附件目錄

ICCBA

International Cargo Cooperative Biosecurity Arrangement

APEC Economic Development Fund
ICCBA Technical Working Groups
4 - 6 December 2019
Furama Burkit Bintang
Kuala Lumpur, Malaysia

Day One: 4 December 2019 Start at 9AM

Agenda number	Topic	Person responsible
1	Welcome and Introduction	Secretariat
2	Advanced Methyl Bromide Auditing Workshop (all day)	Australia to lead workshop

Day Two: 5 December 2019 Start at 9AM

Agenda number	Topic	Person responsible
3	ICCBA-MB Trial update	New Zealand, Malaysia and Indonesia
4	Joint System Review Process	New Zealand
5	ICCBA-MB Participation Application Process	Secretariat
6	Methyl Bromide Equilibrium Discussion	New Zealand
7	Methyl Bromide Methodology Review	Secretariat
8	ICCBA funding options	All

Day Three: 6 December 2019 Start at 9AM

Agenda number	Topic	Person responsible
9	Fumigation App Update	Australia
10	Methyl Bromide as a treatment for perishables	Australia
11	Heat Treatment Methodology	Australia
12	Irradiation as an ICCBA Treatment	Secretariat
13	Connecting ICCBA and the IPPC	New Zealand
14	Other Business	All

ICCBA

International Cargo Cooperative Biosecurity Arrangement

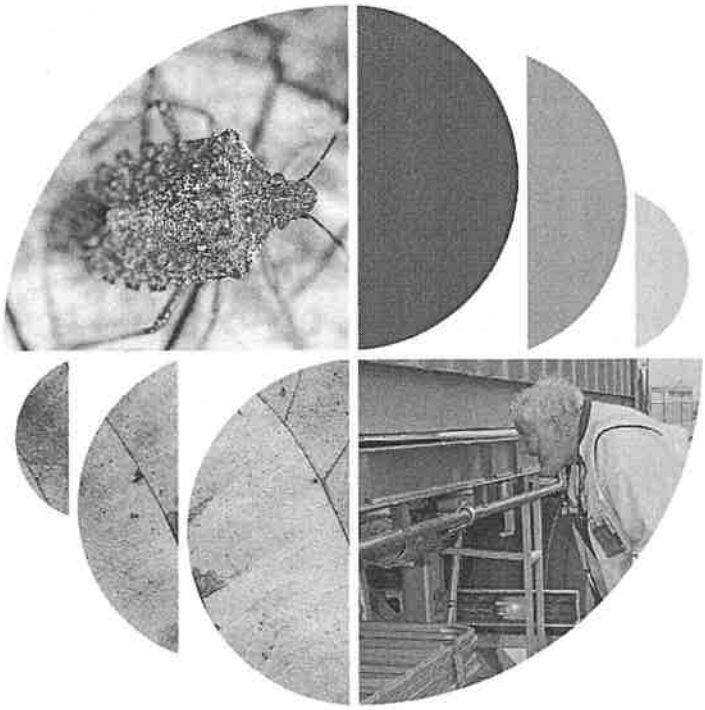
ICCBA Technical Working Groups
9 April 2019
Wyndham Panama Albrook Mall
Panama City, Panama

Forward work plan

ACTION REQUIRED	RESPONSIBLE AGENCY / PERSON	DATE DUE
All agencies are to look for sustainable methods for funding their participation in ICCBA. It is becoming increasingly difficult for Australia to provide the level of funding it has historically.	**All agencies**	On-going
Australia to monitor the progress of an app being developed by Australian industry that may be valuable to ICCBA members. Australia to provide regular updates.	**Australia**	On-going
Indonesia, Malaysia and New Zealand to continue the trial of ICCBA-MB and develop the process for joining the ICCBA MB Schedule, including the development of a Processes and Procedures document.	**Indonesia/Malaysia/New Zealand**	Next ICCBA meeting
Australia to conduct a comparison of all currently available methyl bromide measuring devices	**Australia**	Next ICCBA meeting
Australia to engage with companies manufacturing fumigation monitoring devices to discover future monitoring capabilities.	**Australia**	Next ICCBA meeting
Australia and New Zealand to finalise a version of the heat treatment methodology for their own use and then circulate that version for ICCBA comment.	**Australia and New Zealand**	Next ICCBA meeting
Indonesia to translate their phosphine standard to English and share with the group.	**Indonesia**	Next ICCBA meeting
Chile and India to send information on hot water treatments to OIRSA so that OIRSA can summarise the information and distribute to the group.	**India, Chile and OIRSA**	Next ICCBA meeting

Advanced Methyl Bromide

Auditing Workshop



December 2019

Workshop agenda

- Fumigation principals
- Documentation
- Sophisticated non-compliance
- Audit techniques
  - Analysing ROF's
  - Questioning techniques
  - Unannounced activities
  - Cross referencing
- Exercises - real examples of deliberate non-compliance
- Knowledge sharing

Fumigation principals

Biosecurity treatments involve the application of a harmful agent to the target pest to the extent necessary to kill it

The harmful effect of the agent is directly related to the strength of the agent in combination with the length of time the target is exposed to that agent

The effect is cumulative over time

There is a level below which the treatment will become ineffective

Fumigation principals

Verification is required to ensure a fumigation has been successful

Critical treatment criteria are measured and recorded to demonstrate compliance

Fumigation principals

YOU MUST VERIFY THE TREATMNET WAS EFFECTIVE

The amount of harmful agent must be measured to ensure that a lethal dose has been applied

- For fumigations, tubes must be placed in suitable locations to draw samples from within the treatment space
  - to verify gas concentrations are above the minimum level required
  - to check even distribution

The temperature of the commodity can affect the efficacy of the treatment

Documentation

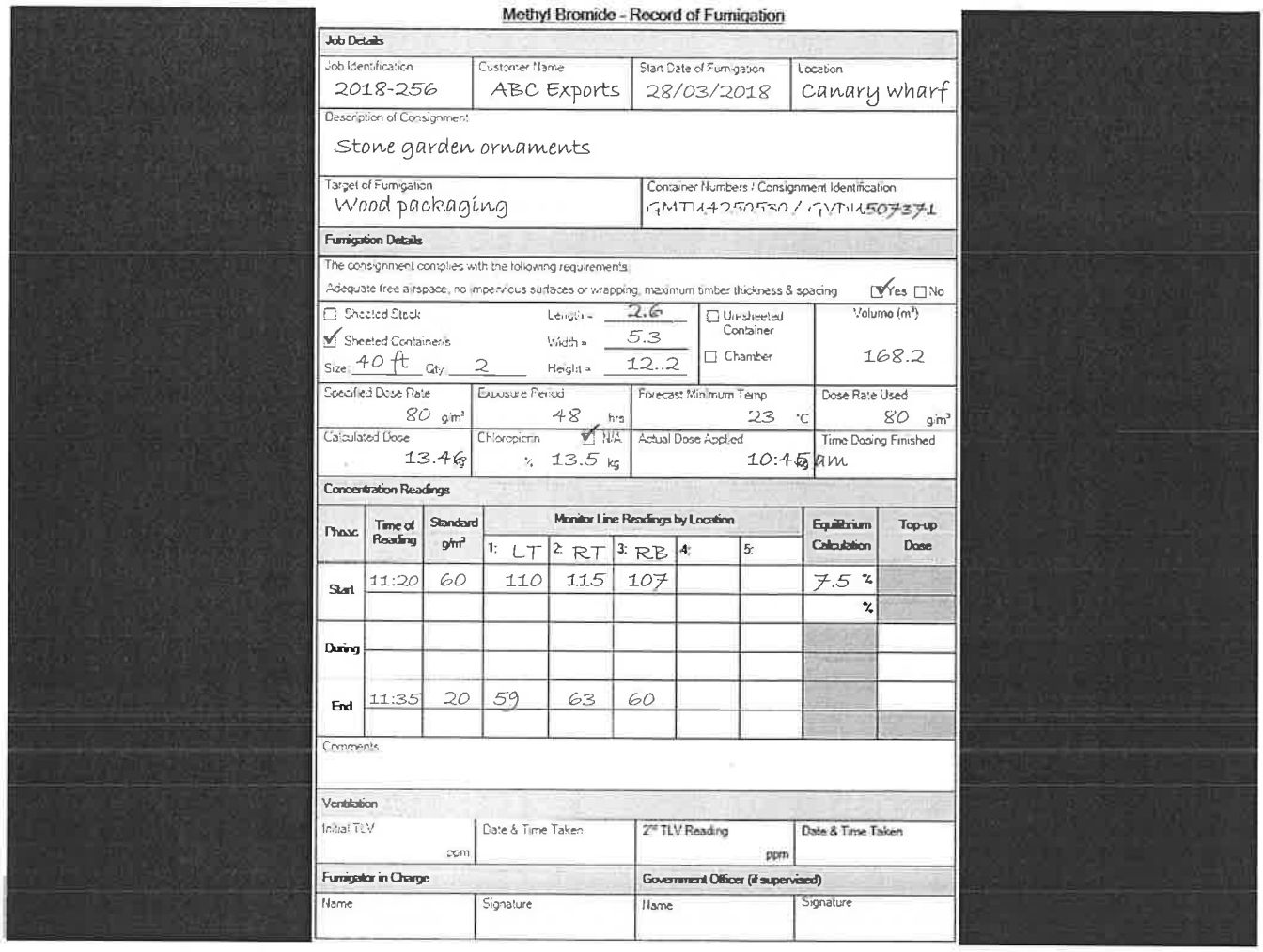
All the relevant information for each treatment must be recorded

Concentration readings and the times they were taken must be recorded

- Must be written on the record of fumigation on-site
- When auditing we are reverse engineering what is presented back to the original record and activity

Data logs can easily be falsified

Cross reference all available documentation



Methyl Bromide - Record of Fumigation

Job Details

Job Identification	Customer Name	Start Date of Fumigation	Location
2018-256	ABC Exports	28/03/2018	Canary wharf

Description of Consignment: Stone garden ornaments

Target of Fumigation	Container Numbers / Consignment Identification
Wood packaging	GMTU4250530 / GVTU4507371

Fumigation Details

The consignment complies with the following requirements:

Adequate free airspace, no impervious surfaces or wrapping, maximum timber thickness & spacing ☑ Yes ☐ No

☐ Sheeted Stack ☑ Sheeted Containers Size: 40 ft Qty: 2	Length = 2.6 Width = 5.3 Height = 12..2	☐ Unsheeted Container ☐ Chamber	Volume (m³): 168.2

Specified Dose Rate	Exposure Period	Forecast Minimum Temp	Dose Rate Used
80 g/m³	48 hrs	23 °C	80 g/m³

Calculated Dose	Chloropicrin	Actual Dose Applied	Time Dosing Finished
13.46 kg	☑ N/A % 13.5 kg	10:45 am	

Concentration Readings

Phase	Time of Reading	Standard g/m³	Monitor Line Readings by Location 1: LT	2: RT	3: RB	4:	5:	Equilibrium Calculation	Top-up Dose
Start	11:20	60	110	115	107			7.5 %	
								%	
During									
End	11:35	20	59	63	60				

Comments:

Ventilation

Initial TLV	Date & Time Taken	2nd TLV Reading	Date & Time Taken
ppm		ppm	

Fumigator in Charge		Government Officer (if supervised)	
Name	Signature	Name	Signature

Sophisticated non-compliance

We now have a community of fumigators around the world with an in depth knowledge of fumigation

Many are capable of deliberately falsifying documentation to show compliance with the intent of passing an AFAS audit

As auditors we must continually adapt to identify these behaviours

Examples range from not putting gas in at all to opportunistic non-compliance

Analysing ROF's

Analysing ROF's

- Odd decimals
- Unrealistic readings - Odd vs Even numbers
- Patterns such as tiering
- Unrealistic gas behaviour
- Readings always just above the standard
- Treatment locations
- Equipment required vs owned
- Timing/movements – gas introduction through to TLV

Questioning techniques

Once you have identified non-compliance or become suspicious questioning is crucial to gain evidence or admissions

Work as a team – independently question different technicians and staff members then corroborate responses

Questioning techniques

Types of Questions

- Open
- Closed
- Specific
- Hypothetical
- Reflective
- Leading questions

Be willing to verify answers E.g. equipment lending

Unannounced activities

All treatment providers have the ability to put on a performance (especially if passed AFAS registration)

Arriving unannounced identifies what is really occurring outside of audit

When at or near a fumigation pad look at the set up of all containers under gas

Take your own readings without their knowledge - if you know a treatment has failed, wait to see what outcome is presented

Check they are achieving the required exposure period

Are they actually treating....?

Cross referencing

Saved data on a measuring instrument vs data log print outs

Equipment

MB usage logs

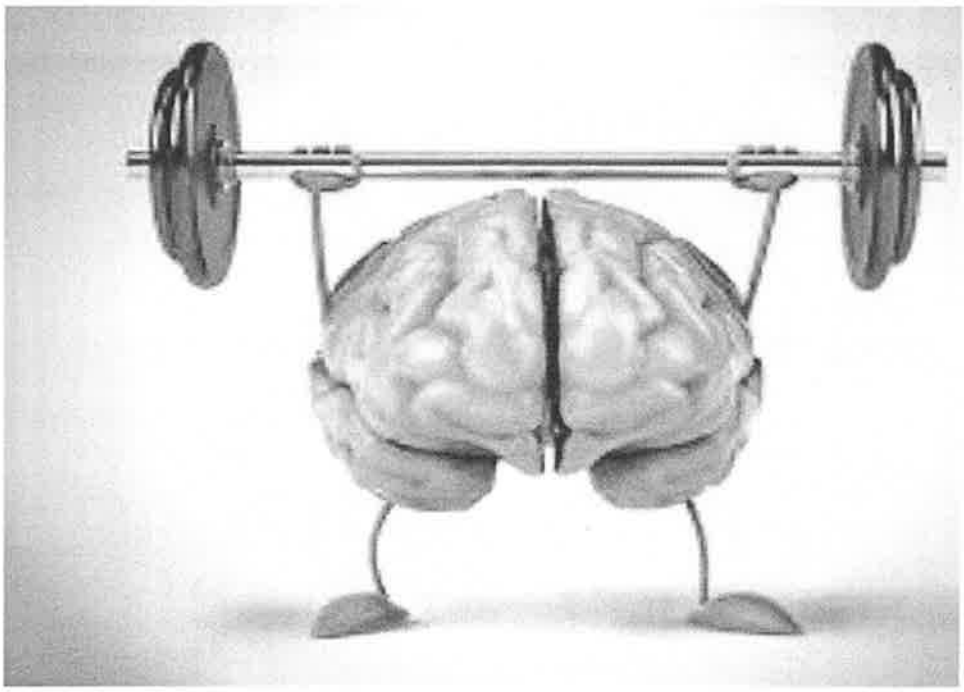
Movements

Readings viewed during demonstration vs records presented

Large volume of treatments?

- Go and verify
- Observe fumigators capacity during demonstration

Exercise 1



Exercise 1 - Answer

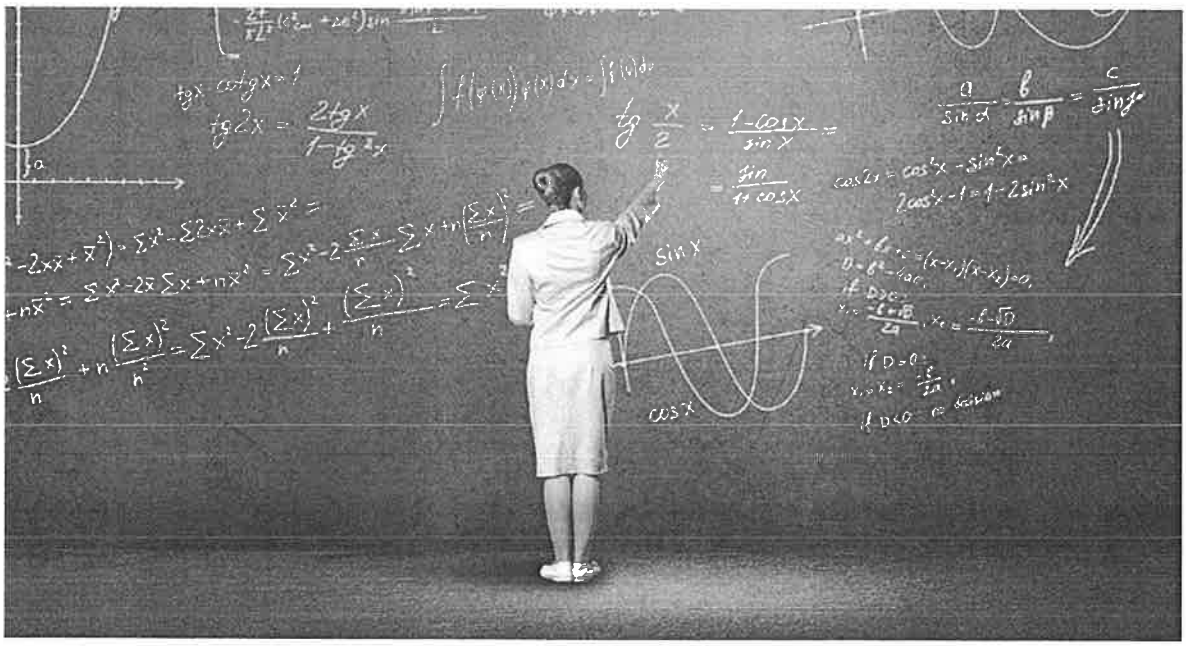
Odd vs Even numbers

36 even number readings from this sample

How likely is this to occur?

Tabulating numbers can help identify

Exercise 2

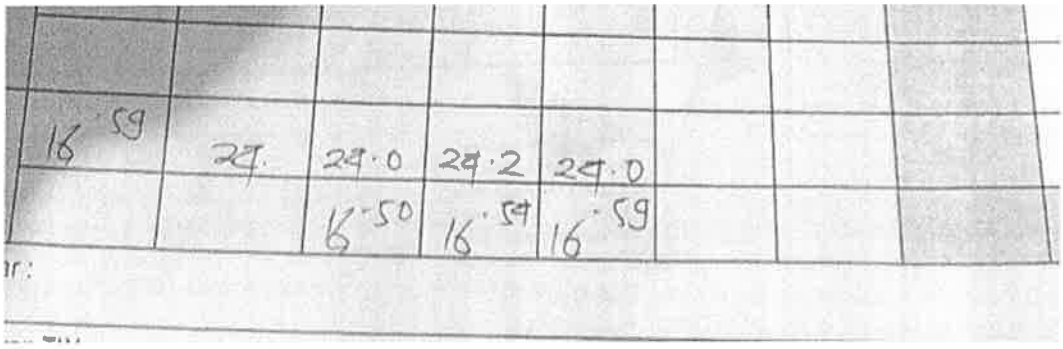


Exercise 2 - Answer

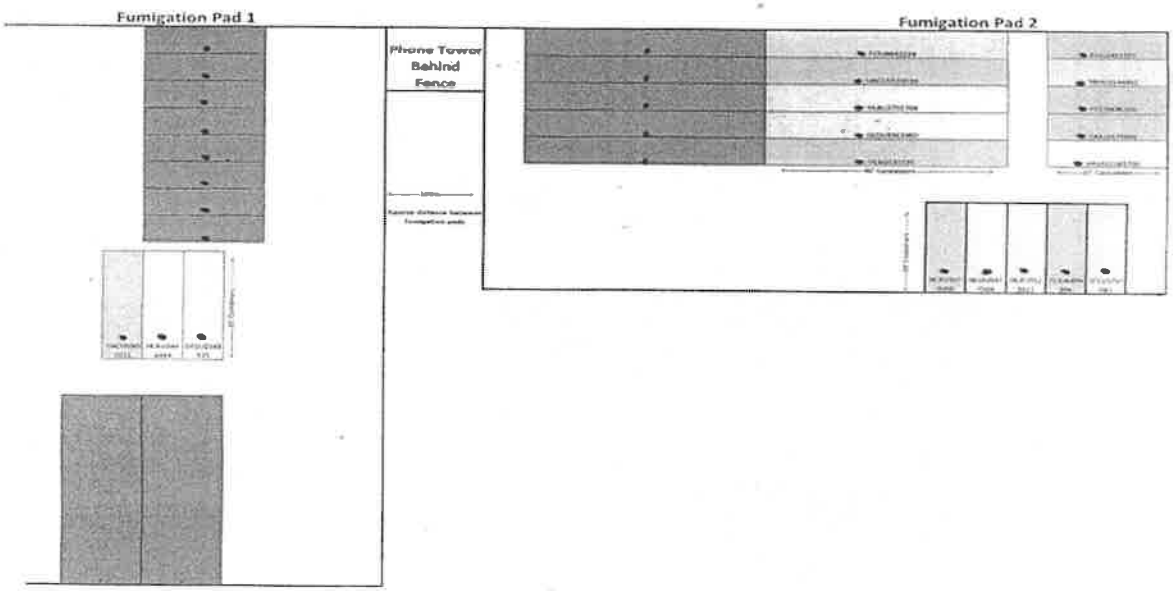
At or just above the standard at end time

Ask if they have ever had failures

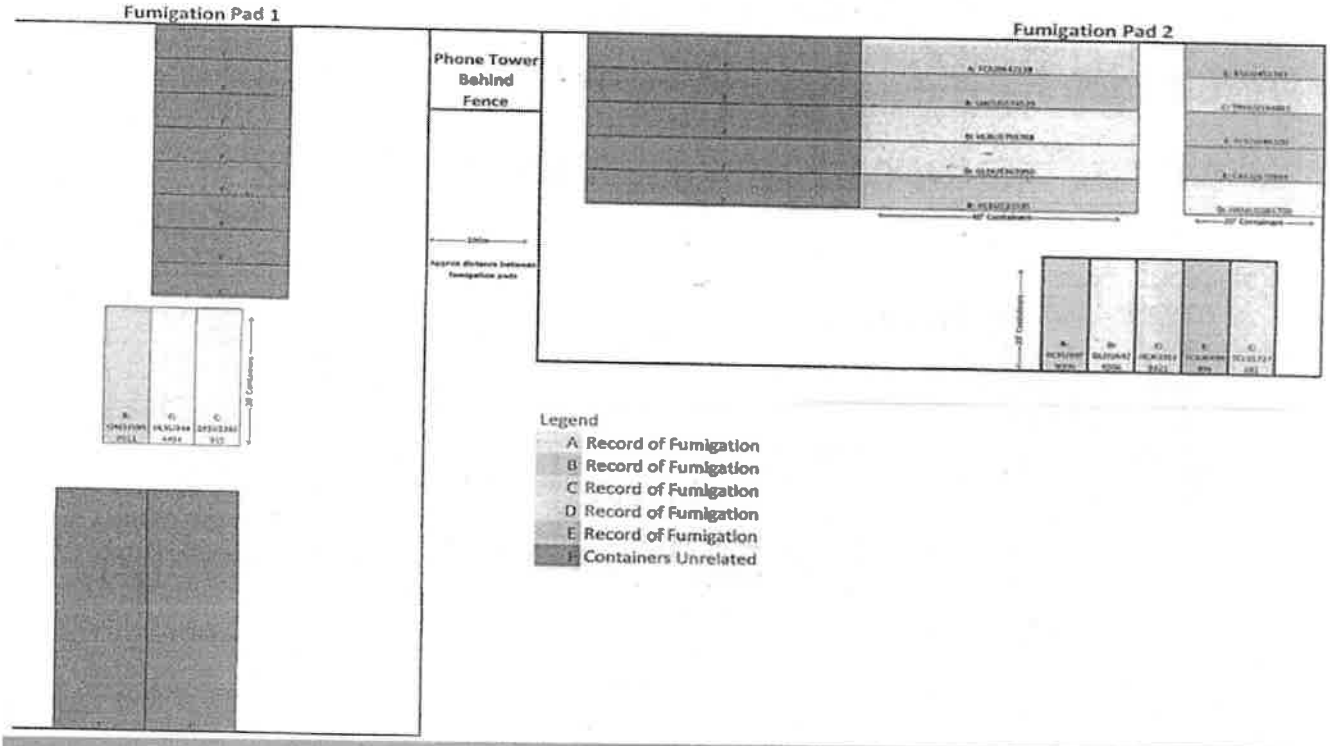
Likelihood of always finishing just above?



Exercise 3

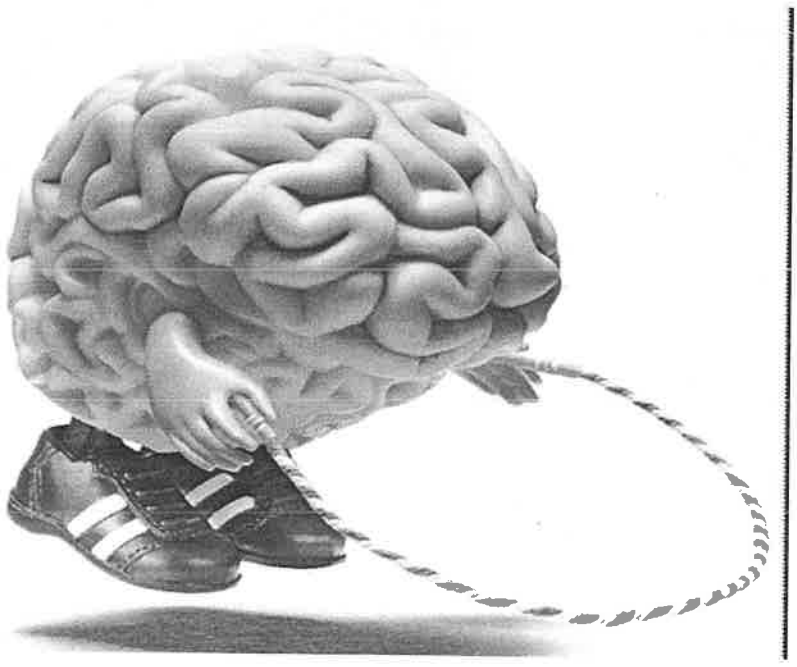


Exercise 3 - Answer

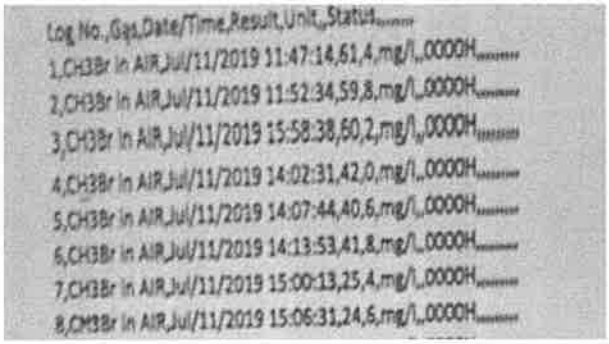


Exercise – 4

Analysing data logs



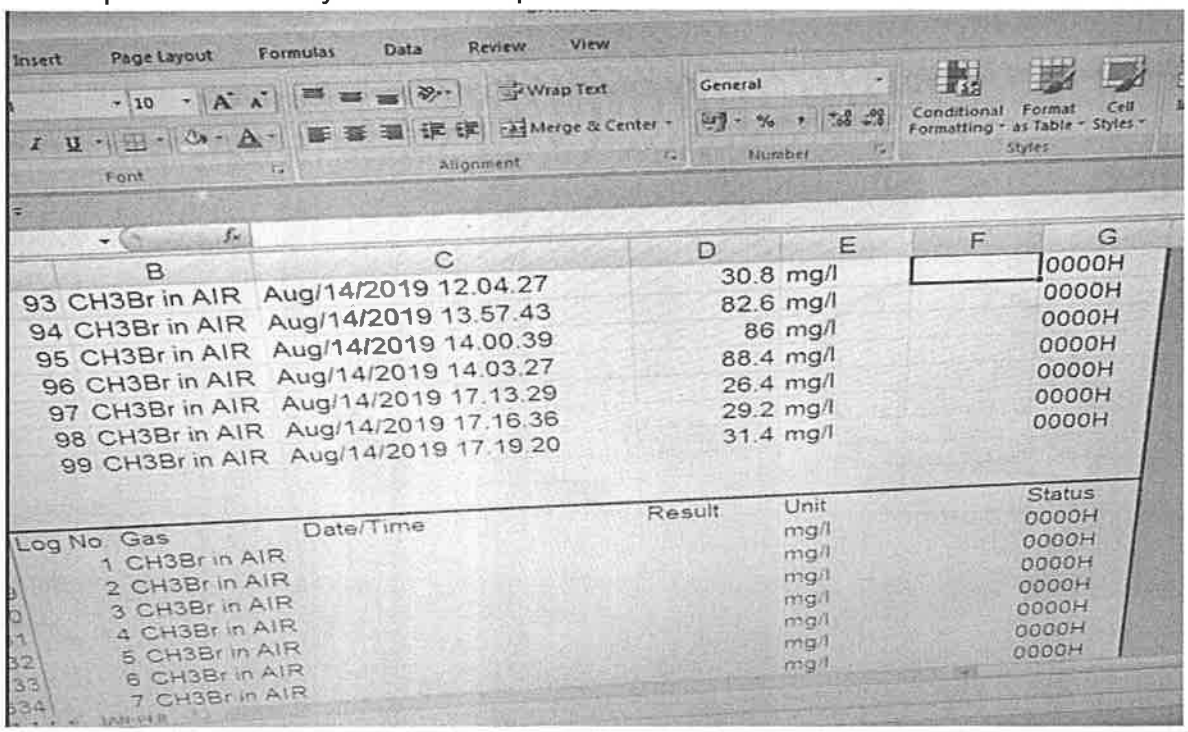
Exercise – 4 - Answer



11:47
11:52
15:58
14:02
14:13

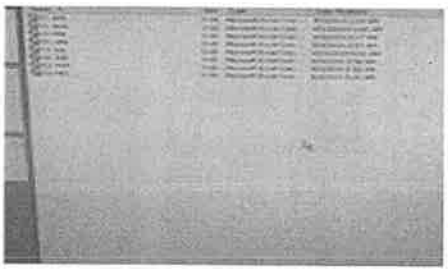
Exercise 4- Answer

Example of how easy it is to manipulate data



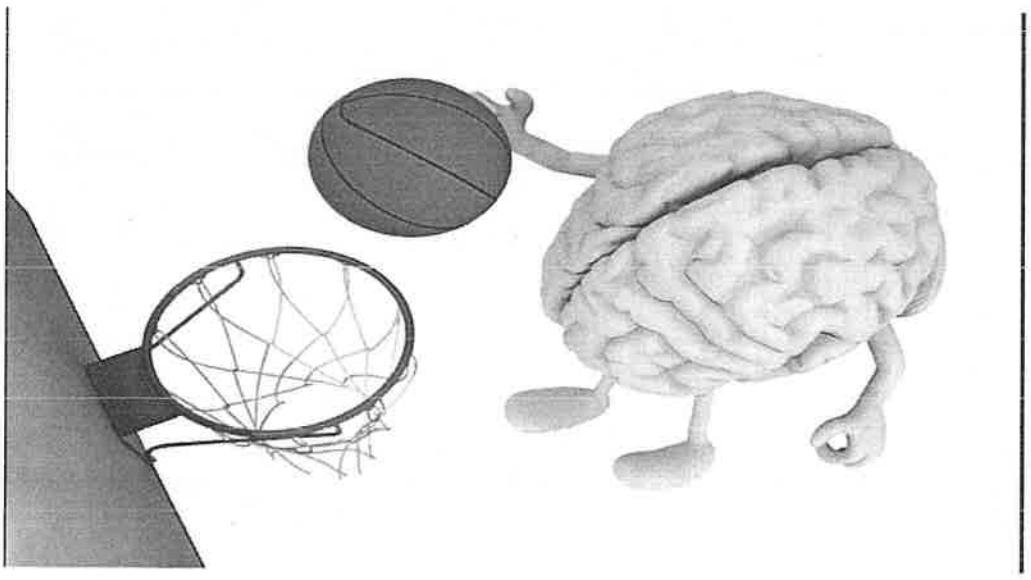
Exercise 4- Answer

Example of how easy it is to manipulate data



Exercise – 5

Company only has a

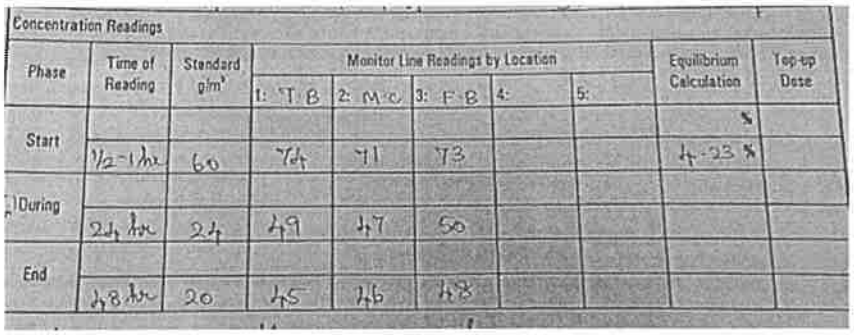


Exercise – 5 - Answer

Unrealistic gas behaviour

47g after 24 hours

46g after 48 hours

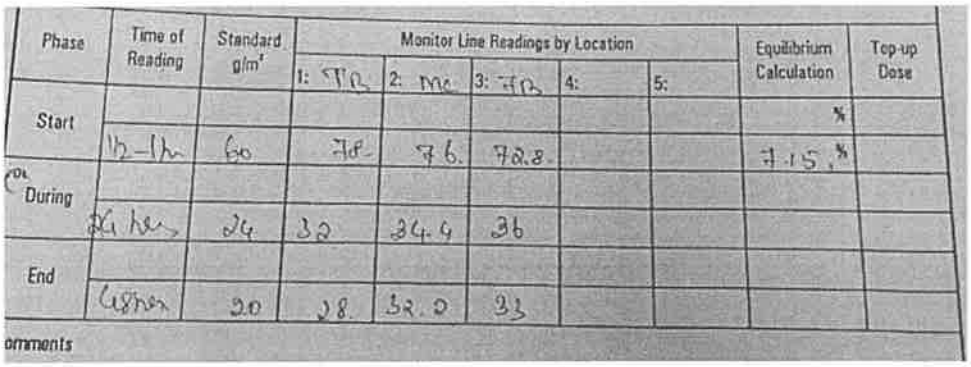


Concentration Readings

Phase	Time of Reading	Standard g/m³	Monitor Line Readings by Location 1: TB	2: MC	3: FB	4:	5:	Equilibrium Calculation	Top-up Dose
Start								%	
	½-1hr	60	76	71	73			4-23 %	
During									
	24 hr	24	49	47	50				
End									
	48 hr	20	45	46	48				

Exercise – 5 - Answer

Company only has a Riken FI-21 – Realistic representation of decimals



Phase	Time of Reading	Standard g/m³	Monitor Line Readings by Location 1: TB	2: MC	3: FB	4:	5:	Equilibrium Calculation	Top-up Dose
Start								%	
	½-1hr	60	78	76.	72.8			7.15 %	
During									
	24 hrs	24	32	34.4	36				
End									
	48hrs	20	28	32.0	33				

Comments

Exercise – 5 - Answer

Readings from 4 March

Calculated Dosage 1362.56 g | Chloropicrin 2 % 1298.54 g | ☐ N/A | Actual Dosage Applied 40 g | Time Dosing Finished 10.50 AM

Concentration Readings

Phase	Time of Reading	Standard g/m³	Monitor Line Readings by Location 1: TP	2: MC	3: BP	4:	5:	Equilibrium Calculation	Top up Dose
Start	10-1hr	36	38.4	37.2	37.0			3.29 %	
During									
End	24hrs	14.4	16.4	13.8	19.2				

Readings from 29 November

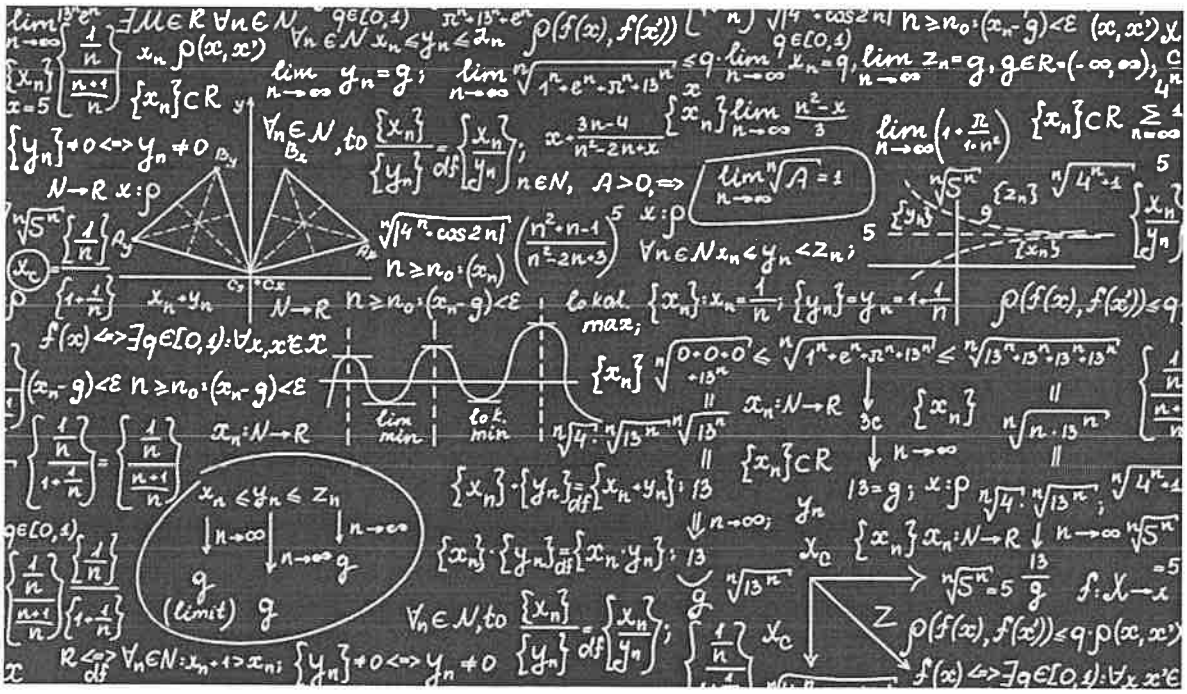
Calculated Dosage 1362.56 g | Chloropicrin 2 % 1298.54 g | ☐ N/A | Actual Dosage Applied 40 g | Time Dosing Finished 10.50AM

Concentration Readings

Phase	Time of Reading	Standard g/m³	Monitor Line Readings by Location 1: TP	2: MC	3: BP	4:	5:	Equilibrium Calculation	Top up Dose
Start	10-1hr	36	38.4	37.2	37.0			3.29 %	
During									
End	24hrs	14.4	16.4	13.8	19.2				

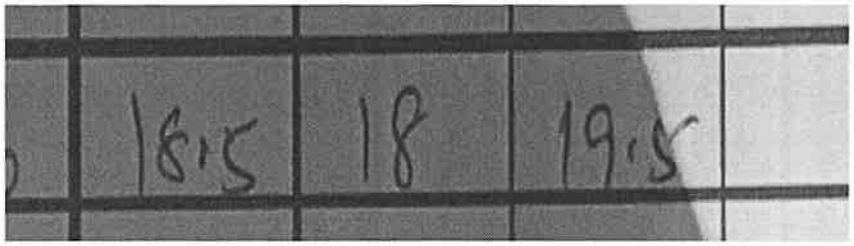
Also note how every number tiers up at end time monitoring
Have a look at the dates recorded on 26 August scratch paper

Exercise – 6



Exercise 6 - Answer

Odd numbers – know the requirements of measuring equipment

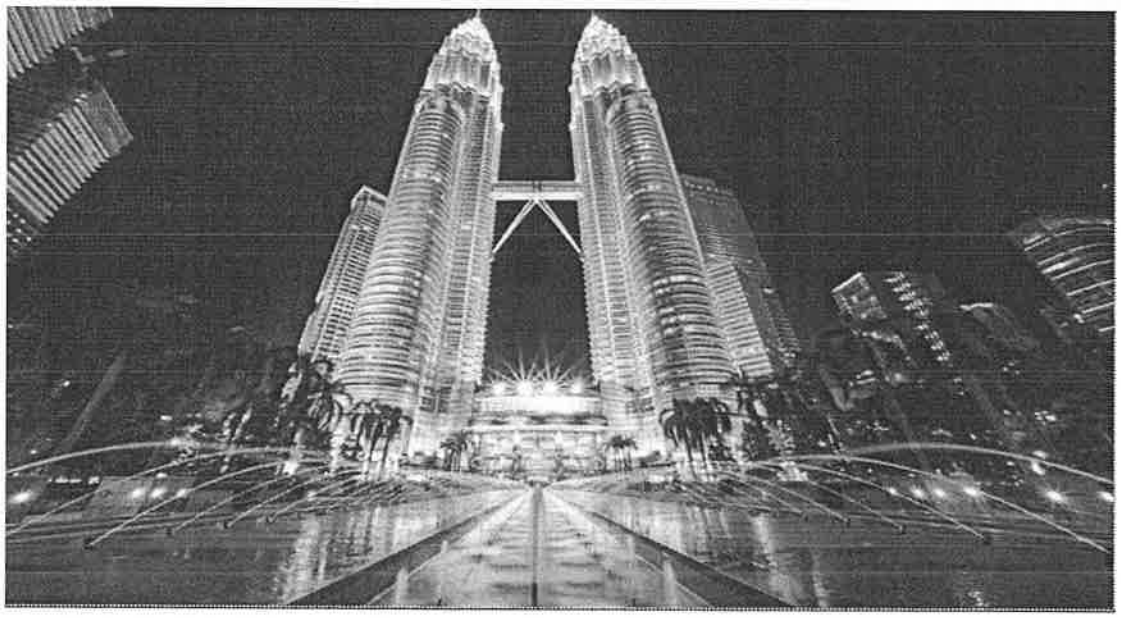


Knowledge sharing

Examples from the room of how they have identified deliberate non-compliance

How did you identify it?

Thank you / Terima Kasih



ICCBA

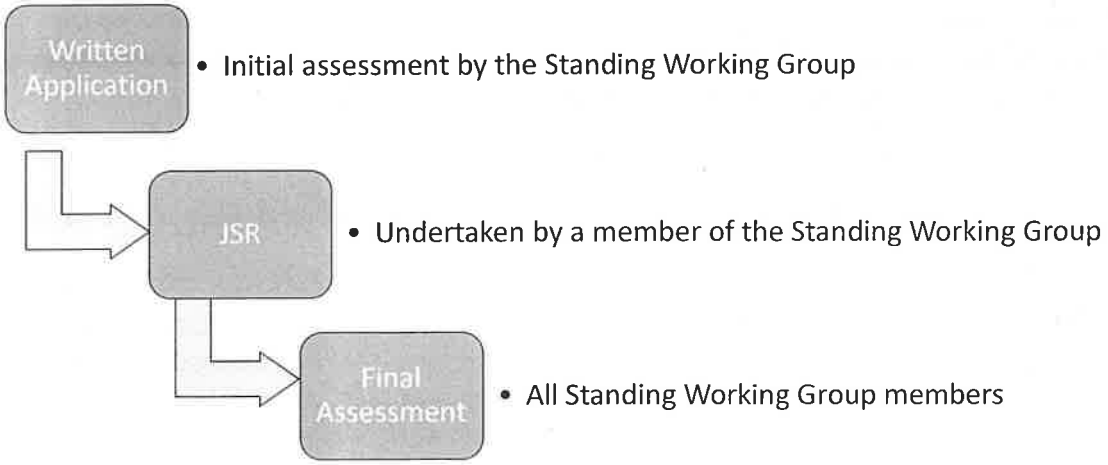
International Cargo Cooperative Biosecurity Arrangement

Participating in ICCBA-MB

ICCBA Secretariat

December 2019

Process – Developed during ICCBA-MB Trial



Written Application

- Template has been developed
  - Guide only
  - May need to clarify or seek additional information
- Schedule requirement with questions
- May need to change over time

Written Application

3. Management

3.2 Each Participating Agency will implement and administer a system within their own jurisdiction for managing its obligations under ICCBA-MB.

1. Which area within your agency will be responsible for managing the requirements of ICCBA-MB?

Explanatory note: *is there a section or team within your agency that will ultimately be responsible for managing ICCBA-MB in your country? This may be the team that coordinates registrations and audits. Please provide an organisation chart for this team with roles and responsibilities .How many people are involved for technical and administrative work, respectively? Are there any requirements for personnel to be involved in the team (ex. have attended training of ICCBA-MB, recognized as competent in ICCBA - MB or as supervisor or auditor of ICCBA-MB)? Do you have enough to ensure continuity? How does this team manage the system (could explain by flowchart)?*

Written Application

3. Management

3.3 All treatments conducted under ICCBA-MB will comply with the requirements of the ICCBA-MB Methodology.

2. How is the Methyl Bromide Fumigation Methodology made available locally?

Explanatory note: *is the generic ICCBA Methyl Bromide Methodology being used or have you amended the cover pages and introduction to make a local version? Is the methodology available on your website, is so provide a link, if not how do you ensure your treatment providers are aware of the methodology and can access it? Is the methodology available in local language or English?*

Written Application

4. Import Clearance Management

4.2 Where an Importing Agency detects ineffective treatments, it will make a determination, based on available evidence, as to whether the treatment is suspected or confirmed to have failed.

3. How will your agency manage the import of ICCBA-MB goods?

Explanatory note: *each importing agency has the right to decide how to manage its imports and participation in ICCBA-MB does not change that. Will your agency undertake any inspection, assessment or other assurance control on goods treated under ICCBA-MB?*

4. How will your agency determine failed treatments under ICCBA?

Explanatory note: *where a failed treatment is detected, does your agency have the diagnostic capability to accurately determine a failed treatment as opposed to post treatment reinfestation?*

Written Application

4. Import Clearance Management

4.3 Where an Importing Agency detects ineffective treatments or documentation irregularities under ICCBA-MB, they will notify the Authorising Agency in writing as soon as practicable and provide relevant information that would assist the Authorising Agency to investigate its possible cause.

5. Which area will be responsible for reporting non-compliance?

Explanatory note: *will a specific area of your agency be responsible for reporting non-compliance? Is this the same area that is responsible for managing your agencies requirements under ICCBA-MB more broadly?*

Written Application

5. Training and Accreditation

5.1 Each Agency will establish their own ICCBA-MB training team to provide training for the accreditation of Accredited Officers and Accredited Fumigators against the requirements of the ICCBA-MB training package.

6. How is industry training and accreditation managed by your agency?

Explanatory note: *does your agency conduct the training for your industry or do you use a third party? Is the accreditation conducted by your agency or a third party? If training and accreditation is conducted by a third party how do you ensure the training is being effectively delivered? Is training conducted on a regular basis or is it adhoc / on request?*

Written Application

5. Training and Accreditation

5.2 Training and accreditation must only be conducted by ICCBA-MB Trainers.

7. How do you develop staff into ICCBA-MB Trainers and how many do you have?

Explanatory note: *how do you appoint ICCBA-MB Trainers? Do you have a succession plan in place?*

Written Application

6. Registration of Treatment Providers

6.1 Each Authorising Agency will maintain a register of ICCBA-MB Registered Treatment Providers in its respective jurisdiction.

8. Where is your agency's registered treatment provider list? How many acceptable, suspended, under investigation and withdrawn providers does your agency currently have?

Explanatory note: *is your agency's list available publically, if so please provide a link?*

Written Application

6. Registration of Treatment Providers

6.2 Before listing a Registered Treatment Provider on the database, Authorising Agencies will ensure that each Registered Treatment Provider is able to comply with ICCBA-MB requirements.

9. What is your agency's process for registering a treatment provider?

Explanatory note: *do you have a set of written requirements? Is this public? Is the assessment based on documentation as well as a physically assessment? What is checked during assessment? Equipment or process? Do you have set timeframes for this process?*

10. What is your agency's process for suspending and re-approving a treatment provider?

Explanatory note: *Is the suspension decision made by the auditor, a committee or another individual? Is the process for re-approval different to the approval process? Is there a minimum suspension period?*

Written Application

9. Auditing Registered Treatment Providers

9.1 Authorising Agencies will perform compliance audits on each Registered Treatment Provider in their own jurisdiction to determine if ICCBA-MB requirements are being met.

11. How does your agency conduct audits of registered treatment providers?

Explanatory note: *does your agency or a third party conduct audits? How many regions do you have registered treatment providers? How do you ensure consistent audit outcomes across regions? Do you document the results of each audit? Is a copy made available to the treatment provider after audit?*

Written Application

9. Auditing Registered Treatment Providers

9.1 Compliance audits will be conducted:

(a) (c) at least once in every 12-month period thereafter

or

where a treatment provider has demonstrated a history of compliance over three consecutive audits, once in every 24 month period. With a documentary audit at least once in every 12 month period.

13. How do you schedule audits?

14. Do you conduct full audits every 12 months or do you use documentary audits every second year?

Explanatory note: *what is your process for determining a company's suitability for reduced audit? Do you conduct documentary audits, if so how?*

Written Application

Additional information (not a requirement of the ICCBA-MB Schedule):

15. Is your country currently participating in the Australian Fumigation Accreditation Scheme (AFAS)? If yes, since when?

Explanatory note: *providing a copy of the most recent AFAS Joint System Review report may assist the Standing Working Group assess this submission.*

Joint System Review

- What is included?
- Treatment provider management
  - System overview
  - Auditing (process and outcomes)
  - Training (industry and government)
  - Registration

International Cargo Cooperative Biosecurity Arrangement

International Cargo Cooperative Biosecurity Arrangement: Methyl Bromide Schedule

Version 1.0

Contents

1. Purpose and scope

1.1 This document describes the procedures for the implementation and management of methyl bromide treatments on goods destined for export between countries of the Participating Agencies to ensure compliance with the *ICCBA Methyl Bromide Fumigation Methodology*, in the absence of specific importing country requirements.

2. Definitions

For the purposes of this Schedule, the following definitions apply:

2.1 ***Accredited Fumigator*** means a person that isn't an officer of a Participating Agency who has been assessed as competent by the Authorising Agency in accordance with ICCBA-MB requirements.

2.2 ***Accredited Officer*** means an officer, appointed by or acting for a Participating Agency, who has been assessed as competent in accordance with ICCBA-MB requirements.

2.3 ***Agency*** means the authority[1] responsible for the management of biosecurity systems.

2.4 ***Authorising Agency*** means the relevant Participating Agency in the exporting country.

2.5 ***Endorsing Agency*** means an Authorising Agency that is endorsing the fumigation of a non-Registered Treatment Provider, where the Authorising Agency has the services of an Accredited Officer.

2.6 ***Fumigation Treatment Certificate*** means a document issued by a Registered Treatment Provider which declares that the consignment has been treated in accordance with the requirements of this Schedule.

2.7 ***ICCBA*** means the International Cargo Cooperative Biosecurity Arrangement.

2.8 ***ICCBA-MB*** means the International Cargo Cooperative Biosecurity Arrangement: Methyl Bromide Schedule endorsed by the ICCBA Steering Committee.

2.9 ***ICCBA-MB Guide*** means the *Guide to performing QPS fumigations with methyl bromide* endorsed by the ICCBA-MB Standing Working Group.

2.10 ***ICCBA-MB Methodology*** means the *ICCBA Methyl Bromide Fumigation Methodology* endorsed by the ICCBA Steering Committee.

2.11 **ICCBA-MB Policy and Procedures** means the *ICCBA Methyl Bromide Schedule Policies and Procedures* document endorsed by the ICCBA-MB Standing Working Group.

2.12 ***ICCBA-MB Trainer*** means an Accredited Officer or Accredited Fumigator acting for the Participating Agency for the purpose of training and accrediting officers and fumigators.

[1]Under the National Plant Protection Organisation (NPPO) and/or the OIE, the agency may or may not have the delegated responsibility for that country's legislative or administrative authority for its actions.

2.13 ***ICCBA-MB training package*** means the training and accreditation endorsed by the ICCBA-MB Standing Working Group, which provides instruction on how to conduct methyl bromide fumigations in accordance with the ICCBA-MB Methodology.

2.14 ***Importing Agency*** means the relevant Participating Agency in the country that is receiving goods treated under this Schedule.

2.15 ***ISO*** means International Organisation for Standardisation.

2.16 ***Joint System Review (JSR)*** means the review of an Authorising Agency's performance and management of ICCBA-MB conducted jointly with another Participating Agency.

2.17 ***Member Agency*** means an Agency which is participating in ICCBA.

2.18 ***Participating Agency*** means a Member Agency which is a signatory to ICCBA-MB.

2.19 ***Registered Treatment Provider*** means a fumigation company that is registered under this Schedule.

3. Management

3.1 Member Agencies may apply to become an ICCBA-MB Participating Agency as per the process outlined in the ICCBA-MB Policies and Procedures document.

3.2 Each Participating Agency will implement and administer a system within their own jurisdiction for managing its obligations under ICCBA-MB.

3.3 All treatments conducted under ICCBA-MB will comply with the requirements of the ICCBA-MB Methodology.

3.4 ICCBA-MB accreditation allows Accredited Officers or Accredited fumigators to perform treatments only where they are permitted to do so under their local legislative and regulatory requirements.

4. Import clearance management

4.1 Each Participating Agency will ensure that the importation of consignments treated by an 'Acceptable' ICCBA-MB Registered Treatment Provider or, endorsed by an Endorsing Agency and, accompanied by valid certification is cleared efficiently.

4.2 Where an Importing Agency detects ineffective treatments, it will make a determination, based on available evidence, as to whether the treatment is suspected or confirmed to have failed.

4.3 Where an Importing Agency detects ineffective treatments or documentation irregularities under ICCBA-MB, they will notify the Authorising Agency in writing as soon as practicable and provide relevant information that would assist the Authorising Agency to investigate its possible cause.

4.4 Consignments shipped in accordance with ICCBA-MB must also comply with other relevant requirements of the Importing Agency.

5. Training and accreditation

5.1 Each Agency will establish their own ICCBA-MB training team to provide training for the accreditation of Accredited Officers and Accredited Fumigators against the requirements of the ICCBA-MB training package.

5.2 Training and accreditation must only be conducted by ICCBA-MB Trainers.

5.3 A Participating Agency may assist another Participating Agency to administer training and conduct assessments of Accredited Officers and Accredited Fumigators, subject to the mutual agreement of the two Participating Agencies.

5.4 The training and competency assessments of ICCBA-MB Trainers may be supervised by any Participating Agency, subject to the mutual agreement of the two Participating Agencies.

5.5 Upon successful completion of the ICCBA-MB training package each participant will be issued with a certificate of accreditation by the Authorising Agency. The certificate will, at a minimum, include the following:

(a) name of the Participating Agency issuing the certificate

(b) reference to ICCBA-MB fumigation training

(c) accreditation number

(d) name of the fumigator accredited

(e) location and date the training was conducted

(f) name and signature of the assessing ICCBA-MB Trainer.

5.6 ICCBA-MB accreditation is specific to individuals and recognises their competency. An individual's accreditation stays with them if they change Registered Treatment Providers.

6. Registration of treatment providers

6.1 Each Authorising Agency will maintain a register of ICCBA-MB Registered Treatment Providers in its respective jurisdiction. Each Authorising Agency's register will:

a) be linked to the ICCBA-MB member database administered by the ICCBA Secretariat

b) assign each registered treatment provider with a unique registration number

c) include sufficient information to uniquely identify the Registered Treatment Provider, indicate their current registration status and the date they achieved that status

d) Ensure that no treatment provider is listed more than once

6.2 Before listing a Registered Treatment Provider on the database, Authorising Agencies will ensure that each Registered Treatment Provider is able to comply with ICCBA-MB requirements.

6.3 Each Participating Agency will also be issued with a separate ICCBA-MB registration number for use as an Endorsing Agency.

6.4 The ICCBA-MB registration number will be included on all treatment certificates.

6.5 The format of the registration number will be:

CC0001MB
Where:

1. CC is the ISO 2 letter country code
2. 0001 is a unique numeric identifier
3. MB means ICCBA-MB

6.6 Where a Registered Treatment Provider, or Endorsing Agency has multiple branches, where each branch has direct control over the performance of fumigation and associated administration, each branch will be issued with a separate registration number. Each branch must only use their unique ICCBA-MB registration number to certify treatments performed or supervised by that branch.

6.7 ICCBA-MB registration numbers will not be reassigned regardless of the status of the treatment provider, including the cessation of its operations.

6.8 The registration status of Registered Treatment Providers listed under item 6.1 (c) of this Schedule will be classified into one of the following four categories, in accordance with the procedures outlined on the ICCBA Secretariat's centralised database:

(a) **Acceptable**

The treatment provider meets all requirements and the Authorising Agency is confident that the treatment provider is conducting treatments in accordance with ICCBA-MB requirements.

(b) **Under Investigation**

The treatment provider is suspected of having ineffective practices and will require an Endorsing Agency supervise and accredit treatments under ICCBA-MB.

(c) **Suspended**

The treatment provider's practices are deficient or major documented irregularities have been identified that are critical. There is no confidence that the treatment provider is performing treatments in accordance with ICCBA-MB requirements.

(d) **Withdrawn**

The treatment provider has voluntarily withdrawn from ICCBA-MB.

6.9 Participating Agencies will promptly notify each other and the ICCBA Secretariat, in writing, of any amendments to treatment provider registration status and other details to allow for the updating of treatment provider lists.

6.10 Agencies will not be liable for any losses incurred as a result of errors of facts or omissions on the register.

7. Certification

7.1 Accredited Officers acting for an Endorsing Agency may endorse a treatment conducted by a non-ICCBA-MB registered, withdrawn or suspended treatment provider, if:

(a) the treatment was conducted as part of the Authorising Agency's assessment of a treatment provider's registration status

(b) the treatment was conducted under direct supervision by an Accredited Officer who is satisfied that the treatment was effective and carried out in accordance with ICCBA-MB requirements

(c) the treatment certificate is issued on the Endorsing Agency's letterhead and meets the certification requirements of the ICCBA-MB Methodology.

7.2 Where the product is not accompanied by a phytosanitary certificate, Importing Agencies may accept methyl bromide treatment certificates that are:

(a) issued by an 'Acceptable' Registered Treatment Provider or Endorsing Agency and include an ICCBA-MB registration number on or after the date this Schedule comes into effect

or

(b) meet the requirements of ICCBA-MB

or

(c) other alternative treatment certificates which have been mutually decided by the two Agencies.

8. Managing registered treatment providers

8.1 Where a confirmed failed treatment is reported to an Authorising Agency, the Registered Treatment Provider that conducted the treatment will be listed as 'Suspended' as soon as practicable.

8.2 Where a suspected failed treatment is reported to an Authorising Agency, the Authorising Agency will investigate and report back within 10 working days, unless otherwise mutually decided between the Agencies. If that reporting period is not met the Registered Treatment Provider will be identified as being 'Under Investigation'.

8.3 The Authorising Agency will advise the Importing Agency that reported the failed treatment and the ICCBA Secretariat of the outcome of the investigation and recommend whether the registered treatment provider should be reinstated as 'Acceptable' or 'Suspended'.

8.4 Where a Registered Treatment Provider has not been subject to a compliance audit in three years, its registration status will be changed to 'Withdrawn'.

8.5 Where a Registered Treatment Provider is 'Suspended' or 'Withdrawn' from ICCBA-MB they will be required to pass a compliance audit to be reinstated to 'Acceptable' status.

9. Auditing registered treatment providers

9.1 Authorising Agencies will perform compliance audits on each Registered Treatment Provider in their own jurisdiction to determine if ICCBA-MB requirements are being met. Compliance audits will be conducted:

(a) by ICCBA-MB Accredited Officers

(b) within six months of a Registered Treatment Provider being listed as 'Acceptable'

(c) at least once in every 12-month period thereafter

or

where a treatment provider has demonstrated a history of compliance over three consecutive audits, once in every 24 month period. With a documentary audit at least once in every 12 month period.

9.2 The outcome of each audit will be 'Acceptable', 'Acceptable with Corrective Actions' or 'Suspended'.

9.3 The outcomes of all audits will be documented and made available to any Participating Agency upon request.

10. Joint system reviews

10.1 Participating Agencies will conduct joint system reviews (JSRs) on Authorising Agencies to evaluate the effectiveness of an Authorising Agency's management of ICCBA-MB. JSRs:

(a) will include a review of the Authorising Agency's documentation relating to its management of ICCBA-MB

(b) may include observing the Authorising Agency conduct compliance audits on a selection of registered treatment providers.

10.2 JSR timetables for the year and general administrative requirements will be arranged between the relevant Participating Agencies and will be coordinated by the Secretariat.

10.3 Members of the JSR team will be chosen by mutual agreement of the Participating Agencies. Subject to such agreement, non-Participating Agencies, may attend a JSR as an observer.

10.4 Non-Participating Agency observers of a JSR will have no bearing on the conduct or outcomes of the JSR or individual audits done as part of the JSR.

10.5 A written report on the outcome of the JSR will be provided to the Authorising Agency and the ICCBA Secretariat. A copy will made available to all Participating Agencies by the Secretariat.

11. Documentation and record keeping

11.1 Authorising Agencies are required to keep records of the following documents for at least three years:

(a) training and accreditation records for Accredited Officers, Accredited Fumigators and ICCBA-MB Trainers

(b) registration records of Registered Treatment Providers

(c) audit records of Registered Treatment Providers

(d) notifications of failed, or suspected failed, treatments received from other Participating Agencies

(e) previously conducted JSR reports.

12. Dispute resolution

12.1 Where a Participating Agency suspects serious deficiencies in an Authorising Agency's management of ICCBA-MB it may refer the matter to the Standing Working Group.

12.2 Where an Authorising Agency's performance has been referred to the Standing Working Group, the Standing Working Group will conduct a review of the available evidence and may request that a JSR be conducted. Where serious deficiencies are confirmed, the Standing Working Group will, by written notice, request the Authorising Agency show cause as to why its participation in ICCBA-MB should not be suspended or revoked.

12.3 Where an Authorising Agency has been requested to show cause by the Standing Working Group, it will respond in writing within 90 days or will have their participation in ICCBA-MB suspended.

12.4 Members of the Standing Working Group, except the Authorising Agency, will review all responses to show cause requests and will determine the appropriate course of action.

ICCBA

International Cargo Cooperative Biosecurity Arrangement

Application to participate in ICCBA-MB submission template

Agency:
Country, economy or jurisdiction represented:
Application contact person:
Contact title:
Contact email:

The ICCBA Methyl Bromide Schedule Policies and Procedures outline that when applying to become an ICCBA-MB Participating Agency, an ICCBA Member Agency must make a written submission to ICCBA-MB Standing Working Group describing how it will meet the requirements of ICCBA-MB. This template is designed to assist Member Agencies in writing that submission.

The questions in this template are designed to help the Standing Working Group gain an understanding of the treatment provider management system of the applicant agency. Each question is accompanied by explanatory notes which provide some guidance for the applicant agency.

ICCBA-MB Schedule Requirements

3. Management
3.2 Each Participating Agency will implement and administer a system within their own jurisdiction for managing its obligations under ICCBA-MB.

1. Which area within your agency will be responsible for managing the requirements of ICCBA-MB?

Explanatory note: *is there a section or team within your agency that will ultimately be responsible for managing ICCBA-MB in your country? This may be the team that coordinates registrations and audits. Please provide an organisation chart for this team with roles and responsibilities .How many people are involved for technical and administrative work, respectively? Are there any requirements for personnel to be involved in the team (ex. have attended training of ICCBA-MB, recognized as competent in ICCBA - MB or as supervisor or auditor of ICCBA-MB)? Do you have enough to ensure continuity? How does this team manage the system (could explain by flowchart)?*

3. Management
3.3 All treatments conducted under ICCBA-MB will comply with the requirements of the ICCBA-MB Methodology.

2. How is the Methyl Bromide Methodology made available locally?

Explanatory note: *is the generic ICCBA Methyl Bromide Methodology being used or have you amended the cover pages and introduction to make a local version? Is the methodology available on your website, is so provide a link, if not how do you ensure your treatment providers are aware of the methodology and can access it? Is the methodology available in local language or English?*

> **4. Import Clearance Management**
>
> 4.2 Where an Importing Agency detects ineffective treatments, it will make a determination, based on available evidence, as to whether the treatment is suspected or confirmed to have failed.

3. How will your agency manage the import of ICCBA-MB goods?

Explanatory note: *each importing agency has the right to decide how to manage its imports and participation in ICCBA-MB does not change that. Will your agency undertake any inspection, assessment or other assurance control on goods treated under ICCBA-MB?*

4. How will your agency determine failed treatments under ICCBA?

Explanatory note: *where a failed treatment is detected, does your agency have the diagnostic capability to accurately determine a failed treatment as opposed to post treatment reinfestation?*

> **4. Import Clearance Management**
>
> 4.3 Where an Importing Agency detects ineffective treatments or documentation irregularities under ICCBA-MB, they will notify the Authorising Agency in writing as soon as practicable and provide relevant information that would assist the Authorising Agency to investigate its possible cause.

5. Which area will be responsible for reporting non-compliance?

Explanatory note: *will a specific area of your agency be responsible for reporting non-compliance? Is this the same area that is responsible for managing your agencies requirements under ICCBA-MB more broadly?*

> **5. Training and Accreditation**
>
> 5.1 Each Agency will establish their own ICCBA-MB training team to provide training for the accreditation of Accredited Officers and Accredited Fumigators against the requirements of the ICCBA-MB training package.

6. How is industry training and accreditation managed by your agency?

Explanatory note: *does your agency conduct the training for your industry or do you use a third party? Is the accreditation conducted by your agency or a third party? If training and accreditation is conducted by a third party how do you ensure the training is being effectively delivered? Is training conducted on a regular basis or is it adhoc / on request?*

5. Training and Accreditation

5.2 Training and accreditation must only be conducted by ICCBA-MB Trainers.

7. How do you develop staff into ICCBA-MB Trainers and how many do you have?

Explanatory note: *how do you appoint ICCBA-MB Trainers? Do you have a succession plan in place?*

6. Registration of Treatment Providers

6.1 Each Authorising Agency will maintain a register of ICCBA-MB Registered Treatment Providers in its respective jurisdiction.

8. Where is your agency's registered treatment provider list? How many acceptable, suspended, under investigation and withdrawn providers does your agency currently have?

Explanatory note: *is your agency's list available publically, if so please provide a link?*

6. Registration of Treatment Providers

6.2 Before listing a Registered Treatment Provider on the database, Authorising Agencies will ensure that each Registered Treatment Provider is able to comply with ICCBA-MB requirements.

9. What is your agency's process for registering a treatment provider?

Explanatory note: *do you have a set of written requirements? Is this public? Is the assessment based on documentation as well as a physically assessment? What is checked during assessment? Equipment or process? Do you have set timeframes for this process?*

10. What is your agency's process for suspending and re-approving a treatment provider?

Explanatory note: *Is the suspension decision made by the auditor, a committee or another individual? Is the process for re-approval different to the approval process? Is there a minimum suspension period?*

9. Auditing Registered Treatment Providers

9.1 Authorising Agencies will perform compliance audits on each Registered Treatment Provider in their own jurisdiction to determine if ICCBA-MB requirements are being met.

11. How does your agency conduct audits of registered treatment providers?

Explanatory note: *does your agency or a third party conduct audits? How many regions do you have registered treatment providers? How do you ensure consistent audit outcomes across regions? Do you document the results of each audit? Is a copy made available to the treatment provider after audit?*

9. Auditing Registered Treatment Providers

9.1 Compliance audits will be conducted:

(a) by ICCBA-MB Accredited Officers

12. How do you develop staff into auditors and how many do you have?

Explanatory note: *how do you train your auditors? Is there ongoing on the job training or performance reviews? how do you manage your auditor's skill in conducting audits (via refresher training or coordination meeting per year)?*

9. Auditing Registered Treatment Providers

9.1 Compliance audits will be conducted:

(a) (c) at least once in every 12-month period thereafter

or

where a treatment provider has demonstrated a history of compliance over three consecutive audits, once in every 24 month period. With a documentary audit at least once in every 12 month period.

13. How do you schedule audits?

14. Do you conduct full audits every 12 months or do you use documentary audits every second year?

Explanatory note: *what is your process for determining a company's suitability for reduced audit? Do you conduct documentary audits, if so how?*

Additional information (not a requirement of the ICCBA-MB Schedule):

15. Is your country currently participating in the Australian Fumigation Accreditation Scheme (AFAS)? If yes, since when?

Explanatory note: *providing a copy of the most recent AFAS Joint System Review report may assist the Standing Working Group assess this submission.*

7

Australian Government
Department of Agriculture and Water Resources

Methyl bromide fumigation methodology

Version 2.0

Cataloguing data

This publication (and any material sourced from it) should be attributed as: Department of Agriculture and Water Resources 2018, *Methyl bromide fumigation methodology*, Canberra, July. CC BY 4.0.

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

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Purpose

This methodology sets out the minimum requirements for treatment providers performing methyl bromide fumigations 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 with methyl bromide.

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.

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

Countries receiving treatment certification through this system expect the treatment has been undertaken in accordance with this methodology. 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 they can demonstrate satisfactory compliance.

Methyl bromide is listed as a category 1 ozone depleting substance under the Montreal Protocol 1992. Performing methyl bromide fumigations in accordance with these requirements will reduce the use of methyl bromide by minimising the need for re-treatment of consignments due to ineffective fumigations caused by poor fumigation practices.

Scope

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

This document is not intended to specifically cover the performance of methyl bromide fumigation treatments under ISPM 15. However, the basic principles, requirements and recommendations described in this document and the associated guideline are still generally applicable.

Even though the basic principles and requirements would be relevant this document is not intended to specifically cover fumigations of vessels (whether it is the vessel itself or its cargo) silos or other storage facilities, buildings or other fumigations that are not done in the types of enclosure described herein and not related to import or export.

How to use this document

Some of the requirements in this methodology only apply in certain circumstances, generally related to the type of enclosure used or fumigating perishables. It is important for the fumigators and compliance auditors to understand the purpose of the requirements and the outcomes they are intended to achieve and the particular circumstances in which they apply.

This document should be read in conjunction with the *Guide to performing QPS fumigations with methyl bromide,* which provides information on how to meet these requirements in commonly encountered situations.

Contents

Tables

Figures

1 Prior to fumigation

1.1 Target of the fumigation

1.1.1 The fumigator must know what the target of the fumigation is.

1.1.2 The target of the fumigation must be recorded on the fumigation documentation.

1.2 Consignment suitability

1.2.1 The fumigator must determine if the consignment is suitable for fumigation with methyl bromide.

1.2.2 If the consignment does not conform to the suitability requirements remedial action must be taken or an alternative acceptable treatment method used.

1.3 Free airspace

1.3.1 There must be free space throughout the enclosure to allow the fumigant to freely circulate around the target of the fumigation.

1.3.2 There must be sufficient free airspace to permit the positioning of sampling tubes in appropriate locations within the enclosure. See 4.1 Concentration sampling tubes

1.3.3 Some treatments may specify a maximum load factor in the enclosure. The volume of commodity must not exceed the specified load factor as a proportion of the enclosure volume and must be stacked so there is sufficient separation between items to allow the fumigant to circulate freely and penetrate easily into boxes, bags or other types of packaging.

1.3.4 For perishable commodities, the following free air space requirements apply unless otherwise stated in the treatment schedule being applied:

- a maximum load factor of 80%
- packages must be placed on pallets or raised off the ground by at least 100mm by other means.

1.4 Timber thickness and spacing

1.4.1 Untreated timber products must have at least one physical dimension which is less than 200 mm thick.

1.4.2 Timber and timber product fumigations must be conducted before any surface coating are applied, unless all parts of the timber or timber product have at least one uncoated surface and a maximum thickness of 100 mm from the uncoated surface.

1.4.3 Where timber is the target of the fumigation it must be separated by a minimum of 5 mm of airspace every 200 mm. This separation can be horizontal or vertical.

1.5 Impervious wrappings, coatings and surfaces

1.5.1 The target of the fumigation must not be coated in materials that will prevent the methyl bromide from penetrating into the target of fumigation such as lacquers, paints, waxes, natural oils, veneers or plastic wraps.

1.5.2 Impervious wrappings must be removed, opened or slashed prior to fumigation in such a way to allow methyl bromide to come into contact with and, if needed, penetrate into the target of the fumigation.

1.5.3 Requirement 1.5.2 is not necessary if the wrapping complies with 1.6 Impervious wrapping perforation requirements.

1.5.4 Where the target of fumigation is a perishable commodity, all packaging material must also be fumigated.

1.5.5 Due to the short exposure periods for many perishable commodities, all packaging must be opened or otherwise arranged as follows to allow the fumigant to readily circulate around and into the target of the fumigation:

- Products that are tightly packed into cartons in plastic sleeves (e.g. Cut flowers) must be loosened within boxes to ensure adequate gas penetration during fumigation.
- Polythene type liners or non-perforated liners must be opened at the top.
- If open ends of plastic sleeves are packed together in the middle of the carton, the cartons must be re-packed with the open ends be placed towards the sides of the cartons.
- Cartons without ventilation holes or with flowers in plastic sleeves obscuring the holes must be stacked with the tops open or with holes punctured in the sides.

1.6 Impervious wrapping perforation requirements

1.6.1 Impervious wrappings must have 4 or more holes of 6 mm diameter or 5 or more holes of 5 mm diameter for every 100 mm x 100 mm of surface area. Wrappings with at least 6 pinholes per 10 mm x 10 mm surface area are also acceptable.

1.6.2 The wrapping must be in a single layer so the perforations are not blocked by the wrapping overlapping itself.

1.7 Site suitability

1.7.1 The fumigation site must:

- have adequate space to establish a risk area around the enclosure
- allow for safe ventilation
- be flat and even
- be well ventilated
- have power available, either mains or generator.

2 Safety

2.1 Risk assessment

2.1.1 Before commencing any fumigation a risk assessment must be carried out to determine if any hazards are present and evaluate the potential consequences to:

- fumigation personnel
- people in the vicinity
- occupants of surrounding buildings.

2.1.2 Appropriate control measures must be in place to address the hazards identified.

2.1.3 The risks must be reviewed as needed to respond to changing circumstances and the control measures must be adjusted accordingly.

2.1.4 The designated fumigator-in-charge is responsible for the safe conduct of the fumigation.

2.2 Risk area

2.2.1 A risk area must be established around the perimeter of the enclosure warning people the fumigation is taking place.

2.2.2 The risk area must be demarcated by a physical barrier for the duration of the fumigation.

2.2.3 The size of the risk area should be set according to the risk but must not be less than:

- 3 metres from the enclosure outdoors
- 6 metres from the enclosure inside a building or structure.

2.2.4 For fumigations in a chamber, see 3.4 Fumigation chambers, a risk area is not required after the fumigant has been applied provided that the chamber is locked from the time the fumigant is ready to be applied until the fumigant has been ventilated and the concentration verified at or below the TLV–TWA. See 9.1 Threshold limit value—time-weighted average (TLV–TWA).

A risk area must still be established according to requirement 2.2.3 and personal protective equipment must be worn while injecting the fumigant into the chamber to protect the fumigator and others against accidental exposure to the fumigant from a failure in the supply system.

2.2.5 Warning signs must be placed around the enclosure. They must:

- be large enough to be visible from a reasonable distance
- be visible from all angles of approach
- display easily understood symbols indicating danger and/or toxic gas is in use
- provide contact details of the fumigator
- be in a language or languages appropriate to the location.

2.2.6 The risk area, with the exception of chamber fumigations, must be in force from the time immediately prior to connection of the methyl bromide supply (either cylinder or can) to the supply system up until the gas concentration in the risk area and the enclosure is verified at or below the TLV–TWA.

2.2.7 Anyone entering the risk area while it is in force must be wearing appropriate Personal Protective Equipment (PPE) at all times.

2.3 Personal protective equipment (PPE)

2.3.1 Suitable respiratory protection must be worn at all times inside the risk area while it is in force.

2.3.2 Respiratory protection must be worn at all times when inside the buffer zone during ventilation. See 9 Ventilating the enclosure.

2.3.3 A full-face respirator must be:

- operated in accordance with the manufacturer's instructions
- fitted with the correct gas filter canister (AX for methyl bromide) and replaced in accordance with the manufacturer's instructions

- maintained in good condition with all valves clean and intact
- able to form an airtight seal against the face of the fumigator.

2.3.4 Self-contained breathing apparatus must be:

- operated in accordance with the manufacturer's instructions
- used only by properly trained personnel
- maintained in good working order
- refilled from a safe source.

3 Fumigation enclosures

3.1 Gas-tightness

3.1.1 All fumigation enclosures must be sufficiently gas-tight to retain the fumigant for the duration of the exposure period and maintain the concentrations at or above the requirements.

3.2 Sheeted enclosures

3.2.1 The surface on which the sheeted enclosure will be created must be:

- impervious to methyl bromide or covered with a gas-proof sheet if the surface is not impervious
- free of debris that might prevent a gas-tight seal or damage the sheet
- free of cracks and drains or other openings that will permit excessive leakage.

3.2.2 The fumigation sheets must be impervious to methyl bromide. They must be able to retain the required concentration for the duration of the fumigation without needing to add additional methyl bromide due to permeation through the sheet.

3.2.3 A gas-tight seal must be created between the fumigation surface and the sheet.

3.2.4 If one or more shipping container is fumigated in a sheeted enclosure at least one door of each container must be open during the fumigation.

3.3 Un-sheeted shipping containers

3.3.1 A shipping container can be used as a fumigation enclosure if it can be sealed to make it adequately gas-tight. The fumigator must:

- check the container for any visible holes or damage that would make it unsuitable
- seal the air vents from the outside
- install sampling tubes—see 4.1 Concentration sampling tubes
- install a fan—if there is insufficient space the container must be fumigated as a sheeted enclosure
- arrange the tubes and leads so they exit the container where the doors meet at the base of the container
- create a barrier to reduce air flow under the container.

3.3.2 The methyl bromide must be applied through the door seals and the supply pipe must be removed after the process is complete. This is easiest to do through the door seals where they meet at the top of the container.

3.3.3 Where a false door is fitted to create a gas tight seal, the supply pipe, sampling tubes and power leads must pass through the false door.

3.3.4 Where an un-sheeted shipping container fumigation is conducted on a skeletal trailer, leak checks must be conducted on the underside of the container. A barrier to reduce airflow under the container is not required.

3.3.5 Shipping containers under gas must not be moved until they have been ventilated.

3.3.6 If the target of the fumigation includes the exterior of the container, for example Giant African Snail treatments, the container(s) must be enclosed under gas-proof sheets.

3.4 Fumigation chambers

3.4.1 Fumigation chambers are permanent structures designed specifically for fumigation. To be considered a fumigation chamber for the purposes of this methodology they must:

- be constructed from rigid materials on all sides, including the door
- be permanently sealed along all joins between the walls, roof and floor
- be gas-tight once the door is closed without the need to use tape, sealant, sand snakes or any other means.
- not have anything, such as sampling tubes, supply pipes or electrical leads, enter the chamber through the door that will interfere with the seal
- have an inbuilt extraction system that actively removes the fumigant from the enclosure
- pass a pressure test at least every six months according to 3.5 Pressure testing.

3.5 Pressure testing

3.5.1 Raise the pressure in the enclosure by 250 Pa. Count the seconds it takes to fall from 200 Pa to 100 Pa. If the time is 10 seconds or more the enclosure has passed the pressure test and is considered gas-tight for fumigation purposes.

3.5.2 The pressure test must be performed with the enclosure set up ready for fumigation. Sampling tubes, supply pipes and electrical leads must be in place during the pressure test as they would be for a fumigation.

4 Preparing the fumigation enclosure

4.1 Concentration sampling tubes

4.1.1 Each sampling tube must be clearly identified according to their location within the enclosure.

4.1.2 The sampling tubes must be free of kinks and blockages.

4.1.3 The diameter of the sampling tubes must fit the inlet of the concentration measuring instrument.

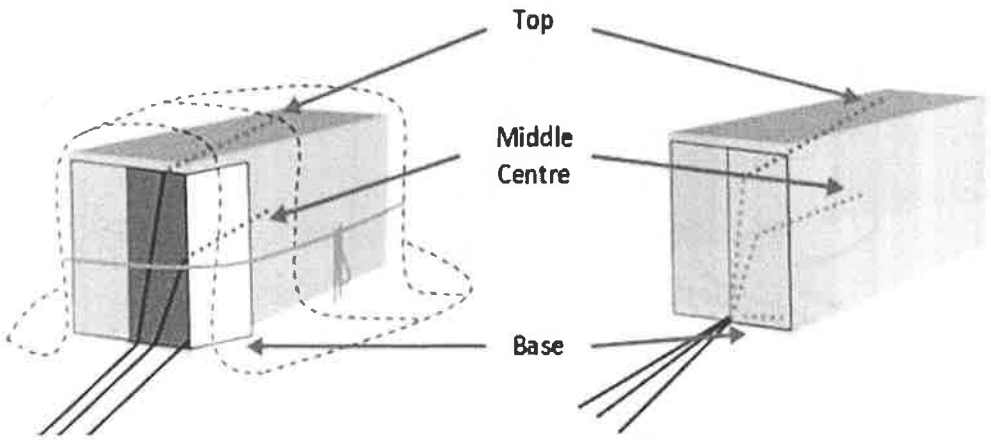
4.2 Concentration sampling tube placement—non-perishable commodities

4.2.1 Enclosures that are 30 m^3 or less in volume require at least one sampling tube positioned as near as practicable to the top centre of the commodity.

4.2.2 Enclosures larger in volume than 30 m^3 must have at least three samplings tubes. The sampling tubes must be positioned to check that even distribution of the fumigant has been achieved (Figure 1). The tubes must be placed as close as practicable to:

- the top of the commodity at one end of the enclosure
- the centre of the commodity around the middle of the enclosure
- the base of the commodity at the opposite end of the enclosure from the top sampling tube.

Figure 1 Concentration sampling tube positions within a single enclosure

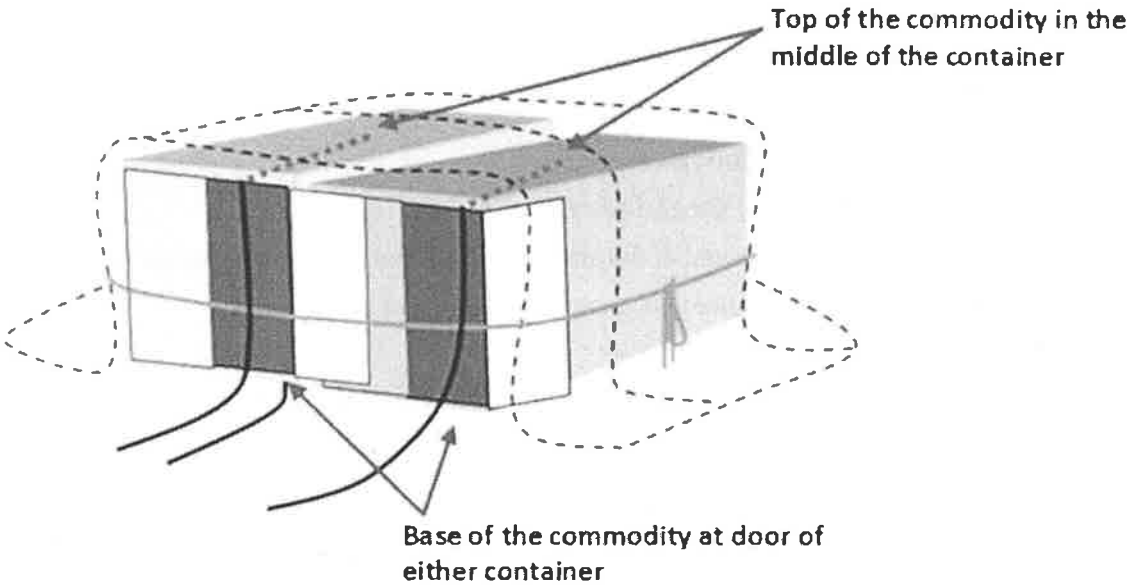


4.2.3 If a consignment consists of more than one un-sheeted container then each container is a separate fumigation and needs to have a minimum of three sampling tubes in each container.

4.2.4 Two containers under a gas-tight sheet is a single enclosure and must have at least three sampling tubes placed as close as practicable to (Figure 2):

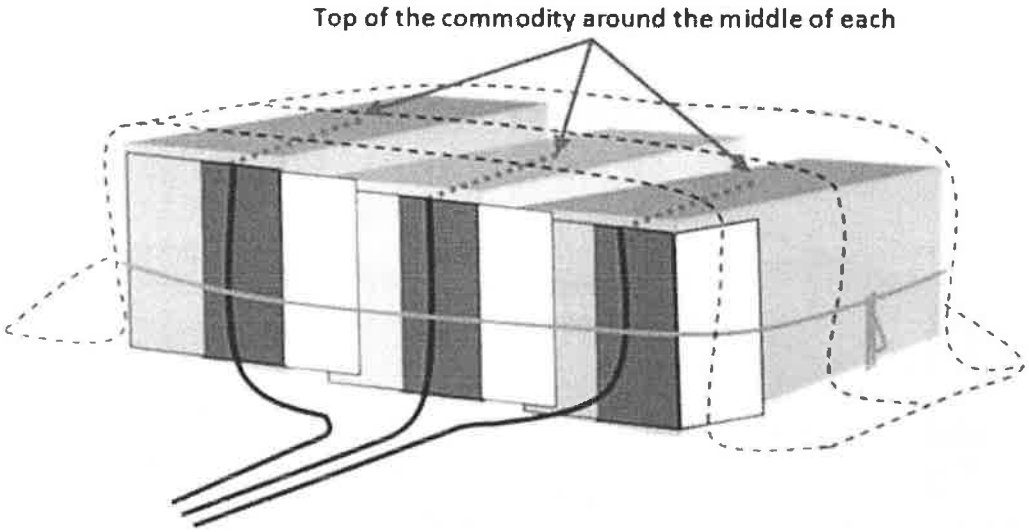
- the top of the commodity in the middle of each containers
- the base of the commodity at the door in either container.

Figure 2 Concentration sampling tube positions within two containers under a single enclosure



4.2.5 Three or more containers under a gas-proof sheet is a single enclosure and must have at least one sampling tube placed as close as practicable to the top of the commodity in the middle of each container (Figure 3).

Figure 3 Concentration sampling tube positions within three containers under a single enclosure



Four containers in one enclosure must have at least four sampling tubes, five containers, five sampling tubes and so on.

4.3 Concentration sampling tube placement—perishable commodities

4.3.1 All perishable fumigations must have at least three sampling tubes placed within the middle of packaging, and in the positions specified in 4.3.3, to demonstrate that the treatment fumigant concentration is reached and maintained for the full exposure period within the commodity.

4.3.2 For cut flowers, this is within a sleeve or bunch in the centre of a carton. For other produce, this is in the centre of the carton.

4.3.3 Where cartons are stacked in the enclosure, sampling tubes must be placed inside cartons located in the following positions:

- the top carton at one end of the enclosure
- the centre carton in the middle of the enclosure
- the bottom carton at the opposite end of the enclosure from the top sampling tube.

4.3.4 Where different types packaging are present, sampling tubes must be placed in a representative carton of each packing type.

4.4 Temperature probes for perishable commodities

4.4.1 Where the treatment schedule requires the commodity temperature of perishable fumigations is used for dose calculations, temperature readings must be taken by:

- For fruit and vegetables, the pulp temperature must be measured by inserting temperature probes into the centre of a piece, or pieces, of fruit or vegetable in the middle of a carton, ensuring that the whole temperature probe is covered.
- For cut flowers, leaf or stem material, temperate probes must be placed within the bunch in the middle of a carton.

4.4.2 At least three temperature readings must be taken from different cartons in different locations and, if applicable, different varieties within the consignment.

4.4.3 The temperature probes must be maintained to an accuracy of at least plus or minus (+/-) 1 °C.

4.5 Fumigant supply pipes

4.5.1 Multiple containers fumigated in a single enclosure must have at least one supply pipe placed in each container.

4.5.2 For fumigations under sheets the supply pipes must be left in position for the duration of the exposure period.

4.5.3 The supply pipes must be sealed once the fumigant has been applied.

4.6 Fans

4.6.1 Enclosures must have at least one fan for each 100 m^3 of volume or part thereof.

4.6.2 Multiple containers fumigated in a single enclosure must have at least one fan to be placed in each container.

5 Calculating the dose

5.1 Dose rate

5.1.1 The dose rate for the appropriate temperature prescribed by the relevant authority must be used for QPS fumigations with methyl bromide.

5.2 Dose rate compensation for temperatures below 21 °C

5.2.1 If the treatment rate is set with a minimum of 21 °C and the temperature within the enclosure is expected to fall below 21 °C at any time during the exposure period, the dose rate must be adjusted to compensate for the lower temperature.

5.2.2 In the absence of any other specific schedule set by the relevant authority the following compensation must be made: For each 5 °C, or part thereof, the temperature is expected to fall below 21 °C add 8 g/m^3 to the prescribed dose rate.

5.3 Temperature

5.3.1 The temperature of the consignment must be equal to or above the minimum allowable temperature before any fumigant can be applied.

5.3.2 Unless stated otherwise in a specific treatment schedule, fumigation of non-perishable commodities is not permitted if the ambient minimum temperature is forecast to fall below 10 °C.

5.3.3 Unless stated otherwise in a specific treatment schedule, fumigation of perishables is not permitted if the commodity temperature is below 10 °C.

5.3.4 The commodity temperature of perishable commodities must be measured according to 4.4 Temperature probes for perishable commodities and the lowest recorded temperature used to calculate the dose rate. See 5.2 Dose rate compensation for temperatures below 21 °C

5.3.5 Where the enclosure is subject to the ambient temperature of the surrounding environment, the fumigator must check what the forecast minimum temperature will be during the exposure period for the location closest to the fumigation site and adjust the dose rate accordingly.

5.3.6 The forecast minimum temperature used and the source of the information must be recorded.

5.3.7 Fumigation is not permitted if the temperature of the enclosure and consignment is expected to fall below any specified minimum temperature during the exposure unless the temperature can be raised to and maintained at or above the allowed minimum temperature by using heaters or moving the consignment inside a structure where the temperature can be adequately controlled.

5.3.8 Where the fumigation is performed in a controlled temperature environment, the temperature within the enclosure must be monitored and recorded. Temperature recording instruments must be placed as far away as practicable from the heat source.

5.4 Dose calculation

5.4.1 The dose must be calculated by multiplying the dose rate (including any adjustments) by the volume of the enclosure. The formula is:

Dose (g) = Enclosure Volume (m^3) x Dose Rate Concentration (g/m^3)

5.5 Enclosure volume

5.5.1 If the fumigation is done under gas-proof sheets, the external dimensions must be measured each time and used to calculate the volume.

5.5.2 For fixed sized enclosures such as chambers and un-sheeted containers the internal volume must be used.

5.6 Chloropicrin

5.6.1 When methyl bromide is mixed with chloropicrin, compensation must be made to the dose to ensure that full amount of methyl bromide required is applied to the enclosure.

For methyl bromide supplied with 2% chloropicrin the formula is:

Dose = (Volume x Concentration) ÷ 0.98

5.7 Rounding

5.7.1 Once the dose has been calculated, the amount must be rounded up to next increment that can be accurately measured by the equipment used to dispense the dose. If the methyl bromide is supplied in cans then the dose must be rounded up to the next full can.

5.7.2 The dose must not be rounded up until all other calculations have been completed.

6 Applying the dose

6.1 Vaporising the methyl bromide

6.1.1 A vaporiser must be used when methyl bromide is applied to the enclosure.

6.1.2 The heat source for the vaporiser must be capable of heating the water in the vaporiser to at least 65 °C and maintaining the temperature at or above this while the methyl bromide is being applied to the enclosure.

6.1.3 If the temperature of the water falls below 65 °C, the rate of methyl bromide release must be slowed or stopped until the water temperature is heated back above 65 °C.

6.1.4 The time methyl bromide injection was completed must be recorded.

6.1.5 The connections in the supply system must be secure and free from leaks.

6.2 Checking for leaks

6.2.1 Suitable leak detection equipment must be used.

6.2.2 The leak detection equipment must be sensitive enough to reliably detect methyl bromide concentrations down to 20 ppm.

6.2.3 The leak detection equipment must be maintained and electronic equipment calibrated in accordance with the manufacturer's instructions.

6.2.4 During the injection of the dose the supply system must be checked for leaks. If a leak is detected the problem must be rectified before continuing to inject the dose.

6.2.5 The fumigation enclosure must be checked for leaks. If leaks are detected they must be rectified.

6.3 Circulating the fumigant

6.3.1 The fans must be operating prior to and during the injection of the fumigant dose into the enclosure.

6.3.2 The fans must be turned off before taking concentration readings.

7 Monitoring fumigant concentration levels

7.1 Concentration measuring instruments

7.1.1 The instrument used for measuring fumigant concentrations in the enclosure must be fit for purpose and in good working order.

7.1.2 The concentration measuring instruments must be calibrated and/or serviced according to the manufacturer's instructions.

7.1.3 The fumigator must have a copy of the user's manual for the particular instrument they use and must operate the equipment in accordance with the manual.

7.1.4 The instrument must be fitted with any moisture, carbon dioxide or other filters as specified by the manufacturer to suit the circumstances of the fumigation.

7.2 Monitoring frequency

7.2.1 Concentration readings must be taken at the start of the fumigation and at the end of the exposure period for all fumigations.

Additional readings can be taken at any time during the exposure period to check the concentrations are equal to or above the levels required for an effective treatment. See 8. Topping-up to compensate for low concentrations for details on topping-up the concentration levels.

7.2.2 Fumigations with exposure periods longer than 24 hours require concentration readings to be taken at least every 24 hours in addition to the start and end point readings.

7.3 Start time of the fumigation

7.3.1 The fumigation exposure period starts when:

- all concentration readings are equal to or above the standard concentration
- equilibrium has been established

7.3.2 Equilibrium is achieved when the highest concentration reading is within 15% of the lowest concentration reading.

The formula for calculating equilibrium is:

$$\frac{\textbf{Highest reading - Lowest reading}}{\textbf{Lowest reading}} \textbf{ X 100 = \%}$$

7.3.3 If the result of this calculation is more than 15%, equilibrium has not been achieved and the fans must be turned on again to further circulate the fumigant. Additional readings must then be taken until equilibrium has been achieved or the concentration falls below the standard concentration. Once initial equilibrium has been achieved it is not required at any other time.

7.3.4 A concentration reading must be taken from all sampling tubes.

7.3.5 The concentration readings must all be at or above the standard concentration (Table 1) or as specified in a treatment schedule.

Table 1 Time of concentration readings after release and percentage of initial concentration dose rate required

Time after fumigant release	Per cent of initial dose rate concentration
15 to 30 minutes	85% or more
30 minutes to 1 hour	75% or more
More than 1 hour	70% or more

Note: See Appendix 4 Methyl bromide monitoring table for the standard concentrations required for a range of initial dose rates at specified time increments.

7.3.6 If additional fumigant needs to be added before start point has been reached, the amount must be calculated by subtracting the lowest concentration reading from the initial dose rate and multiplying that by the volume of the enclosure.

The formula for this is:

(Initial dose rate - Lowest concentration reading) x Volume

7.3.7 If more fumigant is added to the enclosure before start time is achieved, the time the injection of additional fumigant is completed becomes the new injection completion time for determining the required start time concentration.

7.3.8 All initial concentration readings and the time they were taken must be recorded. This includes any readings taken prior to achieving start point.

7.4 Minimum concentration levels

7.4.1 A minimum concentration of fumigant must be maintained within the enclosure during the exposure period.

7.4.2 The concentration of fumigant must not fall below the levels specified in Appendix 5: Concentrations for dose rates and times, or Appendix 6 where a treatment schedule requires a minimum gas retention of 80%.

Note: Fumigations for ISPM 15 require a minimum gas retention of 50% of the initial dose rate at the end of 24 hours.

7.5 End of the exposure period

7.5.1 The elapsed time between the start time and the end time of the fumigation must not be less than the prescribed exposure period.

7.5.2 After the specified exposure period has elapsed concentration readings from all sampling tubes must be taken. The readings and the time they were taken must be recorded on the Record of Fumigation.

7.5.3 The final concentration readings must all be at or above the standard concentration for the required exposure period. If any of the readings are below the standard concentration, the fumigation has failed unless the option of end point top-up is permitted.

8 Topping-up to compensate for low concentrations

8.1 Topping-up

8.1.1 If concentration monitoring indicates that fumigant levels are at risk of falling below the standard concentration, then the target of the fumigation may not be exposed to the minimum lethal dose needed to for effective treatment. Therefore, in some circumstances, the fumigator can add extra methyl bromide to increase the concentration levels to prevent the fumigation from failing.

8.1.2 The top-up amount must be applied to the enclosure in the same way as the original dose, that is:

- vaporised (see 6.1 Vaporising the methyl bromide)
- fans on
- PPE worn.

8.1.3 After adding the top-up amount and allowing time for the extra fumigant to circulate, a concentration reading must be taken from the sampling tube that had the lowest reading to verify that the fumigant level is back above the standard concentration.

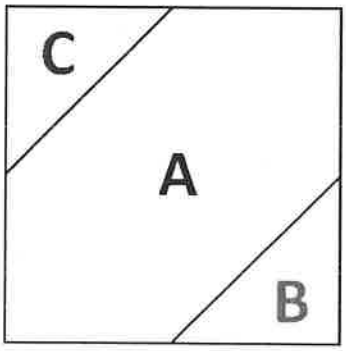
8.1.4 Equilibrium is NOT required.

8.1.5 Details must be recorded on the Record of Fumigation.

8.2 Calculating the top-up amount

8.2.1 To calculate the top-up amount, subtract the lowest concentration reading from the maximum top-up concentration and multiply by the volume of the enclosure (Figure 4).

Figure 4 Methyl bromide minimum concentration requirement and top-up calculation guide



A Standard concentration. B Minimum concentration to allow top-up. C Maximum top-up concentration. See Appendix 4: Methyl bromide monitoring table. Note: (C – lowest concentration reading) x enclosure volume = top-up amount.

8.2.2 Adjust for chloropicrin if applicable. See 5.5 Chloropicrin.

8.2.3 Round-up. See 5.6 Rounding.

8.3 Restrictions on topping-up

8.3.1 Topping-up the concentration is NOT permitted if:

- the lowest concentration reading is below the minimum concentration to allow top-up
- the lowest concentration reading is above the maximum top-up concentration
- the fumigation exposure period is less than 12 hours
- it will result in exposure to excessive concentrations of methyl bromide that will adversely affect that commodity.

8.3.2 Where the concentration readings at any of the sampling tubes, at any time, is below the minimum concentration to allow top-up, the fumigation has failed and topping-up is not permitted.

8.4 Topping-up during the exposure period

8.4.1 If a top-up is done during the normal exposure period, no extension of the exposure period, is required.

8.4.2 Multiple top-ups are permitted during the exposure period.

8.4.3 If a top-up is required during the second half of the exposure period it is indicative of excessive leakage rather than sorption by the commodity so the enclosure must be re-checked for leaks.

8.5 Topping-up at the end of the exposure period

8.5.1 If the lowest of the concentration readings taken at the end of the exposure period is below the standard concentration but equal to or above the minimum to allow top-up, extra fumigant must be added. See 8.2 Calculating the top-up amount.

8.5.2 If a top-up is done at the end of the normal exposure period, the fumigation must be extended for at least another four hours to allow time for the extra fumigant to take effect.

8.5.3 Only one extension of the exposure period is allowed. If, at the end of the extended period, the lowest reading is below the standard concentration as specified for the original exposure period, the fumigation has failed.

9 Ventilating the enclosure

9.1 Threshold limit value—time-weighted average (TLV-TWA)

9.1.1 The enclosure must be ventilated until the concentration of fumigant within the enclosure falls below the TLV–TWA. The TLV–TWA is 5 ppm unless a lower concentration is imposed by the relevant authorities in the jurisdiction in which the fumigation takes place.

9.1.2 The equipment used for measuring TLV–TWA must be fit for purpose and capable of accurately measuring the actual concentration, not just the presence, of methyl bromide in the range of 1 to 20 ppm.

9.1.3 If stain tubes are used, they must be used in conjunction with the sampling pump specified by the manufacturer.

9.1.4 If electronic instruments are used they must be calibrated and serviced in accordance with the manufacturer's instructions.

9.2 Releasing the fumigant from the enclosure

9.2.1 At the end of the exposure period the fumigant must be fully ventilated from the enclosure in a controlled and safe manner.

9.2.2 An assessment of the risks must be done to manage the ventilation process so that unprotected personnel in the vicinity are not exposed to unsafe levels of fumigant. The assessment must take into account:

- prevailing wind direction
- location and proximity of unprotected personnel
- establishment of a temporary buffer zone around the enclosure that is sufficient to prevent unprotected personnel in the vicinity from being exposed to unsafe levels of methyl bromide
- prevention of unprotected personnel entering the buffer zone during ventilation.

9.2.3 Unprotected personnel are not permitted to enter the risk area until the fumigator verifies that concentration in the area and throughout the enclosure is at or below the TLV–TWA.

9.2.4 If the consignment is fumigated in the shipping container(s) that will be used to transport the goods, then each container must be checked individually to verify gas clearance below TLV–TWA.

9.3 Releasing the consignment from the fumigator's control

9.3.1 The consignment can only be released from the fumigators control once the following conditions have been met:

- The fumigation has been performed in accordance with requirements.

  or

- The fumigation has failed and it is subsequently unsuitable for further treatment with methyl bromide, requiring the consignment to be sent for an alternative treatment option.

and

- The fumigant concentrations have been verified to the TLV–TWA or below.

9.3.2 The TLV–TWA readings and the time they were taken must be recorded.

10 Documentation

10.1 Record of Fumigation

10.1.1 The fumigator must record sufficient information to demonstrate that the fumigation complied with these requirements.

10.1.2 At a minimum it must include the following:

- job identification
- client or customer name
- start date of the fumigation
- location—the site address where the fumigation was performed
- a description of the consignment
- the target of the fumigation—why is the fumigation being performed
- consignment identification—container number(s), bill of lading or other means to clearly identify the consignment
- a declaration that the consignment is suitable for fumigation with the requirements set out at in section 1 Prior to Fumigation.
- type of enclosure
- enclosure volume
- chamber load factor—expressed as % of chamber volume—this is only for perishables
- the specified dose rate and exposure period
- the forecast minimum temperature and any adjustment made for temperatures below 21 °C (and commodity temperature readings for perishables)
- the dose—amount of fumigant to be used and the actual dose used
- the time the injection of the dose into the enclosure was completed
- the concentration readings from each sampling tube and the time they were taken
- the TLV–TWA readings and the time they were taken
- the name and signature of the fumigator-in-charge.

Note: See Appendix 1: Example record of fumigation for an example Record of Fumigation.

10.1.3 The Record of Fumigation must be completed on the fumigation site as the tasks are performed and copies must be maintained for audit purposes for a minimum of two years.

10.1.4 Recording of false or misleading information is not permitted under any circumstances.

10.2 Fumigation treatment certificate

10.2.1 A fumigation treatment certificate can be issued by a suitably accredited person once they are satisfied that the fumigation has been performed in accordance with the requirements.

10.2.2 All sections of the fumigation certificate are mandatory and must be filled out correctly to ensure the certificate can be accepted.

10.2.3 An example fumigation certificate is provided at Appendix 3: Example fumigation certificate.

10.2.4 The fumigation certificate travels with the consignment to state that it has been effectively treated for QPS purposes.

Appendix 1: Example record of fumigation

Methyl Bromide - Record of Fumigation

Job Details			
Job Identification	Customer Name	Start Date of Fumigation	Location
Description of Consignment			
Target of Fumigation		Container Numbers / Consignment Identification	

Fumigation Details			
The consignment complies with the following requirements: Adequate free airspace, no impervious surfaces or wrapping, maximum timber thickness & spacing ☐ Yes ☐ No			
☐ Sheeted Stack ☐ Sheeted Containers Size: _____ Qty: _____	Length = _____ Width = _____ Height = _____	☐ Un-sheeted Container ☐ Chamber	Volume (m^3)
Specified Dose Rate g/m^3	Exposure Period hrs	Forecast Minimum Temp °C	Dose Rate Used g/m^3
Calculated Dose g	Chloropicrin ☐ N/A % g	Actual Dose Applied g	Time Dosing Finished

Concentration Readings									
Phase	**Time of Reading**	**Standard g/m^3**	**Monitor Line Readings by Location** 1:	2:	3:	4:	5:	**Equilibrium Calculation**	**Top-up Dose**
Start								%	
								%	
During									
End									
Comments									

Ventilation			
Initial TLV ppm	Date & Time Taken	2nd TLV Reading ppm	Date & Time Taken
Fumigator in Charge		**Government Officer (if supervised)**	
Name	Signature	Name	Signature

Appendix 2: Example record of fumigation for perishable commodities

Australian Government
Department of Agriculture and Water Resources

Methyl Bromide - Record of Fumigation for Perishables

Job Details

Job Identification	Customer Name	Date of Fumigation	Location

Consignment Identification	Certificate Reference
Description of Consignment	**Description of Packaging**

Fumigation Details

Treatment Dose Rate g/m³ hrs	Treatment Temp °C	Dose Rate Used g/m³	Volume m³	Dose Amount g
Load Factor:	Maximum:_____ % Estimated: _____ %	**Probe location:**	☐ Inside packaging ☐ Inserted into pulp	Time Dosing Finished

Temperature Readings							Time
1:	2:	3:	4:	5:	6:	7:	

Concentration Readings

Phase	Time of Reading	STD g/m³	Free airspace			Inside packaging			Equilibrium Calculation
			1:	2:	3:	1:	2:	3:	
Start									%
									%
End									

Comments	Final TLV _____ ppm Time Achieved _____

Fumigator in Charge		**Government Officer (if supervised)**	
Name	Signature	Name	Signature

Appendix 3: Example fumigation certificate

COMPANY LETTERHEAD
(including address as it appears on the treatment providers list)

METHYL BROMIDE FUMIGATION CERTIFICATE

Certificate number: ☐ **Registration number:** ☐

TARGET OF FUMIGATION DETAILS

Target of fumigation: ☐ Commodity ☐ Packing ☐ Both Commodity and Packing

Commodity: ..... Quantity: .....

Consignment link: .....

Country of origin: ..... Port of loading: ..... Country of destination: .....

Name and address of exporter:	Name and address of importer:
.....	.....
.....	.....
.....	.....

TREATMENT DETAILS

Date fumigation completed: ...../...../..... Place of fumigation: .....

Prescribed dose rate (g/m^3) ..... Exposure period (hrs): .....

Forecast minimum temp (°C): ..... Applied dose rate (g/m^3): .....

How was the fumigation conducted? ☐ Un-sheeted Container ☐ Sheeted Container/s

☐ Chamber ☐ Pressure-tested container ☐ Sheeted Stack

Container number/s (where applicable): .....

Does the target of the fumigation conform to the plastic wrapping, impervious surface and timber thickness requirements at the time of fumigation? Yes ☐ No ☐

Ventilation Final TLV reading (ppm): ..... (not required for stack or permanent chamber fumigations)

DECLARATION

By signing below, I, the accredited fumigator responsible, declare that these details are true and correct and the fumigation has been carried out in accordance with all the requirements in the Methyl Bromide Fumigation Methodology.

ADDITIONAL DECLARATIONS

.....

.....

.....

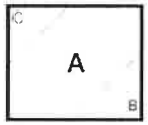
....
Signature Date

....
Name of Accredited Fumigator Accreditation Number

Company stamp

Appendix 4: Methyl bromide monitoring table

Dosing Phase	Initial Dose	32 g/m³	40 g/m³	48 g/m³	56 g/m³	64 g/m³	72 g/m³	80 g/m³	88 g/m³	128 g/m³	Dosing is complete once ALL the required amount of gas has been applied to the enclosure.
Gas Distribution Phase Start Point	¼ - ½ hr 85% or more of initial dose	32 **27.2**	40 **34**	48 **40.8**	56 **47.6**	64 **54.4**	72 **61.2**	80 **68**	88 **74.8**	128 **108.8**	Start Point is achieved when ALL concentration readings are at or above the Standard.
	½ - 1 hr 75% or more of initial dose	32 **24**	40 **30**	48 **36**	56 **42**	64 **48**	72 **54**	80 **60**	88 **66**	128 **96**	
	> 1 hr 70% or more of initial dose	32 **22.4**	40 **28**	48 **33.6**	56 **39.2**	64 **44.8**	72 **50.4**	80 **56**	88 **61.6**	128 **89.6**	
Fumigation Phase Methyl Bromide Concentration After Start Point	2 hrs 60% or more of initial dose	24.2 **19.2** 14.2	29 **24** 19	33.8 **28.8** 23.8	38.6 **33.6** 28.6	46.4 **38.4** 30.4	51.2 **43.2** 35.2	56 **48** 40	60.8 **52.8** 44.8	84.8 **76.8** 68.8	The duration of the fumigation is measured from when the Start Point is achieved. For example, if a 24 hr fumigation reaches Start Point 1 ½ hrs after dosing, the fumigation is completed 25 ½ hrs after applying the dose and ALL concentrations are at or above the standard specified for 24 hrs.
	4 hrs 50% or more of initial dose	21 **16** 11	25 **20** 15	29 **24** 19	33 **28** 23	40 **32** 24	44 **36** 28	48 **40** 32	52 **44** 36	72 **64** 56	
	12 hrs 35% or more of initial dose	16.2 **11.2** 6.2	19 **14** 9	21.8 **16.8** 11.8	24.6 **19.6** 14.6	30.4 **22.4** 14.4	33.2 **25.2** 17.2	36 **28** 20	38.8 **30.8** 22.8	52.8 **44.8** 36.8	
	24 hrs 30% or more of initial dose	14.6 **9.6** 4.6	17 **12** 7	19.4 **14.4** 9.4	21.8 **16.8** 11.8	27.2 **19.2** 11.2	29.6 **21.6** 13.6	32 **24** 16	34.4 **26.4** 18.4	46.4 **38.4** 30.4	
	48 hrs 25% or more of initial dose	13 **8** 3	15 **10** 5	17 **12** 7	19 **14** 9	24 **16** 8	26 **18** 10	28 **20** 12	30 **22** 14	40 **32** 24	



A = Standard Concentration
B = Minimum concentration to allow top-up
C = Maximum top-up concentration

Appendix 5: Concentrations for dose rates and times

		Minimum Standard Concentrations Required (g/m^3)												
Hours	**Retention**	**32**	**48**	**56**	**64**	**72**	**80**	**88**	**96**	**104**	**128**	**136**	**144**	**152**
½	75.00%	24.0	36.0	42.0	48.0	54.0	60.0	66.0	72.0	78.0	96.0	102.0	108.0	114.0
1	70.00%	22.4	33.6	39.2	44.8	50.4	56.0	61.6	67.2	72.8	89.6	95.2	100.8	106.4
2	60.00%	19.2	28.8	33.6	38.4	43.2	48.0	52.8	57.6	62.4	76.8	81.6	86.4	91.2
3	54.80%	17.5	26.3	30.7	35.1	39.5	43.8	48.2	52.6	57.0	70.1	74.5	78.9	83.3
4	50.00%	16.0	24.0	28.0	32.0	36.0	40.0	44.0	48.0	52.0	64.0	68.0	72.0	76.0
5	47.80%	15.3	22.9	26.8	30.6	34.4	38.2	42.1	45.9	49.7	61.2	65.0	68.8	72.7
6	45.70%	14.6	21.9	25.6	29.2	32.9	36.6	40.2	43.9	47.5	58.5	62.2	65.8	69.5
7	43.70%	14.0	21.0	24.5	28.0	31.5	35.0	38.5	42.0	45.4	55.9	59.4	62.9	66.4
8	41.80%	13.4	20.1	23.4	26.8	30.1	33.4	36.8	40.1	43.5	53.5	56.8	60.2	63.5
9	40.00%	12.8	19.2	22.4	25.6	28.8	32.0	35.2	38.4	41.6	51.2	54.4	57.6	60.8
10	38.30%	12.3	18.4	21.4	24.5	27.6	30.6	33.7	36.8	39.8	49.0	52.1	55.2	58.2
11	36.60%	11.7	17.6	20.5	23.4	26.4	29.3	32.2	35.1	38.1	46.8	49.8	52.7	55.6
12	35.00%	11.2	16.8	19.6	22.4	25.2	28.0	30.8	33.6	36.4	44.8	47.6	50.4	53.2
16	33.35%	10.7	16.0	18.7	21.3	24.0	26.7	29.3	32.0	34.7	42.7	45.4	48.0	50.7
20	31.65%	10.1	15.2	17.7	20.3	22.8	25.3	27.9	30.4	32.9	40.5	43.0	45.6	48.1
24	30.00%	9.6	14.4	16.8	19.2	21.6	24.0	26.4	28.8	31.2	38.4	40.8	43.2	45.6
28	29.15%	9.3	14.0	16.3	18.7	21.0	23.3	25.7	28.0	30.3	37.3	39.6	42.0	44.3
32	28.31%	9.1	13.6	15.9	18.1	20.4	22.6	24.9	27.2	29.4	36.2	38.5	40.8	43.0
36	27.47%	8.8	13.2	15.4	17.6	19.8	22.0	24.2	26.4	28.6	35.2	37.4	39.6	41.8
40	26.64%	8.5	12.8	14.9	17.0	19.2	21.3	23.4	25.6	27.7	34.1	36.2	38.4	40.5
44	25.82%	8.3	12.4	14.5	16.5	18.6	20.7	22.7	24.8	26.9	33.0	35.1	37.2	39.2
48	25.00%	8.0	12.0	14.0	16.0	18.0	20.0	22.0	24.0	26.0	32.0	34.0	36.0	38.0
Minimum concentration to allow top-up is		- $5g/m^3$ below the Standard Concentration			- $8g/m^3$ below the Standard Concentration									
Maximum top-up concentration		+ $5g/m^3$ above the Standard Concentration			+ $8g/m^3$ above the Standard Concentration									

Concentration readings must be equal to or above the required concentrations specified for the hour preceding the reading. For example, a reading taken at 2.5 hours must be equal to or above the concentrations specified at 2 hours in the above table.

If the concentration measuring instrument used can only read in whole grams then the Minimum Standard Concentration required must be rounded up to the nearest whole number.

Appendix 6: Concentrations for dose rates for fumigations that require 80% retention

	Minimum Standard Concentrations Required (g/m^3)												
Starting Concentration	**32**	**48**	**56**	**64**	**72**	**80**	**88**	**96**	**104**	**128**	**136**	**144**	**152**
Minimum Concentration	25.6	38.4	44.8	51.2	57.6	64.0	70.4	76.8	83.2	102.4	108.8	115.2	121.6

If the instrument used only reads in whole grams, the Standard Concentration must be rounded up to the nearest whole number.

Glossary

Term	Definition
Ambient temperature	The air temperature of the surrounding area where the fumigation will be conducted.
Buffer zone	The area around the enclosure, outside of which, the concentration levels of methyl bromide should not exceed the TLV–TWA during ventilation.
Chloropicrin	A strong-smelling chemical commonly added to the odourless methyl bromide to indicate the presence of gas.
Commodity	The item or goods that are being exported or imported.
Concentration	The amount of fumigant present at a certain point in the fumigation enclosure, usually expressed as grams per cubic metre (g/m^3).
Consignment	Refers collectively to the commodity, any packing materials used and the mode of transport such as a shipping container.
Dosage	The cumulative concentration of fumigant in the enclosure over the exposure period. Also referred to as the Concentration by Time Product (CT Product) normally expressed as gram hours per cubic metre.
Dose	The amount of fumigant applied to a fumigation enclosure.
Dose rate	The prescribed concentration of fumigant to be used per unit of volume and the exposure period.
Enclosure	Any gas-tight space intended to contain sufficient concentrations of fumigant for a period of time. Common examples of fumigation enclosures used for QPS fumigations are sealed shipping containers, gas-proof sheets sealed to an impervious floor and purpose-built chambers
Equilibrium	An even distribution of fumigant throughout the enclosure.
Exposure period	The amount of time, in one continuous block, that the consignment must be exposed to sufficient concentration levels of fumigant to be lethal to the targeted pests.
Free air space	Empty space in the enclosure between, above or around a commodity.
Fumigant	A chemical, which at a particular temperature and pressure can exist in a gaseous state in sufficient concentration and for sufficient time to be lethal to insects and other pests
Fumigation sheets	A sheet (or tarpaulin) that is made of material impervious to the fumigant used to create a temporary fumigation enclosure.
ISPM15	International Standards for Phytosanitary Measures No. 15 – Regulation of wood packaging material in International trade
Load factor	Specifies the maximum volume of space that the commodity can occupy in the enclosure to achieve rapid fumigation circulation. Normally expressed as a percentage (for example, maximum load factor of 50%).
Maximum top-up concentration	The concentration used to calculate the amount of fumigant to be added to the enclosure when topping-up.
Minimum top-up concentration	The absolute minimum concentration below which levels fumigant concentration must not fall at any time during the exposure period.
Pascal (Pa)	The standard international unit for pressure. Standard atmospheric pressure is 101.325 kPa.
Perishable commodities	Commodities such as, cut flowers, fresh fruit, vegetables and nursery stock that will deteriorate rapidly if not stored or transported under suitable conditions.
Permeability	The rate at which a substance (such as methyl bromide) passes through a material (such as a fumigation sheet).
Pest	Any animal, plant or other organism that may pose a threat to the community or the natural environment.

Term	Definition
Quarantine pest	A pest of potential economic and/or environmental importance to an area where it is not yet present, or is present but not widely distributed and is being officially controlled.
Quarantine and Pre-shipment (QPS)	1) '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: a) Official control is that performed by, or authorised by, a national plant, animal or environmental protection or health authority. b) 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. 2) '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. This definition is based on the Montreal Protocol which is seeking to phase-out methyl bromide for non-QPS uses by 2015.
Record of fumigation	A document that records the relevant information to demonstrate the fumigation complied with requirements.
Relevant authority	The government department, ministry or agency responsible for animal and plant biosecurity in the importing or exporting country.
Risk area	The area around the enclosure to which access is restricted to personnel wearing personal protective equipment.
Sampling tube	A small diameter tube used to draw a sample of gas/air mixture from within a fumigation enclosure to measure the fumigant concentration.
Sheet fumigation	A process of creating a gas-tight enclosure by covering/enclosing the commodities to be fumigated under a gas-proof sheet.
Shipping container	Standardised transportation units that can be moved from one mode of transport to another without needing to unload the contents.
Sorption/sorptive	A physical and chemical process by which one substance becomes attached to another. De-sorption is the reversal of this process.
Standard concentration	The fumigant concentration below which the fumigation will not be effective unless additional fumigation is added to the enclosure to compensate.
Target of the fumigation	The target of the fumigation may be the commodity, packaging material or both.
Treatment	Application of a set of specified requirements intended to kill pests and diseases that may be associated with a consignment.
Threshold limit value—time-weighted average (TLV–TWA)	TLV–TWA is the maximum concentration of fumigant that a person can be repeatedly exposed to in the workplace without harmful effects. This figure is based on an 8-hour day, 40-hour working week.

Australian Government
Department of Agriculture

Ministry for Primary Industries
Manatū Ahu Matua

Heat treatment methodology

Version 2.8

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.

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 target goods for a specified temperature and time.

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 treatment 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.

General

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 performing official 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 not complying with the requirements of this methodology and/or other specified treatment conditions will have their registration status changed to under investigation, suspended or terminated depending on the non-compliance.

How to use this document

Some of the requirements in this methodology only apply in certain circumstances, generally related to the type of goods 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.

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 enclosure.

1.3.2 The consignment must be loaded in the enclosure with separation between items to allow for effective circulation of hot air. The consignment must be loaded in a way that exposes the target of the heat treatment to the hot air.

1.3.3 Where the target of heat treatment has compartments that can be opened and closed, the compartments must be opened or exposed to ensure they reach the required temperature for the duration of the exposure period.

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

1.3.5 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 enclosure.

1.4 Enclosure suitability

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

1.4.2 Where a heat treatment is conducted in a sheeted enclosure, the heat treatment surface must be hard and flat.

1.4.3 Where a heat treatment is conducted in a chamber, the chamber must be:

- constructed from rigid materials on all sides, including the door
- be permanently sealed along all joins between the walls, roof and floor.

2 Performing the heat treatment

2.1 Hot air delivery and circulation

2.1.1 The heat source must be able to raise and maintain the temperature of the enclosure to the required treatment temperature.

2.1.2 The air within the enclosure must be circulated in a way that ensures the target of the heat treatment is raised and maintained at or above the required 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 temperature sensors are at or above the required temperature, allowing for the accuracy of the temperature sensor.

2.2.3 Where the treatment schedule requires the relative humidity of the enclosure be maintained, the start of the treatment period commences only when all humidity sensors are also at or above the required humidity, allowing for the accuracy of the humidity sensor.

3 Monitoring the heat treatment

3.1 Treatment measuring equipment

3.1.1 All measuring equipment must be fit for purpose and in good working order.

3.1.2 All measuring equipment must be individually identified for data recording and calibration.

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

3.1.4 Temperature sensors must be capable of measuring the range between 0°C and a temperature above the required treatment temperature.

3.2 Temperature sensors requirements

3.2.1 All treatments must be measured by a minimum of two ambient air temperature sensors.

3.2.2 Ambient sensors must be placed in the coldest ambient air space identified by temperature mapping, or where temperature mapping has not been conducted, within the enclosure in a way that indicates that the free airspace temperature throughout the enclosure has been raised above the required treatment temperature for the required treatment period. The free air space temperature sensors must be placed away from the heat source so as to not to adversely affect their measurement readings.

3.2.3 For timber, grain, seed and perishable treatments, the core temperature of the target of heat treatment must be monitored and recorded.

3.2.4 For all other treatments, the temperature of the coldest surface of the target of heat treatment must be monitored and recorded.

3.2.5 The number of core or surface temperature sensors depends on the size of the enclosure. Enclosures smaller than 100m^3 must have at least three core or surface temperature sensors. Enclosures greater than 100m^3 but smaller than 500m^3 require four core or surface sensors. An additional core or surface temperature sensor is required for every additional 500m^3 or part thereof (Table 1).

Table 1 Number of temperature sensors required where core temperature requirements are specified

Volume of enclosure (cubic meters)	Minimum Number of free air space sensors	Minimum number of core or surface temperature sensors	Minimum total number of sensors
0-100	2	3	5
101-500	2	4	6
501-1,000	2	5	7
1,001-1,500	2	6	8
1,501-2,000	2	7	9
2,001-2,500	2	8	10
2,500-3,000	2	9	11

3.2.6 Core temperature sensors must be inserted into the core of the target of the heat treatment.

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

3.2.8 Where treating mixed consignments, at least one core temperature sensors must be inserted into each type of commodity.

3.2.9 Where inserting core temperature sensors will damage the commodity, substitutes of the same thickness and thermal properties may be used.

3.2.10 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 with heat resistant material
- away from heat conductors such as metal nails and screws.

3.2.11 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.

3.2.12 Core and surface temperature sensors must be positioned to measure the temperature of the target of heat treatment as close as practicable to the coldest areas identified by temperature mapping, or where temperature mapping has not been conducted, throughout the enclosure in the areas expected to be the hardest to heat.

3.3 Humidity sensors

3.3.1 Where the treatment schedule requires the relative humidity of the ambient air inside the

enclosurebe measured, the relative humidity must be measured by a minimum of one humidity sensor.

3.3.2 The relative humidity sensor must be placed in the free air space in the warmest part of the heat treatment enclosure.

3.4 Monitoring readings

3.4.1 The temperature must be monitored from the start of the heat application until the end of the treatment period.

3.4.2 Temperature readings must be recorded at least once every 60 seconds.

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

3.4.4 All required readings must be monitored and recorded using data logging equipment.

3.5 End of treatment period

3.5.1 The treatment period ends when all temperature sensor readings and humidity sensor readings (where required) have been continuously at or above the required temperature and humidity for the required exposure period, allowing for the accuracy of the sensors.

3.5.2 Where the temperature and humidity (where required) has fallen below the required reading, the treatment has failed and must be restarted.

4 Documentation

4.1 Record of Heat Treatment

4.1.1 A Record of Heat Treatment must be completed for all successful and failed 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 (commodity/non-commodity/both) – including quantity
- dimensions of the consignment
- country of destination
- consignment identification/link —container number/s, bill of lading, or other means to clearly identify the consignment

- required treatment temperature and exposure period
- temperature sensors used (identification number)
- humidity sensors used if required
- heat treatment method
- enclosure type (chamber/container/sheeted) and number/s
- whether a substitute was used, and if so, its dimensions and material composition
- start and completion time of the treatment period
- minimum temperature achieved during the exposure period
- name and signature of the heat treatment operator-in-charge.

4.1.3 All monitoring readings must be documented and included as an attachment to the Record of Heat Treatment. The time, temperature and humidity (where relevant) of each reading must be documented and the location and identification of the sensor must be clearly stated.

4.1.4 All sections of the Record of Heat Treatment must be completed accurately.

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

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. An example heat treatment certificate is provided at Appendix 2: Example heat treatment certificate.

4.2.2 The following information must be recorded on a Heat Treatment Certificate to demonstrate that the heat treatment complied with requirements:

- treatment provider's letterhead including name and physical address
- treatment provider's registration number
- certificate number
- description of the target of the heat treatment (commodity/non-commodity/both) – including quantity
- consignment identification/link – container number/s, bill of lading, or other means to clearly identify the consignment
- country of origin, country of destination, and port of loading
- name and address of exporter
- name and address of importer
- date and time for the start of the heat treatment and when it was completed
- location—the site address where the treatment was performed
- required treatment temperature and exposure period

- minimum temperature achieved during the exposure period
- minimum humidity achieved during the exposure period (if required)
- enclosure type (chamber/container/sheeted)
- a declaration that the heat treatment met all of the compliance requirements set out in this methodology
- the name and signature of the heat treatment operator-in-charge.

4.2.3 All sections of the Heat Treatment Certificate must be completed accurately.

4.2.4 The Heat Treatment Certificate must accompany 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, Heat Treatment Certificate, and all calibration records and/or certificates must be maintained for a minimum of two years.

Appendix 1: Example record of heat treatment

Record of Heat Treatment

Job Details			
Job identification		Customer name and destination country	
Date of treatment		Location of treatment	
Description of consignment		Target of treatment and quantity	
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 ☐ Kiln Drying ☐ Forced Dry Air ☐ Humidity Controlled Forced Air		Substitute Used for Core Temperature Sensor Requirements ☐ N/A ☐ Yes Material_____ Length_____ Width_____ Height_____	
Specified Treatment Temperature ☐ °C or ☐ °F	Minimum Temperature Achieved ☐ °C or ☐ °F	Specified Treatment Exposure Period ☐ minutes or ☐ hours	Enclosure Volume (cubic meters)
Specified Humidity Rate (if applicable) _____%	Minimum Humidity Achieved _____%	Heat Treatment Enclosure Type and Number ☐ Chamber ☐ Container ☐ Sheeted	
Treatment Period Start Time:		Treatment Period Completion Time:	
Heat Treatment Monitoring Readings			
The time, date and position of all temperature and humidity readings must be documented and attached to the Record of Heat Treatment. Each device used to take readings must be individuality identifiable.			
Comments:			
Heat Treatment Operator in Charge			
Name	Signature		

Appendix 2: Example heat treatment certificate

COMPANY LETTERHEAD

(including address as it appears on the Australian Department of Agriculture's approved list of Brown Marmorated Stink Bug treatment providers.

BROWN MARMORATED STINK BUG HEAT TREATMENT CERTIFICATE

Certificate number: | **Registration Number:**

CONSIGNMENT DETAILS

Target of treatment: ☐ Commodity ☐ Non-commodity ☐ Both

Target description: ..... Quantity: .....

Consignment link: .....

Country of origin: ..... Port of loading: ..... Country of destination: .....

Name and address of exporter:	Name and address of importer:
.....	.....
.....	.....
.....	.....

TREATMENT DETAILS

Date heat treatment completed: ..... /...../..... Time heat treatment completed: .....

Location of heat treatment ..... Exposure period (☐ minutes or ☐ hours): .....

Required temperature (☐ °C or ☐ °F): ..... Minimum temperature achieved (☐ °C or ☐ °F): .....

Humidity Rate (☐ % or ☐ not applicable) ..... Minimum humidity Rate (☐ % or ☐ not applicable) .....

Heat treatment method: ☐ Forced dry air ☐ Kiln drying ☐ Humidity controlled forced air / Variable humidity

Enclosure type ☐ Chamber ☐ Container ☐ Sheeted

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 Heat Treatment Methodology.

ADDITIONAL DECLARATIONS

.....

.....

.....

....

Signature Date

....

Name of Accredited Treatment Provider Accreditation Number

Company stamp

Glossary

Term	Definition
Consignment	Refers collectively to the goods, any packing materials used and the mode of transport such as a shipping container.
Core	The central, most inner part of the goods/consignment being treated.
Core temperature	The temperature at the core of the target of the heat treatment, or an acceptable substitute.
Core temperature sensor	A temperature sensor inserted into the target of the heat treatment, or an acceptable substitute, to measure the core temperature.
Enclosure	A physical container or chamber, purposely built, temporary or mobile, used for performing heat treatments.
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 enclosureto heat the consignment to the requirement treatment temperature. The humidity inside the enclosureis not monitored and loss of moisture from the goods will not result in adverse effects. This method is commonly used to treat wood packaging material.
Free air space	Empty space within an enclosure between, above or around the consignment.
Goods	The items that are being exported or imported.
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 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, or removing, water vapour to the heat treatment enclosure. This is commonly used for commodities that may be damaged by: • excessive moisture (wetting of the goods) that would occur during heat treatment methods, such as vapour; or • excessive moisture loss that has the potential to char, crack or combust the goods 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.
Load factor	Specifies the maximum volume of space that the goods can occupy in the enclosure to achieve rapid air circulation. Usually expressed as a percentage (for example, maximum load factor of 50%).

Term	Definition
Quarantine and Pre-shipment (QPS)	**Quarantine and Pre-Shipment** **Pre-Shipment** a. Any treatments applied to meet: i. The official requirements of the importing country; or ii. The existing official requirements of the exporting country - being the official requirement performed or authorised by a national plant, animal, environmental, health, or stored product authority; but b. Does not include quarantine applications **Quarantine** Any treatments to prevent the introduction, establishment and/or spread of quarantine pests (including diseases), or to ensure their official control, where: a. Official control is that performed by, or authorised by, a national plant, animal or environmental protection or health authority. b. 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.
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 goods/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.
Surface temperature sensor	A temperature sensor placed on or attached to surface of the target of the heat treatment, to measure the surface temperature.
Target of the heat treatment	The target of the heat treatment may be the goods, 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

Heat Treatment Methodology Feedback

Who	Country	Comments on Methodology	Feedback on any gaps within the Methodology
Alphonese Bannick	PNG	• In PNG, our service providers are still confused as to how one can construct or assemble a treatment facility. It be very useful if some drawings or simple designs with specifications can be added to the information for those who wish to construct or assemble one can use the designs to assemble the treatment facility.	
Michael Areke	PNG	Scope: This document applies to commercial and government treatment providers performing QPS heat treatments for countries that have adopted a specific heat treatment schedule/regime.	
Michael Areke	PNG	General: Importing countries have the right to impose more stringent treatment conditions/protocols/requirements 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. How to use this document: Some of the requirements in this methodology only apply in certain circumstances/situations, generally related to the type of goods 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.	
Michael Areke	PNG		
Michael Areke	PNG	3.1.3 All measuring equipment must be calibrated in accordance by accredited calibrators with the manufacturer' s instructions international standards or appropriate national standards.	
Michael Areke	PNG	4.1.2 The following information must be recorded in the Record of Heat Treatment to demonstrate that the heat treatment complied with requirements:	
Michael Areke	PNG	• name and signature of the heat treatment operator-in-charge.	
Michael Areke	PNG	• Type of surface where the treatment is being conducted	
Michael Areke	PNG	4.2 Heat treatment certificate	
Michael Areke	PNG	4.2.1 A Heat Treatment Certificate must be issued by a suitably accredited competent person once they are satisfied that the heat treatment has been performed in accordance with the necessary requirements of this methodology and the importing country' s requirements. An example heat treatment certificate is provided at Appendix 2: Example heat treatment certificate.	
Michael Areke	PNG	4.2.2 The following information must be recorded on a Heat Treatment Certificate to demonstrate that the heat treatment complied with requirements:	
Michael Areke	PNG	• a declaration that the heat treatment met all of the compliance requirements set out/as stipulated-in this methodology	
Michael Areke	PNG	Glossary	
Michael Areke	PNG	a. Any treatments applied to meet:	
Michael Areke	PNG	i. The official requirements of the importing country; or	
Michael Areke	PNG	ii. The existing official requirements of the exporting country - being the official requirement performed or authorised by a national plant, animal, environmental, health, or stored product authority; but	
Michael Areke	PNG		
Michael Areke	PNG	b. Does not include quarantine applications	
Michael Areke	PNG	Quarantine	
Michael Areke	PNG	Any treatments to prevent the introduction, establishment and/or spread of quarantine pests (including diseases),of animal and animal origin products and plant and plant origin products or to ensure their official control, where:	
Michael Areke	PNG	a. Official control is that performed by, or authorised by, a national plant, animal or environmental protection or health authority.	
Michael Areke	PNG	b. 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.	
Michael Areke	PNG	Customer name and destination name should be in separate columns and not in the same column (record of heat treatment). This is so that it makes it easier for people to know where the cargo/consignment that is being treated is going to.	
Raul Rodas/ Jose Ivan Hernandez	OIRSA	1.2 Consignment Suitability	
Raul Rodas/ Jose Ivan Hernandez	OIRSA	1.2.1 The consignment must be suitable for heat treatment	
Raul Rodas/ Jose Ivan Hernandez	OIRSA	According to the selected programme	
Raul Rodas/ Jose Ivan Hernandez	OIRSA	1.3 Loading and free air space	
Raul Rodas/ Jose Ivan Hernandez	OIRSA	1.3.1 The consignment must be loaded to allow even distribution of hot air throughout the enclosure.	
Raul Rodas/ Jose Ivan Hernandez	OIRSA	Specify measurements for the separations: above, below, at the sides and in between the consignment; in such a way that the target is exposed to the hot air circulating in the enclosure.	
Raul Rodas/ Jose Ivan Hernandez	OIRSA	~~1.3.2 The consignment must be loaded in the enclosure with separation between items to allow for effective circulation of hot air. The consignment must be loaded in a way that exposes the target of the heat treatment to the hot air.~~	
Raul Rodas/ Jose Ivan Hernandez	OIRSA	~~1.3.4 The consignment must be loaded off the floor of the enclosure to provide free air space under the target of the heat treatment and to prevent cooling influences from the ground affecting the treatment.~~	
Raul Rodas/ Jose Ivan Hernandez	OIRSA	2.1 Hot air delivery and circulation	
Raul Rodas/ Jose Ivan Hernandez	OIRSA	2.1.1 The heat source must be able to raise and maintain the temperature of the enclosure to the required treatment temperature.	
Raul Rodas/ Jose Ivan Hernandez	OIRSA	The time it takes for the heat source to rise and maintain the temperature must be indicated.	
Raul Rodas/ Jose Ivan Hernandez	OIRSA	3.5 End of treatment period	
Raul Rodas/ Jose Ivan Hernandez	OIRSA	3.5.2 Where the temperature and humidity (where required) has fallen below the required reading, the treatment has failed and must be restarted.	
Raul Rodas/ Jose Ivan Hernandez	OIRSA	The failures must be identified and corrected and then restart the treatment.	
Raul Rodas/ Jose Ivan Hernandez	OIRSA	4.3 Record management	
Raul Rodas/ Jose Ivan Hernandez	OIRSA	5.0 Include occupational safety measures	
Kuo-Shiou Huang	Taiwan	N/A	
Jo-Anne	NZ	Heat Treatment Methodology	
Jo-Anne	NZ	General	
Jo-Anne	NZ	Countries receiving heat treatment certification through this system expect that the treatment has been undertaken in accordance with this methodology. Heat treatment providers found to be not complying with the requirements of this methodology and/or other specified treatment conditions will have their registration status changed to under investigation, suspended or withdrawn depending on the non-compliance.	
Jo-Anne	NZ	How to use this document	
Jo-Anne	NZ	Addition: A guidance document to explain options for specific heat treatment requirements (i.e. loading configurations for adequate air circulation, temperature mapping and sliding scale heat treatment for specific timber types) will be developed by the ICCBA Technical Working Group for Heat.	
Jo-Anne	NZ	Contents	
Jo-Anne	NZ	Addition: Appendix 3: Example of applying a sliding scale to heat treatment for timber	
Jo-Anne	NZ	1.3 Loading and free air space	
Jo-Anne	NZ	1.3.2 The consignment must be loaded in the enclosure with separation between items to allow for the effective circulation of hot air. Delete: The consignment must be loaded in a way that exposes the target of the heat treatment to the hot air.	
Jo-Anne	NZ	To allow for hot air circulation:	
Jo-Anne	NZ	i) Where the target of heat treatment has compartments that can be opened and closed, the compartments must be opened or exposed to ensure they reach the required temperature for the duration of the exposure period.	
Jo-Anne	NZ	ii) The consignment must be loaded off the floor of the enclosure to provide free air space under the target of the heat treatment and to prevent cooling influences from the ground affecting the treatment.	
Jo-Anne	NZ	1.3.3 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 enclosure.	
Jo-Anne	NZ	1.4 Enclosure Suitability	

Jo-Anne	NZ	1.4.2 Where a heat treatment is conducted in a sheeted enclosure, ~~the heat treatment~~ base of enclosure surface must be able to ~~hard and flat or of a thermal capacity to~~ contain heat.
Jo-Anne	NZ	1.4.3 Where a heat treatment is conducted in a chamber, the chamber must be:
Jo-Anne	NZ	• Be permanently sealed along all joins between the walls, roof and floor.
Jo-Anne	NZ	3.2 Temperature sensors requirements
		3.2.1 The number of core or surface temperature sensors depends on the size of the enclosure. Enclosures smaller than 100m3 must have at least three core or surface temperature sensors. For large consignments (> 100m3) temperature mapping or additional temperature sensors (see table 1) must be used.
Jo-Anne	NZ	Table 1 Number of temperature sensors required where core temperature requirements are specified.
Jo-Anne	NZ	0-100 enclosure. Min Number of free air space sensor (1). Min total number of sensors (4).
		3.2.1.1 Ambient sensors must be placed in the coldest ambient air space identified by temperature mapping, or where temperature mapping has not been conducted, within the enclosure in a way that indicates that the free airspace temperature throughout the enclosure has been raised above the required treatment temperature for the required treatment period. The free air space temperature sensors must be placed away from the
Jo-Anne	NZ	heat source so as to not to adversely affect their measurement.
		3.2.1.2 Where temperature mapping is used, temperature mapping is required to be undertaken for each goods type, configuration, arrangement and density of the commodity, and for each treatment chamber that will
Jo-Anne	NZ	be used during the selected heat treatment. It should be carried out following modifications or adjustments in equipment or processes that affect attainment of the target temperature for the treatment.
		Comment: Temperature mapping should be used for large chambers. This is because airflow from the heat source is variable in large chambers and cold spots should be identified as a matter of good practice. This
Jo-Anne	NZ	method of temperature mapping is used in the vehicle and timber industries.
		3.2.2 For timber, grain, seed and perishable treatments, the core temperature of the ~~target of the heat~~ treatment target must be monitored and recorded. Equivalent measures to that of taking core temperature, where
Jo-Anne	NZ	core temperature sensors will damage the commodity, are:
Jo-Anne	NZ	i) A sliding scale heating variation that changes depending on the timber type (softwood and hardwood timber species) or thickness as identified in the sliding scale in Appendix 3 of this document.
Jo-Anne	NZ	Or
Jo-Anne	NZ	ii) Insert the core temperature sensors into substitutes of the same thickness and thermal properties.
Jo-Anne	NZ	Or
Jo-Anne	NZ	iii) Requirements for monitoring core temperature may be modified where it can be technically proven and when other measures can compensate for deviation. Any modifications must be NPPO or agency approved.
Jo-Anne	NZ	For all other heat treatments, the temperature of the coldest surface of the target of heat treatment must be monitored and recorded.
		Delete: The number of core or surface temperature sensors depends on the size of the enclosure. Enclosures smaller than 100m3 must have at least three core or surface temperature sensors. Enclosures greater than
Jo-Anne	NZ	100m3 but smaller than 500m3 require four core or surface sensors. An Additional core or surface temperature sensor is required for every additional 500m3 or part thereof (Table 1).
Jo-Anne	NZ	~~3.2.10 Where inserting core temperature sensors will damage the commodity, substitutes of the same thickness and thermal properties may be used.~~
Jo-Anne	NZ	Added: Appendix 3: Sliding scale for Timber heat treatment
Jo-Anne	NZ	Added in glossary: Temperature Mapping
Jose Luis Diaz	Peru	N/A
		• Ambient sensors must be placed at different locations within the enclosure in the coldest ambient air space identified by temperature mapping, or where temperature mapping has not been conducted, within the enclosure in a way that indicates that the free airspace temperature throughout the enclosure has been raised above the required treatment temperature for the required treatment period. The free air space temperature sensors must be placed at separate locations to each other and be away from the heat source so as to not to adversely affect their measurement readings.
		• Core and surface temperature sensors must be positioned at separate locations to each other, to measure the temperature of the target of heat treatment as close as practicable to the coldest areas identified by temperature mapping, or where temperature mapping has not been conducted, throughout the enclosure in the areas expected to be the hardest to heat.
Steve Welling	AA	
		Updating sensor requirements of the Methodology to accommodate any class 4.1s operating small scale ovens that could not meet requirements for increased number of sensors. Potential questions with this are: a) confirm that this was in fact an issue for these operators and b) obtain any relevant details for site chamber setups. So far we have identified two AA sites worth looking at, in the context of potentially updating conditions of the methodology. S0195 Primary Industry and Regiosn South Australia have small seed volume which they transfer from foil packets to envelopes. They are currently complying with the sensor
Steve Welling	AA	requirements but have been advised that this could potentially change. W1544 Valdrew Nominees Pty Ltd use 2 electric powered ovens each with one free air space and one core sensor.
		• whether updating the methodology is an option i.e. add a row in Table 1 to cater enclosure size 0-X cubic metres (not sure yet on maximum) and support 1 free air sensor and 1 core/surface sensor? Or should we just make this update in the class 12.3 only, preference is not to
		• next steps in CPs view, which I assume would include site visits?
Steve Welling	AA	
Sam Griffiths	CP	For table 1 in HT methodology I'd suggest either 0-5m3 or 0-10m3 should only require one ambient and one core sensor.
		I' d lean toward going 0-10m3 as we require three core sensors for a 20 foot container which is about 35ish cubic meters, divide the volume and the sensors by three and you get one sensor for every 10ish cubic
Sam Griffiths	CP	meters. But as easily could be convinced 10m3 is too big and it should be 5m3. But as more information comes back from treatment providers this may become clearer.
		I' d lean towards 0-10m3. We could potentially update the class 12.3 document to include wording (perhaps just in 'information' only) around biosecurity directions specifying additional sensors, which
Steve Welling	AA	supersede sensor requirements of the HT Meth
		• Probes need to be placed in not just the "largest target of the heat" but also placed in such a way to ensure the probe is placed at the deepest part of the target. E.g. for elongated fruit the probed must be placed where the mesocarp is thickest. This would also apply to timber.
		• This methodology refers to humidity sensors but does not require them to be placed in the commodity if core measurement is stipulated in the treatment schedule.
		• The methodology mentions size in relation to probe placement. Density also needs to be considered.
		• There is no mention of the required level of accuracy for sensors.
		• Temperature mapping should not be optional. Temperature and humidity mapping studies should be conducted to fully characterize the distribution of heat and humidity within the treatment chamber and the load (by volume and arrangement of the commodity) to determine where sensors should be placed.
		• Might be useful to include a requirement for core sensors to be appropriately secured so that they don' t become dislodged. Method of securing must be in a manner that does not interfere with heat transfer in and out of the commodity.
		• Could do with more information regarding consignment suitability. If it was to become a generic heat standard it suggest adding something for moist heat treatment i.e. Any bags or packaging impervious to moisture must be opened, removed or adequately punctured to allow the moist heat to contact the target of treatment.
		• Hot Water Treatment (HWT). The department has introduced conditions which rely on the use of hot water treatment as a risk mitigation measure for some nursery stock and seed for planting pathways. For example, to manage the risks of Xylella fastidiosa in host plants (depending on the form of material and country of origin), as well as a range of pathogen risks in seed (e.g. Cannabis, Candidatus Liberibacter solanacearum host seed). HWT is currently not within the scope of Class 4.1 (Heat treatment) AA criteria. The general requirements for conducting HWT have not been formalised for consistency and clarity. Given the increasing number of seed/NS reviews that are looming in the next few years, the formalisation of HWT methodology/requirements would be a good future-proofing exercise.
		• Moist Heat Treatment (MHT) for seed devitilisation. Known issues in the application of this treatment include measurement of temperature and humidity at the core of the product coupled with impervious packaging not allowing the hot moist air to reach the seeds.
Doug Kerruish	TGG	

		• The humidity sensors are placed in the heat treatment chamber and not in the core of the fruit. The application of moist heat treatment is to heat the product without adding or removing any moisture from it. • These parameters have been developed for moist heat treatment and we do not need to measure the humidity of fruits as temperature is the only parameters considered effective against pests and diseases of these products. • I consider density is associated with the load factor and space between the boxes, etc. Accuracy of sensors is very important and I believe it is described in the calibration of sensors area. • Temperature mapping is mandatory and a treatment facility cannot be approved without submitting and auditing the temperature mapping records.	• I think we may separate Vapor Heat Treatment from Dry Heat Treatment and Hot Water Treatment as all the parameters with the exception of temperature for all these three heat treatments are different. • I consider dry heat treatment is more effective than moist heat treatment for seed devitalisation. Moist heat may result in the mould development and affect the quality of seed.
Rashid	TGG		
Aprida Cristin	Indonesia	Heat Treatment Methodology	
Aprida Cristin	Indonesia	General	
Aprida Cristin	Indonesia	Heat treatment providers found to be not complying with the requirements of this methodology and/or other specified treatment conditions with have their registration status changed to under investigation, or suspended ~~or terminated~~ depending on the non-compliance. Comments: What is the explantation of 'terminated' here? Categories under MB Schedule are acceptable, under supervision, suspended, and withdrawn (voluntarily).	
Aprida Cristin	Indonesia	1.3 Loading and free air space	
Aprida Cristin	Indonesia	1.3.2 The consignment must be loaded in the enclosure with separation between items to allow for effective circulation of hot air~~. The consignment must be loaded~~ and in a way that exposes the target of the heat treatment to the hot air.	
Aprida Cristin	Indonesia	1.4 Enclosure Suitability	
Aprida Cristin	Indonesia	1.4.2 Where a heat treatment is conducted in a sheeted enclosure, the heat treatment surface must be hard and flat. Comments: In regard to the heat treatment surface does it refer to floor surface?	
Aprida Cristin	Indonesia	1.4.3 Where a heat treatment is conducted in a chamber, the chamber must be:	
Aprida Cristin	Indonesia	• be constructed from rigid material on all sides, including the door	
Aprida Cristin	Indonesia	• be permanently sealed along all joins between the walls, roof and floor.	
Aprida Cristin	Indonesia	3.2 Temperature sensors requirements	
Aprida Cristin	Indonesia	3.2.2 Ambient sensors must be placed in the coldest ambient air space identified by temperature mapping.	
Aprida Cristin	Indonesia	3.2.3 ~~, or w~~Where temperature mapping has not been conducted, ambient sensors must be placed within the enclosure in a way that indicates that the free airspace temperature throughout the enclosure has been raised above the required treatment temperature for the required treatment period and~~. The free air space temperature~~ sensors must be placed away from the heat source so as to not to adversely affect their measurement readings.	
Aprida Cristin	Indonesia	3.2.4 For timber, grain, seed and perishable treatments, the core temperature of the target of heat treatment must be monitored and recorded.	
Aprida Cristin	Indonesia	3.2.5 For all other treatments, the temperature of the coldest surface of the target of heat treatment must be monitored and recorded.	
Aprida Cristin	Indonesia	3.2.6 The number of core or surface temperature sensors depends on the size of the enclosure. Enclosures smaller than 100m3 must have at least three core or surface temperature sensors. Enclosures greater than 100m3 but smaller than 500m3 require four core or surface sensors. An additional core or surface temperature sensor is required for every additional 500m3 or part thereof (Table 1).	
Aprida Cristin	Indonesia	Table 1 Number of temperature sensors required where core temperature requirements are specified.	
Aprida Cristin	Indonesia	Minimum ~~N~~number of free air space sensors	
Aprida Cristin	Indonesia	3.2.7 Core temperature sensors must be inserted into the core of the target of the heat treatment.	
Aprida Cristin	Indonesia	3.2.8 Where the target of heat treatment is not uniform in size, core temperature sensors must be inserted into the largest target of the heat treatment.	
Aprida Cristin	Indonesia	3.2.9 Where treating mixed consignments, at least one core temperature sensors must be inserted into each type of commodity.	
Aprida Cristin	Indonesia	3.2.10 Where inserting core temperature sensors will damage the commodity, substitutes of the same thickness and thermal properties may be used.	
Aprida Cristin	Indonesia	3.2.11 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 with heat resistant material • away from heat conductors such as metal nails and screws.	
Aprida Cristin	Indonesia	3.2.12 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.	
Aprida Cristin	Indonesia	3.2.13 Core and surface temperature sensors must be positioned to measure the temperature of the target of heat treatment as close as practicable to the coldest areas identified by temperature mapping, or where temperature mapping has not been conducted, throughout the enclosure in the areas expected to be the hardest to heat.	
Aprida Cristin	Indonesia	3.4 Monitoring readings	
Aprida Cristin	Indonesia	3.4.1 The temperature must be monitoried from the start of the heat application until the end of the treatment period. Comments: Does this mean from the start of warming up or from the start of the treatment period?	
Aprida Cristin	Indonesia	3.4.2 Temperature readings must be recorded at least once every 60 seconds. Comments: During treatment period or warming up?	
Aprida Cristin	Indonesia	4.1 Record of Heat treatment	
Aprida Cristin	Indonesia	4.1.3 All monitoring readings must be documented and included as an attachment to the Record of Heat Treatment.	
Aprida Cristin	Indonesia	4.1.4 The time, temperature and humidity (where relevant) of each reading must be documented and the location and identification of the sensor must be clearly stated.	
Aprida Cristin	Indonesia	4.1.5 All sections of the Record of Heat Treatment must be completed accurately.	
Aprida Cristin	Indonesia	4.1.6 The Record of Heat Treatment must be completed at the same time and location as the heat treatment.	
Aprida Cristin	Indonesia	Glossary	
Aprida Cristin	Indonesia	Formated the glossary in the table Definition Quarantine and Pre-Shipment.	
Bill Crowe	TGG	• In terms of the chamber loading I think it would be worth including guidance on the maximum loading (e.g. 80%). The location of the probes is critical as we worked out from the BMSB HT that the Italians were doing where they just placed the probes next to the heat source as I understand it. The probes need to be placed in the anticipated coldest spot in the consignment and we should have them record these locations via words (top back, middle middle, bottom front or core top middles etc) and/or with a drawing/schematic I reckon.	
Bill Crowe	TGG	• I think it would be worth spelling out in a specific sub-section in section 3 that the 'treatment commences when all required temperature sensors and humidity sensors (where required) have reached or are above the required temperature' or equivalent wording. I know it sort of says this in the section 3.6 when describing when the treatment ends, but it can't hurt to have it clear up front.	
Bill Crowe	TGG	• In terms of the example heat treatment certification (App 2), I can't see where they record the chamber size, number of probes used, position of the probes or the individual probe readings and times etc.?	
Bill Crowe	TGG	• Under 4.2.2, 'date and time the heat treatment was completed', I think it should be clearer and require the start and end times as well as the date. And for 'minimum temperature achieved during the exposure period', wouldn't we want them to specify the minimum temperatures of all probes used during the treatment period or alternatively attach the time vs temp graphs as an attachment?	
Ross Rickard	TGG	• 1.4 Enclosure suitability - (1.4.2) - getting a true airtight seal from the sheet to the hard flat surface can prove difficult. I understand this is up to the treatment provider to achieve but I would not expect an airtight seal with using sand snakes weighting the sheet to the hard surface, for example. It might be achievable with good gaffa-taping of the sheet to a clean hard surface but again, this might be difficult to achieve.	

Ross Rickard	TGG	• 1.4 Enclosure suitability - (1.4.3) - the same applies to air tightness of shipping containers. I am not sure if the definition of air tightness is technically the same as 'gas tightness' but I know has been done in the past showing that a resonably high percentage of shipping containers fail the gas tightness test. This is due to ill-aligned doors, bad or perishable door seals, holes in the floor and other samll gaps ect. See page 2 of this paper; https://www.researchgate.net/publication/240764887_Fumigation_of_Shipping_or_Freight_Containers
Ross Rickard	TGG	• Section 3.2.8 (temp sensors) - *'plugged behind the probe'* - we normally ask for the plugging to be done with heat resistant putty. • 3.3 - *Temperature sensors where the core temperature requirements are NOT specified*. Last year (in PK) we did have some very large crane pieces (each piece over 100 tonnes) which were heat treated but failed (*live stinkbugs found after the treatment*). Even though the treatment provider did use sensors and applied them to where they thought would be the coldest accessible surface of the target, they were wrong. Somewhere deeper into this complex crane, were pockets where the insects took refuge from the heat. The only answer that I can think of, to avoid a repeat, is that when large complex machinery or other goods are heat treatment, then plans / technical drawings of the equipment be provided to the heat treatment operator. These plans should then be studied and this may result in cover plate removal or some partial disassembly of the equipment, to allow full penetration of the hot air, to all parts of the equipment to achieve the minimum temperature.
Ross Rickard	TGG	• The only other point is (*and I am not sure if it is covered elsewhere*) should there be something in the methodology, stating that the goods need to be safeguarded / isolated to avoid re-infestation POST heat treatment?
Ross Rickard	TGG	• Most of the heat treatment set-ups that I have seen used diesel or LPG space heaters. These burn fuel and pump hot air into the enclosure. Therefore that system is not going to be compatible with an airtightness enclosure system as the hot air pumped in, needs to be exhausted somehow. Years ago I did see radiant heaters used under tarps (to help warm fruit to get the pulp temp to minimum temp)but I have never seen radiant heaters used to heat cargo. I believe the main reason, is that it would take too long to get the cargo up to temp (days/weeks).
Tully Francis	Compliance Partnerships	Humidity Sensors
Tully Francis	Compliance Partnerships	3.3.1 Where the treatment schedule requires the relative humidity of the ambient air inside the enclosurebe measured, the relative humidity must be measured by a minimum of one humidity sensor.
Tully Francis	Compliance Partnerships	Glossary
Tully Francis	Compliance Partnerships	Forced dry air A heat treatment method where hot air is forced into the enclosureto heat the consignment to the requirement treatment temperature. The humidity inside the enclosureis not monitored and loss of moisture from the goods will not result in adverse effects. This method is commonly used to treat wood packaging material.

Temperature Mapping Information

ISPM 15

NPPOs should ensure that treatment providers monitor the treatment temperature at a location likely to be the coldest, which will be the location taking the longest time to reach the target temperature in the wood, to ensure that the target temperature is maintained for the duration of treatment throughout the batch of wood being treated. The point at which a piece of wood is the coldest may vary depending on the energy source or process applied, the moisture content and the initial temperature distribution in the wood.

The coldest location within the chamber is identified for each load and temperature sensors are placed there, either in the wood or in the chamber.

ISPM 15 Explanatory Document

The most practical and measurable way to determine whether the phytosanitary standard has been achieved in a heat treatment process is to employ multiple temperature sensors placed in the core of representative pieces of wood located in predetermined areas of the treatment chamber known to be the coolest. These areas are referred to as the cold spot. This will ensure that even pieces of wood heating at the slowest rate within the wood stack have been appropriately heat treated. The orientation and configuration of wood in the wood stack will also influence the location and size of the coolest parts of the heat chamber.

In most cases, the heat treatment of wood is a consistent process relying on wood that is of the same size, thickness, species, and so on, and occupying the same volume of the chamber from one treatment to another. Schedules therefore may be based on trials of wood with specific characteristics, or the use of a temperature sensor or several sensors placed in the piece of wood in those parts of the heat chamber predetermined to take the longest time to reach the required temperature (i.e. the cold spot).

cold spot - An area of a heat chamber where wood undergoing treatment is the slowest to achieve a desired temperature, as demonstrated by monitoring the temperature at various points throughout the wood stack.

Figure 2: A type of heat chamber with the heating pipes in the middle. Temperature sensors should be placed at a location where the air exits the wood stack and is therefore likely to be the coolest. This is dependent on fan installation in a common direction p 22.

The heat chamber may use baffles to control air flows through the wood stack. Baffles are generally pieces of canvas, metal or wood used to regulate or deflect air flows within the chamber.

ISPM 42

4.1 Temperature mapping

4.1 Temperature mapping Temperature mapping should be conducted by the NPPO or an authorized entity (person or organization) of the country in which the treatment is initiated or conducted. The NPPO should ensure that the temperature mapping follows the approved procedures and is appropriate for: - the packaging type - the arrangement and density of the commodity within the packaging - the load configuration to be used in the treatment facility - the type of treatment facility.

Temperature mapping studies should be conducted to characterize the temperature distribution within the temperature treatment facility and the commodity (in relation to the volume and

arrangement of the commodity). Such information is used to identify where the temperature monitoring and recording devices should be placed during the application of a temperature treatment using the same facility and commodity configuration. Temperature mapping is not required for each consignment, as it is designed for each facility. Temperature mapping may rely on historical use of treatments for information on the configuration, arrangement and density of a facility or commodity. In other cases, based on recognized research, the positions of the sensors may be fixed. Temperature mapping may also be conducted regularly to check possible changes of temperature distribution over time. Independent temperature mapping for a partially filled treatment facility is required to determine whether the temperature distribution is significantly different from a filled facility and therefore whether the treatment needs to be adjusted accordingly.

Temperature mapping should be carried out following modifications or adjustments in equipment or processes that affect attainment of the required temperature for the treatment. Mapping should also be carried out following changes in packaging or pack configuration.

NSPM 20 – India Vapour Heat Treatment – Fresh fruits and vegetables against fruit flies

2.3.3. Conduct of an actual test treatment

The inspecting officer/expert will insert the numbered portable and permanent sensors into the pulp of fruits for carrying out actual test treatment. The portable sensors should be placed especially in the load at the sites, where the coolest spots are most likely to occur.

USDA Heat treatment

- **Steam Pressure sterilization**

For closely packed material, measures are put in place to ensure heat penetration. Eg Baled rice straw is to have a density of less than 30 pounds per cubic foot – higher densities are too slow.

- **Vapour Heat and Forced air treatment – Loading**

These requirements may specify that containers with larger fruit must be located in the colder areas of the stack, or certain layers of containers are left empty when partial loads are treated.

- **Irradiation**

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 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.

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 temperatures represent colder areas of the chamber.

NOTICE

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 a 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 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.

Thermal Mapping

Thermal mapping determines the placement of sensors in the chamber. Because the 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 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. The thermal mapping 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. The fruits selected for the test must be similar in size, ripeness, and variety. Sort the fruit and select a subset totaling the number of sensors plus 20 percent. The difference between the heaviest and lightest fruit must not be more than 5 percent or higher (at the discretion of the certifying official) of the heaviest fruit's weight.
3. Place one sensor in each of the largest fruit collected. Place the most sensitive portion of the sensor 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 sensors in the areas thought to be cold regions. In order to verify the hypothesis, place a portion of the sensors in the areas thought to be warmer.

If no hypotheses were formed in #1 above, sensors **must** be placed in a systematic pattern that can provide a complete thermal map of the entire load.

NOTICE
Each chamber may require a different number of 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.

5. Create a map of the chamber that shows the relative horizontal and vertical location of each sensor.
6. Conduct the treatment.
7. Remove the sensors and read their data.
8. Determine the amount of time each sensor took to reach treatment temperature. The sensors which required the longest time to reach treatment temperature indicate cold spots.

NOTICE
All 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 for each load/volume configuration to ensure that correct and consistent cold spots are found. Results from the two consecutive tests must be similar.
11. Based on the conclusion of two consecutive tests, create a map showing the location of each permanent temperature sensor for each load/volume configuration.

NOTICE
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 A facility cannot perform a commercial treatment between recertification tests.

APPPC RSPM 1

4.2.2 Determination of a heat disinfestation treatment

It is necessary to demonstrate that the treatment unit has adequate heating, cooling, insulation, humidity and thermostat controls. In the case of Vapour Heat Treatment and High Temperature Forced Air units, the coolest points should be determined based on a temperature map of the inside of the unit. Heat sensors should be located at these points and placed in the largest fruit in the treatment batch. The rate of heating and cooling should be accurately recorded with measurements taken at appropriate pre-determined intervals (e.g. every 2 minutes).

NSPM 20 VHT

2.3.3. Conduct of an actual test treatment

The inspecting officer/expert will insert the numbered portable and permanent sensors into the pulp of fruits for carrying out actual test treatment. The portable sensors should be placed especially in the load at the sites, where the coolest spots are most likely to occur.

. The inspecting officer/expert will draw a three-dimensional diagram showing where each numbered sensor has been placed. The operator should place the fruits into the VHT chamber, close the door, turn on the heat generator and start the automatic temperature recorder. The inspecting officer/expert must take readings on the portable sensors at least once every 5 minutes. He should note the ram up time i.e, time taken to reach the chamber temperature around 50-52 0C and the pulp temperature of 46-48 0C. The exposure period starts when all the pul sensors indicate the required treatment temperature and then holds it for the minimum amount of time required by the particular treatment schedule. He should review all temperature records from the portable as well as permanent sensors and record in format prescribed in Appendix-VII and recordings of pulp sensors (Appendix-VIII). One successful test is required, for certification or recertification. At the end the inspecting officer/expert will submit a official performance test report (Appendix-IX) along with his comments and recommendation for certification.

COLD TEMPERATURE MAPPING

USDA – Cold treatment

Placement of temp sensors – 3-7-17

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 consignment 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). If necessary (in the case of small fruit), the sensor should penetrate multiple fruit (Figure 3-7-2). The number and location of the temperature sensors are determined during warehouse certification. (Table 3-7-1)

Table 3-7-1 Number of Sensors in a Warehouse

Cubic Feet	Cubic Meters	Number of Pallets	Number of Air Sensors	Number of Pulp Sensors	Total Number of Sensors
0 - 10,000	0 - 283	1 - 100	1	2	3
10,001 - 20,000	284 - 566	101 - 200	1	3	4
20,001 - 30,000	567 - 849	201 - 300	1	4	5
30,001 - 40,000	850 - 1132	301 - 400	1	5	6
40,001 - 50,000	1133 - 1415	401 - 500	1	6	7
50,001 - 60,000	1416 - 1698	501 - 600	1	7	8
60,001 - 70,000	1699 - 1981	601 - 700	1	8	9
70,001 - 80,000	1982 - 2264	701 - 800	1	9	10
80,001 - 90,000	2265 - 2547	801 - 900	1	10	11
90,001 - 100,000	2548 - 2830	901 - 1000	1	11	12
Over 100,000	> 2830	1000+	**Must** be approved by CPHST-TMT		

Cold Treatment Methodology

3.6 Placement of temperature sensors

3.6.1 Sensors must be placed by a suitable trained individual. Supervision by the responsible certifying authority or their representative may be required.

Onshore cold treatment in cool rooms

3.6.2 Sensors must be placed as follows for onshore cold treatment:

- two airflow sensors at the inlet (return air) and the outlet (supply air) points of cold air, to measure chamber temperature, and
- four product sensors
    - the centre of the stack in the warmest part of the treatment chamber
    - the corner of the top stack in the warmest part of the treatment chamber
    - further sensors will be placed in different areas in the treatment chamber where temperature or airflow may be impacted and placed from midway to the top height of the stack.

In transit cold treatment and onshore cold treatment in containers

3.6.3 Three sensors must be placed as follows for in transit cold treatment:

- the top of the stack nearest to the air return intake
- slight aft (towards the doors) of the middle of the container, halfway between the top and bottom of the stack
- one pallet stack in from the doors of the container, halfway between the top and bottom of the stack.

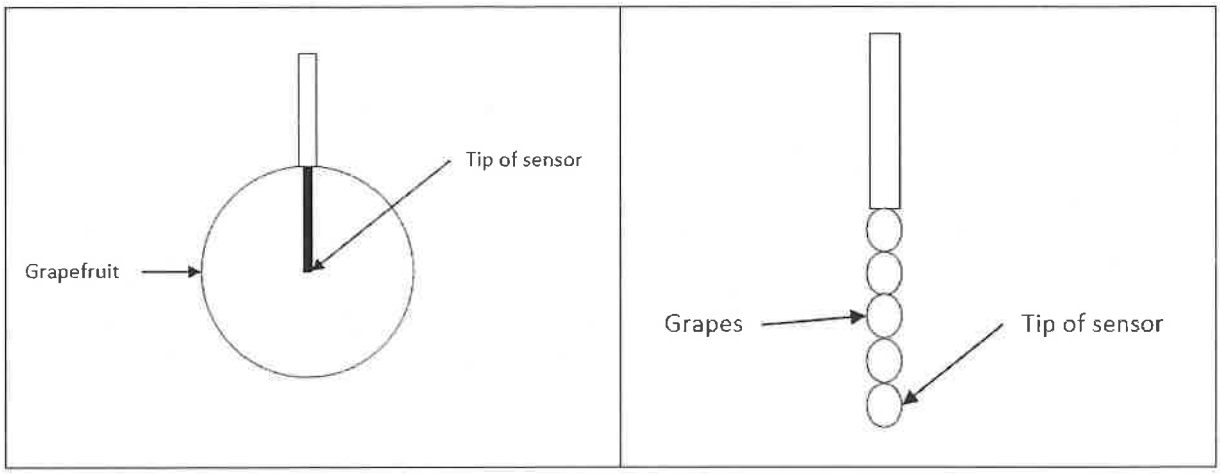
3.6.4 In all cases, a diagram showing the location and identification of each sensor must be available.

3.6.5 Product sensors must be inserted into the product so as much of the sensor as possible is covered, making sure that the tip does not extend beyond the product.

3.6.6 Where the size of the product varies, the temperature sensors must be placed into the largest size product.

3.6.7 A coil of slack cable must be spooled either inside the carton or taped to the outside of the carton to mitigate against sensor dislodgement during treatment. The cable must also be secured to the carton to prevent the sensor being pulled out of the product. This does not apply where stand-alone data loggers have been used.

Figure 1 Correct placement of sensors for large and small product



Irradiation Treatment Standard

Dose mapping

Prior to treatment, the *load configuration* must be dose mapped to determine the lowest and highest dose absorbance points for each treatment configuration, taking into account absorbance variation arising from the goods and its packaging.

Dose mapping must be conducted as part of the following activities:

- *OQ*
- *PQ*

3.1.3 The *OQ* must be used for *load configuration* when *dose mapping* of a specific type of good/s is not practical or possible.

Dose mapping must:

- characterise the dose distribution throughout a process load
- determine the optimal load pattern, exposure time to source radiation and transit speed ensuring that the treatment consistently delivers the required dose for each specific goods/packaging configuration
- ensure that the required dose is delivered and where applicable the prescribed efficacy for the target biosecurity risk is achieved.

Dose mapping must be conducted at least three times per *load configuration* to determine the *minimum* and/or *maximum absorbed doses* for the goods and *load configuration*.

The data obtained from *dose mapping* will determine the required number and placement of *dosimeters* during routine operations, including positioning of *reference dosimeters*.

The results of the *OQ* must be used where the *dose mapping* of the goods is not practical or unable to be replicated.

Where treatment of the consignment is not able to be replicated dosimeter placement must be in accordance with the *minimum* and/or *maximum absorbed dosage* point/s identified through the *OQ*.

The following goods and packaging variation factors must be taken into account when *dose mapping* to ensure the ionising radiation penetrates to all parts of a three-dimensional load:

- goods/material density and composition
- orientation, stacking and volume
- package shape, composition and/or size.

Where sufficient goods are not available for *dose mapping*, other types of goods which display the same characteristics of the target material such as density and packing configuration can be used.

Dose mapping must be repeated whenever changes are made, either in the facility, in its operation or to the *loading configuration* including to the goods, packaging or arrangement of goods within the packaging.

Gamma irradiators

The relationship between the source activity, timer setting, conveyor speed and dose must be established and documented for each *loading configuration* taking into account uncertainties and source decay.

The effect of *dose distribution* when goods of different densities are present in the gamma *irradiator* shall be determined to define goods that can be processed together.

Dose mapping for incomplete (partially filled) *process loads* is required to determine if the *dose distribution* is significantly different from the routine load and to adjust the treatment accordingly.

Dose mapping for the first and last *process loads* is required to determine if the *dose distribution* is significantly different from the routine load and to adjust the treatment accordingly.

Electron beam and x-ray irradiators

The relationship between the beam characteristics (including beam scan width), the conveyor speed and the dose must be established for each *loading configuration*, taking into account uncertainties.

Dose mapping must be carried out at the electron beam energy used for goods *irradiation*.

Where more than one energy is used, *dose mapping* must be carried out for each energy.

Where more than one scan width is used, *dose mapping* must be carried out using selected scan widths to cover the operational limits to be used in the *irradiation* of the goods.

Note: Different types of *dosimeters* can be used for *dose mapping* and routine dosimetry. For phytosanitary applications reference should be made to ATSM F1355-06.

ISPM 18 – Irradiation

4.2 Dose mapping Dose mapping studies should be conducted to fully characterize the dose distribution within the irradiation chambers and commodity, and demonstrate that the treatment consistently meets the prescribed requirements under defined and controlled conditions. Dose mapping should be done in accordance with documented standard operating procedures. The information from the dose mapping studies is used in the selection of locations for dosimeters during routine processing.

Independent dose mapping for incomplete (partially filled) as well as first and last process loads is required to determine if the absorbed-dose distribution is significantly different from a routine load and to adjust the treatment accordingly.

4.3 Routine dosimetry An accurate measurement of absorbed dose in a consignment is critical for determining and monitoring efficacy and is part of the verification process. The required number, location and frequency of these measurements should be prescribed based on the specific equipment, processes, commodities, relevant standards and phytosanitary requirements.

Draft ISPM 8 - *the use of modified atmosphere treatments as phytosanitary measures*

If the modified atmosphere treatment is used together with the temperature, the temperature of the commodity and the atmosphere within the enclosure should be measured and monitored to ensure that the required temperature is reached.

Temperature mapping of the enclosure may be necessary to identify temperature variation under normal operating conditions (e.g. as regards loads and packaging) to determine the best locations for placing temperature sensors. Temperature sensors/probes must be calibrated regularly and have reliability and accuracy within an acceptable range.

Cold refrigeration

Data-loggers and/or their sensors should be placed as shown in Figure A1.1. The minimum recording requirements for qualification testing are:

- Outside ambient temperatures around the external surfaces;
- Air delivery of the refrigeration unit;
- Air return of the refrigeration unit;
- Product close to the delivery air of the refrigeration unit;
- Product in any areas likely to be deprived of airflow;
- Product close to the walls;
- Product close to the door.

World health organisation – temperature mapping cold refrigerators

http://www.wvssm-demo.com/download/Temperature_Mapping_Guide_EN.pdf

The temperature mapping process

Temperature mapping consists of several key steps:

1. Deciding when to perform temperature mapping;
2. Placing an appropriate number of sensors in different areas, particularly areas that might go above or below specified safe temperature ranges. Generally, 20 sensors are used to temperature map a medium-sized cold storage unit, with an additional sensor to measure the ambient temperature. Temperatures are recorded at a specified regular interval, continuously, for a period of at least 48 hours;
3. Reading and transferring recoded temperatures (minimum, maximum, mean and mean kinetic5) to a three-dimensional sketch of the storage vessel (cold- and freezer-rooms, dry storage areas and equipment, such as refrigerators and freezers) to be temperature mapped;

4. Identifying areas where vaccines and thermo-sensitive pharmaceutical products should not be stored; and,
5. Taking action to reduce the exposure of vaccines and pharmaceuticals to incorrect temperatures.

Controlled Temperature Chamber Mapping – Pharmaceuticals

Determining the Number and Locations for the Mapping Sensors

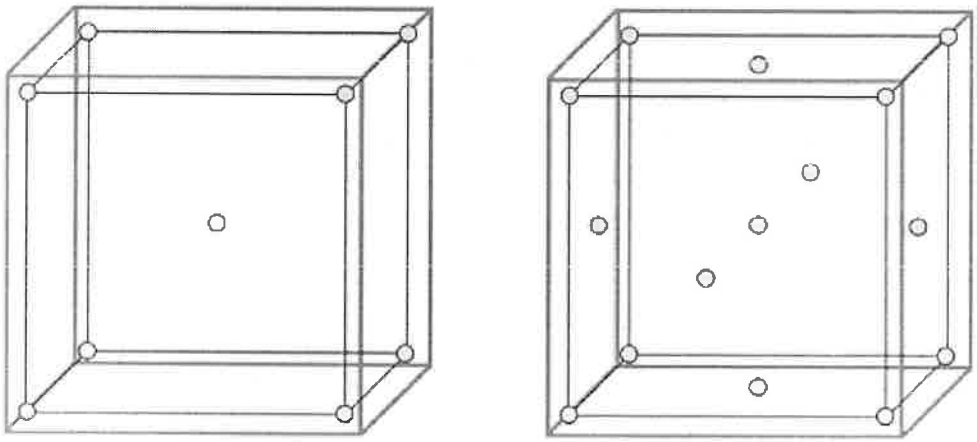
Although there is little guidance on the mapping of controlled temperature chambers, the following may provide useful information:

- The French Standard (NF X15-140 October 2002 Measurement of Air Moisture – Climatic and Thermostatic Chambers – Characterization and Verification) provides some information that is useful to consider when determining the number and location of sensors, see Figure 4.1 [6].
- The German Standard DIN 12880 Electrical Laboratory Devices – Heating Ovens and Incubators [7]
- The Australian Standard AS2853-1986: Enclosures – Temperature Controlled – Performance Testing and Grading [8].
- IEC 60068 Environmental Testing Parts 3-5, 3-6, 3-7, and 3-11 [9]

The diagram on the left of Figure 4.1 shows the suggested minimum number of mapping sensor locations to be used for a system with a chamber volume up to approximately 70 cubic feet, (2 m^3).

The diagram on the right of Figure 4.1 shows the minimum number of mapping sensor locations suggested by the French standard to be used for a system with a chamber volume of up to 700 cubic feet (20 m^3).

Figure 4.1: Example Sensor Locations



Note: the inner box represents the working area (where product is stored), the circles represent the sensor locations.

The sensor locations used for mapping should be defined based on:

- Where product will be stored
- The potential major influences on the internal conditions during use
- The number and location of heating/cooling units

There should be a scientifically based rationale developed for the number and location of the sensors; however, there are some basic requirements:

- For a warehouse, data should be available on the external conditions, this data may come from another source, e.g., the BMS/BAS (not the mapping system).
- For a conditioned room within a facility, e.g., a cold room, there should be data on the conditions at the time of testing outside the store, to ensure that any open door tests are representative of normal operating conditions. The data could be provided by the BMS/BAS system or a sensor included in the mapping system.

Where appropriate there should be a mapping sensor adjacent to the system control sensor (this may not be practical if the control is from a number of sensors that are being used to calculate an average temperature).

When defining the number of sensors and the locations, factors to consider include:

- The mapping sensor locations should be increased as necessary to monitor areas where changes in the conditions are likely to be found during use, e.g., conditions for product located near a conditioned air discharge.
- Where there are multiple air conditioning units or HVAC outlets which operate consistently, the area treated by each unit may be treated as a zone, with the mapping sensor layout developed to suit those zones.
- An area may be laid out so that it can be divided into zones that will perform similarly, e.g., there may be end zones, and internal zones. Temperature mapping a representative zone may provide adequate data.

A rationale that describes the location and number of sensors to be used should be developed. This should be reviewed and approved by the Quality Unit and the area/system owner.

Load Testing

When defining how the unit will be tested, the following should be considered:

- Is the area used to condition the stored material, or does it arrive within the specified conditions?
- What is the worst case condition:
    - An empty store with the maximum specified load arriving at the most extreme conditions permitted?
    - A store with the maximum load – this may be considered in terms of the thermal mass or maximum size load providing maximum restrictions to airflow?
- What will be the worst case conditions in use:
    - Doors held open for the maximum specified time in extreme environmental conditions?

The area/system owner may also want to use this opportunity to test system performance with simulated failures to provide data that may be useful to defend continued use of the system during operation with an equipment failure.

Australian Government
Department of Agriculture and Water Resources

Australian phytosanitary treatment application standard for irradiation treatment

Version 1.0

Cataloguing data

This publication (and any material sourced from it) should be attributed as: Department of Agriculture and water resources, 2018, *Australian phytosanitary treatment application standard for irradiation treatment*, Canberra, September. CC BY 4.0.

This publication is available at http://agriculture.gov.au/export/controlled-goods/plants-plant-products/plantexportsmanual.

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Contents

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
- reach the required efficacy every time they are applied.

This treatment application standard applies to the use of irradiation as a phytosanitary measure for imported product as well as exported and domestically traded product.

Irradiation is the treatment of product with ionising radiation by either gamma rays, electrons or x-rays. During irradiation, energy is transferred from a source of ionising radiation into the product. The amount of ionising energy absorbed is termed 'absorbed dose' or 'dose' and is measured in Grays (Gy). Its use as a phytosanitary treatment is pest specific. Unlike other treatments, irradiation is effective even if the pest remains alive as it prevents successful development of larvae and causes sterility in adults. Consequently the pest specific dosage is based on sterility rather than the rates required for mortality when using treatments such as fumigation and temperature based treatments.

Irradiation is used as an effective disinfestation treatment for a range of arthropod pests and is particularly effective on internal pests such as fruit flies.

The use of irradiation is subject to regulation by multiple agencies. In addition there are a number of international standards and best practice guides which govern how the treatment is applied. Building and safety requirements are regulated in Australia by the Australian Radiation Protection and Nuclear Safety Authority (ARPANSA), and Food Standards Australia and New Zealand (FSANZ) approves the use of irradiation on food. A list of current FSANZ approved products for irradiation are at www.foodstandards.gov.au. Product not approved for irradiation by FSANZ may be treated for export, to importing country specifications, but must not be sold within Australia for domestic human consumption.

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

1.1 Scope

This standard provides guidance on the effective application of irradiation as a phytosanitary measure for regulated pests on plant products for human consumption.

This standard is the baseline for the application of irradiation in trade with and within Australia. Additional requirements may apply to trade with some countries.

The following is out of scope:

- specific import requirements

- dose rates for specific pests
- operational instructions including requirements for facility registration, certification, approval of arrangements, etc.
- building and safety requirements
- work health and safety requirements
- food safety regulations.

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.

The application of this standard does not exempt compliance with other current and applicable state and federal regulations.

2 Requirements

2.1 Treatment facility

2.1.1 Treatment facilities must be approved by the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) or for off-shore irradiation facilities, the relevant equivalent body recognised by the International Atomic Energy Agency (IAEA).

2.1.2 The treatment facility must:

- be clean and pest free
- provide segregated areas (for example, physical barrier, fence, wall) for handling treated and non-treated products to prevent cross contamination and post treatment reinfestation
- have documented systems for all procedures related to the treatment and handling of product
- have documented systems for traceability (must allow for the identification of product at each step in their path through the facility).

2.2 Personnel

2.2.1 The irradiator operator must be able to competently demonstrate their capability to conduct irradiation treatments. Personnel performing tasks that could impact the effectiveness of the treatment must be competent on the basis of appropriate education, training, skills and experience.

2.3 Irradiator specifications

2.3.1 The irradiator must be capable of providing doses within the specified limits for phytosanitary treatments.

2.3.2 The radiation source must be either:

- gamma irradiation from Cobalt 60 (^{60}Co); or
- accelerated electrons (forming electron beams) with a maximum energy of 10MeV; or
- x-rays with a maximum energy of 5MeV.

2.3.3 The irradiator and it's method of operation must be documented. The following must be described:

- the location of the irradiator within the facility
- means provided for the segregation of non-irradiated and irradiated product
- construction and operation of any associated conveyor system
- conveyor path(s) and the range of conveyor speed
- dimensions, materials and construction of the irradiator container(s)
- manner of operating and maintaining the irradiator and any associated conveyor system.

2.3.4 Software used to control and/or monitor the process must meet the design intentions (for example, as documented by the software provider).

2.4 Radiation source specifications

Gamma irradiators

2.4.1 The type of radiation and radiation source must be documented.

2.4.2 The following specification must be documented:

- type of radionuclide, its activity and source geometry
- means of indicating the position of the gamma source
- means of automatically returning the gamma source to the storage position and automatically ceasing conveyor movement if the process control timer or the conveyor system fails
- means of returning the gamma source to the storage position, and automatically ceasing conveyor movement or identifying affected products if the gamma source is not in its intended position.

Electron beam (eBeam) and x-ray irradiators

2.4.3 The energy of radiation must be documented.

2.4.4 The following specifications must be documented:

- the characteristics of the beam (electron or x-ray energy and, where applicable, average beam current, dose rate, scan width and scan uniformity)
- for x-ray irradiators, the dimensions, materials and construction of the x-ray converter
- the means of indicating that the beam and the conveyor system are operating
- the means of ceasing irradiation if any failure of the conveyor occurs which affects the dose and product requirements
- the means of ceasing conveyor movement or identifying affected product if any fault in the beam occurs.

2.5 Process specifications

2.5.1 For each product treated the process specifications must be documented. These specifications must include:

- description of packaged product, including dimensions, density and orientation of product within the package and acceptable variations
- loading configuration of product within the irradiation container
- irradiator operating conditions and limits (for example, beam characteristics, conveyor speed and source configuration)
- conveyor path(s) to be used
- minimum and maximum doses
- routine dosimeter monitoring position(s)

- relationship between the dose at the monitoring position(s) and the minimum and maximum doses.

2.5.2 If the product is to be given multiple exposures, process specifications must include any special requirements needed between exposures (for example, change of level within the carrier or time restrictions).

2.5.3 If the product has specific handling and storage conditions requirements (for example, temperature and humidity conditions) these must be documented in the process specifications.

2.6 Dosimetry system

2.6.1 Dosimeters (used in accordance with manufacturer's specifications) must be appropriate for the treatment conditions (such as temperature and humidity in the treatment chamber).

2.6.2 Dosimeters must be capable of recording and measuring the entire range of dosages likely to be received by the product.

2.6.3 Dosimeters must be appropriate for the treatment, taking into consideration radiation type, effect of influence quantity, required level of uncertainty and required spacial resolution (see ISO ASTM 51261, ISO ASTM 51707:2005).

2.6.4 Dosimeters must be placed correctly, as per the process specifications, to ensure the specified doses are received by the product.

2.6.5 Dosimeters must be stored according to manufacturer's specifications to negate the effects of variables such as light, temperature, humidity, storage time, and the type and timing of analyses required.

2.6.6 All components of the dosimetry process must be calibrated. The calibrations must be traceable to national or international standards.

2.7 Validation

Installation qualification (IQ)

2.7.1 Installation qualification must be performed when a new irradiation facility is being commissioned. It verifies that the irradiation facility meets its installation requirements. Validation of information generated during IQ is not usually performed by the responsible certifying authority under this standard.

2.7.2 Records must be kept of IQ.

Operational qualification (OQ)

2.7.3 Operational qualification must be performed when a new irradiation facility is commissioned. It verifies the irradiation facility operates to its design specifications. Validation of information generated during OQ is not usually performed by the responsible certifying authority under this standard.

2.7.4 Records must be kept of OQ.

Performance qualification (PQ)

2.7.5 Performance qualification must be performed when a new irradiation facility is commissioned. It verifies the irradiation facility will consistently deliver the required process to a given loading configuration within predetermined tolerances. Information generated during PQ must be reviewed by the responsible certifying authority and the outcome of the review must be recorded.

2.7.6 Dose mapping must occur during PQ.

2.7.7 Records must be kept of PQ.

3 Procedures

3.1 Dosimetry application

3.1.1 Dosimetry must be performed to ensure the specified doses are received by the product and maximum doses are not exceeded.

3.2 Dose mapping

3.2.1 Prior to the initial routine treatment, the product load configuration must be dose mapped to determine the lowest and highest dose absorbance points for each treatment configuration, taking into account absorbance variation arising from the product and its packaging.

3.2.2 Dose mapping studies are required:

- to characterise the dose distribution throughout a process load
- to determine the optimal load pattern, exposure time to source radiation, transit speed, ensuring that the treatment consistently delivers the required dose for each specific product/packaging configuration
- to ensure that the prescribed efficacy for the target pest is achieved.

3.2.3 Dose mapping must be conducted at least three times per load configuration to determine the maximum and minimum doses for that product and load configuration.

3.2.4 The data obtained from dose mapping will determine the required number and placement of dosimeters during routine operations, including positioning of reference dosimeters.

3.2.5 The following product and packaging variation factors must be taken into account when dose mapping to ensure the ionising radiation penetrates to all parts of a three-dimensional load:

- product density and composition
- orientation, stacking and volume
- package shape, composition and/or size.

3.2.6 Configurations used for phytosanitary treatments may require approval by the responsible certifying authority.

3.2.7 As seasonality may impact on whether sufficient product is available for dose mapping, other types of product which display the same characteristics of the target product such as density and packing configuration can be used. Where required, this must be approved by the responsible certifying authority.

3.2.8 Dose mapping records must include:

- description of the irradiation container
- product loading configuration
- conveyor path
- irradiator operating conditions
- dosimeter locations and measurements

- conclusions drawn.

3.2.9 Dose mapping must be repeated whenever changes are made, either in the facility, in its operation or to the loading configuration including to the product, packaging or arrangement of product within the packaging.

Gamma irradiators

3.2.10 The relationship between the source activity, timer setting, conveyor speed and dose must be established and documented for each loading configuration taking into account uncertainties and source decay.

3.2.11 The effect of dose distribution when product of different densities are present in the gamma irradiator shall be determined to define products that can be processed together.

3.2.12 Dose mapping for incomplete (partially filled) process loads is required to determine if the absorbed dose distribution is significantly different from the routine load and to adjust the treatment accordingly.

3.2.13 Dose mapping for the first and last process loads is required to determine if the absorbed dose distribution is significantly different from the routine load and to adjust the treatment accordingly.

Electron beam and x-ray irradiators

3.2.14 The relationship between the beam characteristics, the conveyor speed and the dose must be established for each loading configuration taking into account uncertainties.

Note: Different types of dosimeters can be used for dose mapping and routine dosimetry. For phytosanitary applications reference should be made to ATSM F1355-06.

3.3 Routine dosimetry

3.3.1 Dosimeter(s) must be placed in the process load at the predetermined maximum and minimum dose positions, or at a qualified reference dose location.

3.3.2 If the locations of the dose extremes identified during the dose mapping procedure are not readily accessible during routine processing, alternative positions may be used for routine dose monitoring. The relationships between the doses at these alternative reference positions and the maximum and minimum doses shall be reproducible, established and documented.

3.3.3 The frequency of dosimeter placement in the process load should be sufficient to verify the process is in control. For example, a placement frequency ensuring there is at least one dosimeter in the irradiator at any given moment, with at least one dosimeter on the first and last irradiation containers of each process load. The frequency and its rationale must be documented.

3.4 Routine monitoring and control

3.4.1 Prior to the irradiation process, any specific periodic tests, calibrations, maintenance tasks and necessary requalification should be performed and outcomes recorded.

3.4.2 Procedures for product handling and maintaining product integrity before, during and after irradiation must be documented.

3.4.3 Process parameters (for example, irradiation time, conveyor speed, product loading configuration) must be set, controlled, monitored and documented, taking into account uncertainty in routine dosimetry, to ensure that the product in each process load is processed within specifications.

3.4.4 If process parameters deviate outside prescribed processing limits appropriate actions must be taken. The responsible certifying authority will determine the reporting requirements for deviations outside prescribed processing limits.

3.5 Process interruptions

3.5.1 If a process interruption occurs it must be recorded and appropriate action must be taken. The responsible certifying authority will determine the reporting requirements for process interruptions.

3.6 Process loads

3.6.1 Product must be loaded in the product loading configuration according to the process specification. Products must be presented for processing in the same configuration used for dose mapping.

3.7 Equipment calibration

3.7.1 Documented procedures must be established for implementing and recording calibration and control systems.

3.7.2 All systems should be periodically checked to ensure that they are functioning according to specifications. The calibrations must be traceable to national or international standards.

3.7.3 Instrumentation used to control, indicate or record the irradiation process must be recalibrated at intervals determined by the manufacturer's instructions.

3.7.4 Following any modification or servicing of the instruments they must be recalibrated.

3.8 Equipment maintenance

3.8.1 Documented procedures must be established for all equipment maintenance. All maintenance undertaken must be documented.

3.8.2 Procedures and records must be reviewed at least annually. The results of the review must be documented.

3.8.3 Equipment must not be used to treat product until all specified maintenance tasks have been satisfactorily completed and recorded.

4 Verification of treatment

4.1 Determining efficacy of treatment

4.1.1 The efficacy of the treatment must be verified by dosimetry which confirms the treatment is within the treatment parameters.

4.1.2 Documented systems must be established for reading the dosimeters after irradiation and determining a treatment result. Procedures must take into account the uncertainties of the measurement system.

4.1.3 Immediately following each treatment, the reference dosimeter(s) must be collected by the irradiator operator and analysed to determine what dose has been applied to the product.

4.1.4 Responsible certifying authorities will determine the frequency of auditing of the treatment facility.

Note: Radiation sensitive indicators cannot be used as proof of satisfactory radiation processing or as the sole means of differentiating irradiated products from non-irradiated products.

4.2 Treatment failure

4.2.1 The treatment is deemed to have failed if:

- the minimum dose is not achieved
- the maximum dose is exceeded.

4.2.2 Documented systems must be established for the management of failed treatments including:

- control of product
- procedures for identification of the cause of the failure
- identification of corrective actions
- records of corrections or preventative actions taken.

4.2.3 The responsible certifying authority may require notification when treatments fail.

Note: The phytosanitary dose rates are not always fatal for the target pest, the detection of live insects in irradiated product does not indicate a treatment failure.

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 body 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 practices 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 kept in secure conditions to prevent infestation by regulated pests when stored at the treatment facility.

5.1.5 The responsible certifying body will determine when treated product is required to be kept in secure conditions to prevent infestation by regulated pests when transported from the treatment facility.

5.1.6 After treatment, all product must be identified as 'treated' for identification and traceability purposes.

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
- maintenance procedures
- dosimetry 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 irradiation treatment including:
  - treatment certificates
  - dose mapping
  - maintenance records
- internal verification records
- any additional records required by the responsible certifying authority or importing authority.

6.2.2 Treatment certificates must accompany all product treated by the irradiator operator. All details must be:

- legible
- free from erasures and non-certified alterations
- in English.

6.2.3 Treatment certificates must be signed, dated and contain the following details:

- description of the commodities including quantity and distinguishing numbers such as irradiation lot number, specification number or a reference to load configuration
- radiation source, and energy level for electron beam and x-ray
- date of treatment
- name of treatment facility
- minimum and maximum doses (specified and actual)
- consignment owner
- any deviation from the treatment specification.

6.2.4 All records must be retained from a minimum of two years, unless otherwise specified by responsible certifying authority, importing authority or other regulations.

Glossary

Absorbed dose	Quantity of radiating energy absorbed per unit of mass of a specified target. [Note, for the purposes of this Standard, the term dose is used to mean absorbed dose and the unit of absorbed dose is the gray (Gy) where 1 Gy is equivalent to the absorption of 1 joule per kilogram]. [ISO 11137-1:2006]
Calibration	Set of operations that establish, under specified conditions, the relationship between values of a quantity indicated by a measuring instrument or measuring system, or values represented by a material measure or a reference material, and the corresponding values realized by standards. [ISO 11137-1:2006]
Correction	Action to eliminate a detected non-conformity. A correction can be made in conjunction with a corrective action. [ISO 9000:2005]
Corrective action	Action to eliminate the cause of a non-conformity or other undesirable situation. There can be more than one cause of non-conformity. Corrective action is taken to prevent recurrence whereas preventive action is taken to prevent occurrence. (There is a distinction between correction and corrective action). [ISO 9000:2005]
Dose	The term refers to absorbed dose.
Dose distribution	Spatial variation of absorbed dose throughout the process load, integrated over a complete treatment. The extreme values are the maximum dose (Dmax) and the minimum dose (Dmin).
Dose mapping	Measurement of dose distribution and variability in material irradiated under defined conditions. [ISO 11137-1:2006]
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 18 2003]
Dosimetry	Measurement of absorbed dose by the use of dosimeters. [ISO 11137-1:2006]
Dosimetry system	The procedures and interrelated elements used for determining absorbed dose, including dosimeters, instruments and associated reference standards. [ISO 11137-3:2006]

Import requirements	Specific phytosanitary measures prescribed by an importing authority, concerning consignments moving into that territory.
Installation qualification (IQ)	Obtaining and documenting evidence that equipment has been provided and installed in accordance with its specification. [ISO 11137-1:2006]
Irradiation	Treatment with any type of ionising radiation. [ISPM 5]
Irradiation container	Holder in which product is transported through the irradiator. The holder can be a carrier, cart, tray, product carton, pallet, tote or other container. [ISO 11137-1:2006]
Irradiator	The assembly of equipment and its housing where product is exposed to ionizing radiation. The irradiator provides for safe and reliable radiation processing and includes the source of radiation and associated mechanisms together with the conveyor, safety devices and biological shield.
Irradiator operator	Organization or body responsible for irradiating the product. [ISO 11137-1:2006]
Loading configuration	Defined arrangement of product placed in or on the irradiation container.
Maximum adsorbed dose (Dmax)	The localised maximum adsorbed dose within a process load. [ISPM 18 2003]
Minimum absorbed dose (Dmin)	The localised minimum adsorbed dose within a process load. [ISPM 18 2003]
Operational qualification (OQ)	Obtaining and documenting evidence that installed equipment operates within predetermined limits when used in accordance with its operational procedures. [ISO 11137-1:2006]
Performance qualification (PQ)	Obtaining and documenting evidence that the equipment, as installed and operated in accordance with operational procedures, consistently performs in accordance with predetermined criteria and thereby yields product meeting its specification. [ISO 11137-1:2006]
Preventative action	Action intended to eliminate the cause of a potential non-conformity or other undesirable potential situation. There can be more than one cause for a potential non-conformity. Preventive action is taken to prevent occurrence whereas corrective action is taken to prevent reoccurrence. [ISO 9000:2005]
Process	The combination of actions and parameters that result in a product being exposed to the correct dose of irradiation within set minimum and maximum dose. These include pre, during and post treatment actions such as loading

	configuration, conveyor speed, source position or energy level and dosimetry.
Process interruption	Intentional or unintentional stoppage that acts to prevent the irradiation process from proceeding continuously. [ISO 11137-1:2006]
Process load	A volume of product with a specified loading configuration and treated as a single entity. [ISPM 5]
Process parameter	Specified value for a process variable. The specification for a process includes the process parameters and their tolerances. [ISO 11137-1:2006]
Process variable	A parameter within an irradiation process that can be altered in magnitude and by doing so changes or alters the process effectiveness. For example conveyor speed and source position.
Radiation-sensitive indicator	Material which may be affixed to, or printed on, the process load and which undergoes a visual change when exposed to ionizing radiation. These indicators do not provide a quantitative measure of dose and may not work or be unreliable at low doses (for example in the dose range employed for phytosanitary treatments). [Adapted from ISO/ASTM 51539:2005]
Radiation source	Device that emits ionizing radiation.
Radionuclide	Radioactive isotope of an element (such as cobalt-60 or cesium-137).
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.
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 facility	Any site where irradiation takes place.

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ISO/ASTM 51631. 2003. Practice for use of calorimetric dosimetry systems for electron beam dose measurements and dosimeter calibrations.

ISO/ASTM 51649. 2005. Practice for dosimetry in an electron beam facility for radiation processing at energies between 300keV and 25MeV.

ISO/ASTM 51702. 2004. Practice for dosimetry in gamma irradiation facilities for radiation processing.

ISO/ASTM 51707. 2005. Guide for estimating uncertainties in dosimetry for radiation processing.

ICCBA

International Cargo Cooperative Biosecurity Arrangement

International Cargo Cooperative Biosecurity Arrangement

Contents

Member agencies

Recognise that, as agencies responsible for the management of biosecurity systems, their objective is to reduce the biosecurity risks associated with the movement of cargo (including commodity and non-commodity items) between their respective jurisdictions;

Recognise the mutual benefits gained through cooperative biosecurity initiatives;

Promote consistency and compliance with the prevailing laws and regulations of their respective countries, territories and regions;

Have reached the following arrangement:

1. Purpose

1.1 The purpose of this arrangement is to:

(a) facilitate and promote cooperation and information exchange among the Member Agencies, with a view to developing, implementing and maintaining consistent biosecurity measures and assurance processes for cargo traded between the Member Agencies' jurisdictions to minimise biosecurity risk

(b) help build the capacity of Member Agencies to deliver harmonised biosecurity measures and assurance processes

(c) standardise the training and delivery of biosecurity measures and assurance processes to improve the integrity and transparency of activities included in the Schedules

(d) establish a basis for the mutual recognition of biosecurity measures and assurance processes among Member Agencies.

1.2 This arrangement records the understandings of the Member Agencies, but it does not create legal obligations.

1.3 This arrangement is intended to complement the activities of the International Plant Protection Convention (IPPC), the World Organisation for Animal Health (OIE) and Codex Alimentarius, and the obligations of Member Agencies as members of these organisations.

1.4 Each Participating Agency retains the right to apply further biosecurity measures and assurance processes to cargo and to refuse entry to cargo, even where the goods have been dealt with under the terms of a Schedule to this arrangement.

2. Definitions

For the purposes of this arrangement, the following definitions apply:

2.1 ***Agency*** means the authority[1] responsible for the management of biosecurity systems.

2.2 ***Applicant Agency*** means a Member Agency that submits an application, indicating its intention to participate in a specific Schedule.

2.3 ***Biosecurity Measures*** means actions carried out to prevent the risks associated with the movement of pests and diseases.

2.4 ***Cargo*** means goods, including commodity and non-commodity.

2.5 ***ICCBA*** means the International Cargo Cooperative Biosecurity Arrangement.

2.6 ***Member Agencies*** means the Agencies which are participating in this arrangement.

2.7 ***Participating Agencies*** means the Agencies which are signatories to a Schedule(s) under this arrangement.

2.8 ***Schedule*** means an annex to this arrangement, adopted under Section 7, which sets out the procedures and processes relating to a specific biosecurity measure and/or assurance process.

3. ICCBA Steering Committee

3.1 There will be an ICCBA Steering Committee consisting of one named representative from each Member Agency.

3.2 ICCBA Steering Committee meetings do not require a quorum however, decisions must be considered by all members.

3.3 The steering committee will have responsibility for the overall strategic direction and decision making capacity of the ICCBA and will discuss and make decisions on any issues concerning the operation of the ICCBA referred to it by a working group or the ICCBA Secretariat.

3.4 The specific roles and responsibilities of the steering committee will be outlined in the terms of reference for the steering committee.

3.5 Annual face-to-face meetings of the steering committee will be held on a rotational basis, unless otherwise decided by the steering committee.

3.6 Additional meetings of the steering committee may be held as decided by the steering committee. Such additional meetings may be held by telephone or computer link or other electronic means, or face-to-face.

[1]Under the National Plant Protection Organisation (NPPO) and/or the OIE, the agency may or may not have the delegated responsibility for that country's legislative or administrative authority under the National Plant Protection Organisation (NPPO) and/or the OIE for its actions.

3.7 A chairperson will be appointed by the steering committee on a rotational basis for each meeting.

4. ICCBA standing working groups

4.1 To ensure the effective ongoing management of the Schedules under this arrangement, there will be an ICCBA standing working group created for each individual Schedule.

4.2 Only Participating Agencies of a particular Schedule will be represented in the standing working group for that particular Schedule and each Participating Agency in that particular Schedule will have representation in the standing working group for that Schedule.

4.3 Standing working groups will meet as required, by telephone, computer link or other electronic means, or face-to-face.

4.4 The main functions of the standing working group will be to:

(a) provide advice and reports to the steering committee on matters concerning the operation of the arrangement, pertaining to the specific Schedule(s) that the standing working group is involved with

(b) liaise with the Secretariat and other standing working groups as necessary, to ensure the ongoing effectiveness of the arrangement and any attached Schedules

(c) manage the administrative requirements and assurance processes pertaining to the specific Schedule(s) that the standing working group is involved with

(D) consider specific issues at the request of the steering committee

5. ICCBA technical working groups

5.1 A standing working group or the steering committee may establish ad hoc technical working groups to develop or address any specific treatment or operational requirements of an existing Schedule as raised by an Agency (regardless of their participation in the arrangement or not). These ad hoc technical working groups will be comprised of representatives from the Member Agencies, chosen according to their technical knowledge and experience. Subject-matter experts who are not part of the arrangement may also be engaged if their expertise will add value to the technical working group.

5.2 The outcomes of the process detailed in paragraph 5.1 will be forwarded to the standing working group for this subject (where one exists), for a decision, or to the steering committee (where required).

5.3 A technical working group can also be formed to review the viability of a new biosecurity measure if proposed by either a Member Agency or an Agency that is not party to the arrangement. The proposal will be coordinated by the Secretariat. The outcomes of the review will be forwarded to the Secretariat, who will advise the steering committee accordingly. The steering committee will have the final decision on

the inclusion of a new biosecurity measure and, if accepted, will be responsible for forming a technical working group to develop a Schedule for that biosecurity measure.

5.4 Any outcomes from actions taken as per paragraph 5.1 of the arrangement will not result in the exclusion of any Participating Agencies of that Schedule.

6. ICCBA Secretariat

6.1 The Secretariat will be provided by a Member Agency (or Agencies) for a period of four (4) years and may be subject to an extension, as agreed to by the steering committee and accepted by the Member Agency (or Agencies).

6.2 The Secretariat will be responsible for:

(a) organising all meetings under ICCBA, arranging external funding where applicable, and general coordination of meeting resources and attendance

(b) providing the reporting function for all ICCBA meetings when required

(c) maintaining all records pertaining to the operation of ICCBA

(d) coordinating media relations or events that require a central point of contact or management, while recognising that normally each Member Agency will be responsible for handling its own media relations

(e) assisting, where necessary, in applications for funding from external sources to support the activities and function of ICCBA

(f) general administrative duties as required

(g) facilitating the exchange of information.

7. Participation in and termination of schedules under this arrangement

7.1 Only Member Agencies can seek to participate in Schedules under this arrangement.

7.2 Each biosecurity measure accepted as part of ICCBA will be included as a separate Schedule, and will form part of the arrangement.

7.3 A Member Agency may apply to participate in any Schedule under this arrangement by notifying the Secretariat of its intention to do so in writing.

7.4 The relevant standing working group will evaluate the proposal against the policies and procedures of that particular Schedule.

7.5 Any appeals arising from, or pertaining to, the proposal will be carried out as per the approved policy and procedure.

7.6 Once adopted, the terms of a Schedule will apply to, and among, all Participating Agencies that have accepted the Schedule.

7.7 Any Participating Agency may choose to exit a Schedule, with the provision of 90-days written notice to the Secretariat.

8. Inclusion of new Schedules under this arrangement

8.1 Any Agency (regardless of their participation in the arrangement or not) may propose the addition of a new Schedule by notifying the Secretariat or the steering committee. The Secretariat will action this as per paragraph 5.3 of the arrangement.

8.2 As per the outcome of paragraph 5.3, the technical working group formed for a new Schedule will be responsible for drafting the administrative requirements of that particular Schedule. Once these requirements have been determined and agreed on by the steering committee then Member Agency participation in a Schedule will undergo the same assessment process outlined in Section 7.

8.3 All Schedules under this arrangement will be listed in Appendix II to this arrangement. Appendix II may be amended as required.

9. Amendments to existing Schedules under this arrangement

9.1 Any Agency (regardless of their participation in the arrangement or not) may propose the amendment of an existing Schedule under the arrangement by notifying the Secretariat.

9.2 The Secretariat will inform the relevant standing working group of this proposal. The standing working group will action the proposal as per paragraph 5.1 of the arrangement.

10. Resolving concerns

10.1 Member Agencies will seek to avoid any disputes concerning the operation of the arrangement or its Schedules.

10.2 Where any Member Agency has concerns about the application of the arrangement by any other Member Agency, it should discuss these concerns on an Agency-to-Agency basis where possible.

10.3 If concerns listed under 10.2 cannot be resolved or if any Member Agency considers that any objectives of this arrangement are being impeded as the result of the failure of another Agency or Agencies to carry out its role under this arrangement, it may make a written representation to the steering committee.

10.4 The steering committee, in attempting to resolve any concerns, will assess all physical and documentary evidence as necessary and as available at a meeting of the committee. The steering committee may request the assistance of the relevant standing working group(s) in considering the technical aspects of the concern(s). During this process, it is expected that the steering committee will actively consult with the Agencies concerned, ensuring that an equitable, cooperative and flexible approach is undertaken.

10.5 The steering committee will have 90 days to finalise a recommendation and provide this to the Agencies concerned.

10.6 Agencies will consider the recommendations of the steering committee and endeavour to address and action them accordingly.

10.7 Pending resolution of any non-performance issues, other Participating Agencies in a particular Schedule may take measures consistent with relevant legislation to ensure the integrity of biosecurity measures conducted in the jurisdiction of the non-performing Participating Agency.

11. Key contact person(s)

11.1 Each Member Agency will appoint a contact person responsible for managing the liaison between it and all other Member Agencies, and will be the first point of contact on matters relating to this arrangement.

11.2 Any changes in the details of the contact person shall be communicated to the Secretariat and Member Agencies within 15 days of this change.

12. Costs and resources

12.1 Each Member Agency is responsible for any costs it incurs in carrying out its responsibilities under this arrangement, subject to any arrangements that may be reached between Member Agencies to provide assistance.

12.2 Member Agencies will make available resources and officials for any tasks taken under the arrangement, including the Schedule(s) in which they are participating, as far as their technical and economic capacity allows.

12.3 The costs of the Secretariat relating to its core responsibilities set out in Section 6 will be funded by the Member Agencies that provide the Secretariat. The Secretariat may accept requests made by the steering committee or a working group to carry out activities in addition to its core responsibilities, subject to agreement being reached on the funding of those activities.

12.4 Member Agencies will individually or jointly investigate funding sources and develop proposals to finance cooperative biosecurity initiatives where applicable and this may be coordinated by the Secretariat.

13. Intellectual property

13.1 Intellectual property provided or created for the purposes of this arrangement, or derived from such material, will remain or vest in the Agency(ies) that provided or were involved in creating the material, consistent with international law and practices.

14. Amendments to the arrangement

14.1 Any Member Agency may propose an amendment to this arrangement, other than the Schedule(s).

14.2 Proposed amendments to the arrangement should be sent to the Secretariat, which will then be forwarded to all Member Agencies within 15 days.

14.3 Amendments to the arrangement, other than the Schedules, may be adopted only when agreed to by at least 80 per cent of the steering committee.

14.4 Each amendment will come into effect on the date it is adopted, or on such other date as is determined by the steering committee, and will be reflected in Appendix III to this arrangement. Appendix III may be amended as required.

15. Entry into effect of the arrangement

15.1 This arrangement will only have effect when there are at least three (3) Member Agencies.

15.2 After the arrangement has come into effect, an Agency may become a Member Agency by formally notifying the Secretariat in writing of its intention to do so.

15.3 Appendix I to this arrangement records the Agencies that have notified the Secretariat of their intention to participate in this arrangement. Appendix I may be amended as required.

16. Withdrawal from the arrangement

16.1 A Member Agency may withdraw from this arrangement by giving 90-days written notice to the Secretariat.

16.2 If a Member Agency withdraws from the arrangement, it will automatically withdraw from any Schedules that it is participating in.

17. Review of the arrangement

17.1 This arrangement will be subject to review every three (3) years.

17.2 The review process will be coordinated by the Secretariat and any amendments to the arrangement resulting from the review will be actioned as per Section 14.

Appendix I

The following Agencies have notified the Secretariat of their intention to participate in this arrangement.

Member Agency	**Countries, economies, regions or jurisdictions represented**	**Date notified**
International Regional Organisation for Plant and Animal Health–OIRSA	Representing Belize, Honduras, Nicaragua, Mexico, Guatemala, Costa Rica, Panama, El Salvador and the Dominican Republic	20 June 2013
The Australian Department of Agriculture, Fisheries and Forestry	Australia	23 July 2013
Biosecurity Authority of Fiji	Fiji Islands	13 September 2013
National Agrarian Health Service	Peru	30 September 2013
Bureau of Plant Industry	The Philippines	07 November 2013
Department of Agriculture Plant Biosecurity Division	Malaysia	11 March 2014
National Agriculture Quarantine and Inspection Authority	Papua New Guinea	21 March 2014
Indonesian Agricultural Quarantine Agency	Indonesia	7 July 2014
Ministry for Primary Industries	New Zealand	12 August 2014
Thai Department of Agriculture	Thailand	28 September 2016
Chilean Agriculture and Livestock Service	Chile	12 October 2016
Bureau of Animal and Plant Health Inspection and Quarantine	Taiwan	18 December 2017
Development Plant Protection Department	Vietnam	05 September 2019

Appendix II

This table lists cooperative biosecurity initiatives agreed to by the Member Agencies:

i. **Schedule A:**

ii. **Schedule B:**

iii. **Schedule C:**

Appendix III

This table lists the revisions to the arrangement and the date they came into effect:

Version	Description	Nature of change	Date
1	Final arrangement	–	13 September 2013
2.0	First revision	Scheduled review of the arrangement	12 April 2019