mumbai, India 5-5-43, 5-5-44
breadfruit 5-2-53
    from Hawaii 5-2-68, 5-2-69
break bulk cargo
    tarpaulin fumigation 2-4-7
        fan arrangement and operation 2-4-10
        gas introduction lines 2-4-11
        gas sampling tubes 2-4-12, 2-4-13
Brevipalpus chilensis 5-2-66
    fumigation plus cold treatment 5-2-80
    MB at NAP treatment 5-2-20
    soapy water and wax treatment 5-2-53, 5-2-54, 5-2-58
broccoli 5-2-8
    Chinese 5-2-8
broccoli raap 5-2-9
bromeliads 5-3-4, 5-3-12, 5-6-8
broomcorn and broomcorn articles 5-4-25, 5-4-26, 5-6-19
    treatment options 5-4-25, 5-6-19
brooms
    made of rice straw 5-6-12
Bruchidae 5-2-25, 5-3-38
    MB at NAP treatment 5-2-5, 5-2-36, 5-2-42, 5-2-45, 5-3-37
    MB in 26" vacuum treatment 5-3-34
    MB in 26" vacuum/chamber only treatment 5-2-25
Bruchophagus spp.
    MB in 26" vacuum treatment 5-3-35
brussels sprouts 5-2-9
Bubble Fumigation System H-1-20
bulb nematode
    hot water dip treatment 5-6-19
    other treatment options 5-6-14, 5-6-16
bulb scale mite
    hot water treatment 5-3-26, 5-3-27
    MB at NAP treatment 5-3-26
bulbs 5-6-14, 5-6-15
bulbs, corms, tubers, rhizomes, and roots 5-3-23
Bulinidae
    hot water treatment 5-3-3
bumet 5-2-30
Buprestidae
    kiln sterilization treatment 5-5-17
butter
    restricted MB fumigation item 2-3-8
bw 7-4-10

C

CA 7-4-9
cabbage 5-2-10, 5-2-63, 5-2-64
    Chinese 5-2-11
    Chinese mustard 5-2-12
cabbageworm
    MB at NAP treatment 5-5-13
cacti 5-3-4, 5-3-5, 5-3-12
cactus 5-6-15
cactus fruit 5-2-63
Calendula officinalis 5-2-30
Calibration of Temperature Probes (Cold Treatment) A-A-7
California
    state hazardous waste management agencies 7-3-12
Calla
    rhizomes 5-6-16
calliopsis 5-6-15
Camellia 5-3-10, 5-6-9
camomile 5-2-30
Campanula 5-6-15
Candidula 5-5-5, 5-5-7, 5-5-10
cantaloupe 5-2-12, 5-2-63, 5-2-64
cape gooseberry 5-2-75
caper buds 5-2-30
Capparis spinosa 5-2-30
Capsicum spp.
    from Hawaii 5-2-68
Caracollina
    MB at NAP treatment 5-5-5, 5-5-8
carambola 5-2-76, 5-2-78
    from Hawaii 5-2-68
caraway 5-2-30

carbon dioxide 2-10-4, 7-4-9
cardamom 5-2-30
Caribbean fruit fly
irridiation treatment 5-2-66
carpenter ant
kiln sterilization treatment 5-5-17
SF at NAP treatment 5-5-16
carpenter bee
kiln sterilization treatment 5-5-17
SF at NAP treatment 5-5-16
carpenter worm
kiln sterilization treatment 5-5-17
Carposina niponensis
cold treatment followed by MB at NAP 5-2-84
carrot 5-2-13, 5-2-63, 5-2-64
Carum carvi 5-2-30
Caryedon spp. 5-3-36
CAS 7-4-10
Cascade Air Tank Recharging System (SCBA) H-1-21
cassava 5-2-14
manihot 5-2-14
yuca 5-2-14
cassia bark 5-2-30
cassia buds 5-2-30
Casurina
seeds of 5-3-35
Cathaica 5-5-9, 5-5-10
catnip 5-2-30
cattleya fly
MB in 15" vacuum treatment 5-3-15
CATTS 5-7-1
cauliflower 5-2-14
Caulophilus latinasus
MB in 26" vacuum treatment 5-3-29
Cavalo broccolo 5-2-15
cc 7-4-10
Cecidomyid galls 5-3-15
celeriac
celery root 5-2-15
celery 5-2-63, 5-2-64
above-ground parts 5-2-16
celery seed 5-2-30
central nervous system (CNS) 7-4-11
Cepaea
cold treatment 5-5-10
MB at NAP treatment 5-5-5, 5-5-8
Cerambycidae
kiln sterilization treatment 5-5-17
Cerambycids
Chlorpyrifos spray treatment 5-5-13
Ceratitis capitata 5-2-61
cold treatment 5-2-75
cold treatment followed by MB at NAP 5-2-83
forced hot air treatment 5-2-59, 5-2-61
fumigation plus cold treatment 5-2-80
hot water immersion treatment 5-2-55, 5-2-56
irradiation treatment 5-2-66
MB at NAP followed by cold treatment 5-2-82
MB at NAP treatment 5-2-4, 5-2-7, 5-2-19, 5-2-27, 5-2-33, 5-2-49, 5-2-50
vapor heat treatment 5-2-70, 5-2-71, 5-2-72, 5-2-73
Ceratitis rosa
cold treatment 5-2-75, 5-2-77
CERCLA 7-4-10
Cercospora mamaonis
hot water dip treatment 5-6-17
Cercospora spp.
Bordeaux dip or spray treatment 5-6-3
treatment options 5-6-3
cereal leaf beetle
phosphine at NAP treatment 5-4-28
Cernuella
cold treatment 5-5-10
MB at NAP treatment 5-5-5, 5-5-7
certifying
atmospheric fumigation chambers 6-3-1
facilities 6-1-1
forced hot air treatment facilities 6-7-1
heat treatment of firewood facilities 6-9-1
hot water immersion treatment facilities 6-5-1
irradiation treatment facilities 6-8-1
vacuum fumigation chambers 6-2-1
vapor heat treatment facilities 6-7-1
Cestrum 5-6-15
Chain Hoist (electronic) H-1-21
charcoal
restricted MB fumigation item 2-3-8
chayote 5-2-63, 5-2-64
fruit only 5-2-16
ChE 7-4-10
Chemical Abstracts Service (CAS) 7-4-10
chemical treatments

fumigants 2-2-1
characteristics of 2-2-1
introduction to 2-2-1
overview of 2-1-1
CHEMTREC 7-4-11
cherimoya
from Chile 5-2-53
cherry 5-2-17, 5-2-63, 5-2-64, 5-2-75, 5-2-76, 5-2-80
chervil 5-2-30
chestnut 5-2-17, 5-2-18, 5-2-63, 5-2-64, 5-3-29
chestnut dioon 5-3-8
chicory 5-2-63, 5-2-64
above-ground parts 5-2-18
root 5-2-19
Chilean false spider mite of grapes
MB at NAP treatment 5-2-20
soapy water and wax treatment 5-2-53, 5-2-54, 5-2-58
Chinese chive 5-2-30
chive 5-2-30
chloropicrin
poisoning 7-1-3
cholinesterase (ChE) 7-4-10
Christmas trees 5-6-3
treatment schedules for 5-4-37
Chrysanthemum 5-6-16
chrysanthemum 5-6-3
Chrysanthemum balsamita 5-2-30
Chrysanthemum spp. 5-3-12
rooted and unrooted cuttings 5-3-5, 5-3-6
chrysomelid beetle
MB in 15" vacuum/chamber only treatment 5-2-19
Chrysomyxa spp. 5-6-3, 5-6-4, 5-6-6
cigarette beetle
Kabat application treatment 5-4-22
MB in 28" vacuum treatment 5-4-23
vacuum steam flow treatment 5-4-22
Cimicifuga 5-6-15, 5-6-18
cinder blocks
restricted MB fumigation item 2-3-8
Cinnamomum aromaticum 5-2-30
Cinnamomum verum 5-2-30
cinnamon 5-2-30
cipollini 5-2-63, 5-2-64
bulbs 5-2-19
Cissus 5-6-15
citron 5-2-63, 5-2-64
citrus 5-2-77
from citrus canker countries 5-6-10
from Hawaii 5-2-59
from Mexico and infested U.S. areas 5-2-59
from U.S. 5-2-19
seeds of 5-3-37
citrus blackfly
MB at NAP treatment 5-2-28, 5-3-13
citrus canker
domestic treatment of 5-8-2
hot water treatment plus chemical dip 5-3-37
citrus whitefly
MB at NAP treatment 5-3-11, 5-3-14
citrus whitefly hosts
MB at NAP treatment 5-3-10
clary 5-2-30
Clean Water Act (CWA) 7-4-11
clear-winged moth
kiln sterilization treatment 5-5-17
Clematis 5-6-15
clementine 5-2-63, 5-2-64, 5-2-75, 5-2-76
from Chile 5-2-20
from Mexico 5-2-70, 5-2-71
from Mexico and U.S. quarantine areas 5-2-20
clove buds 5-2-30
CNS 7-4-11
CO2 fire extinguishers
precautions 2-11-4
Coast Guard regulations B-B-1
Cochlicella
cold treatment 5-5-10
MB at NAP treatment 5-5-5, 5-5-7
cocoa bean 5-2-63
coconut 5-2-63, 5-2-64
whole, without husk 5-2-22
codling moth
CATTS treatment 5-7-2, 5-7-3
irradiation treatment 5-2-66
MB at NAP/chamber only treatment 5-2-17
cold storage, 5-8-13
Cold treatment
integral containers used for cold treatment 6-4-12–??
temperature recording instruments standards 6-4-15–??
vessels used for intransit cold treatment 6-4-2–??

approval requirements 6-4-4–??
temperature recording systems standards 6-4-2–??
warehouses used for 6-4-15–??
coles 5-2-21
collard greens 5-2-22
Colorado
state hazardous waste management agencies 7-3-12
Colosius
MB at NAP treatment 5-3-6, 5-5-8
commercial line conditioner 3-3-5
commodity injury 5-2-1
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) 7-4-10
conifer seed 5-3-30
Connecticut
state hazardous waste management agencies 7-3-12
Conogethes punctiferalis
cold treatment followed by MB at NAP 5-2-84
Conopomorpha sinensis
cold treatment 5-2-78
Conotrachelus spp.
MB in 26" vacuum treatment 5-3-29
Conotrachleus nenuphar 5-2-66
Consultants (hot water immersion treatments) H-1-22
containerized cargo
methyl bromide 2-4-13
tarpaulin fumigation 2-4-8
fan arrangement and operation 2-4-11
gas introduction lines 2-4-11
gas sampling tubes 2-4-13
containers 5-5-22, 5-6-7
approved for intransit cold treatment F-1-1
used 5-5-23
continuous flow system 3-3-4
Contracting Officer's Representative (COR) 7-4-11
controlled atmosphere (CA) storage 7-4-9
Controlled Atmosphere Temperature Treatment System (CATTS) 5-7-1
contruction equipment 5-5-22
without cabs 5-5-23
Convallaria 5-6-14
conversion tables D-D-1
Convolvus japonicus 5-6-15
Copitarsia spp.
MB at NAP treatment 5-2-3, 5-2-5, 5-2-7, 5-2-37, 5-2-44, 5-2-47
copra 5-2-22
Copturus agyacatae
MB in 26" vacuum treatment 5-3-29
COR 7-4-11
coriander 5-2-30
Coriandrum sativum 5-2-30
corn
-on-the-cob 5-2-22, 5-2-63, 5-2-64
-related diseases, treatment schedules for 5-6-9
seed, nonpropagative 5-6-9
seed, not for food, feed, or oil purposes 5-6-10
shelled 5-4-12
shelled and contaminated with cottonseed 5-4-12
corrugated cartons
methyl bromide fumigation 2-3-6
Corytholoma 5-6-15
CosMed Group
vacuum chamber manufacturers 6-2-5
Cossidae
kiln sterilization treatment 5-5-17
costmary 5-2-30
cotton and cotton products 5-4-5
samples of 5-4-7
treatment schedules for 5-4-2
cottonseed 5-4-3, 5-4-6, 5-4-7
bagged, packaged, bulk 5-3-31, 5-3-32
hulls 5-4-6, 5-4-7
meal 5-4-4, 5-4-6, 5-4-7
covers
for small grains 5-6-5
for soil-grown commodities 5-6-4
for wheat 5-6-6
cowpea
from Hawaii 5-2-69
CPK 7-4-11
creatine phosphokinase (CPK) 7-4-11
cricket
residual insecticidal spray treatment 5-5-4
crocus 5-6-18
Crocus sativus 5-2-30
Cryptomphalus
MB at NAP treatment 5-5-5, 5-5-8

Cryptophlebia illepida 5-2-66
MB at NAP treatment 5-3-33
Cryptophlebia ombrodelta 5-2-66
cu.m 7-4-11
cubic centimeter (cc) 7-4-10
cubic meter (cu.m) 7-4-11
cucumber 5-2-23, 5-2-63, 5-2-64
cucurbit seed
FIFRA section 18 exemption 2-3-3
cucurbit vegetables not on Q-label
FIFRA section 18 exemption 2-3-3
Cucurbita spp.
from Hawaii 5-2-68
culantro 5-2-30
cumin 5-2-30
Cuminum cyminum 5-2-30
Curculio caryae
cold treatment 5-2-78
Curculio spp.
MB at NAP treatment 5-2-17, 5-4-8
MB in 26" vacuum/chamber only treatment 5-2-18, 5-4-8
Curculionidae
kiln sterilization treatment 5-5-17
Curcuma 5-6-15
curry 5-2-30
curry leaf
from Hawaii 5-2-68
Curtains (air, safeguarding) H-1-24
Cuscuta spp.
dry heat treatment 5-5-43
steam heat treatment 5-5-43
cut
conifer Christmas trees 5-4-37
flowers and greenery 5-4-17, 5-4-18
treatment schedules for 5-4-17
pine Christmas trees 5-4-37
pine logs 5-4-37
CWA 7-4-11
cycads 5-3-7, 5-3-10, 5-3-12
Cyclamen 5-6-15
cyclamen mite
MB in 15" vacuum treatment 5-3-12
Cydia fabivora
MB at NAP treatment 5-2-29
MB in 15" vacuum/chamber only treatment 5-2-29
Cydia pomonella
CATTS treatment 5-7-2, 5-7-3
irradiation treatment 5-2-66
MB at NAP/chamber only treatment 5-2-17
Cydia splendana
MB at NAP treatment 5-2-17, 5-4-8
MB in 26" vacuum/chamber only treatment 5-2-18, 5-4-8
Cylas formicarius elegantulus
irradiation treatment 5-2-66
Cylindrosporium camalliae
treatment options 5-6-9
Cymbopogon citratus 5-2-30
cyst nematode
hot water treatment 5-6-15
Cytec 2-10-36
Cytisus 5-6-15

D

dahlia 5-6-15
Daphne spp. 5-3-10
dasheen 5-2-23, 5-2-24, 5-2-63, 5-2-64
FIFRA section 18 exemption 2-3-3
deciduous woody plants
dormant 5-3-7, 5-3-8
Degesch Fumi-Cel 5-4-39, 5-5-48
Degesch Fumi-Strip 5-4-39, 5-5-48
Degesch Phostoxin 5-4-39, 5-5-48
Degesch Phostoxin Tablet Prepac Rope 5-4-39, 5-5-48
Delaware
state hazardous waste management agencies 7-3-13
deoxyribonucleic acid (DNA) 7-4-11
Deroceras
MB at NAP treatment 5-3-6, 5-5-8
detector kits 8-1-23
Detia 5-4-39, 5-5-48
Detia Gas EX-B 5-4-39, 5-5-48
Detia Rotox AP 5-4-39, 5-5-48
DHEW 7-4-11
Dialeurodes citri
MB at NAP treatment 5-3-11, 5-3-14
Dialeurodes citri foliated host plants
treatment options 5-3-11
Dialeurodes citri nonfoliated host plants
treatment options 5-3-14
Dicentra 5-6-15
Dieffenbachia spp. 5-3-9, 5-3-12
Digital Thermister Instrument and Portable Sensors H-1-24
Digitaria spp.

dry heat treatment 5-5-42
dill 5-2-30
Dinoderus
Chlorpyrifos spray treatment 5-5-13
dioon edule 5-3-8
Dioscorea spp. 5-2-51, 5-3-28
dip treatment
equipment 2-12-1
procedures
clean up 2-12-4
designate restricted use areas 2-12-3
dip plants 2-12-4
disinfect original shipping containers 2-12-4
dry plants 2-12-4
plan 2-12-3
prepare pesticide solution 2-12-3
prepare plant material 2-12-3
release cargo 2-12-4
remove plants 2-12-4
responsibilities 2-12-5
Diplosolenodes
MB at NAP treatment 5-3-6, 5-5-8
Directory of commercial suppliers H-1-1–??
Disinfectants H-1-34
District of Columbia
state hazardous waste management agencies 7-3-13
Ditylenchus destructor
hot water treatment 5-6-18
other treatment options 5-6-14, 5-6-16
Ditylenchus dipsaci
hot water treatment 5-6-19
other treatment options 5-6-16
presoak treatment 5-6-14
DNA 7-4-11
dosage calculations
preparation 2-4-17
dose mapping 3-8-5
dosimetry 3-8-5
DOT 7-4-11
downy mildews infestation
treatment options 5-6-5
Dracaena spp. 5-3-9, 5-3-12, 5-6-15
dragon fruit
from Hawaii 5-2-68, 5-2-69
from Viet Nam 5-2-69
drainboard, 5-8-6
dried coconut 5-2-22
dried mint
FIFRA section 18 exemption 2-3-3
Drierite 8-1-4
Drierite (anhydrous calcium sulfate) H-1-24
Drierite® H-1-24
drinking water (DW) 7-4-11
dry heat, 5-8-13
drying tube
thermal conductivity gas analyzers 8-1-4
durian 5-2-53
dusts 2-13-1
DW 7-4-11
Dyspessa ulula
MB in 15" vacuum treatment 5-3-24
MB in 15" vacuum/chamber only treatment 5-2-25

E

ear corn 5-4-9
earwig
MB at NAP treatment 5-2-63
ECO2FUME 2-10-9
edible podded legume vegetables
FIFRA section 18 exemption 2-3-3
eggplant 5-2-63, 5-2-64, 5-2-70
from Ghana 5-2-69
from Hawaii 5-2-68
electrical generator 3-3-6
electrical power supply
tarapulin fumigation sites 2-4-6
electronic equipment
restricted MB fumigation item 2-3-8
Elettaria cardamomum 5-2-30
emerald ash borer
heat treatment 5-4-38
quarantine areas 5-4-38
empty holds 5-5-3
endive 5-2-24, 5-2-63, 5-2-64
Environmental Protection Agency (EPA) 7-4-11
EPA 7-4-11
Ephestia elutella
Kabat application treatment 5-4-22
MB in 28" vacuum treatment 5-4-23
vacuum-steam flow treatment 5-4-22
Epimendium pinnatum 5-6-15, 5-6-18
Epinotia aporema
MB at NAP treatment 5-2-29
MB in 15" vacuum/chamber only treatment 5-2-29
Epiphyas spp.

cold treatment followed by MB at NAP 5-2-83
MB at NAP followed by cold treatment 5-2-82
Equipment
reference guide to commercial suppliers H-1-1–??
Eryngium foetidum 5-2-30
ethrog 5-2-63, 5-2-64, 5-2-75, 5-2-76
ETO Sterilization (ETO)
vacuum chamber manufacturers 6-2-5
Eucalyptus wood chips 5-5-21
Eugenia caryophyllata 5-2-30
Euonymus alata 5-6-15
Eupatorium 5-6-15
Euphorbia 5-6-15
European cherry fruit fly
MB at NAP treatment 5-3-36
European corn borer
MB at NAP treatment 5-2-22, 5-2-45, 5-4-26
MB at NAP/chamber only treatment 5-4-25
steam sterilization treatment 5-4-26
European pine shoot moth
MB at NAP treatment 5-3-17
Eurytoma spp.
hot water treatment 5-3-16
MB in 26" vacuum treatment 5-3-35
Euscepes postfasciatus
irradiation treatment 5-2-66
evergreens 5-3-10
Exhaust Duct H-1-25
exhaust outlet
thermal conductivity gas analyzers 8-1-4
exhausting gas
conducting fumigation 2-4-35
Exosoma lusitanica
MB in 15" vacuum/chamber only treatment 5-2-19
exotic legume pod borer 5-2-29
MB in 15" vacuum/chamber only treatment 5-2-29
external feeder
hot water treatment 5-3-23
Malathion-carbaryl chemical dip treatment 5-3-6
MB at NAP treatment 5-2-3, 5-2-5, 5-2-6, 5-2-7, 5-2-8, 5-2-9, 5-2-10, 5-2-11, 5-2-12, 5-2-13, 5-2-14, 5-2-15, 5-2-16, 5-2-18, 5-2-19, 5-2-20, 5-2-21, 5-2-22, 5-2-23, 5-2-24, 5-2-26, 5-2-31, 5-2-32, 5-2-33, 5-2-34, 5-2-35, 5-2-37, 5-2-38, 5-2-39, 5-2-41, 5-2-42, 5-2-43, 5-2-44, 5-2-45, 5-2-46, 5-2-47, 5-2-48, 5-2-49, 5-2-50, 5-2-51, 5-2-52, 5-3-4, 5-3-7, 5-3-10, 5-3-11, 5-3-14, 5-3-15, 5-3-18, 5-3-19, 5-3-30, 5-3-34, 5-4-17
MB at NAP/chamber only treatment 5-3-9, 5-3-27, 5-3-31
MB at NAP/tarpaulin only treatment 5-3-19, 5-3-27, 5-3-31
MB in 15" vacuum treatment 5-3-7, 5-3-25
MB in 16" vacuum/chamber only treatment 5-3-31
MB in 26" vacuum treatment 5-3-8
phosphine at NAP 5-3-32
warm, soapy water treatment 5-2-53

F

FAA 7-4-11
facepiece 8-1-17
negative pressure test 8-1-18
positive pressure test 8-1-18
Fairchild Aerospace Corp. 5-5-30
false codling moth
cold treatment 5-2-77
false red spider mite
fumigation plus cold treatment 5-2-80
irradiation treatment 5-2-66
Fans H-1-26
farm equipment
used 5-5-22
without cabs 5-5-23
fava bean
dried 5-2-25, 5-2-63, 5-2-64
feather pillows
restricted MB fumigation item 2-3-8
Federal Aviation Administration (FAA) 7-4-11
Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) 7-4-11
feeds and milled products 5-4-21
felt
restricted MB fumigation item 2-3-8
fennel 5-2-30
fenugreek 5-2-30
FIFRA 7-4-11
FIFRA section 18 exemptions 5-2-1

avocado 2-3-3
banana 2-3-3
blackberry 2-3-3
cucurbit seed 2-3-3
cucurbit vegetables not on Q-label 2-3-3
dasheen 2-3-3
dried mint 2-3-3
edible podded legume vegetables 2-3-3
fresh herbs 2-3-3
fresh mint 2-3-3
fresh spices 2-3-3
gherkin 2-3-3
ivy gourd 2-3-3
kiwi 2-3-3
leafy vegetables not on Q-label 2-3-3
longan 2-3-3
lychee fruit 2-3-3
opuntia 2-3-3
plantain 2-3-3
pointed gourd 2-3-3
rambutan 2-3-3
raspberry 2-3-3
roots not on Q-label 2-3-3
tubers not on Q-label 2-3-3

final reading
methyl bromide 2-4-22

first aid with rescue breathing 7-1-2, 7-2-2

flag smut
dry heat treatment 5-6-5, 5-6-6
steam treatment 5-6-5, 5-6-6

flat-headed borer
kiln sterilization treatment 5-5-17

Florida
state hazardous waste management agencies 7-3-13

flow rate adjustment
thermal conductivity gas analyzers 8-1-3

flow rate meter
thermal conductivity gas analyzers 8-1-3

Foeniculum vulgare 5-2-30

foliar nematode
hot water treatment 5-6-15, 5-6-20
treatment options 5-6-18
on Begonia and Oryza 5-6-17
on Fragaria 5-6-20
on Senecio 5-6-20

forced hot air treatment 3-5-1, 6-7-1
niger seed 3-6-1

forced hot air treatment facilities
calibrating permanent temperature sensors 6-7-4
calibrating portable temperature sensors 6-7-4
certification of 6-7-1
conducting test treatment 6-7-7
documentation 6-7-8
plan and process approval 6-7-2
preliminary performance testing 6-7-3

Foreign treatment facilities protocols 6-5-7–??

Formicidae
kiln sterilization treatment 5-5-17

forms
APHIS Form 205-R, Instructions and Worksheet for Calibrating Portable Temperature Sensors A-A-3
APHIS Form 2061, Residue Sample for Food or Feed Product A-A-2
APHIS Form 206-R, Test of the Accuracy of the Permanent RTD Sensors Installed in Hot Water Tanks A-A-4
APHIS Form 207-R, Sensor Location Diagram Fruit Weights and Pulp Temperatures A-A-5
APHIS Form 208, Performance Test for Mango Hot Water Immersion Tank A-A-6
Calibration of Temperature Probes (Cold Treatment) A-A-7
Location of Temperature Sensors in Containerized Cargo (Cold Treatment) A-A-8
PPQ Form 203, Foreign Site Certificate of Inspection and/or Treatment A-A-29
PPQ Form 429, Fumigation Record A-A-9
PPQ Form 519, Compliance Agreement A-A-13
PPQ Form 523, Emergency Action Notification A-A-16
PPQ Form 556, Intransit Cold Treatment Clearance Report A-A-32

Fragaria 5-6-15, 5-6-17, 5-6-20

Fraxinus 5-4-38

fresh herbs
FIFRA section 18 exemption 2-3-3

fresh mint
FIFRA section 18 exemption 2-3-3

fresh spices
FIFRA section 18 exemption 2-3-3

frozen food locker, 5-8-13

Fruit Crates (plastic) H-1-26
fruit fly
depulping treatment 5-3-38
MB at NAP treatment 5-5-2
Fruit Sizing Equipment H-1-26
fruit tree spider mite
cold treatment followed by MB at NAP 5-2-84
Fruit, imported
foreign treatment facilities protocols 6-5-7–??
fruit-sizing equipment 3-3-6
fumigant safety 7-1-4, 7-1-6
fumigant selector switch
thermal conductivity gas analyzers 8-1-4
fumigants
physical properties of 2-2-4
thermal conductivity gas analyzers 8-1-14
fumigation
exposure to 7-1-1
guidelines 2-2-3
Fumigation Chamber (Vacuum) H-1-27
Fumigation Chamber, NAP H-1-27
Fumigators (commercial) H-1-28
Fumiphos
bags 5-4-39, 5-5-48
pellets 5-4-39, 5-5-48
tablets 5-4-39, 5-5-48
Fumiscope 8-1-2
Fumitoxin 5-4-39, 5-5-48
Fungicides H-1-28
fungous diseases
steam sterilization treatment 5-4-14
fungous rice diseases
dry heat treatment 5-4-14, 5-4-15
steam sterilization treatment 5-4-15
furs
restricted MB fumigation item 2-3-8

G

g 7-4-11
Galium odorata 5-2-30
garbage 5-5-45, 5-5-46
Gardenia 5-6-15
gardenia 5-6-15
garlic 5-2-25, 5-2-63, 5-2-64, 5-3-24
garlic beetle
MB in 15" vacuum treatment 5-3-24
MB in 15" vacuum/chamber only treatment 5-2-25
garlic carpenterworm
MB in 15" vacuum/chamber only treatment 5-2-25
Gas Analyzers H-1-30
gas- and vapor-removing respirators 8-1-15
Gas Detector Tube (colorimetric) and Apparatus H-1-32
Gas Drying Tube (for Drierite) H-1-33
gas introduction
methyl bromide 2-4-20
gas introduction lines
methyl bromide 2-4-11
gas penetration and distribution
tarpaulin fumigation 2-4-10
gas samples 8-1-23
gas sampling tubes
methyl bromide 2-4-12
Gastoxin 5-4-39, 5-5-48
gastrointestinal (GI) 7-4-11
Gaultheria procumbens 5-2-30
Gentiana 5-6-8, 5-6-15
Georgia
state hazardous waste management agencies 7-3-13
Gerbera 5-6-15
Germicides H-1-34
gesneria 5-6-15
Geum 5-6-15
gherkin
FIFRA section 18 exemption 2-3-3
GI 7-4-11
gin trash 5-4-2, 5-4-6, 5-4-7
ginger 5-2-63
rhizome 5-2-26
ginger root 5-2-64
Gladiolus 5-6-15, 5-6-18
Gladiolus spp. 5-3-24, 5-3-25
gladiolus thrips
MB at NAP treatment 5-3-24
MB in 26" vacuum treatment 5-3-25
glass mercury and certified precision thermometers 8-1-35
Globodera pallida
hot water treatment 5-6-14, 5-6-15, 5-6-19
other treatment options 5-6-14
Globodera rostochiensis
hot water treatment 5-6-15, 5-6-19
MB at NAP treatment 5-5-22, 5-5-27

MB at NAP/chamber only treatment 5-4-5
MB in 26" vacuum treatment 5-4-18, 5-5-11, 5-5-14, 5-5-22, 5-5-26, 5-5-27
other treatment options 5-6-14
steam cleaning treatment 5-5-22
steam treatment 5-5-23
goatskin 5-5-46, 5-5-47
goatskin, lambskin, sheepskin
treatment options 5-5-46
golden nematode 5-5-22
hot water treatment 5-6-15
MB at NAP treatment 5-5-27
MB at NAP/chamber only treatment 5-4-5
MB in 26" vacuum treatment 5-4-18, 5-5-11, 5-5-14, 5-5-22, 5-5-26, 5-5-27
steam treatment 5-5-23
Gow-Mac Instrument Company 8-1-2
grains
nonpropagative 5-4-12
grains and seeds
nonpropagative 5-4-9, 5-4-10, 5-4-11
treatment options 5-4-8
nonpropagative and contaminated with cottonseed 5-4-11
grains of paradise 5-2-30
gram (g) 7-4-11
grape 5-2-27, 5-2-63, 5-2-64, 5-2-75, 5-2-76, 5-2-77, 5-2-80, 5-2-82, 5-6-15
from Australia 5-2-83
from Chile 5-2-28
grapefruit 5-2-28, 5-2-63, 5-2-64, 5-2-75, 5-2-76
from Mexico 5-2-70
from Mexico and U.S. quarantine areas 5-2-28
Grapes
methyl bromide fumigation treatment schedule ??–5-2-28, ??–5-2-34
grapevine moth
fumigation plus cold treatment 5-2-80
Graphognathus spp.
MB at NAP treatment 5-2-44
Grapholita molesta 5-2-66
CATTS treatment 5-7-2, 5-7-3
gray (Gy) 3-8-6
green pod vegetables 5-2-29, 5-2-63, 5-2-64
greenhouse-grown plants 5-3-11, 5-3-12
greenwood cuttings of woody plants 5-3-11, 5-3-12
Guam
state hazardous waste management agencies 7-3-13
guava
from Mexico 5-2-69
Guizotia abyssinica 5-5-42
gummosis disease
domestic treatment of 5-8-13
gypsy moth egg masses
heat treatment 5-4-38
MB at NAP treatment 5-4-37, 5-5-44

H

Halotydeus destructor
MB at NAP treatment 5-2-4
handicrafts 5-4-16
hardwood firewood 5-4-38
Harmolita spp.
MB at NAP/chamber only treatment 5-4-16
Hawaii
state hazardous waste management agencies 7-3-13
hazard communication 7-4-1
HDT 7-4-11
heat treatment 3-2-1
heat treatment of firewood facilities
calibrating temperature sensors 6-9-3
certification frequency 6-9-5
certification of 6-9-1
conducting test treatment 6-9-5
contact information 6-9-6
documentation 6-9-6
official certification testing 6-9-3
plan and process approval 6-9-2
thermal mapping 6-9-4
heated regulated dispenser 2-10-13
Heilipus lauri
MB in 26" vacuum treatment 5-3-29
Helicella
cold treatment 5-5-10
MB at NAP treatment 5-5-5, 5-5-7
Helicella spp.
MB in 26" vacuum treatment 5-3-33
Helicellidae
cold treatment 5-5-10
Helicidae

cold treatment 5-5-10
MB at NAP treatment 5-5-8
Helicopsis
MB at NAP treatment 5-5-5, 5-5-7
Helicostyla
cold treatment 5-5-10
MB at NAP treatment 5-5-9
Helicoverpa armigera
MB at NAP treatment 5-2-36
Heliopsis 5-6-15
Helix
cold treatment 5-5-10
MB at NAP treatment 5-5-5, 5-5-8
Helleborus 5-6-15
Hemileia spp.
treatment options 5-6-9
hemoglobin (Hgb) 7-4-11
herbaceous plants and cuttings 5-3-11, 5-3-12
herbs and spices
dried 5-2-30
fresh 5-2-31, 5-2-63, 5-2-64
Hessian fly
phosphine at NAP treatment 5-4-28
Heterodera humuli
hot water treatment 5-6-15
Hevea brasiliensis
seeds of 5-3-35
Hgb 7-4-11
HHS 7-4-11
Hibiscus 5-6-15
pods and seeds of 5-3-32, 5-3-33
hibiscus
pods and seeds of 5-3-32
hickory nuts 5-2-78
highest dose tested (HDT) 7-4-11
high-protein flours
restricted MB fumigation item 2-3-8
hitchhiking insect
d-phenothrin aerosols treatment 5-5-29
MB at NAP treatment 5-2-63, 5-4-17
residual insecticidal spray treatment 5-5-4
honeydew melon 5-2-37, 5-2-63, 5-2-64
horehound 5-2-30
horsehair articles
restricted MB fumigation item 2-3-8
horseradish 5-2-32, 5-2-63, 5-2-64
root 5-3-25, 5-6-15
Hosta 5-6-15, 5-6-18
hot water immersion treatment
facility electrical components 3-3-5
USDA checklist 3-3-3
facility design 3-3-4
on-site inspection 3-3-4
proposal submission 3-3-3
hot water immersion treatment facilities
certification of 6-5-1
foreign treatment facility protocols 6-5-7
mango temperatures prior to treatment 6-5-3
new procedures 6-5-2
permanent probe temperatures 6-5-4
preliminary performance testing 6-5-1
Hoya 5-6-15
humulus 5-6-15
Hyacinthus
bulbs 5-6-16
Hygromiidae
cold treatment 5-5-10
Hymenoptera
kiln sterilization treatment 5-5-17
hyssop 5-2-30
Hyssopus officinalis 5-2-30

I

i.m. 7-4-11
i.p. 7-4-11
i.v. 7-4-11
Idaho
state hazardous waste management agencies 7-3-13
Ilex 5-3-10
Illicium verum 5-2-30
Illinois
state hazardous waste management agencies 7-3-13
impermeable papers
methyl bromide fumigation 2-3-5
impervious surface
methyl bromide 2-4-5
imported crucifer weevil
MB in 15" vacuum/chamber only treatment 5-2-32
imported fire ant
domestic treatment of 5-8-5
inanimate, nonfood articles with gypsy moth egg masses 5-5-44
incense-cedar wood wasp
kiln sterilization treatment 5-5-17
Incinerators H-1-34

Indiana
state hazardous waste management agencies 7-3-13
Infrared Spectroscopy Gas Monitoring Device
Spectros 8-1-9
inhalation reference dose (RfDi) 7-4-12
inlet
thermal conductivity gas analyzers 8-1-3
internal feeder
dry heat treatment 5-4-14
MB at NAP treatment 5-2-36, 5-2-40, 5-2-43, 5-2-47, 5-2-49, 5-2-51, 5-3-25, 5-3-32, 5-4-14
MB in 15" vacuum treatment 5-2-13, 5-3-4
MB in 15" vacuum/chamber only treatment 5-2-6, 5-2-24, 5-2-26, 5-2-41, 5-2-46, 5-2-51
MB in 26" vacuum treatment 5-3-9, 5-3-29, 5-3-30, 5-3-33, 5-3-35, 5-4-15
MB in 26" vacuum treatment/kenaf and okra seed only 5-3-32
MB in 26" vacuum/chamber only treatment 5-3-28
phosphine at NAP 5-3-33
steam sterilization treatment 5-4-14
intramuscular (i.m.) 7-4-11
intraperitoneal (i.p.) 7-4-11
intravenous (i.v.) 7-4-11
ionizing radiation 3-8-6
Iowa
state hazardous waste management agencies 7-3-13
Ipomoea 5-2-49
Ipomoea spp. 5-3-28
iris 5-6-15
bulbs and rhizomes 5-6-16
irradiation 3-8-1, 3-8-6
documentation 3-8-5
terminology 3-8-6
treatment objectives 3-8-2
irradiation minimum absorbed dose for
Anastrepha ludens 5-2-66
Anastrepha obliqua 5-2-66
Anastrepha serpentina 5-2-66
Anastrepha suspensa 5-2-66
apple maggot 5-2-66
Bactrocera cucurbitae 5-2-66
Bactrocera dorsalis 5-2-66
Bactrocera jarvisi 5-2-66
Bactrocera tryoni 5-2-66
Brevipalpus chilensis 5-2-66
Caribbean fruit fly 5-2-66
Ceratitis capitata 5-2-66
codling moth 5-2-66
Conotrachelus nenuphar 5-2-66
Cryptophlebia illepida 5-2-66
Cryptophlebia ombrodelta 5-2-66
Cydia pomonella 5-2-66
Cylas formicarius elegantulus 5-2-66
Euscepes postfasciatus 5-2-66
false red spider mite 5-2-66
Grapholita molesta 5-2-66
Jarvis fruit fly 5-2-66
koa seedworm 5-2-66
litchi fruit moth 5-2-66
mango seed weevil 5-2-66
Mediterranean fruit fly 5-2-66
melon fruit fly 5-2-66
Mexican fruit fly 5-2-66
Omphisa anastomosalis 5-2-66
oriental fruit fly 5-2-66
oriental fruit moth 5-2-66
plum curculio 5-2-66
Queensland fruit fly 5-2-66
Rhagoletis pomonella 5-2-66
Sapote fruit fly 5-2-66
Sternochetus mangiferae 5-2-66
sweet potato vine borer 5-2-66
sweet potato weevil 5-2-66
West Indian fruit fly 5-2-66
West Indian sweet potato weevil 5-2-66
irradiation treatment facilities
audits 6-8-3
certificate of approval 6-8-3
certification of 6-8-1
certification requirements 6-8-1
recertification 6-8-2
Isoptera
kiln sterilization treatment 5-5-17
ivy gourd
FIFRA section 18 exemption 2-3-3

J

jackfruit
from Hawaii 5-2-68, 5-2-69
Jarvis fruit fly 5-2-66
Jasminum 5-6-15
Jerusalem artichoke 5-2-63, 5-2-64
jointworm
MB at NAP/chamber only treatment

5-4-16
juniper berry 5-2-30
Juniperus communis 5-2-30

K

kaempferia 5-6-15
Kalanchoe synsepala 5-3-12
kale 5-2-32
Kansas
state hazardous waste management agencies 7-3-13
Kanzawa mite
cold treatment followed by MB at NAP 5-2-84
karnal bunt
domestic treatment of 5-8-14
kenaf
pods and seeds of 5-3-32, 5-3-33
Kentucky
state hazardous waste management agencies 7-3-13
kg 7-4-11
khapra beetle
aircraft treatment 5-5-29
heat treatment 5-4-21
Malathion spray treatment 5-5-3, 5-5-4
MB at NAP treatment 5-3-34, 5-4-4, 5-4-19, 5-5-6, 5-5-11, 5-5-19, 5-5-43
MB at NAP/chamber only treatment 5-4-2
MB at NAP/tarpaulin only treatment 5-4-2, 5-4-3, 5-4-9, 5-5-46
MB at NAP/tarpaulin-covered car treatment 5-5-2, 5-5-6
MB in 26" NAP/chamber only treatment 5-4-10
MB in 26" vacuum treatment 5-4-19, 5-5-47
MB in 26" vacuum/chamber only treatment 5-4-10, 5-5-47
khapra beetle-infested material
treatment options 5-4-21
kilogram (kg) 7-4-11
kiwi 5-2-33, 5-2-63, 5-2-64, 5-2-75, 5-2-76, 5-2-80
FIFRA section 18 exemption 2-3-3
Kniphofia 5-6-15
koa seedworm
irradiation treatment 5-2-66
MB at NAP treatment 5-3-33
Kodo millet 5-5-42
kohleria 5-6-15
kohlrabi 5-2-34
kraft paper
methyl bromide fumigation 2-3-6
kumquat 5-2-63, 5-2-64

L

L 7-4-11
lablab bean 5-2-29
lambskin 5-5-46, 5-5-47
treatment options 5-5-46
lard
restricted MB fumigation item 2-3-8
Lasioderma serricorne
Kabat application treatment 5-4-22
MB in 28" vacuum treatment 5-4-23
vacuum-steam flow treatment 5-4-22
Laurus nobilis 5-2-30
Lavandula spp. 5-3-10, 5-3-12
lavender 5-2-30
Lavendula offinalis 5-2-30
LC50 7-4-11
LCLO 7-4-11
LD50 7-4-11
LDLO 7-4-11
LDT 7-4-11
leaf miner
hot water treatment 5-3-6, 5-3-16
MB at NAP treatment 5-2-8, 5-2-9, 5-2-10, 5-2-11, 5-2-12, 5-2-14, 5-2-15, 5-2-21, 5-2-22, 5-2-29, 5-2-31, 5-2-32, 5-2-34, 5-2-35, 5-2-38, 5-2-39, 5-2-40, 5-2-46, 5-2-47, 5-2-50, 5-2-63, 5-3-11, 5-4-17
MB in 15" vacuum/chamber only treatment 5-2-29
leaf tobacco for export 5-4-22
leafy vegetables 5-2-35, 5-2-63, 5-2-64
not on Q label
FIFRA section 18 exemption 2-3-3
leather goods
restricted MB fumigation item 2-3-8
leek 5-2-36
Leguminosae=Fabaceae
seeds of 5-3-35, 5-3-36
Leidyula
MB at NAP treatment 5-3-6, 5-5-8
LEL 7-4-11
lemon 5-2-63, 5-2-64, 5-2-75
from Chile 5-2-20

lemon balm 5-2-30
lemongrass 5-2-30
lentil
dry 5-2-36
Lepidoptera
kiln sterilization treatment 5-5-17
MB at NAP treatment 5-5-13
Leptosphaeria spp.
treatment options 5-6-9
lesion nematode
hot water treatment 5-6-15
lethal concentration 50 (LC50) 7-4-11
lethal concentration low (LCLO) 7-4-11
lethal dose 50 (LD50) 7-4-11
lethal dose low (LDLO) 7-4-11
lettuce
from Spain 5-2-36
Levisticum officinale 5-2-30
Libium
bulbs 5-6-19
light brown apple moth complex
cold treatment followed by MB at NAP 5-2-83
MB at NAP followed by cold treatment 5-2-82
Lignus 5-5-7
cold treatment 5-5-10
MB at NAP treatment 5-5-5
lily bulbs packed in subsoil 5-3-25
Limacidae
MB at NAP treatment 5-3-6, 5-5-8
Limax
MB at NAP treatment 5-3-6, 5-5-8
lime 5-2-54, 5-2-63, 5-2-64
from Chile 5-2-20, 5-2-54
Limicolaria
cold treatment 5-5-10
MB at NAP treatment 5-5-5
other treatment options 5-5-7
Limnaeidae
hot water treatment 5-3-3
line switches
thermal conductivity gas analyzers 8-1-3
lint 5-4-6, 5-4-7
linters 5-4-2, 5-4-6
litchi 5-2-37, 5-2-64, 5-2-75, 5-2-76, 5-2-78
from Hawaii 5-2-55, 5-2-68, 5-2-71
from Thailand 5-2-69
litchi fruit moth
irradiation treatment 5-2-66
liter (L) 7-4-11
liver-seed grass 5-5-42
liverworts
herbarium specimens in soil 5-5-26
herbarium specimens in soil 5-5-26
LOAEL 7-4-11
Lobesia botrana
fumigation plus cold treatment 5-2-80
MB at NAP treatment 5-2-27
Lobesia botrana
methyl bromide fumigation treatment schedule ??–5-2-27
location of Temperature Sensors in Containerized Cargo (cold treatment) A-A-8
logs and firewood
treatment schedules for 5-4-38
Logs and lumber
adjusting exposure period 5-4-31
logs from gypsy moth quarantine areas 5-4-38
longan 5-2-76, 5-2-78
FIFRA section 18 exemption 2-3-3
from Hawaii 5-2-55, 5-2-68
from Thailand 5-2-69
long-horned borer
kiln sterilization treatment 5-5-17
Lonicera
seeds of 5-3-36
loquat 5-2-75
Louisiana
state hazardous waste management agencies 7-3-14
lovage 5-2-30
lower exposure limit (LEL) 7-4-11
lowest dose tested (LDT) 7-4-11
lowest-observed adverse effect level (LOAEL) 7-4-11
lychee 5-2-37, 5-2-64, 5-2-75, 5-2-76, 5-2-78
FIFRA section 18 exemption 2-3-3
from Hawaii 5-2-55, 5-2-68, 5-2-71
from Thailand 5-2-69
lychee fruit borer
cold treatment 5-2-78
lycoris 5-3-26
Lyctidae
kiln sterilization treatment 5-5-17
lygaeid bug
MB at NAP treatment 5-2-63

Lymantria dispar egg masses
heat treatment 5-4-38
MB at NAP treatment 5-4-37
Lymexylonidae
kiln sterilization treatment 5-5-17

M

m 7-4-11
macadamia nut
seeds of 5-3-33
mace 5-2-30
machinery with milled surfaces
restricted MB fumigation item 2-3-8
magazines
restricted MB fumigation item 2-3-8
magnesium articles
restricted MB fumigation item 2-3-8
Magnesium Phosphide H-1-35
Maine
state hazardous waste management agencies 7-3-14
Maintenance- Supporting and Updating the Export Certification Manual H-1-1–??
Mamestra brassicae
MB at NAP treatment 5-2-36
mandarin 5-2-63, 5-2-64, 5-2-75
from Chile 5-2-20
mango 5-2-56
from Hawaii 5-2-69
from India 5-2-69
from Mexica 5-2-60
from Mexico 5-2-70
from Taiwan 5-2-72
from Thailand 5-2-69
from the Philippines 5-2-71
mango seed weevil
irradiation treatment 5-2-66, 5-2-69
mangosteen
from Hawaii 5-2-68, 5-2-69
from Thailand 5-2-69
Manometer H-1-35
margin of exposure (MOE) 7-4-11
margin of safety (MOS) 7-4-11
marigold 5-2-30
marjoram 5-2-30
Marribium vulgare 5-2-30
Maruca testulalis
MB at NAP treatment 5-2-29
MB in 15" vacuum/chamber only treatment 5-2-29
Maryland
state hazardous waste management agencies 7-3-14
Massachusetts
state hazardous waste management agencies 7-3-14
Material Safety Data Sheets (MSDS) 7-4-1
maximum tolerated dose (MTD) 7-4-11
Mayetiola destructor
phosphine at NAP treatment 5-4-28
McDonald-Douglas Corporation 5-5-31
mealybug
hot water immersion treatment 5-2-54
MB at NAP treatment 5-2-37, 5-2-64, 5-4-18
mechanical cotton picker and other cotton equipment 5-5-25
treatment schedules for 5-5-25
MED 7-4-11
median threshold limit (MTL) 7-4-11
Medicago falcata 5-6-14
Medicago gaetula 5-6-14
Medicago glutinosa 5-6-14
Medicago media 5-6-14
Medicago sativa 5-6-14
Mediterranean fruit fly
cold treatment 5-2-75
cold treatment followed by MB at NAP 5-2-83
forced hot air treatment 5-2-59, 5-2-61
fumigation plus cold treatment 5-2-80
hot water immersion treatment 5-2-55, 5-2-56
irradiation treatment 5-2-66
MB at NAP followed by cold treatment 5-2-82
MB at NAP treatment 5-2-4, 5-2-7, 5-2-19, 5-2-27, 5-2-33, 5-2-49, 5-2-50
vapor heat treatment 5-2-70, 5-2-71, 5-2-72, 5-2-73
Meghimatium
MB at NAP treatment 5-3-6, 5-5-8
Melissa officinalis 5-2-30
Meloidogyne spp.
hot water treatment 5-6-15, 5-6-16, 5-6-17
on Chrysanthemum 5-6-16
on Rosa 5-6-17
melon 5-2-37
from Hawaii 5-2-68, 5-2-69

melon fly
cold treatment 5-2-78
forced hot air treatment 5-2-59, 5-2-61
fumigation plus cold treatment 5-2-80
irradiation treatment 5-2-66
vapor heat treatment 5-2-70, 5-2-72
Mentha pulegium 5-2-30
mesquite 5-5-42
metal and wood surfaces 5-5-4
metallic borer
kiln sterilization treatment 5-5-17
Metam-sodium H-1-36
meter (m) 7-4-11
methyl bromide 2-3-1
"Q labels" and section 18 exemptions 2-3-2
box and package aeration 2-3-5
box and package penetration 2-3-5
chamber fumigation 2-5-1, 2-5-4
container fumigations without tarpaulin 2-8-1
corrugated cartons 2-3-6
gas analysis 2-3-5
humidity effects 2-3-5
impermeable papers 2-3-5
kraft paper 2-3-6
leak detection 2-3-5
plastic wrappings 2-3-5
poisoning 7-1-3
properties and use 2-3-1
recapture equipment H-1-39
recapture standards 8-1-36
residual effect 2-3-7
ship fumigation 2-6-1
sorption 2-3-6
structure fumigation 2-7-1
tarpaulin fumigation 2-4-1
break bulk cargo 2-4-7
preparation 2-4-13
tarpaulin fumigation sites
ability to heat area 2-4-5
aeration requirements 2-4-6
electrical power supply 2-4-6
impervious surface 2-4-5
nonwork area 2-4-5
water supply 2-4-6
well-lighted area 2-4-6
well-ventilated, sheltered area 2-4-4
temperature effects 2-3-5
wooden boxes 2-3-6
Methyl Bromide 100% H-1-37
Mexican fruit fly
cold treatment 5-2-76
forced hot air treatment 5-2-60
hot water immersion treatment 5-2-56
irradiation treatment 5-2-66
mg 7-4-11
mg/kg 7-4-11
mg/L 7-4-11
Michigan
state hazardous waste management agencies 7-3-14
microgram (ug) 7-4-12
micrograms per cubic meter (ug/cu.) 7-4-12
micrograms per liter (ug/L) 7-4-12
micronized dusts 2-11-2
cartridges 2-11-2
equipment 2-11-2
Milacidae
MB at NAP treatment 5-3-6, 5-5-8
Milax
MB at NAP treatment 5-3-6, 5-5-8
milligram (mg) 7-4-11
milligrams per kilogram (mg/kg) 7-4-11
milligrams per liter (mg/L) 7-4-11
millimeters of mercury (mmHg) 7-4-11
minimum absorbed dose 3-8-6
minimum effective dose (MED) 7-4-11
Minnestoa
state hazardous waste management agencies 7-3-14
miscellaneous cargo
nonfood 5-5-7, 5-5-9
miscellaneous cargo (nonfood and nonfeed commodities) 5-5-7, 5-5-8, 5-5-9, 5-5-10, 5-5-11, 5-5-13, 5-5-22
nonfood that is NOT sorptive or difficult to penetrate 5-5-11, 5-5-12
nonfood that IS sorptive or difficult to penetrate 5-5-12
treatment options 5-5-7
Mississippi
state hazardous waste management agencies 7-3-14
Missouri
state hazardous waste management agencies 7-3-14
mite
hot water treatment 5-3-6
Mityvac hand-held vacuum pump 8-1-33
mizuna 5-2-38

mmHg 7-4-11
MOE 7-4-11
Moisture Meter (for wood) H-1-39
Monarcha
MB at NAP treatment 5-5-5, 5-5-7
Montana
state hazardous waste management agencies 7-3-14
Mordellistena spp.
MB in 15" vacuum treatment 5-3-15
moringa pods
from Hawaii 5-2-68, 5-2-69
MOS 7-4-11
mosses
herbarium specimens in soil 5-5-26
moth 5-5-17
mountain papaya 5-2-70
from Chile 5-2-61
MP 2-10-9
MSDS 7-4-1
MTD 7-4-11
MTL 7-4-11
Murrya koenigii 5-2-30
Muscari 5-6-19
muskmelon 5-2-37, 5-2-63, 5-2-64
mustard greens 5-2-38
mustard seed 5-2-30
mustard spinach 5-2-39
Mycosphaerella spp.
treatment options 5-6-9
Myristica fragrans 5-2-30

N

naegelia 5-6-15
nanogram (ng) 7-4-12
Narcissus
bulbs 5-6-16
narcissus 5-3-26, 5-3-27
narrow-wasted bark beetle
kiln sterilization treatment 5-5-17
nasturtium 5-2-30
natal fruit fly 5-2-77
cold treatment 5-2-75, 5-2-77
National Fire Prevention Association (NFPA) 7-4-11
National Institute for Occupational Safety and Health (NIOSH) 7-4-12
National Monitoring and Residue Analysis Laboratory (NMRAL) 7-4-12
National Toxicology Program (NTP) 7-4-12
natural rubber goods
restricted MB fumigation item 2-3-8
Nebraska
state hazardous waste management agencies 7-3-14
nectarine 5-2-3, 5-2-39, 5-2-63, 5-2-64, 5-2-75, 5-2-77, 5-2-80, 5-7-2
nematode
other treatment options 5-6-18
steam cleaning treatment 5-5-28
nematode cyst
high pressure steam cleaning treatment 5-5-2
Nepeta cataria 5-2-30
Nevada
state hazardous waste management agencies 7-3-15
New Hampshire
state hazardous waste management agencies 7-3-15
New Jersey
state hazardous waste management agencies 7-3-15
New Mexico
state hazardous waste management agencies 7-3-15
New York
state hazardous waste management agencies 7-3-15
Newsletters H-1-40
newspapers
restricted MB fumigation item 2-3-8
NFPA 7-4-11
ng 7-4-12
Nigelia sativa 5-2-30
niger seed 5-5-42
treatment facilities 3-6-1
USDA-APHIS requirements 3-6-1
NIOSH 7-4-12
NMRAL 7-4-12
NOAEL 7-4-12
Noctuidae spp.
MB at NAP treatment 5-2-3, 5-2-5, 5-2-7, 5-2-37, 5-2-44, 5-2-47
NOEL 7-4-12
Nonchemical treatments
heat
Cold Treatment (CT) 3-7-1–??
nonperishable commodities in temporary

enclosures 2-2-2
nonplant articles 5-5-42, 5-6-7
nonwork area
methyl bromide 2-4-5
no-observed adverse effect level (NOAEL) 7-4-12
no-observed effect level (NOEL) 7-4-12
normal atmospheric pressure (NAP) chambers 2-5-5, 2-5-6
North Carolina
state hazardous waste management agencies 7-3-15
North Dakota
state hazardous waste management agencies 7-3-15
Northern Mariana Islands
state hazardous waste management agencies 7-3-15
novelties
made from rice straw 5-6-13
made of rice straw 5-6-12
noxious weed seeds
other treatment options 5-5-43
steam heat treatment 5-5-43
NTP 7-4-12
nut fruit tortrix
MB at NAP treatment 5-2-17, 5-4-8
MB in 26" vacuum/chamber only treatment 5-2-18, 5-4-8
nutmeg 5-2-30
Nysius huttoni
MB at NAP treatment 5-2-33

O

oak logs and lumber 5-4-30
treatment schedules for 5-4-29
oak wilt disease
MB at NAP treatment 5-4-30
Occupational Safety and Health Administration (OSHA) 7-4-1
Ocimum basilicum 5-2-30
officer in charge (OIC) 7-4-12
Ohio
state hazardous waste management agencies 7-3-15
OIC 7-4-12
Oklahoma
state hazardous waste management agencies 7-3-15
okra 5-2-40, 5-2-63, 5-2-64
from Ghana 5-2-69
pods and seeds of 5-3-32, 5-3-33
Omalomyx unguis
water spray treatment 5-3-13
Omalonyx
MB at NAP treatment 5-5-5, 5-5-9
Omalonyx unguis host plants
treatment options 5-3-13, 5-3-14
Omphisa anastomosalis
irradiation treatment 5-2-66
onion 5-2-40, 5-2-63, 5-2-64
onion/garlic carpenterworm
MB in 15" vacuum treatment 5-3-24
onionweed
dry heat treatment 5-5-42
open-arm manometer 8-1-30
Opiodothella orchidearum 5-6-9
opuntia 5-2-50
FIFRA section 18 exemption 2-3-3
oral reference dose (RfDo) 7-4-12
orange 5-2-63, 5-2-64, 5-2-75, 5-2-76
from Mexico 5-2-70, 5-2-71
from Mexico and U.S. quarantine areas 5-2-40
orchid plant pest infestation
treatment options 5-6-9
orchids 5-3-12, 5-6-3, 5-6-9, 5-6-10, 5-6-15
plants and cuttings 5-3-14, 5-3-15, 5-3-16
to Florida 5-6-8
Oregon
state hazardous waste management agencies 7-3-16
oriental fruit fly
cold treatment 5-2-78
forced hot air treatment 5-2-59, 5-2-61
fumigation plus cold treatment 5-2-80
hot water immersion treatment 5-2-55
irradiation treatment 5-2-66
vapor heat treatment 5-2-70, 5-2-71, 5-2-72, 5-2-73
oriental fruit moth
CATTS treatment 5-7-2, 5-7-3
irradiation treatment 5-2-66
Origanum spp. 5-2-30
Ornithogalum 5-6-15, 5-6-19
ortanique 5-2-75
Orussidae
kiln sterilization treatment 5-5-17
Oryza 5-6-17
Oryza spp. 5-5-42
OSHA 7-4-1

Osmanthus americanus
treatment options 5-3-10, 5-3-12
Ostrinia nubilalis
MB at NAP treatment 5-2-22, 5-2-45, 5-4-26
MB at NAP/chamber only treatment 5-4-25
MB in 26" vacuum treatment 5-4-25
steam sterilization treatment 5-4-26
Otala
cold treatment 5-5-10
MB at NAP treatment 5-5-5, 5-5-8
Oulema melanopus
phosphine at NAP treatment 5-4-28
oxygen 7-4-9

P

p.o. 7-4-12
packaged cottonseed 5-4-7
padding corners
methyl bromide 2-4-13
paddy rice 5-6-17
Paeonia 5-6-15, 5-6-18
Pallifera
MB at NAP treatment 5-3-6, 5-5-8
Papaver somniferum 5-2-30
papaya 5-2-70, 5-2-72, 5-6-17
from Belize 5-2-61
from Hawaii 5-2-61, 5-2-68
paper with high rag or sulfur content
restricted MB fumigation item 2-3-8
parasitic wood wasp
kiln sterilization treatment 5-5-17
parsley 5-2-30
parsnip 5-2-41, 5-2-63, 5-2-64
particulate-removing respirators 8-1-15
parts per billion (ppb) 7-4-12
parts per million (ppm) 7-4-12
Paspalum scrobiculatum
dry heat treatment 5-5-42
Passalidae
kiln sterilization treatment 5-5-17
Passiflora 5-6-15
passion fruit
from Chile 5-2-58
pea 5-2-29, 5-2-63
dry 5-2-42
peach 5-2-3, 5-2-41, 5-2-63, 5-2-64, 5-2-75, 5-2-76, 5-2-77, 5-2-80, 5-7-2
peach fruit moth
cold treatment followed by MB at NAP 5-2-84
peanut
with gypsy moth egg masses 5-3-10
pear 5-2-3, 5-2-42, 5-2-63, 5-2-64, 5-2-75, 5-2-76, 5-2-80, 5-2-82
from Australia 5-2-83
pecan 5-2-78
pecan weevil
cold treatment 5-2-78
Pectinophora gossypiella
MB at NAP treatment 5-5-2, 5-5-25
MB at NAP/chamber only treatment 5-2-40
Pectinophora spp. 5-4-7
acid delinting and heat treatment 5-4-3
MB at NAP/chamber only treatment 5-4-6, 5-4-18
MB at NAP/tarpaulin only treatment 5-4-2, 5-4-7
MB in 26" vacuum/chamber only treatment 5-4-6
other treatment options 5-4-11, 5-4-12
phosphine at NAP treatment 5-4-6
PEL 7-4-12
Pelargonium spp.
MB in 15" vacuum treatment 5-3-12
Pennsylvania
state hazardous waste management agencies 7-3-16
pennyroyal 5-2-30
Pentatomidae spp.
MB at NAP treatment 5-2-7, 5-2-47
pepper 5-2-43, 5-2-63, 5-2-64
from Ghana 5-2-69
per os (by mouth) (p.o.) 7-4-12
perishable commodities in temporary enclosures 2-2-3
permanent temperature sensors 6-7-4
permissible exposure limit (PEL) 7-4-12
persimmon 5-2-75, 5-2-76
Personal Air Sample Pump H-1-41
pesticide exposure 7-2-1
mild poisoning 7-2-3
moderate poisoning 7-2-3
severe poisoning 7-2-3
pesticide safety 7-2-3
pesticide spills
cleanup techniques 7-3-8
contaminated materials disposal 7-3-10
contamination control 7-3-5
crash notification 7-3-5

decontamination 7-3-9
emergency kit 7-3-17
emergency procedures 7-3-2
environmental monitoring 7-3-10
evaluate situation 7-3-3
identify contacts 7-3-3
managing of 7-3-1
planning for 7-3-11
post-spill procedures 7-3-10
reporting 7-3-10
safety and first aid 7-3-3
site security 7-3-7
pesticides other than fumigants
thermal conductivity gas analyzers 8-1-14
Pestroselinum crispum 5-2-30
Philodendron spp. 5-3-9, 5-3-12
Philomycidae
MB at NAP treatment 5-3-6, 5-5-8
Phomo chrysanthemi
Bordeaux spray or dip treatment 5-6-3
other treatment options 5-6-3
Phomopis carica-papayae
hot water treatment 5-6-17
on papaya 5-6-17
Phomopsis orchidophilia
treatment options 5-6-9
Phos-Kill 5-4-39, 5-5-48
phosphine
AP and MP 2-10-18
AP and MP fumigation 2-10-30
probing 2-10-30
AP, MP, ECO2FUME, VAPORPH3OS
intransit ship board fumigation 2-10-31
intransit wood chip fumigation 2-10-31
despensing ECO2FUME fumigant gas 2-10-11
approved dispensing methods 2-10-13
equipment specification and use 2-10-12
unapproved dispensing methods 2-10-12
ECO2FUME 2-10-19
leak detection 2-10-4
poisoning 7-1-3
properties and use 2-10-1
respiratory protection 2-10-7
safety 2-10-4
applicator requirements 2-10-4
first aid treatment 2-10-7
storage and handling 2-10-5
VAPORPH3OS 2-10-20
phosphine detector 8-1-33
Photinia 5-3-10
photo ionization detector 8-1-34
photographic prints
restricted MB fumigation item 2-3-8
photography chemicals
restricted MB fumigation item 2-3-8
PHS 7-4-12
Phthorimaea operculela
MB at NAP treatment 5-2-45
Phyllachora spp.
treatment options 5-6-9
Phyllosticta bromeliae
Captan treatment 5-6-8
Phyllosticta spp.
treatment options 5-6-9
Physoderma diseases
treatment options 5-6-5
Phytophthora ramorum
domestic treatment of 5-8-15
piece goods 5-4-2
Pieris spp.
MB at NAP treatment 5-5-13
piers 5-5-22
pigeon pea 5-2-29
Pimenta dioica 5-2-30
pimento 5-2-63, 5-2-64
Pimpinella anisum 5-2-30
pine
from Canada 5-3-17
pine shoot beetle
domestic treatment of 5-8-1
MB at NAP treatment 5-4-37
pineapple 5-2-43, 5-2-63, 5-2-64, 5-2-70
from Hawaii 5-2-68
from Thailand 5-2-69
pineapple slip 5-3-16
pin-hole borer
kiln sterilization treatment 5-5-17
pink bollworm
MB at NAP treatment 5-5-2, 5-5-25
MB at NAP/chamber only treatment 5-2-40
Pinus radiata wood chips 5-5-21
Pinus spp.
from Canada 5-3-10, 5-3-17
Piper nigrum 5-2-30

pips 5-6-14
pitahaya 5-2-50
Placards H-1-73
Planorbidae
hot water treatment 5-3-3
plant cuttings 5-3-18
root cuttings 5-3-19
plant material not tolerant to fumigation 5-3-20, 5-3-21, 5-3-22
Plant Protection and Quarantine (PPQ) 7-4-12
plantain 5-2-44, 5-2-63, 5-2-64
FIFRA section 18 exemption 2-3-3
Plants in Growing Media H-1-1
plastic wrapping
methyl bromide fumigation 2-3-5
Platypodidae
kiln sterilization treatment 5-5-17
Platytheba
MB at NAP treatment 5-5-5, 5-5-7
plum 5-2-3, 5-2-44, 5-2-63, 5-2-64, 5-2-75, 5-2-76, 5-2-77, 5-2-80
plum curculio
irradiation treatment 5-2-66
plumcot 5-2-75
pointed gourd
FIFRA section 18 exemption 2-3-3
Polyanthes 5-6-15
tuberose 5-6-19
pomegranate 5-2-75, 5-2-76
poppy 5-2-30
Portable Sensors H-1-24
portable temperature sensors
calibration of 6-7-4
PortaSens phosphine detector 8-1-33
post-treatment cooling options 3-3-13
potato 5-2-63, 5-2-64
white or Irish 5-2-44, 5-2-45
potato cyst nematode
MB in 26" vacuum treatment 5-6-4, 5-6-7
potato tuber 5-6-19
potato tuberworm
MB at NAP treatment 5-2-45
powder-post beetle
kiln sterilization treatment 5-5-17
ppb 7-4-12
ppm 7-4-12
PPQ 7-4-12
PPQ Form 203, Foreign Site Certificate of Inspection and/or Treatment A-A-29
PPQ Form 429, Fumigation Record A-A-9
PPQ Form 519, Compliance Agreement A-A-13
PPQ Form 523, Emergency Action Notification A-A-16
PPQ Form 556, Intransit Cold Treatment Clearance Report A-A-32
Pratylenchus infestation
on Fragaria
hot water treatment 5-6-17
Pratylenchus spp.
hot water treatment 5-6-15, 5-6-16, 5-6-17, 5-6-20
on Chrysanthemum
hot water treatment 5-6-16
Preclearance programs
see Certifying facilities
pressure-leakage test for NAP fumigation chambers 6-3-4
pretreatment warming options 3-3-13
prickly pear 5-2-50
Primula 5-6-15
Prosopis spp.
dry heat treatment 5-5-42
Pseudococcidae
hot water immersion treatment 5-2-54
MB at NAP treatment 5-2-37, 5-2-64
Pseudotrichia
MB at NAP treatment 5-5-5, 5-5-7
Pseudoveronicella
MB at NAP treatment 5-3-6, 5-5-8
Puerto Rico
state hazardous waste management agencies 7-3-16
pulp-infesting insect
depulping treatment 5-3-38
pulses
dried 5-2-45
pummelo 5-2-75
pumpkin 5-2-45, 5-2-63, 5-2-64

Q

quarantine treatments
monitoring of 2-2-2
fumigation guidelines 2-2-3
nonperishable commodities in temporary enclosures 2-2-2
perishable commodities in temporary enclosures 2-2-3

quarantine-significant slug
treatment options 5-3-6
Queensland fruit fly
cold treatment 5-2-76
cold treatment followed by MB at NAP 5-2-83
fumigation plus cold treatment 5-2-80
irradiation treatment 5-2-66
MB at NAP followed by cold treatment 5-2-82
quick-release dispensing equipment 2-10-14
quince 5-2-75, 5-2-80

R

radish 5-2-46, 5-2-63, 5-2-64
radura 3-8-7
railroad cars (empty) 5-5-2, 5-5-22
treatment schedules for 5-5-2
rambutan 5-2-64
FIFRA section 18 exemption 2-3-3
from Hawaii 5-2-61, 5-2-68, 5-2-73
from Thailand 5-2-69
range switch
thermal conductivity gas analyzers 8-1-4
rape greens 5-2-46
raspberry 5-2-47, 5-2-63, 5-2-64
FIFRA section 18 exemption 2-3-3
RBC 7-4-12
recapture
methyl bromide 8-1-36
red blood cell(s) (RBC) 7-4-12
red rice 5-5-42
reference dose (RfD) 7-4-12
Refrigerated transport
See also Cold treatment
vessels used for intransit cold treatments 6-4-2–??
Refrigerated warehouses
used for cold treatment 6-4-15–??
reichsteineria 5-6-15
residue monitoring 4-1-1
safety 4-2-1
sample
collection 4-2-2
labeling 4-2-2
shipment 4-2-3
storage 4-2-3
respiratory protection 8-1-14
restricted MB fumigation item
automobiles 2-3-8
baking powder 2-3-8
blueprints 2-3-8
bone meal 2-3-8
butter 2-3-8
charcoal 2-3-8
cinder blocks 2-3-8
electronic equipment 2-3-8
feather pillows 2-3-8
felt 2-3-8
furs 2-3-8
high-protein flours 2-3-8
horsehair articles 2-3-8
lard 2-3-8
leather goods 2-3-8
machinery with milled surfaces 2-3-8
magazines 2-3-8
magnesium articles 2-3-8
natural rubber goods 2-3-8
newspapers 2-3-8
paper with high rag or sulfur content 2-3-8
photographic prints 2-3-8
photography chemicals 2-3-8
rug pads 2-3-8
silver polishing papers 2-3-8
soft yarns 2-3-9
sweaters 2-3-9
viscose rayon fabrics 2-3-9
woolens 2-3-9
yak rugs 2-3-9
resurrection plants 5-3-27, 5-3-28
RfD 7-4-12
RfDi 7-4-12
RfDo 7-4-12
Rhagoletis cerasi
MB at NAP treatment 5-3-36
Rhagoletis indifferens
CATTS treatment 5-7-3
MB at NAP/chamber only treatment 5-2-17
Rhagoletis pomonella
irradiation treatment 5-2-66
Rhagoletis tomatis
MB at NAP treatment 5-2-49
Rhode Island
state hazardous waste management agencies 7-3-16
rhododendron 5-6-4, 5-6-6
Rhyacionia buoliana
MB at NAP treatment 5-3-17
Rhyzophagidae
kiln sterilization treatment 5-5-17

rice hulls
closely packed 5-6-13
imported for purposes other than approved processing 5-4-15
imported in small lots of 25 lbs. or less 5-4-15
loose 5-6-13
rice straw
articles 5-4-14
indoor use only 5-4-14
brooms 5-6-12
closely packed 5-6-13
imported for purposes other than approved processing 5-4-15
imported in small lots of 25 lbs. or less 5-4-15
loose 5-6-13
novelties 5-6-12, 5-6-13
treatment schedules for 5-4-13
rice-related diseases
treatment options 5-6-12, 5-6-13
root not on Q label
FIFRA section 18 exemption 2-3-3
root-eating beetle
kiln sterilization treatment 5-5-17
root-feeding weevil
kiln sterilization treatment 5-5-17
root-knot nematode
hot water treatment 5-6-15, 5-6-16
Rosa spp. 5-6-17
Rosemarinus officinalis 5-2-30
rosemary 5-2-30
Rosmarinus seeds 5-3-33
round-headed borer
kiln sterilization treatment 5-5-17
ruaceous seed
from citrus canker countries 5-6-10
rubber tree
seeds of 5-3-35
rue 5-2-30
rug pads
restricted MB fumigation item 2-3-8
rust infestation
treatment options 5-6-8
rusts 5-6-8
Ruta graveolens 5-2-30
rutabaga 5-2-63, 5-2-64

S

s.c. 7-4-12
saccharum
bagasse 5-6-11
field and processing equipment 5-6-11
seed pieces 5-6-11
true seed 5-6-11
safeguarding treated fruit 3-3-12
Safety Equipment H-1-42
saffron 5-2-30
sage 5-2-30
Salpingidae
kiln sterilization treatment 5-5-17
salsify 5-2-63, 5-2-64
Salvia officinalis 5-2-30
Salvia sciarea 5-2-30
sand pear 5-2-75, 5-2-78
Sanguisorba minor 5-2-30
Sansevieria 5-6-15
sapodilla
from Hawaii 5-2-68
Sapote fruit fly
irradiation treatment 5-2-66
Sarasinula
MB at NAP treatment 5-3-6, 5-5-8
Saturega spp. 5-2-30
saw fly
MB at NAP/chamber only treatment 5-4-25, 5-4-26
MB in 26" vacuum treatment 5-4-25
steam sterilization treatment 5-4-26
Scabiosa 5-6-15
Scale (portable platform) H-1-43
scale insect
MB at NAP treatment 5-2-63
scale or digital display
thermal conductivity gas analyzers 8-1-3
scallion 5-2-64
scarab beetle
residual insecticidal spray treatment 5-5-4
SCBA 8-1-15
scilla 5-6-19
scion wood
plant cuttings 5-3-18
Scirtothrips dorsalis
MB at NAP treatment 5-2-4
Scolytidae
kiln sterilization treatment 5-5-17
Sealing Tape H-1-43
Sedum 5-6-15
Sedum adolphi 5-3-12
seed beetle

MB at NAP treatment 5-2-5, 5-2-25, 5-2-36, 5-2-42, 5-2-45, 5-3-37
MB in 26" vacuum treatment 5-3-34, 5-3-38
MB in 26" vacuum/chamber only treatment 5-2-25
seed-boring insect
MB at NAP treatment 5-3-35
seeds 5-3-34
nonpropagative 5-4-9, 5-4-10, 5-4-11, 5-4-12
nonpropagative and contaminated with cottonseed 5-4-11
not listed in T203 schedules 5-3-34, 5-3-35
treatment options 5-3-29
with infested pulp 5-3-38
Selaginella spp. 5-3-27, 5-3-28
Selenicereus megalanthus
from Colombia 5-2-73
Self-Contained Breathing Apparatus (SCBA) H-1-44
self-contained breathing apparatus (SCBA) 8-1-15
Semperula
MB at NAP treatment 5-3-6, 5-5-8
Senecio 5-6-15, 5-6-20
Septoria gentinae
treatment options 5-6-8
Sesiidae
kiln sterilization treatment 5-5-17
shallot 5-2-47, 5-2-64
sheepskin 5-5-46, 5-5-47
ship
deck 5-5-4
hold 5-5-5, 5-5-6
storeroom 5-5-5, 5-5-6
ship timber beetle
kiln sterilization treatment 5-5-17
ships, containers, and surrounding area
treatment options 5-5-3
short-term exposure limit (STEL) 7-4-12
silver polishing papers
restricted MB fumigation item 2-3-8
Siricidae 5-5-17
Slack Associates, Inc.
vacuum chamber manufacturers 6-2-4
slug
MB at NAP treatment 5-2-63, 5-4-17
Smoking Candle H-1-45
snail
MB in 26" vacuum treatment 5-3-33
mechanical separation treatment 5-4-12
snail host plants
treatment options 5-3-13, 5-3-14
Snakes (sand) H-1-46
Snakes (water) H-1-46
snap bean 5-2-29
snow pea 5-2-63, 5-2-64
soft scale
MB at NAP treatment 5-3-14
MB in 15" vacuum treatment 5-3-5, 5-3-12, 5-3-15, 5-4-17
soft yarns
restricted MB fumigation item 2-3-9
soil 5-6-4
as such 5-5-26, 5-5-27, 5-5-28
treatment options 5-5-26
contaminated durable commodities 5-5-27, 5-5-28
contaminated nonfood commodities 5-5-28
Soil Fumigants H-1-47
soil fungi 5-5-28
soil samples, 5-8-13
Solanum 5-6-19
Solanum viarum
dry heat treatment 5-5-42
South American fruit fly
MB at NAP treatment 5-2-7
vapor heat treatment 5-2-73
South Carolina
state hazardous waste management agencies 7-3-16
South Dakota
state hazardous waste management agencies 7-3-16
Sphaerodothis spp.
treatment options 5-6-9
Sphenospora spp.
treatment options 5-6-9
spider mite
MB at NAP treatment 5-2-63
Spill Recovery Materials H-1-48
Spodoptera littoralis
MB at NAP treatment 5-2-36
sprays 2-14-1
squash 5-2-64, 5-2-70
summer and winter 5-2-63
winter, summer, and chayote 5-2-48
stack covering
methyl bromide 2-4-16

state hazardous waste management agencies 7-3-12
Alabama 7-3-12
Alaska 7-3-12
American Samoa 7-3-12
Arizona 7-3-12
Arkansas 7-3-12
California 7-3-12
Colorado 7-3-12
Connecticut 7-3-12
Delaware 7-3-13
District of Columbia 7-3-13
Florida 7-3-13
Georgia 7-3-13
Guam 7-3-13
Hawaii 7-3-13
Idaho 7-3-13
Illinois 7-3-13
Indiana 7-3-13
Iowa 7-3-13
Kansas 7-3-13
Kentucky 7-3-13
Louisiana 7-3-14
Maine 7-3-14
Maryland 7-3-14
Massachusetts 7-3-14
Michigan 7-3-14
Minnesota 7-3-14
Mississippi 7-3-14
Missouri 7-3-14
Montana 7-3-14
Nebraska 7-3-14
Nevada 7-3-15
New Hampshire 7-3-15
New Jersey 7-3-15
New Mexico 7-3-15
New York 7-3-15
North Carolina 7-3-15
North Dakota 7-3-15
Northern Mariana Islands 7-3-15
Ohio 7-3-15
Oklahoma 7-3-15
Oregon 7-3-16
Pennsylvania 7-3-16
Puerto Rico 7-3-16
Rhode Island 7-3-16
South Carolina 7-3-16
South Dakota 7-3-16
Tennessee 7-3-16
Texas 7-3-16
Utah 7-3-16
Vermont 7-3-16
Virgin Islands 7-3-17
Virginia 7-3-17
Washington 7-3-17
West Virginia 7-3-17
Wisconsin 7-3-17
Wyoming 7-3-17
Steam boilers (for hot water immersion treatment) H-1-49
Steam Generators H-1-49
steam heat, 5-8-13
steam jet method 3-4-2
steam pressure sterilization 3-4-1
closely packed 3-4-2
loose masses 3-4-1
Steam Sterilizers H-1-49
steam treatments 3-4-1
STEL 7-4-12
Steneotarsonemus laticeps
hot water treatment 5-3-27
MB at NAP treatment 5-3-26
MB in 26" vacuum treatment 5-3-26
Stenoma catenifer
MB in 26" vacuum treatment 5-3-29
Sterilization and Fumigation Services, Inc. (SFS)
vacuum chamber manufacturers 6-2-5
Sternochetus mangiferae
irradiation treatment 5-2-66, 5-2-69
Stipa tenacissima 5-4-16
stone fruit 5-2-63, 5-2-64
stored product pest
MB at NAP treatment 5-2-30
stored tobacco for export 5-4-22
strawberry 5-2-48, 5-2-63, 5-2-64, 5-6-15, 5-6-17, 5-6-20
Striga spp.
dry heat treatment 5-5-42
MB at NAP/tarpaulin only treatment 5-5-28
string bean 5-2-29
subcutaneous (s.c.) 7-4-12
Succinea horticola 5-3-12
Succinea spp.
MB at NAP treatment 5-5-5, 5-5-9
Succinea spp. host plants
treatment options 5-3-13, 5-3-14
Succineidae
cold treatment 5-5-10
MB at NAP treatment 5-5-9
sugar beet 5-2-63, 5-2-64
sugarcane

bagasse 5-6-11
baled 5-6-11
field and processing equipment 5-6-11
loose 5-6-12
-related diseases
treatment schedules for 5-6-11
seed pieces 5-6-11
true seed 5-6-11
sugarcane leaf scald
domestic treatment of 5-8-13
Sulfuryl Fluoride H-1-49
sulfuryl fluoride
chamber fumigation 2-9-6
leak detection 2-9-2
poisoning 7-1-3
properties and use 2-9-1
safety and first aid 2-9-7
eye contact 2-9-7
if inhaled 2-9-7
if spilled on skin 2-9-7
protective clothing 2-9-7
shipboard fumigation 2-9-6
structural fumigation 2-9-6
tarpaulin fumigation 2-9-2
aeration 2-9-5
circulation 2-9-3
condensation prevention 2-9-3
dosage rate 2-9-5
gas concentration measurements 2-9-5
gas introduction 2-9-4
gas sampling lines 2-9-3
replacing lost gas 2-9-5
sealing 2-9-3
summer savory 5-2-30
Supplied-Air Respirators H-1-50
Suppliers
reference guide to commercial suppliers H-1-1–??
surface
diseases 5-6-17
pests 5-2-63, 5-4-17
surface-feeding caterpillar
MB at NAP treatment 5-2-63
sweaters
restricted MB fumigation item 2-3-9
sweet bay 5-2-30
sweet cherry 5-7-3
sweet corn 5-2-63, 5-2-64
sweet orange 5-2-75
sweet potato 5-2-49, 5-2-63, 5-2-64, 5-3-28
from Hawaii 5-2-68, 5-2-69
sweet potato vine borer
irradiation treatment 5-2-66
sweet potato weevil
irradiation treatment 5-2-66
Syntexicae
kiln sterilization treatment 5-5-17
Systole spp.
MB in 26" vacuum treatment 5-3-37

T

T100 schedules 5-2-1
T101 methyl bromide fumigation schedules 5-2-3
T102 water treatment schedules 5-2-53
T103 high temperature forced air treatment schedules 5-2-59
T104 pest specific/host variable treatment schedules 5-2-62
T105 irradiation treatment schedules 5-2-65
T106 vapor heat treatment schedules 5-2-70
T107 cold treatment schedules 5-2-74
T108 fumigation plus refrigeration of fruits treatment schedules 5-2-79
T109 cold treatment plus fumigation of fruits treatment schedules 5-2-83
T110 quick freeze treatment schedules 5-2-85
T200 schedules 5-3-1
T201 plant treatment schedules 5-3-3
T202 treatment schedules for bulbs, corms, tubers, rhizomes, and roots 5-3-23
T203 treatment schedules for seeds 5-3-29
T300 schedules 5-4-1
T301 treatment schedules for cotton and cotton products 5-4-2
T302 treatment schedules for grains and seeds not intended for propagation 5-4-8
T303 treatment schedules for rice straw and hulls 5-4-13
T304 treatment schedules for alpha grass and handicrafts 5-4-16
T305 treatment schedules for cut flowers and greenery 5-4-17
T306 treatment schedules for bags and bagging material 5-4-18
T308 treatment schedules for tobacco for export 5-4-22

T309 treatment schedules for broomcorn and broomcorn articles 5-4-25
T310 treatment schedules for nonfood, tick-infested materials 5-4-26
T311 treatment schedules for baled hay 5-4-28
T312 treatment schedules for oak logs and lumber 5-4-29
T312-a-Alternative
adding gas and time to 2-4-33
special procedures for adding gas to oak logs 2-4-29
T313 treatment schedules for Christmas trees 5-4-37
T314 treatment schedules for logs and firewood 5-4-38
T400 schedules 5-5-1
T401 treatment schedules for empty railroad cars 5-5-2
T402 treatment schedules for ships, containers, and surrounding area 5-5-3
T403 treatment schedules for nonfood, miscellaneous cargo 5-5-7
T404 treatment schedules for wood products 5-5-13
T404-f 5-5-21
T405 treatment schedules for bags and bagging material 5-5-21
T406 treatment schedules for golden nematode contaminations 5-5-22
T407 treatment schedules for mechanical cotton pickers and other cotton equipment 5-5-25
T408 treatment schedules for soil as such and soil contaminating durable commodities 5-5-26
T409 treatment schedules for aircraft 5-5-29
T410 treatment schedules for tick infestations 5-5-42
T411 treatment schedules for ant infestation of nonplant products 5-5-42
T412 treatment schedules for noxious weed seeds 5-5-42
T413 treatment schedules for brassware from Mumbai, India 5-5-43
T414 treatment schedules for inanimate, nonfood articles with gypsy moth egg masses 5-5-44
T415 treatment schedules for garbage 5-5-45
T416 treatment schedules for goatskins, lambskins, sheepskins 5-5-46
T500 schedules 5-6-1
T501 treatment schedules for Chrysomyxa spp., Cercospora spp., and Phomo chrysanthemi infestation 5-6-3
T502 treatment schedules for potato cyst nematode infestation 5-6-4
T503 treatment schedules for downy mildews infestations and physoderma maize diseases 5-6-5
T504 treatment schedules for flag smut infestation 5-6-5
T505 treatment schedules for Chrysomyxa spp. infestation 5-6-6
T506 treatment schedules for potato cyst nematode infestation 5-6-7
T507 treatment schedules for Phyllosticia bromeliae, Uredo, and Septoria gentinae infestation 5-6-8
T508 treatment schedules for rust infestation 5-6-8
T509 treatment schedules for Camellia and orchid infestation 5-6-9
T510 treatment schedules for corn-related diseases 5-6-9
T511 treatment schedules for Xanthomonas axonopodis, pv. citri infestation 5-6-10
T513 treatment schedules for Ascochyta infestation 5-6-10
T514 treatment schedules for Xanthomons albilineans and X. vasculorum 5-6-11
T515 treatment schedules for sugarcane-related diseases 5-6-11
T518 treatment schedules for rice-related diseases 5-6-12
T519 treatment schedules for rice-related diseases 5-6-13
T520 treatment schedules for Verticillium albo-atrum infestation 5-6-14
T551 treatment schedules for Globodera rostochiensis on Convallaria 5-6-14
T552 treatment schedules for Ditylenchus dipsaci and Ditylenchus destructor infestation 5-6-14

T553 treatment schedules for nematode infestation 5-6-15
T554 treatment schedules for Ditylenchus dipsaci and Ditylenchus destructor infestation on Hyacinthus 5-6-16
T555 treatment schedules for Ditylenchus dipsaci infestation on Narcissus 5-6-16
T556 treatment schedules for root-knot nematode infestation on Calla 5-6-16
T557 treatment schedules for root-knot nematode infestation on Chrysanthemum 5-6-16
T558 treatment schedules for Pratylenchus surface diseases on Fragaria 5-6-17
T559 treatment schedules for foliar nematode infestation on Begonia and Oryza 5-6-17
T560 treatment schedules for Meloidogyne spp. infestation on Rosa 5-6-17
T561 treatment schedules for Cercospora mamaonis and Phomopis carica-papayae infestation on papayas 5-6-17
T564 treatment schedules for foliar nematode infestation 5-6-18
T565 treatment schedules for nematode infestation 5-6-18
T566 treatment schedules for various diseases on broomcorn, broomcorn articles, and Libium 5-6-19
T567 treatment schedules for bulb nematode infestation 5-6-19
T568 treatment schedules for foliar nematode infestation on Senecio 5-6-20
T569 treatment schedules for foliar nematode infestation on Fragaria 5-6-20
T570 treatment schedules for Acalypha and Aconitum diseases 5-6-20
T600 schedules 5-7-1
Taeniothrips eucharii 5-3-26
Taeniothrips simplex 5-3-24, 5-3-25
taking concentration readings
  methyl bromide 2-4-21
  phosphine 2-10-17
  sulfuryl fluoride 2-9-5
Tanacetum vulgare 5-2-30
tangelo 5-2-63, 5-2-64, 5-2-75
tangerine 5-2-63, 5-2-64, 5-2-75, 5-2-76
  from Chile 5-2-20
  from Mexico and U.S. quarantine areas 5-2-20
tansy 5-2-30
tarpaulin sealing
  methyl bromide 2-4-17
  phosphine 2-10-25
  sulfuryl fluoride 2-9-2
Tarpaulins H-1-52
tarragon 5-2-30
Tarsonemus spp.
  MB at NAP treatment 5-2-7
Technical and Scientific Services (TSS) 7-4-12
temperature measurements
  methyl bromide 2-4-14
temperature recorder 3-3-8
  accuracy 3-3-9
  APHIS-approved models 3-3-9
  automatic operation 3-3-8
  calibration 3-3-9
  frequency 3-3-8
  long-term recording 3-3-8
  range 3-3-9
  repeatability 3-3-9
Temperature Recorders (built-in for cold treatment) H-1-56, H-1-58
Temperature Recorders (hot water immersion treatment) H-1-58
Temperature Recorders (portable for cold treatment) H-1-54
Temperature Recorders and Sensors (general use) H-1-53
Temperature recording systems
  standards for integral containers used for cold treatment 6-4-15–??
  standards for vessels used for intransit cold treatment 6-4-2–??
temperature sensors 3-3-7
Tennessee
  state hazardous waste management agencies 7-3-16
termite
  kiln sterilization treatment 5-5-17
  MB at NAP treatment 5-5-18
  other treatment options 5-5-11
  SF at NAP treatment 5-5-14, 5-5-16
testing for leaks
  methyl bromide 2-4-20
  phosphine 2-10-27
  sulfuryl fluoride 2-9-2
Tetranychus kanzawai

cold treatment followed by MB at NAP 5-2-84
Tetranychus viennensis
cold treatment followed by MB at NAP 5-2-84
Texas
state hazardous waste management agencies 7-3-16
Thaumatotibia leucotreta
cold treatment 5-2-77
Theba
cold treatment 5-5-10
MB at NAP treatment 5-5-5, 5-5-8
thermal conductivity gas analyzers 8-1-2
air purifying respirators 8-1-14
drying tube 8-1-4
dust masks 8-1-14
exhaust outlet 8-1-4
flow rate adjustment 8-1-3
flow rate meter 8-1-3
fumigant selector switch 8-1-4
fumigants 8-1-14
inlet 8-1-3
instrument description 8-1-2
line switches 8-1-3
pesticides other than fumigants 8-1-14
range switch 8-1-4
respiratory protection 8-1-13
scale or digital display 8-1-3
zero adjustment 8-1-3
thermal mapping 6-7-5
Thermocouple Wire H-1-62
Thermometers H-1-62
thermometers
glass mercury certified precision 8-1-35
Thermometers (approved calibration companies) H-1-69
Thermometers (digital certified precision) H-1-66
Thermometers (glass mercury certified precision) H-1-63
Thermometers (glass non-mercury certified precision) H-1-65
Thompsonia nepalensis 5-6-15
threshold limit value (TLV) 7-4-12
thrips
MB at NAP treatment 5-2-63, 5-3-11
Thrips spp.
MB at NAP treatment 5-2-3, 5-2-5, 5-2-7, 5-2-37, 5-2-44, 5-2-47
thyme 5-2-30
Thymus spp. 5-2-30
tick
MB at NAP treatment 5-4-26
MB at NAP/chamber only treatment 5-4-25
MB in 26" vacuum treatment 5-4-25
other treatment options 5-5-42
tick infestation (nonfood materials)
MB in 26" vacuum treatment 5-4-27
other treatment options 5-4-26, 5-5-42
sulfuryl fluoride at NAP treatment 5-4-27
ticks 5-4-26
Tigridia 5-6-16
time-weighted average (TWA) 7-4-12
TLV 7-4-12
tobacco
blended strip 5-4-22
for export 5-4-23, 5-4-24
treatment schedules for 5-4-22
leaf 5-4-22
stored 5-4-22
tobacco moth
Kabat application treatment 5-4-22
MB in 28" vacuum treatment 5-4-23
vacuum steam flow method 5-4-22
vacuum steam flow method followed by reconditioning 5-4-22
tomato 5-2-63, 5-2-64, 5-2-70
from Chile 5-2-49
from Hawaii 5-2-49, 5-2-68
tomato fruit fly
MB at NAP treatment 5-2-49
tomato fruit moth
MB at NAP treatment 5-2-49
Tomicus piniperda
MB at NAP treatment 5-4-37
TQAU 2-10-36, 6-5-7
Trade Journals H-1-40
Treatment facilities
certifying 6-4-1
treatment facilities
directory of E-1-1
Treatment Manual
application of 1-1-3
comment sheet CS-1-1
conventions of 1-1-4
maintenance of C-C-1
purpose of 1-1-1
related documents of 1-1-3
reporting problems of 1-1-4

restrictions of 1-1-1
scope of 1-1-2
use of 1-1-3
users of 1-1-2
Treatment Quality Assurance Unit (TQAU) 2-10-36, 6-5-7
treatment schedule index 5-1-1
Trigonella foenumgraecum 5-2-30
Trishoplita
cold treatment 5-5-10
MB at NAP treatment 5-5-9
Trochoidea
cold treatment 5-5-10
MB at NAP treatment 5-5-5, 5-5-7
Trogoderma granarium
Malathion spray treatment 5-5-3, 5-5-4
MB at NAP treatment 5-3-34, 5-4-2, 5-4-4, 5-4-19, 5-5-6, 5-5-11, 5-5-19, 5-5-43
MB at NAP/chamber only treatment 5-4-2, 5-4-11
MB at NAP/tarpaulin only treatment 5-4-3, 5-4-9, 5-5-46
MB at NAP/tarpaulin-covered car treatment 5-5-2, 5-5-6
MB in 26" vacuum treatment 5-5-47
MB in 26" vacuum/chamber only treatment 5-4-10, 5-4-11, 5-4-19, 5-5-47
other treatment options 5-5-29
Trogositidae
kiln sterilization treatment 5-5-17
Tropaeolum majus 5-2-30
tropical soda apple 5-5-42
TSS 7-4-12
tuber 5-6-15
not on Q label FIFRA section 18 exemption 2-3-3
Tubing (gas sampling) H-1-71
tuna 5-2-50
turmuric 5-6-15
turnip 5-2-51, 5-2-63, 5-2-64
Tuta absoluta
MB at NAP treatment 5-2-49
TWA 7-4-12
tydaea 5-6-15

U

U.S Department of Health, Education, and Welfare (DHEW) 7-4-11
U.S. Department of Agriculture (USDA) 7-4-12
U.S. Department of Health and Human Services (HHS) 7-4-11
U.S. Department of Transportation (DOT) 7-4-11
U.S. Public Health Service (PHS) 7-4-12
UCL 7-4-12
UEL 7-4-12
UF 7-4-12
ug 7-4-12
ug/cu. 7-4-12
ug/L 7-4-12
Umbelliferae
seeds of 5-3-37
uncertainty factor (UF) 7-4-12
upper confidence limit (UCL) 7-4-12
upper exposure limit (UEL) 7-4-12
Uredo infestation
treatment options 5-6-8
Uredo spp.
treatment options 5-6-8, 5-6-9
Urochloa panicoides
dry heat treatment 5-5-42
USDA 7-4-12
Utah
state hazardous waste management agencies 7-3-16

V

Vacudyne Altair
vacuum chamber manufacturers 6-2-4
vacuum chamber 6-2-1
vacuum chamber manufacturers
Baltimore Quality Associates, Inc. (BQA) 6-2-5
CosMed Group 6-2-5
ETO Sterilization 6-2-5
Slack Associates, Inc. 6-2-4
Sterilization and Fumigation Services, Inc. (SFS) 6-2-5
Vacudyne Altair 6-2-4
vacuum fumigation chamber 2-5-7
accessories 6-2-3
certification of 6-2-1
certification standards 6-2-3
circulation and exhaust system 6-2-2
construction and performance standards 6-2-1
fumigant introduction systems 6-2-2
Vacuum Pump H-1-72
vacuum pump 6-2-2

Vaginulus
MB at NAP treatment 5-3-6, 5-5-8
vanilla 5-2-30
Vanillia planifolia 5-2-30
Vapam H-1-73
vapor heat treatment 3-5-1, 6-7-1
vapor heat treatment facilities
calibrating the permanent temperature sensors 6-7-4
calibrating the portable temperature sensors 6-7-4
certification of 6-7-1
conducting test treatment 6-7-7
documentation for 6-7-8
plan and process approval 6-7-2
preliminary performance testing 6-7-3
VAPORPH3OS 2-10-9
velometer 8-1-27
Verbena 5-6-15
Vermont
state hazardous waste management agencies 7-3-16
Veronicella
MB at NAP treatment 5-3-6, 5-5-8
other treatment options 5-3-12
Veronicellidae
MB at NAP treatment 5-3-6, 5-5-8
Verticillium albo-atrum
treatment options 5-6-14
vessel
equipped for intransit cold treatment G-1-1
Vessels
used for intransit cold treatment 6-4-2–??
Vicia spp.
seeds of 5-3-37, 5-3-38
Vikane H-1-49
Vine moth
treatment schedule ??–5-2-27
vine moth
MB at NAP treatment 5-2-27
Vinsonia spp.
MB in 15" vacuum treatment 5-3-15
Virgin Islands
state hazardous waste management agencies 7-3-17
Virginia
state hazardous waste management agencies 7-3-17
viscose rayon fabrics
restricted MB fumigation item 2-3-9
Vitis 5-6-15
Viviparidae
hot water treatment 5-3-3
Volatizer H-1-73
volitilizer 8-1-25
volume measurements
methyl bromide 2-4-17

W

Warehouses
used for cold treatment 6-4-15–??
Warning Signs H-1-73
Washington
state hazardous waste management agencies 7-3-17
wasp
kiln sterilization treatment 5-5-17
waste 5-4-2, 5-4-6, 5-4-7
water
circulation 3-3-7
quality 3-3-5
supply
tarpaulin fumigation sites 2-4-6
watermelon 5-2-37, 5-2-63, 5-2-64
weevil
MB at NAP treatment 5-4-8
MB in 26" vacuum/chamber only treatment 5-4-8
Weigela 5-6-15
well-lighted area
tarpaulin fumigation sites 2-4-6
well-ventilated, sheltered area
tarpaulin fumigation sites 2-4-4
West Indian fruit fly
forced hot air treatment 5-2-60
irradiation treatment 5-2-66
West Indian sweet potato weevil
irradiation treatment 5-2-66
West Virginia
state hazardous waste management agencies 7-3-17
western cherry fruit fly
CATTS treatment 5-7-3
MB at NAP/chamber only treatment 5-2-17
wheat bug
MB at NAP treatment 5-2-33
white fringed beetle
MB at NAP treatment 5-2-44
white tip nematode

hot water treatment 5-6-17
white zapote 5-2-76
winter savory 5-2-30
wintergreen 5-2-30
Wisconsin
state hazardous waste management agencies 7-3-17
witchweed
dry heat treatment 5-5-42
MB at NAP/tarpaulin only treatment 5-5-28
wood borer
treatment options 5-5-11
wood packing material 5-5-20, 5-5-21
wood products
including containers 5-5-14, 5-5-16, 5-5-17, 5-5-18, 5-5-19
treatment schedules for 5-5-13
wood wasp
Chlorpyrifos spray treatment 5-5-13
kiln sterilization treatment 5-5-17
SF at NAP treatment 5-5-16
wood-boring weevil
kiln sterilization treatment 5-5-17
wooden boxes
methyl bromide fumigation 2-3-6
woodruff 5-2-30
woolens
restricted MB fumigation item 2-3-9
wormwood 5-2-30
Wyoming
state hazardous waste management agencies 7-3-17

X

X. vasculorum 5-6-11
Xanthomonas albilineans
dry heat treatment 5-6-11
other treatment options 5-6-11
Xanthomonas axonopodis, pv. citri
treatment options 5-6-10
Xanthomonas citri
hot water treatment followed by chemical dip 5-3-37
Xanthomonas vasculorum
treatment options 5-6-11
Xerolenta
cold treatment 5-5-10
MB at NAP treatment 5-5-5, 5-5-7
Xeropicta
cold treatment 5-5-10
MB at NAP treatment 5-5-5, 5-5-7
Xerosecta
cold treatment 5-5-10
MB at NAP treatment 5-5-5, 5-5-7
Xerotricha
cold treatment 5-5-10
MB at NAP treatment 5-5-5, 5-5-7
Xylocopidae
kiln sterilization treatment 5-5-17
Xyphydriidae
kiln sterilization treatment 5-5-17

Y

ya pear
from Chile 5-2-78
yak rugs
restricted MB fumigation item 2-3-9
yam 5-2-51, 5-2-63, 5-3-28
yard-long bean 5-2-29
yellow peach moth
treatment options 5-2-84
yellow pitaya
from Colombia 5-2-73

Z

Zantedeschia 5-6-15
zero adjustment
thermal conductivity gas analyzers 8-1-3
Zingiberaceae 5-6-15
zucchini 5-2-52, 5-2-63, 5-2-64, 5-2-70