



Australian Government
Department of Agriculture,
Fisheries and Forestry

Australian phytosanitary treatment application standard for vapour heat treatment

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1 Introduction

The objective of phytosanitary treatment is to prevent the introduction or spread of regulated pests. Effective phytosanitary treatments are critical to managing Australia's plant biosecurity risks and safeguarding trade. The Australian treatment application standards ensure that treatments:

- are carried out in a consistent and effective manner

AND

- reach the required efficacy every time they are applied.

This treatment application standard applies to the use of vapour heat treatment (VHT) as a phytosanitary measure for imported product as well as exported and domestically traded product.

VHT uses water vapour-saturated air to heat the product for a specific period of time in order to effectively control infestations of certain pests. Because of the high heat energy of hot moist air, VHT is capable of raising the commodity temperature faster than dry air, allowing shorter treatment times. Additionally, as VHT can readily penetrate to the interior of the commodity being treated, it can be applied to products of any shape or size. The required temperature and humidity must be reached and maintained in line with the treatment schedule. This is verified by monitoring of the core temperature of the product and air humidity.

VHT is used primarily for products such as tropical fruit that are hosts of fruit fly and are resistant to high moisture and vulnerable to drying out.

Responsible certifying authorities must ensure, through audit or verification, that treatment facilities can demonstrate they meet requirements to effectively deliver VHT. This may include registration, or approval arrangements by third parties.

1.1 Scope

- 1.1.1 This standard describes the effective application of VHT as a phytosanitary measure for regulated pests on fresh fruit and vegetables for human consumption.
- 1.1.2 The following is out of scope:
- other heat treatment methods
 - Specific import/export requirements
 - target temperatures and durations for specific pests
 - operational instructions including requirements for facility registration, certification, approval of arrangements, and the like.
- 1.1.3 The import requirements for trade with Australia can be found on the department's website at www.agriculture.gov.au. The Biosecurity Import Conditions (BICON) database contains the requirements for imports to Australia and the Manual of Importing Country Requirements (Micor) lists known conditions for exports from Australia. The specific State and Territory Department of Agriculture websites for domestic trade can be found on the relevant state websites.

2 Requirements

2.1 Treatment facility

- 2.1.1 The treatment facility must have purpose-built chambers for conducting VHT, the chambers must be located within the treatment facility.
- 2.1.2 All treatment facilities used for VHT must have:
- systems in place to maintain the facility in a hygienic condition.
 - pest control systems in place.
 - a treatment chamber fit for purpose.
 - a pest free, secure area for cooling, packing and storing products after treatment. All openings must be sealed or covered in mesh with a gauge no greater than 1.6mm (hypotenuse) to prevent potential infestation from occurring.
 - systems in place to reduce the entry of pests into the treatment and packing areas (for example, air lock or double door entry system, spraying area between doors, electronic insect zappers, vertical plastic strips, or positive air flow curtains).
 - data collection and storage system for treatment tracking to ensure treatment specifications are met.
- 2.1.3 The treatment facility must comply with any additional requirements of the responsible certifying authority or importing authority.

2.2 Treatment chamber

- 2.2.1 The VHT treatment chamber must:
- be clean and pest free.
 - be capable of reaching and maintaining the temperature and relative humidity within the limits prescribed for the range of products being treated.
 - be able to monitor air temperature, product temperature, and relative humidity of the chamber.
 - have separate lockable or sealable entry and exit doors to ensure that the treatment cannot be compromised by the doors being opened during the treatment.
 - be custom built for the purpose of treating commercial product.

2.3 Temperature and humidity recording equipment

- 2.3.1 All treatment recording systems must:
- have tamper proof or tamper evident, computer controlled and monitored temperature and humidity recording equipment.

- accommodate the required number of sensors (air and product temperatures, and humidity sensors), in accordance with the chamber manufacturer's specifications, or as specified by product treatment requirements.
- not be affected by ambient high/low air temperatures, vibration and the like.
- record the treatment facility where the treatment was undertaken.
- identify each sensor and its position within the treatment lot.
- record data continuously for the duration of the treatment process.
- produce treatment data read outs, hard copy and/or electronically.
- record readings of all temperature and humidity sensors from ramp up to completion of cool down, with a minimum recording interval of every 5 (five) minutes during hold time and critical kill time.

2.4 Temperature sensors

2.4.1 Temperature sensors must:

- have an overall accuracy of $\pm 0.3^{\circ}\text{C}$ in the range of $37 - 52^{\circ}\text{C}$ with a resolution of 0.1°C in the normal operating and environmental conditions in which they will be used. Some product/market specific variations to these specifications may be permitted.
- be functional and calibrated
- have a unique identification.

3 Procedures

3.0.1 Certifying or importing authorities may impose additional requirements to those listed below, for temperature mapping (including commissioning tests and annual verification tests), as well as the number and calibration of sensors.

3.1 Temperature mapping studies on commissioning

- 3.1.1 Temperature mapping studies must be conducted to determine the temperature distribution within the VHT facility on commissioning of the VHT unit.
- 3.1.2 Initial temperature mapping studies must be carried out (in accordance with the manufacturer's specifications) by the treatment facility and verified by the responsible certifying authority to determine the coldest points within the treatment chamber. These tests must be used to develop a sensor placement plan showing precise locations for placement of each sensor determined by the coldest points within the treatment chamber.
- 3.1.3 The product used in the temperature mapping studies must be similar in size, ripeness, and variety.
- 3.1.4 Temperature sensors must be placed in the heaviest product. The weight difference between the heaviest and lightest product selected for probing, must not be more than 5 percent.
- 3.1.5 The number of sensors required during the temperature mapping is dependent on the configuration, make and model of the VHT unit.

3.2 Temperature mapping studies following major changes

- 3.2.1 Temperature mapping studies (as specified in section 3.1) must be repeated following modifications or adjustments in equipment or processes that affect attainment of the required temperature for the treatment.

3.3 Annual verification

- 3.3.1 A chamber test must be performed before the first treatment of the export season to ensure VHT equipment is functioning accurately.
- 3.3.2 The test must be carried out in accordance with the manufacturer's specifications.
- 3.3.3 Additional requirements for annual verification may be required for some export markets.

3.4 Calibration of sensors

- 3.4.1 The calibration of treatment sensors may be supervised by the responsible certifying authority or their representative.
- 3.4.2 Calibration will be performed by placing all temperature sensors in a hot water vat.
- 3.4.3 Each sensor must sit separately within the vat (that is, not touching another sensor or the surfaces of the vat).

- 3.4.4 The temperature of water in the vat must be stabilised to 47°C against a reference thermometer before commencing the calibration test.
- 3.4.5 Once temperature has stabilised, 3 readings must be recorded at 5-minute intervals for each sensor.
- 3.4.6 The temperature sensors must read within $\pm 0.3^{\circ}\text{C}$ of 47°C.
- 3.4.7 Sensors must be calibrated prior to treatment. Calibration results are valid for one month, or otherwise specified by the responsible certifying authority. Calibration date and results must be recorded.
- 3.4.8 The reference thermometer for calibration must be NATA certified every 3 years.

3.5 Product selection and sensor placement

- 3.5.1 Prior to or during the loading of the treatment chamber, the heaviest samples of product must be identified for sensor placement. This can be achieved by either:

- Identifying the heaviest product per stack

OR

- Identifying the heaviest product in the treatment lot.

- 3.5.2 Temperature probes must be inserted into the pulp of the selected product:

- into the centre of the product

OR

- close to the seed.

- 3.5.3 In addition, temperature sensors must be placed within the following specified products:

- Pawpaw (papaya) – sensors must be inserted through the stem into the approximate centre of the seed cavity.
- Mango – sensor tips must be placed next to the seed at the point of maximum pulp thickness.

- 3.5.4 A tool with aperture narrower than the sensor may be used to plot the insertion path of the sensor.

- 3.5.5 The probed products must be placed in the identified coldest spots of the treatment chamber as per the sensor placement plan (section 3.1).

3.6 Treatment

1. The VHT treatment application process includes the following stages:
2. Ramp up: relative humidity raised to minimum prescribed level. Additionally, when required chamber air temperature is also raised to minimum prescribed level.
3. Hold time: minimum relative humidity held for a minimum of one hour to facilitate fruit core reaching temperature required, as per nominated treatment schedule.
4. Critical kill time: temperature sensors reach prescribed minimum temperature and are maintained continuously for the duration as per nominated treatment schedule, including

the relative humidity. Additionally, when required minimum chamber air temperature is also maintained continuously.

5. Cool down: treatment completed, and product cooled down.

IMPORTANT: Certain markets may prescribe additional requirements for the chamber air temperature, relative humidity, and fruit core pulp temperature throughout the VHT treatment application process. For market specific requirements consult the relevant protocols and workplans.

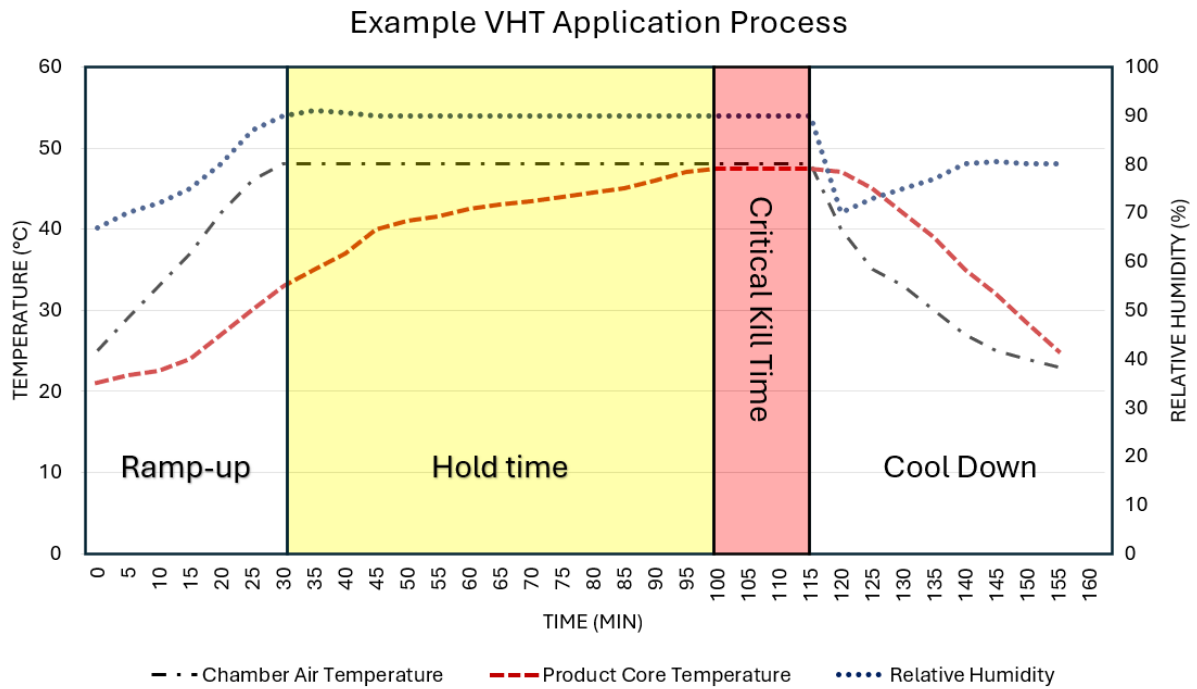


Figure 1: Example VHT Application for disinfesting mangoes against *Bactrocera tryoni* (Queensland fruit fly).

3.7 Sealing treatment chambers

- 3.7.1 Loaded treatment chambers must be sealed with a numbered seal. The treatment chamber details, and seal number must be recorded.

4 Verification of treatment

4.0.1 After treatment, the humidity and product temperature sensor time and temperature readings may be required by the responsible certifying authority to facilitate completion of any required treatment certification. This may be provided in hard copy or electronically depending on the temperature recording equipment.

4.1 Treatment lot failure

4.1.1 A treatment lot is considered a failure if the following has occurred:

- The treatment chamber has been opened or seals have been tampered with at any point during the treatment.
- The sensors are placed incorrectly in the product or in an incorrect location within the treatment lot.
- Temperature records show that the temperature and time required by the nominated treatment schedule have not been maintained.
- The relative humidity was not maintained at or above the required humidity level for the required duration.
- One or more sensors fails to record the required temperature at any stage throughout the treatment process.

4.1.2 When treating multiple treatment lots, if a treatment lot (stack/s) fails, all other treatment lots fail unless the failed treatment lot can be removed without compromising the phytosanitary security of the other treatment lots.

4.1.3 Failed treatment lots must not enter the secure area of the facility.

5 Phytosanitary security measures

5.0.1 Treatment facilities must have a phytosanitary security system in place and the identity and integrity of each consignment must be maintained.

5.1 Phytosanitary security

5.1.1 Phytosanitary security must be maintained during and after treatment. The responsible certifying authority may determine specific phytosanitary security measures. The methods of securing product against pests are:

- using a secure area with product segregation and traceability
- using secure packaging
- a combination of both.

5.1.2 Procedures must be in place to identify and segregate treated product and allow for movement without the risk of it mixing with any other product.

5.1.3 The procedures must cover all processes that pose a phytosanitary security risk to the treated goods including receivals, storage and dispatch. The procedures must enable consignments to be linked to a specific treatment and be traced back to a packhouse and grower if required.

5.1.4 Treated product must be identified as treated (for example, product labelling or separate storage areas for treated product only).

6 Documentation

6.1 Procedures

6.1.1 The following documents must be kept and made available to the responsible certifying authority when requested:

- Treatment procedures
- phytosanitary security procedures.

6.1.2 Procedures must reflect current practices and be compliant with this standard.

6.2 Records

6.2.1 The following records must be kept and made available to the responsible certifying authority when requested:

- all records pertaining to the treatment including:
 - treatment facility number or name
 - recorder serial number
 - date and time (local) the sensors were last calibrated
 - results from sensor calibration with a minimum of three temperature readings for each and correction factor
 - sensor placements in the treated product
 - date and time treatment chamber was sealed
 - treatment chamber seal number
 - link to certification (such as lot or batch number or Phytosanitary certificate)
 - treatment relative humidity, temperature and time recordings.
- documentation of any failed treatments.
- any additional records required by the responsible certifying authority or importing authority.

6.2.2 All records must be retained for a minimum of 2 years, unless otherwise specified by responsible certifying authority or importing authority.

Glossary

Chamber test	Confirms the capability of the chamber to maintain the regulated temperature. The chamber test is conducted without product.
Differential pressure treatment system.	Refers to the use of differential pressure to induce efficient circulation of vapour heat through all spaces in-between products so that each individual product is continuously, evenly and uniformly exposed to vapour heat atmospheres.
Import requirements	Specific phytosanitary measures prescribed by an importing authority, concerning consignments moving into that territory.
Product	The plant product to be treated.
Responsible certifying authority	The National Plant Protection Organisation (NPPO) and State/Territory Departments of Agriculture and potentially any other party approved under the authority of the NPPO or State/Territory Departments of Agriculture.
Sensor	Equipment/probe for monitoring treatment parameters, including the product/air temperature or humidity.
Stack	A sub-unit of the treatment lot. May be referred to as a column.
Tamper evident	Equipment or system that is designed to reveal any interference with data including manual variations to treatment parameters or changes to treatment data.
Temperature mapping	The process of determining the temperature distribution in the treatment chamber during a treatment.
Treatment	Official procedure for the killing, inactivation or removal of pests, or for rendering pests infertile or for devitalization. [FAO, 1990, revised FAO, 1995; ISPM 15, 2002; ISPM 18 2003; ICPM, 2005]
Treatment chamber	Any enclosed space where vapour heat treatment is applied to the product.
Treatment lot	The product treated within the differential pressure unit.
Treatment schedule	A humidity and temperature/time combination, for example: 90% relative humidity at 47°C for 15 minutes.

Vapour heat treatment	A treatment that uses water vapour-saturated air to heat a product for a specific period of time.
Vapour heat treatment facility type	Can include multiple differential pressure units, or single differential pressure fan for multiple units or multiple pressure fans for multiple units.

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