Australian Government
Department of Agriculture and Water Resources

Heat treatment methodology

Version 0.7

Cataloguing data

This publication (and any material sourced from it) should be attributed as: Department of Agriculture and Water Resources, 2017, *Heat treatment methodology*, Canberra, March. CC BY 3.0.

This publication is available at agriculture.gov.au/publications.

Department of Agriculture and Water Resources

Postal address GPO Box 858 Canberra ACT 2601

Telephone 1800 900 090

Web agriculture.gov.au

Purpose

This methodology sets out the minimum requirements for treatment providers performing heat treatments on commodities and/or associated packaging suited to such treatments for Quarantine and Pre–shipment (QPS) purposes. This methodology is the basis for compliance auditing of treatment providers to monitor their performance of effective QPS treatments using hot forced air.

Importing countries have the right to impose more stringent treatment conditions to address their individual biosecurity risks. In such cases, those additional conditions take precedence over the requirements of this methodology and must be complied with to the satisfaction of the relevant authority of the importing country.

Heat treatment providers registering to perform treatments in accordance with these requirements must have the equipment, facilities, accredited operators, management and administrative procedures necessary to ensure that all relevant treatments comply with these requirements.

Countries receiving heat treatment certification through this system expect the treatment has been undertaken in accordance with this methodology. Heat treatment providers found to be wilfully and consistently not complying with the requirements of this methodology and/or other specified treatment conditions will have their registration status changed to 'unacceptable', until such time as they can demonstrate satisfactory compliance.

Scope

This document applies to commercial and government treatment providers performing QPS heat treatments for countries that have adopted a specific heat treatment schedule.

All heat treatment methods included in this methodology use heated air that is forcibly circulated to raise the core temperature of the consignment to the specified treatment temperature and maintain it for the specified treatment period.

The heat treatments covered by this methodology are limited to; forced dry air, humidity controlled forced air and kiln drying.

While the intended outcome of each treatment method is the same, the mode of action of all three heat treatment methods is different.

This document is not intended to specifically cover the performance of heat treatments under ISPM 15, however, the basic principles, requirements and recommendations described in this methodology and the associated guideline are the basis for good treatment practice.

How to use this document

Some of the requirements in this methodology only apply in certain circumstances, generally related to the type of commodity being treated. It is important for the heat treatment providers and compliance auditors to understand the purpose of the requirements and the outcomes they are intended to achieve as well as the particular circumstances in which they apply.

This methodology should be read in conjunction with the *ICCBA Guide to Performing QPS Heat Treatments Using Hot Forced Air* which provides information on how to meet these requirements in commonly encountered situations.

Contents

1 Prior to conducting the heat treatment

1.1 Target of heat treatment

1.1.1 The target of the heat treatment must be identified.

1.2 Consignment Suitability

1.2.1 The consignment must be suitable for heat treatment.

1.3 Loading and free air space

1.3.1 The consignment must be loaded to allow even distribution of hot air throughout the heat treatment chamber.

1.3.2 The consignment must be loaded in the heat treatment chamber with separation between items to allow for effective circulation of hot air.

1.3.3 The consignment must be loaded off the floor of the heat treatment chamber to provide free air space under the target of the heat treatment and to prevent cooling influences from the ground.

1.3.4 Where a treatment schedule specifies a maximum load factor, the volume of the consignment must not exceed the specified load factor as a proportion of the volume of the heat treatment chamber.

1.4 Heat treatment chamber suitability

1.4.1 The heat treatment chamber must be capable of achieving and maintaining the required treatment temperature for the duration of the required treatment period.

2 Performing the heat treatment

2.1 Hot air delivery and circulation

2.1.1 The heat treatment chamber must have heat sources to raise and maintain the temperature of the heat treatment chamber to the required treatment temperature.

2.1.2 The heat treatment chamber must be capable of distributing and circulating hot air in a way that ensures the ambient temperature, and core temperature of the target of the heat treatment, are raised and maintained above the required treatment temperature.

2.2 Performing the heat treatment

2.2.1 All heat treatments must be undertaken in accordance with the specific treatment schedule for the target of the heat treatment.

2.2.2 The start of the treatment period commences only when all free air space temperature measuring points are at least 0.5°C above the required treatment temperature.

2.2.3 Where the treatment schedule requires that the core temperature of the target of the heat treatment be monitored, the start of the treatment period commences only when all core temperature measuring points are at least 0.5°C above the required treatment temperature.

2.2.4 The core temperature of the consignment and the free air space within the heat treatment chamber must be raised at least 0.5°C above the required treatment temperature and then maintained above this temperature for the required treatment period.

3 Monitoring the heat treatment

3.1 Treatment measuring equipment

3.1.1 All measuring equipment must be individually identified for data recording.

3.1.2 All applicable heat treatment measuring equipment must be calibrated in accordance with the manufacturer's instructions, international standards or appropriate national standards.

3.1.3 Temperature sensors and core probes must, at a minimum, be capable of measuring the range between 0°C and 100°C, to an accuracy of within + or - 0.5°C.

3.1.4 Humidity sensors must be capable of measuring to an accuracy within + or - 2 % relative humidity.

3.2 Free air space temperature sensors

3.2.1 The heat treatment chamber must have means of measuring the temperature of the free air space within the heat treatment chamber.

3.2.2 The free air space temperature must be measured by a minimum of XXX temperature sensors.

3.2.3 The free air space temperature sensors must be placed within the heat treatment chamber in a way that would indicate that the free airspace temperature throughout the heat treatment chamber has been raised above the required treatment temperature for the required treatment period. The temperature sensors must not be placed too close to the heat source so as to affect their measurement readings.

3.3 Core temperature sensors

3.3.1 Where the treatment schedule requires that the core temperature of the target of the heat treatment be monitored, the heat treatment must have a means of measuring the temperature of the consignment.

3.3.2 The core temperature must be monitored by inserting temperature sensors into the core of at least XXX individual items of the target of the heat treatment. The sensors must be placed at the following locations:

-
-

3.3.3 Where the consignment is not uniform in size, core temperature sensors must be inserted into the largest example of the target of the heat treatment.

3.3.4 Where the inserting core temperature sensors will damage the consignment, a substitute of the same thickness and thermal property may be used.

3.3.5 Where holes must be drilled into the centre of the target of the heat treatment, holes must be:

- as small as practicable while allowing the probe to be inserted
- plugged behind the probe

- away from heat conductors such as metal nails and screws

3.3.6 Where core temperature sensors cannot be inserted into the centre of target of the heat treatment because individual items are too small, probes must be inserted into the middle of the packaging encasing the items.

3.4 Humidity sensors

3.4.1 Where the treatment schedule requires the relativity humidity of the heat treatment chamber to be monitored, the heat treatment chamber must have means of measuring the relative humidity of the free air space within the heat treatment chamber.

3.4.2 Where the heat treatment chamber is designed for humidity controlled forced air heat treatments, the relative humidity of the heat treatment chamber must be measured by a minimum of one humidity sensor.

3.5 Monitoring readings

3.5.1 The temperature readings must be continuously monitored and recorded using electronic data logging equipment:

3.5.2 Where relative humidity monitoring is required by the treatment schedule, readings must be monitored and recorded at the same time the temperature readings are recorded.

3.5.3 All required readings must be monitored and recorded either:

- manually; or
- using data logging equipment.

3.5.4 Where treatment schedules don't require core temperature monitoring and recording, testing must be conducted and documented on each load configuration and temperature profile. Tests must be conducted every two years, and test methodology and results must be kept for two years for audit purposes.

3.6 End of treatment period

3.6.1 At the completion of the treatment period all readings taken during the monitoring of the heat treatment must be at or above the required treatment temperature.

3.6.2 The core temperature of the target of the heat treatment must have been raised and maintained above the required treatment temperature for the required treatment period.

3.6.3 Where the treatment schedule requires the relativity humidity of the ambient air inside the chamber be measured, the relative humidity must not have fallen below the required relative humidity for the required treatment period.

3.6.4 The heat treatment has failed if at any time during the treatment period the temperature, or where required relative humidity, falls below the required treatment temperature.

3.6.5 Where a heat treatment has failed, re-treatment of the target of the heat treatment must be performed before a treatment certificate can be issued.

4 Documentation

4.1 Record of Heat Treatment

4.1.1 The Record of Heat Treatment must be completed for all successful, and unsuccessful, heat treatments. An example record of heat treatment is provided at Appendix 1: Example record of heat treatment.

4.1.2 The following information must be recorded in the Record of Heat Treatment to demonstrate that the heat treatment complied with requirements:

- job identification
- client, or customer, name
- date of the treatment
- location – the site address where the treatment was performed
- description of the consignment
- description of the target of heat treatment
- dimensions of the consignment
- country of destination
- consignment identification – container number/s, bill of lading, or other means to clearly identify the consignment
- specified treatment requirements
- heat treatment method
- heat treatment chamber number/s
- whether a substitute was used, and if so, its dimensions
- start and completion time of the treatment period
- all temperature, and if required relative humidity recordings, including the time the readings were taken
- treatment results
- name and signature of the heat treatment operator-in-charge.

4.1.3 The Record of Heat Treatment must be completed at the same time and location as the heat treatment is performed.

4.2 Heat treatment certificate

4.2.1 A heat treatment certificate must be issued by a suitably accredited person, once they are satisfied that the heat treatment has been performed in accordance with the requirements of this methodology and the importing country requirements.

4.2.2 All sections of the heat treatment certificate are mandatory and must be filled out correctly to provide evidence that the heat treatment has been undertaken in accordance with these requirements. An example heat treatment certificate is provided at Appendix 2: Example heat treatment certificate.

4.2.3 The heat treatment certificate accompanies the consignment to state that it has been effectively treated for QPS purposes.

4.3 Record management

4.3.1 Copies of the Record of Heat Treatment must be maintained for a minimum of two years, for audit purposes.

4.3.2 Copies of the heat treatment certificate must be maintained for a minimum of two years, for audit purposes.

4.3.3 Calibration records and/or certificates must be kept for a minimum of two years by the heat treatment provider.

Appendix 1: Example record of heat treatment

RECORD OF HEAT TREATMENT

Job Details			
Job Identification:	**Customer Name:**	**Date of Treatment:**	**Location:**

Description of Consignment:	**Target of Heat Treatment:**
Consignment Dimensions:	**Container Numbers / Consignment Identification:**

Heat Treatment Details

The consignment complies with the following requirements:

Adequate free air space and suitable for the applied heat treatment method ☐ Yes ☐ No

Heat Treatment Method: ☐ Forced Dry Air ☐ Humidity Controlled Forced Air ☐ Kiln Drying		**Specified Treatment Temperature:** °C
Specified Treatment Exposure Period: Mins/Hrs	**Specified Humidity Rate (%) (where applicable):**	**Was a Substitute used?** Yes ☐ No ☐ **If Yes, record the Substitute dimensions and material used:**
Heat Treatment Chamber Number:	**Country of Destination:**	

Heat Treatment Readings

Phase	Time and Date of Reading	Temperature Probe and Humidity Readings by Location						
			Location:	Location:	Location:	Location:	Location:	Location:
Start		Temperature						
		Humidity %						
During		Temperature						
		Humidity %						
End		Temperature						
		Humidity %						

Note: If additional temperature probes and humidity readings are taken attached these to the Record of Heat Treatment

Comments:

Heat Treatment Operator in Charge

Name:	**Signature:**

Appendix 2: Example heat treatment certificate

COMPANY LETTERHEAD

(Include address as it appears on the treatment providers list)

HEAT TREATMENT CERTIFICATE

Certificate number: | **Registration number:**

CONSIGNMENT DETAILS

Description of Consignment: **Quantity:**

Country of Origin: **Port of Loading:**

Country of Destination: **Declared Port of Entry:**

Name and Address of Exporter/Shipper:

Name and Address of Importer/Buyer/Client:

HEAT TREATMENT DETAILS

Date of Heat Treatment: **Heat Treatment Method:**

Place of Heat Treatment: **Consignment Dimensions:**

Required Treatment Temperature: °C

Treatment Exposure Period: hr/min

Core Temperature Maintained: °C

Humidity Rate (where applicable): %

DECLARATION

By signing below, I, the accredited treatment provider responsible, declare that these details are true and correct and the treatment has been carried out in accordance with the ICCBA Heat Treatment Methodology.

ADDITIONAL DECLARATIONS

.....

.....

..... Signature ..... Date

..... Name of Accredited treatment provider ..... Accreditation Number

Company stamp

Glossary

Term	Definition
Commodity	The items or goods that are being exported or imported.
Consignment	Refers collectively to the commodity, any packing materials used and the mode of transport such as a shipping container.
Core	The central, most inner part of the commodity/consignment being treated.
Core probe	A temperature sensor inserted into the target of the heat treatment, or an acceptable substitute, to measure the core temperature.
Core temperature	The temperature at the core of the target og the heat treatment, or an acceptable substitute.
Exposure period	The amount of time, in one continuous block, that the consignment must be exposed to sufficient temperatures, and relative humidity where required, to be lethal to the targeted pests.
Forced dry air	A heat treatment method where hot air is forced into the heat treatment chamber to heat the consignment to the requirement treatment temperature. The humidity inside the heat treatment chamber is not monitored and loss of moisture from the commodity will not result in adverse effects. This method is commonly used to treat wood packaging material.
Free air space	Empty space within a heat treatment chamber between, above or around the consignment.
Heat source	An object that produces or radiates heat.
Heat Treatment Certificate	Documentation certifying that a heat treatment has been conducted in accordance with the importing country's requirements.
Heat treatment chamber	A physical container or chamber, purposely built, temporary or mobile, used for performing heat treatments.
Heat Treatment provider	A heat treatment provider which has met certain requirements and is registered as an approved provider of QPS Heat Treatments by the relevant quarantine regulatory authority in the exporting country.
Humidity controlled forced air (also referred to as Variable humidity heat treatment)	A heat treatment method where a percentage of relative humidity (just below dew point) is included after the initial start of the treatment process. The humidity level is managed by adding water vapour to the chamber or the controlled release of moisture laden air from the chamber. This is commonly used for commodities that may be damaged by: • excessive moisture (wetting of the commodity) that would occur during heat treatment methods, such as vapour; or • excessive moisture loss that has the potential to char, crack or combust the commodity at the specified treatment temperature over a long period of time.
Humidity sensor	Refers to any instrument that is used to measure humidity.
Kiln drying	A heat treatment method where timber is heated to extract moisture. May also satisfy biosecurity requirements where required core temperatures are reached and maintained for the treatment period specified.

Term	Definition
Load factor	Specifies the maximum volume of space that the commodity can occupy in the enclosure to achieve rapid air circulation. Usually expressed as a percentage (for example, maximum load factor of 50%).
Quarantine and Pre–shipment (QPS)	Based on the Montreal Protocol, which is seeking to phase–out methyl bromide for non–QPS uses by 2015: *a) "Quarantine applications", with respect to methyl bromide, are treatments to prevent the introduction, establishment and/or spread of quarantine pests (including diseases), or to ensure their official control, where:* *i. Official control is that performed by, or authorised by, a national plant, animal or environmental protection or health authority;* *ii. Quarantine pests are pests of potential importance to the areas endangered thereby and not yet present there, or present but not widely distributed and being officially controlled* *b) "Pre–shipment applications" are those non–quarantine applications applied within 21 days prior to export to meet the official requirements of the importing country or existing official requirements of the exporting country;*
Record of Heat Treatment	A document that records the relevant information to demonstrate that the heat treatment conducted complied with the requirements.
Relative humidity	The amount of water vapour in the air expressed as a percentage of the amount of water that would be present in an equal volume of saturated air at the same temperature.
Substitute	A separate item or object that has the same thermal conductivity properties as the commodity/consignment targeted for heat treatment that can be used to house a core probe when the placement of the probe may cause damage to the consignment.
Target of the heat treatment	The target of the heat treatment may be the commodity, packaging material or both.
Temperature sensor	Refers to any instrument that is used to measure temperature.
Treatment period	The time period for which the specified treatment temperature must be continuously maintained.
Treatment schedule	Refers to importing country requirements or conditions, or other conditions that apply to the consignment.
Treatment temperature	The minimum temperature required to ensure the efficacy of the treatment