Volume 12: Treatments

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Introduction

Treatments include a range of processes targeted at the control or eradication of pests.

Treatments are defined as follows:
- any dismantling, repairing, cleaning or deodorising
- the application of any substance
- fumigation.

A range of circumstances govern the criteria for AQIS to require that commodities and or structures are treated. These conditions are linked to the importing country’s import conditions or health standards.

In the majority of situations, treatments will involve the application of a pesticide, for example fumigation with methyl bromide. Pesticides are used in a wide range of situations for an equally vast range of uses, for example, pesticide treatments are an integral part of the growing and storage of a diverse range of export crops and commodities.

In this regard, treatments may need to be applied and verified depending on the situation.

For example, pesticide treatment of horticulture crops in field may need to be recorded in certain circumstances to meet an importing country requirement.

The use of agricultural pesticides must comply with various state and federally administered legislation, in particular, the use of an agricultural pesticide must be in accordance with the current approved label unless approved under appropriate legislation, for example state control of use.

It is the responsibility of an authorised officer to verify if a pesticide treatment was conducted according to the approved label.

The client should be able to demonstrate appropriate legislation/documents that allow the legal use of a pesticide, for example a permit from the APVMA or an extract from the state control of use legislation.

If the authorised officer is unclear whether the use is consistent with state and federal legislation, the authorised officer is to contact the AQIS regional Plant Export Program Manager.

Until the authorised officer is satisfied that the treatment complies with state and or federal legislation, the treatment would not be accepted.

For more information on the range of agricultural pesticides and their approved use patterns please contact the Australian Pesticides and Veterinary Medicines Authority.
Related Legislation and Work Instructions

The Export Control Act 1982 and subordinate legislation, in particular The Export Control (Plants and Plant Products) Orders 2011, encompass horticultural commodities, grain, seed, timber, woodchip, hay and straw etc. This legislation provides overarching principles and outcomes governing the export of plants and plant products from Australia.

The AQIS Methyl Bromide Fumigation Standard provides in depth detail to assist in understanding the fundamental principles of fumigation. An AAO will need to be able to access this document to monitor fumigations if required and observe OH&S obligations.

Work instructions provide the instructional material to facilitate these outcomes. Note, the instructional material is specific to the plant product being exported, for example instructional material for grain and seeds differs when compared to fresh fruit and vegetables.

Treatment Categories

Treatments applied to consignments generally fall into one of four categories;

- Mandatory
- Treatment following rejection
- Voluntary treatment
- Commercial treatment

Mandatory Treatment

This is the term used for a treatment that is required by the National Plant Protection Organisation (NPPO) of the importing country, as a condition of entry into that country.

Mandatory treatments must be applied to the goods prior to being presented for export inspection and certification unless alternative arrangements have been agreed to between the exporter and AQIS, such as fumigation consistent with Export Industry Advice Notice G2010/06. Treatment details must be included on the Phytosanitary Certificate under the treatment section.

Where a treatment is not supervised by an authorised officer, this requirement may be met via written declaration or presentation of a fumigation certificate from the exporter certifying the details of the treatment performed.

Note, at all times, consider personal safety and obtain a gas free certificate from the exporter prior to inspecting fumigated goods for export certification.

An example of mandatory treatments involving bulk grain may include fumigation with methyl bromide prior to export. In this example, some importing countries may specify the dosage and time concentration whilst other importing countries may simply state that fumigation with methyl bromide prior to export is required. In either
circumstance, the authorised officer must be satisfied that the treatment has been performed and meets the importing country’s requirements.

To be satisfied, the authorised officer must be provided with a copy of the fumigation certificate clearly identifying that the goods were treated and meet the importing country’s requirements.

If the importing country requires treatment that is inconsistent with the current approved label or state control of use legislation, the authorised officer will need to contact the AQIS regional Plant Export office for advice.

**Treatments following Rejection**

This may be applied to prescribed goods following the detection of regulated/prohibited items in the goods upon presentation for export certification. All rejected consignments must be segregated to clearly distinguish the produce from goods that remain eligible for export to avoid cross contamination.

How the exporter segregates the commodity is at the discretion of the exporter. Please refer to Volume 14 (Product Security) for information about product security and maintaining consignments integrity, particularly in relation to the export of horticulture consignments.

Following treatment the exporter must advise the authorised officer in writing that the goods are being resubmitted for inspection. This advice may be in the form of a treatment certificate and must indicate the nature of any further preparation, treatment or processing operations that have been undertaken in relation to the produce to render it suitable for export.

Furthermore, the exporter must provide evidence that further processing or treatment has resulted in the produce being suitable for export. Any produce that has been treated following rejection must be held under conditions that ensure the security of the goods has been maintained to avoid cross contamination and consistent with conditions as considered necessary by an authorised officer.

**Voluntary Treatment**

Voluntary treatment is the term used for a treatment that is applied prior to the presentation of the goods for inspection.

Voluntary treatments are used as a remedial measure to address the presence, or potential presence of regulated and or prohibited pests and diseases as a precautionary measure, where the status of the goods may not be known.

**Commercial Treatment**

This is the term used for a treatment that may be applied as a standard industry practice or at the request of the importer and have no bearing on the certification of the goods.
Fumigation

Phosphine
Phosphine is used to control insects in grains, seeds, flour, plant products and prepared foods. It is used as a fumigant for seeds as it is not reported to adversely affect the germination of the seeds.

Milled and oily commodities such as flour, soybean meal, fish meal, nuts and oilseeds are often fumigated with phosphine because this treatment is less likely to generate undesirable residues. Phosphine is also often used to treat tobacco, as the process does not result in the formation of any taints.

AQIS does not generally recognise phosphine as a quarantine fumigant for timber or timber articles because of concerns over its ability to penetrate these materials sufficiently.

The use of phosphine as a fumigant is limited by the long exposure time necessary to kill all stages of insects, the resistance of certain insect pests, and poor efficacy at temperatures below 15°C.

Phosphine is commonly applied into a grain silo in a gaseous state. Phosphine can be used as a phytosanitary treatment and dosage rates will be applied as per rates prescribed on the label.

Methyl Bromide
Methyl bromide is a colourless, odourless, non-flammable fumigant. It is an effective fumigant for treating a wide variety of plant pests associated with a range of commodities. Methyl Bromide is the most frequently used fumigant in quarantine fumigations.

Methyl Bromide may also be used to devitalize plant material. Methyl Bromide is effective in treating the following pests:
- Insects (all life stages)
- Mites and ticks (all life stages)
- Nematodes (including cysts)
- Snails and slugs
- Fungi

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 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 sub lethal 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 absorption of fumigants and in the effort required to aerate the commodities after fumigation.

Fumigations can be carried out in a variety of different chambers. These include bulk grain vessel holds, fixed capacity chambers, flexible tents and within containers. At all times fumigations are to be carried out by licensed fumigators.

**Occupational Health and Safety**

Methyl bromide is a colourless and odourless gas and is among the most hazardous materials used in pest control. Because it is odourless, some countries add low concentrations of chloropicrin (tear gas) as a warning agent, however the use of chloropicrin is no longer standard practice in Australia.

Routes of entry to the body include inhalation, skin and ingestion. Symptoms of inhalation appear slowly and include dizziness, blurring of vision, fatigue, slurred speech, nausea, vomiting and possibly coma. Skin contact with liquid methyl bromide or a high concentration of gas can cause severe irritation, including temporary blindness.

Safety is the over-riding principle governing inspections, following fumigation. It is very important to approach post-fumigation inspections with great care. The over-riding principle at all times is to put safety first.

AAO’s are advised not to enter a confined area, or inspect fumigated goods if there are concerns with occupational exposure. In these circumstances, contact the Regional Plant Export Program manager.

The Threshold Limit Value (TLV) for a fumigant is the concentration at which an individual can be exposed for eight hours without respiratory protection. The TLV for methyl bromide is 5 ppm; for phosphine it is 0.3 ppm; and for chloropicrin it is 0.1.

Export inspectors are not to enter ships’ holds, following a fumigation, until they have sighted a gas Clearance Certificate, issued by an independent industrial chemist, using methods that include testing for the presence of both methyl bromide and chloropicrin, in the range 0 to 50 ppm.

When an industrial chemist is not available, a member of the Australian Maritime Safety Authority (AMSA) will do the testing and issue gas clearance certification.

Prior to conducting an inspection on fumigated produce, a Gas Clearance Certificate, issued
by a licensed fumigator should be sighted. These are normally found on the treatment certificate itself.

Even after a valid gas Clearance Certificate has been sighted, inspectors are advised to wear protective clothing (overalls, gloves and footwear).

For safety reasons, there should always be at least two (2) people present at inspections of ship’s holds, following fumigation - and then only after sighting a gas Clearance Certificate (the second person, not necessarily an AQIS officer, should to be stationed nearer the exit, always having the officer in sight).

If entry to confined spaces is required, discuss this with the Regional Plant Export Program Manager prior to entry. Wherever possible, a second exit should be identified and inspected before entering any confined area, following fumigation.

**Symptoms of Fumigant Poisoning**

Methyl bromide poisoning symptoms may be delayed for between 30 minutes to 48 hours after exposure. If officer’s suspect that they have been exposed methyl bromide they should consult a medical practitioner immediately.

Controlled atmosphere fumigations, using either nitrogen or carbon dioxide, result in low levels of oxygen. Authorised officers should not enter premises, following controlled atmosphere fumigations, until they are satisfied that confined areas have been adequately aired.

If during controlled fumigations entry to confined spaces is required, discuss this with the Regional Plant Export Program Manager prior to entry. Wherever possible, a second exit should be identified and inspected before entering any confined area.

AAO inspecting products that have been treated with Phosphine require a gas free certificate prior to the inspection taking place. The treatment facility could provide this declaration on the treatment certificate.

**Monitoring Fumigation Treatments**

These procedures apply to onshore methyl bromide treatment providers. The procedures are to be applied at the treatment provider’s fumigation site, for fumigations under fumigation sheets or in a shipping containers or designated fumigation chambers.

**In-Office Preparation**

Ensure that you are aware of the OH&S considerations as described in this manual and have the appropriate equipment.

Ensure that you have the relevant documentation outlining the location of the fumigation and the goods that are to be fumigated. Check the relevant Importing country conditions on the [Manual of Importing Country Requirements (MICO)R](#)
Database or refer to the Import Permit to determine the required fumigation procedure.

Specifications for fumigation include:
- Dosage rate
- Retention rate
- Time
- Temperature
- Pulp temperature of fruit.

**On-site Supervision Prior to Fumigation**

Monitoring of 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 on the fumigant label.

Ensure the goods to be fumigated are free from plastic wrapping and other impervious surfaces. Ensure there is room for adequate circulation of fumigant as required by the AQIS Methyl Bromide Fumigation Standard, Section 3.1 Free air space.

For fumigations under Sheet, ensure that:
- the floor of the fumigation enclosure is free from cracks and joints
- the fumigation sheet is free from holes and tears
- the contact between the fumigation sheet and the floor is sealed using sand/water snakes.

For fumigations in un-sheeted shipping containers, ensure that the container has passed a pressure test prior to fumigation. Alternatively, the container must be fumigated under sheet.

For fumigations in designated fumigation chambers, ensure that the chamber has passed a pressure test in the past 6 months. Also, confirm that the number and position of monitoring tubes complies with the AQIS Treatments and Fumigants standards.

Verify the volume of the enclosure and for fumigations under sheet, ensure that the volume measurement is based on the outside measurement of the sheeted container, not the internal volume of the container.

Artificial heaters must be used to raise the temperature in the fumigation enclosure if the minimum temperature inside the enclosure is expected to fall below 10°C.
Timber

Any timber in consignments must be:
- less than 200mm thick in one dimension and correctly spaced (stickered) every 200mm in height
- there must be adequate physical distance, at least 50 mm (2 inches) between the timber and both the base and top of the fumigation enclosure.

Fresh Fruit and vegetables

For fresh fruit and vegetable the temperature must be measured by placing the temperature probe into the centre of a piece of fruit located in the middle of a carton.

At least three temperature readings must be taken from fruit in three different cartons/pallets and from different varieties within the same consignment:
- one carton at the top of the pallet
- one carton in the middle of the pallet
- one carton at the bottom of the pallet.

Nursery Stock and Cut Flowers

Plants may be covered with single sheets of damp newspaper so that the gas is not circulated directly on to them. The fumigation of plants above 30°C or below 11°C should be avoided as plants may become stressed or damaged.

Plants should not be wet, but roots should be moist to prevent damage. Low humidity during treatment may damage plants. Relative humidity in the fumigation enclosure should be held above 75% during fumigation.

In the absence of water misters within the fumigation chamber, damp newspapers and shallow trays of water may also be placed on the floor of the fumigation chamber to help prevent plant desiccation.

Excessive air currents during fumigation or the post-treatment aeration period aggravate plant injury. It is recommend that circulating and ventilating fans or blowers be operated for the minimum length of time required for distributing the fumigant evenly or for removing toxic concentrations after treatment.

Vessels

Due to the complex nature of vessel fumigations, a written plan for each fumigation must be submitted to AQIS for approval before fumigation commences.

The fumigator must visit the vessel to assess how it will be prepared and fumigated.

The written plan must contain the following information:
- location of the fumigation site
- how the vessel will be sealed/sheeted
- if the vessel is to be sealed, how it will be pressure tested
- number and locations of fumigant supply pipes
• number and location of fans
• number and location of monitoring tubes
• the calculation of fumigant to be used and enclosure volume.

If the vessel is to be fumigated on water, a “risk area” must be set up around the fumigation enclosure or moored vessel (3 metres if achievable) with warning signs visible from all sides of the vessel. See 5.4 of the AQIS Methyl Bromide Fumigation Standard.

Only authorised personnel are allowed within the risk area.

The area must be cleared of any unprotected personnel, that is, personnel not wearing a respirator, and at no time during the fumigation should unprotected personnel be allowed to enter the risk area.

**Monitoring Procedure for Fumigants**

Methyl bromide concentrations within the fumigation enclosure must be measured on at least two occasions during the fumigation exposure period; at the start of the fumigation exposure period and at the end of the fumigation exposure period.

All instruments (Riken) used for measuring and monitoring methyl bromide concentrations must be fit for the purpose, in good working order and calibrated on a regular basis according to manufacturer’s instructions. The Riken is attached to a monitoring line which will give a reading of grams/m$^3$.

All instruments used for measuring and monitoring methyl bromide concentrations within a fumigation enclosure must be fitted with a moisture absorption filter, an appropriate carbon dioxide (CO2), or other filter, as required by the manufacturer.

Fumigant concentrations must be measured at:
1. Start-point monitoring
   The fumigation exposure period begins when the methyl bromide concentrations at all monitoring points are **AT OR ABOVE THE STANDARD** and have reached **EQUILIBRIUM** (when all readings are within 15% of the lowest reading).

2. End-point monitoring
   Methyl bromide concentrations at all monitoring points must be **AT OR ABOVE THE STANDARD** at the end of the fumigation period, before fumigation can be declared successful.
Monitoring Table

<table>
<thead>
<tr>
<th>Exposure Period</th>
<th>Start Point Monitoring</th>
<th>Mid-point monitoring</th>
<th>End-point monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 48 hours</td>
<td>Take the first reading when equilibrium has been achieved</td>
<td>Not required but may be undertaken</td>
<td>End of exposure period</td>
</tr>
<tr>
<td>Greater than 48 hours</td>
<td>Take the first reading when equilibrium has been achieved</td>
<td>24 hours after start and as required</td>
<td>End of exposure period</td>
</tr>
</tbody>
</table>

Standard Concentrations Required at Specific Monitoring Times

<table>
<thead>
<tr>
<th>Monitoring Times</th>
<th>Concentration of original fumigant required</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5 hours</td>
<td>75% or more</td>
</tr>
<tr>
<td>1 hours</td>
<td>70% or more</td>
</tr>
<tr>
<td>2 hours</td>
<td>60% or more</td>
</tr>
<tr>
<td>4 hours</td>
<td>50% or more</td>
</tr>
<tr>
<td>12 hours</td>
<td>35% or more</td>
</tr>
<tr>
<td>24 hours</td>
<td>30% or more</td>
</tr>
<tr>
<td>48 hours</td>
<td>25% or more</td>
</tr>
</tbody>
</table>

If readings from the monitoring points are NOT within 15% of the lowest reading at start point, the exporter/fumigator may decide to top up the concentration to a satisfactory level.

If levels at the end point of the fumigation are below the tolerances outlined in the Ready Reckoner the treatment was unsuccessful and failed in meeting the requirements.

Vapour Heat Treatments

Vapour Heat Treatment (VHT) and Forced Hot Air (FHA) treatments use heated air to warm fruit to temperatures that are lethal to target pests, primarily fruit flies. Generally, VHT 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 VHT and FHA treatments for fruits and vegetables.

Mango is a common fruit to undergo this treatment which is exported to Japan, Korea and China.
Pre-treatment
Prior to treatment, the AAO must ensure that the facility and the chamber are in good working order and the permanent temperature sensors and hygrometer are functioning properly.

The temperature sensors will be calibrated prior to treatment and verified according to the tolerances outlined in the workplan under calibration procedures.

Conduct a brief facility inspection before any other steps in the treatment process are taken. During this inspection, the AAO verifies that all safeguarding and quarantine measures are in place and that there are no obvious problems that may affect the treatment.

The AAO must confirm that the fruit that is to be loaded is a permitted variety to be exported to that specific country.

Other requirements such as grower registration status are checked prior to loading the fruit into the VHT chamber.

Note: refer to the VHT workplan for detailed procedures on the requirements of treating a commodity through the VHT process.

Loading
Load the fruit into containers (crates, lugs, or bins) according to the requirements in the workplan. Co-mingling of lots destined to different countries to be treated at the same time in the same chamber may not be allowed.

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 AAO monitors the placement of the permanent sensors and verifies that the probes are placed in the locations outlined in the applicable workplan.

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 AAO and the NPPO official, if required by the work plan, must initial the treatment temperature record and then the chamber operator can then initiate the treatment.

During the treatment, the AAO must monitor the permanent temperature sensor data to ensure the treatment is proceeding in the approved manner.
An example of a VHT treatment schedule is outlined below and the whole treatment process including heating, maintaining the pulp at the treatment temperature, and cooling shall last no less than two (2) hours.

**Example of a VHT schedule**

<table>
<thead>
<tr>
<th>Schedule</th>
<th>Innermost fruit pulp temperature</th>
<th>Treatment Period Minutes</th>
<th>Humidity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Mango</td>
<td>47deg C or above</td>
<td>15 minutes</td>
<td>90%</td>
</tr>
<tr>
<td>2. Mango</td>
<td>46 deg C or above</td>
<td>20 minutes</td>
<td>90%</td>
</tr>
</tbody>
</table>

**Verifying the Treatment**

The AAO must review the treatment temperature record after the treatment is complete. The AAO must ensure that the temperature and recording interval requirements have been met as outlined in the treatment schedule.

Once the AAO determines that all the treatment requirements are met, the AAO must approve and endorse the treatment record.

Signing and dating the treatment record is an acceptable method of endorsing the record.

**Post-Treatment Handling**

After the treatment is complete, move the fruit from the chamber into the quarantine area.

**Note:** the workplans outline the procedures an AAO will need to follow when working with VHT Protocol commodities

**Chemical Treatments**

Chemical treatments are used on agricultural products both prior to harvest and post harvest. Chemical treatments are intended to destroy, repel and control pests and diseases of agricultural commodities.

They are commonly applied by spraying or dipping (full submersion) the commodity into a chemical pesticide solution.

Chemical treatments also have other applications like destroying pests within the holds of a vessel. When a vessel fails survey from insect infestation, the vessel can be sprayed with an insecticide application and be re-inspected at a later time.

Pesticides, fungicides, and nematicides are used on a wide range of agricultural products.
Examples of agricultural chemicals are:

- **Pesticides:** Contact pesticides are effective in the eradication of a pest. A commonly used pesticide is dimethoate. Dimethoate is an effective treatment for fruit fly. The commodity is either sprayed or immersed at a specified rate for a specified time. The importing country specifies these rates. The AAO will be required to know the rate outlined by the importing country to accept any treatment certificate.

- **Fungicides:** Fungicides are effective in killing or inhibiting fungi and fungal spores. Their application is mainly in the form of spraying or dressing the commodity. Importing countries require fungicides to be used for nursery stock and seeds and the rates and application will be outlined on the import permit.

**Monitoring**

An AAO can verify that a chemical treatment complies with importing country requirements by carefully reviewing the treatment certificate. The treatment certificate will contain sufficient information outlining the application rates.

Example: the following products are being exported to Fiji and must have the following treatment:

- **Tomatoes:** The tomatoes were dipped in dimethoate at the rate of 425 ppm in water for a minimum period of one minute.
- **Maize:** The maize for sowing is to be treated with a suitable fungicide/insecticide prior to export.

In both of these cases a treatment certificate will be provided by the treatment provider. The tomatoes will need to be treated with dimethoate at a rate of 425ppm. The maize will need to be treated by a fungicide/insecticide at a rate prescribed on the chemical label.

**Irradiation**

Irradiation is the process in which food is exposed to a source of ionising energy to reduce the threat of quarantine pests. The food is placed within a chamber and passes by Cobalt 60 rods which emit the rays.

The result of this type of treatment is:

- Inability of insects to emerge or fly
- Inactivation or devitalisation (seeds may germinate but seedlings do not grow; or tubers, bulbs or cuttings do not sprout)
- Mortality to the pests
- Sterility (inability to reproduce)
- With the ability to sterilise quarantine pests of concern, the authorised officer can inspect product after it has been treated and still encounter live pests.
The inspection lot can be passed on the provision that there has been no cross contamination after treatment. The AAO will therefore need to verify post treatment security of the product to ensure that if they do find live insects on the product, that they have gone through the treatment process.

**Monitoring**

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.

Importing country requirements will outline the required absorbed dose measured in Gray.

An example is outlined with the export of mangoes to Malaysia: Prior to export mangoes must be treated with irradiation at a minimum dosage of 300 Gray.

The dosage rate is described as Dmin which is the minimum level of absorption rate and with the example above, Malaysia requires the Dmin for the exports of mangoes to be Dmin 300Gy.

The Dmax is also measured which is the maximum level of absorption rate measured for that particular treatment.

Importing country requirements do not specify the Dmax that is required though the Food Standards Code has set an upper limit of 1000Gy. Therefore if an AAO receives a treatment certificate that has a treatment rate greater than 1000Gy, the product is not fit for human consumption and must be rejected.

The AAO can determine if the treatment was successful by reviewing the treatment certificate. The certificate will outline the lower limit Dmin and the upper limit Dmax. If the range is within the specified limits then the treatment of the commodity was successful.

**Note:** There are additional requirements for the export of irradiated product to Malaysia and New Zealand. Refer to the importing country requirements and applicable workplan prior to endorsing the export.

**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
The data obtained from the dose mapping is used to determine the proper number and placement of dosimeters during routine operations. The dosimeters being the device that captures the dosage received on the product from the treatment.

Cold Treatment

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, refrigcrated compartments of transporting vessels (Conventional Vessels), containers cooled by the ship's refrigeration system (Container Vessels) or by individually refrigerated containers.

Intransit Cold Disinfestation

The term in transit cold disinfestations refers to the cold treatment of a commodity within a refrigerated unit as it travels to its destination.

On Shore Cold Disinfestation

The term on shore cold disinfestations refers to the cold treatment of a commodity within a cold storage unit at export registered establishment. The course of the treatment will start and finish at the export registered establishment.

Pre-cooling Procedures

Experience with in-transit cold treatments show that the fruit must be pre-cooled at or below the prescribed cold treatment temperature before loading. Otherwise, a large quantity of fruit in the middle of large pallet may require a week or more to reach the cold treatment temperature.

Fruit intended for intransit cold treatment should be pre-cooled to the temperature at which the fruit will be treated prior to beginning treatment. Conduct random fruit pulp sampling in the pre-cooling location prior to loading in order to verify that the commodity has completed pre-cooling.

Importing Country Requirements

It is the importing country that determines whether a commodity requires a treatment prior to export or during transportation. The importing country will outline the treatment to be carried out on the import permit or the MICoR Database.

Outlined below are two examples for the export of horticulture commodities to Fiji and grain commodities to Malaysia
Example of the export of tomatoes to Fiji

- The tomatoes were grown on a property approved as having maintained a regular spray programme in the field with an insecticide registered for use against Queensland Fruit Fly (Bactrocera tryoni) and which achieved a high level of control.
- The tomatoes were dipped in dimethoate at the rate of 425ppm in water for a minimum period of one minute
- The dip was made up immediately prior to treatment
- The dimethoate dip was the final operation before packing (i.e. any washing/cleaning of fruit took place before the treatment)
- Only tomatoes were present in the pack-house during the time fruit was graded, treated and packed for export
- All tomatoes entering the pack-house during the time the fruit was graded, treated and packed for export were subject to the dimethoate dip treatment irrespective of whether they were all exported
- No host material of harmful species of fruit fly (other than tomatoes or cucurbit crops regularly sprayed with an insecticide registered for use against fruit flies) was growing within 200 meters of the premises where the tomatoes were treated and packed for export
- The preparation of the dimethoate dip, the dip treatment and subsequent packaging was supervised by a person authorised by the Australian Quarantine and Inspection Service.

Example of export Carpet Grass for sowing purposes to Malaysia

- A representative sample of the seed has been officially tested in a laboratory and no evidence of Ragweed parthenium (Parthenium hysterophorus) and Itch grass (Rottboellia cochinchinensis) were detected.
- Treatment: Full details of treatment must be included on the Phytosanitary Certificate.
- Fumigation with Phosphine as per label recommendation OR Fumigation with methyl bromide 100% at 24 gm/m3 for 4 hours followed by seed dressing with Thiram at the rate of 4gm active ingredient /1000gm seeds or any suitable fungicide at the recommended rate.
- Where seed is treated with Phosphine, the treatment undertaken MUST BE as per label recommendation or as stated on the Import Permit (whichever is the longest).
- Certificate of fumigation MUST state - ingredient used, dose rate, duration and temperature.
- Phosphine fumigation must be applied as Cubic Metres - application per Tonne is not accepted for certification.

Note: Refer to the Plant Exports Operations Manual – Importing Country Requirements for further information.
Calibration of Temperature Sensors USDA Method

- Calibrate all air and pulp temperature sensors in a clean ice water slurry mixture that is at 0 °C the freezing/melting point of freshwater.
- Check individual sensors to verify that they are properly labelled 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.
- Prepare a mixture of clean ice and fresh water in a clean insulated container.
- Crush or chip the ice to completely fill the container.
- Add enough water to stir the mixture.
- 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.
- Add more ice as the ice melts.
- Stir the ice water slurry to maintain a temperature of 0 °C.
- Submerge the sensors in the ice water slurry without touching the sides or bottom of the container.
- Stir the slurry mixture again.
- Continue testing of each sensor in the ice water slurry until the temperature reading stabilizes.
  - 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 or as outlined in the work plan
- 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.
- 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.
- Have the instrument company representative correct any deficiencies in the equipment before certification.
- Replace any sensor that reads more than plus or minus 0.3 °C from the standard 0 °C.
- Replace and recalibrate any sensors that malfunction.
- Determine the calibration factors to the nearest tenth of one degree Celsius.
- 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 written calibration report that is submitted with the shipment.)
• After the calibration factors have been accounted for, no other changes should be made to the temperature recorder microprocessor.

Relevant eLearning Modules
• Export Inspections: Treatments

Questions
• You can contact your Regional Plant Export Program Manager to clarify any aspects of this volume in the first instance.
• You can also direct a specific question or provide feedback to plantexporttraining@daff.gov.au