



**Australian Government**

**Australian Quarantine and Inspection Service**

# **Quarantine Risk Material Matrix**

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## Quarantine Risk Material Matrix

### Background

The Quarantine Risk Matrix (QRM) is a contamination matrix which outlines the AQIS approved treatment options available to treat all types of quarantineable contamination.

This matrix is available to be used for:

- A reference for Quarantine staff to use when quarantine risk material is detected; and
- The public to recognise all options available when a consignment has had quarantine risk material detected.

Quarantine risk material (QRM) includes but is not limited to:

- **Animal material** (such as hair, fur, skin, faeces, shell, blood and fluids, feathers, honey, flesh and bone);
- **Live animals** (such as rodents and reptiles);
- **Food refuse** (such as food scraps);
- **Live insects** (such as Khapra Beetle);
- **Snails** (such as giant African snail);
- **Plant pathogens** (eg fungi, nematodes, bacteria, viruses etc);
- **Plant material** (such as pollen, bark, spores, flowers, seeds, gum, leaves, branches, roots, stems, wood, fruits and vegetables);
- **Soil** (such as dirt, mud, gravel, clay and sand); and
- **Water.**

For treatment options and additional information relating to the importation of goods that may have been contaminated with quarantineable micro-organisms please see the AQIS Import Conditions Database (ICON) [www.aqis.gov.au/icon](http://www.aqis.gov.au/icon). Possible contaminants are included below:

- **Didymo** (*Didymosphenia geminata* or rock snot).

AQIS approved methods of destruction/removal:

- **Deep burial;**
- **Incineration; or**
- **Re export.**

### Onshore Treatment Options for Contamination

Please Note: All expenses of any treatment, supervision of treatment and/or reinspection (if required) are borne by the importer. Not all treatment listed below are available in all Australian States.

<a href="#">Quarantine Risk Material (Contaminant)</a>		<b>Autoclave</b> (Note: size limitations.)	<b>Ethylene Oxide</b> Fumigation (Not for use on food or products that will contact skin – refer to <a href="#">APVMA</a> website.)	<b>Methyl Bromide</b> Fumigation (for commodity limitations refer to <a href="#">Methyl Bromide</a> .)	<b>Gamma Irradiation</b> (Not for use on food @ > 10kGray. For commodity limitations refer to <a href="#">Gamma irradiation</a> . Note: size limitation.)	<b>Heat Treatment</b> (Products may smoulder or ignite with this treatment. For commodity limitations refer to <a href="#">Heat treatment</a> .)	<b>Cold Storage</b> (Size limitations apply.)	<b>Remove and Destroy</b> <a href="#">Approved methods of destruction</a> .	<b>Other</b> Circumstances must be referred to an AQIS Operational Scientist for advice.
<a href="#">Animal Material</a>		121°C 103kPa (15psi) for 15 min; <u>OR</u> 134°C 214kPa (31psi) for 4 min (T9660).		32g/m <sup>3</sup> for 2 hrs at 21°C (for animal hair).	50kGray (5Mrad) (T9652).	Core temperature 100°C ≥30 min (50% relative humidity) (T9990).	-18°C for 7 days for stuffed animal.	✓	Sodium carbonate and formaldehyde for animal hair (T9926).
<a href="#">Animals— Live</a>									An AQIS inspector will seek the direction of an AQIS veterinarian/the Live Animal Imports program.
<a href="#">Food Refuse</a>								✓	
<a href="#">Live Insects</a>	<b>Timber pests</b>		Under vacuum of 50kPa at 1200g/m <sup>3</sup> for 5 hrs at 50°C; <u>OR</u> 1500g/m <sup>3</sup> for 24 hrs at 21°C. (T9020).	48g/m <sup>3</sup> for 24 hrs at ≥21°C at NAP (T9047); <u>OR</u> 64g/m <sup>3</sup> for 4 hrs at ≥21°C under 660mm vacuum (T9075); <u>OR</u> 64g/m <sup>3</sup> for 5 hrs at 4-20°C under 660mm vacuum (T9913).	10kGray (1.0Mrad) (T9924).	Core temperature 74°C ≥60 min with moisture content 6-12% (T9912); <u>OR</u> 56°C ≥30 min at the core (T9968).			
	<b>Khapra beetle</b>			80g/m <sup>3</sup> for 48 hrs at ≥21°C at NAP with an end point concentration of 20g/m <sup>3</sup> (T9056).					
	<b>Other insects (not in/on fresh produce)</b>			32g/m <sup>3</sup> for 24 hrs at ≥21°C at NAP; <u>OR</u> 40g/m <sup>3</sup> for 2 hrs at ≥21°C under 660mm vacuum (T9038). At the direction of AQIS Operational Scientist particularly when seeking to treat insects in seeds for sowing.					Phosphine 1.0–1.5g/m <sup>3</sup> for 10 days at 15°C–25°C; <u>OR</u> 1.0–1.5g/m <sup>3</sup> for 7 days at ≥25°C (T9086).
	<b>Fresh Produce Pests</b>			An AQIS inspector will seek the direction of AQIS Operational Scientist (Entomologist).					
	<b>Non Actionable</b>	No Action required, however, in high numbers an AQIS inspector will seek the direction of an AQIS Operational Scientist (Entomologist).							
<a href="#">Snails and Slugs</a> Follow up inspection is required post-treatment.				Identified as GAS: 128g/m <sup>3</sup> for 24 hrs at ≥21°C at NAP (T9054); <u>OR</u> an AQIS inspector will seek the direction of AQIS Operational Scientist (Entomologist).					
<a href="#">Plant Pathogens</a> (Verification by an AQIS Operational Scientist (Plant Pathologist) is required to determine suitable treatment).		121°C 103kPa (15psi) for 15 min; <u>OR</u> 134°C 214kPa (31psi) for 4 min (T9660).	Under vacuum of 50kPa at 1200g/m <sup>3</sup> for 5 hrs at 50°C; <u>OR</u> 1500g/m <sup>3</sup> for 24 hrs at 21°C. (T9020).		25kGray (2.5Mrad) (T9651).	Core temperature 85°C ≥8 hrs (T9569).			Fungicide (T9221); <u>OR</u> Nematicide (T9280).

<a href="#">Plant Material</a>	<b>Parts</b> (fresh or dry) other than seed	121°C 103kPa (15psi) for 15 min; <u>OR</u> 134°C 214kPa (31psi) for 4 min (T9660).	Under vacuum of 50kPa at 1200g/m <sup>3</sup> for 5 hrs at 50°C; <u>OR</u> 1500g/m <sup>3</sup> for 24 hrs at 21°C. (T9020).	32g/m <sup>3</sup> for 2 hrs at 21°C; 32g/m <sup>3</sup> for 2 1/2 hrs at 21°C; 32g/m <sup>3</sup> for 3 hrs at 21°C (bulb); <u>OR</u> 32g/m <sup>3</sup> for 24 hrs at 21°C (dry part).	25kGray (2.5Mrad) (T9651).	Core temperature 85°C ≥8 hrs (T9569).	✓	
	<b>Seeds</b>	121°C 103kPa (15psi) for 15 min; <u>OR</u> 134°C 214kPa (31psi) for 4 min (T9660).	Under vacuum of 50kPa at 1200g/m <sup>3</sup> for 5 hrs at 50°C; <u>OR</u> 1500g/m <sup>3</sup> for 24 hrs at 21°C. (T9020).		25kGray (2.5Mrad) (T9651).	Core temperature 85°C ≥48 hrs (50% relative humidity) (T9568); <u>OR</u> Core temperature 95°C ≥24 hrs (50% relative humidity) (T9574).	✓	
	<b>Bark</b>		Under vacuum of 50kPa at 1200g/m <sup>3</sup> for 5 hrs at 50°C; <u>OR</u> 1500g/m <sup>3</sup> for 24 hrs at 21°C. (T9020).		25kGray (2.5Mrad) (T9651).	Core temperature 85°C ≥8 hrs (T9569).	✓	
<a href="#">Soil</a>		121°C 103kPa (15psi) for 15 min; <u>OR</u> 134°C 214kPa (31psi) for 4 min (T9660).			50kGray (5Mrad) (T9652).	160°C for 2 hours as long as sample size does not exceed 500g in weight (T10026);	✓	
<a href="#">Water</a>		121°C 103kPa (15psi) for 15 min; <u>OR</u> 134°C 214kPa (31psi) for 4 min (T9660).			50kGray (5Mrad) (T9652).	160°C for 2 hours as long as sample size does not exceed 500g in weight (T10026);		Chlorine: add chlorine to water at the rate of 200ppm. This is one teaspoon (5g) of chlorine per 25 litres of water (T9205); <u>OR</u> Saturation with 1% formalin for at least 8 hrs (T9267).

#### Additional Treatment Options for Surface Contamination only

Please Note: All expenses of any treatment, supervision of treatment or reinspection (if required) are borne by the importer, and that not all treatment listed below are available in all states.

<a href="#">Quarantine Risk Material</a>	<b>Disinfection</b> (Please refer to the <a href="#">Procedures for Disinfecting Machinery and Similar Goods</a> . The removed contamination will require destruction by <a href="#">Approved methods of destruction</a> .)	<b>Remove High Pressure Clean</b> <a href="#">Procedures for Disinfecting Machinery and Similar Goods</a> . The removed contamination requires destruction by <a href="#">Approved methods of destruction</a> .	<b>Remove by Vacuuming</b> <a href="#">Procedures for Disinfecting Machinery and Similar Goods</a> . The removed contamination requires destruction by <a href="#">Approved methods of destruction</a> .	<b>Remove Steam Clean</b> <a href="#">Procedures for Disinfecting Machinery and Similar Goods</a> . The removed contamination requires destruction by <a href="#">Approved methods of destruction</a> .
(Contaminant)				
<a href="#">Animal Material</a>	Virkon disinfectant (T9431) 1% Virkon S (Antec International) 1% Virucidal X (Johnson Diversy).	Water/air under high pressure (T9988).	Minimum capacity 1400watts (T9923).	Hot water under high pressure (T9914).
<a href="#">Plant Pathogens</a> (Verification by an AQIS Operational Scientist (Plant Pathologist) is required to determine suitable treatment.)	For common micro-organisms on non porous surfaces: Chlorine @ 200ppm. (5g chlorine/25L water) (T9205). Not applicable in all circumstances.			
<a href="#">Plant Material</a>	<b>Parts</b> (fresh or dry) other than seed	Water/air under high pressure (T9988).	Minimum capacity 1400watts (T9923).	Hot water under high pressure (T9914).
	<b>Seeds</b>	Water/air under high pressure (T9988).	Minimum capacity 1400watts (T9923).	Hot water under high pressure (T9914).
<a href="#">Soil</a>	Virkon disinfectant (T9431) 1% Virkon S (Antec International) 1% Virucidal X (Johnson Diversy).	Water/air under high pressure (T9988).	Minimum capacity 1400watts (T9923).	Hot water under high pressure (T9914).

## **Animal Material**

Any material that originates from, or is produced by, a living animal including hair, fur, skin, faeces, shell, blood and fluids, feathers, honey, flesh and bone.

### **The Risks of Animal Material**

Products derived from animals pose a significant quarantine risk. All animal parts/products such as animal tissues and blood can introduce serious animal pathogens. Many viruses and bacteria are able to survive for long periods in tissue, blood and mucous.

## **Animals – Live**

Any animal that is alive, unintentionally entering Australia as a hitchhiker in sea or airfreight. They include but are not limited to mammals (e.g. rats), amphibians (e.g. toads and frogs), reptiles, birds and other vertebrates.

### **The Risks of Live Animals**

Live animals can introduce exotic diseases into Australia. Live animals can be infested with parasites such as ticks, mites and fleas, which can act as vectors that transmit disease.

## **Food Refuse**

Food refuse includes any discarded food scraps that contaminate imported cargo. This includes but is not limited to fruit peelings, meat scraps, seeds and pips.

### **The Risks of Food Refuse**

Food refuse may be any quarantine risk material of plant or animal origin. Food refuse may carry animal or plant diseases or be infested with live insects.

## **Live Insects (Invertebrates)**

Live invertebrates include all arthropods such as insects (e.g. bees, wasps, mosquitoes, beetles, moths, bugs and flies) mites, spiders, millipedes and scorpions.

### **The Risks of Live Insects**

Australia is relatively free from most of the world's serious invertebrate pests. Exotic pests could wreak havoc on Australia's economy and environment, and can act as vectors that transmit disease to humans, animals and plants. All life stages (eggs, larvae etc) of invertebrates can also represent a quarantine risk to plant, animals and humans.

## **Snails and Slugs**

There are many species of snails and slugs exotic to Australia, the most significant being the giant African snail (GAS).

### **The Risks of Snails**

Snails and slugs are destructive invertebrates that eat various plant materials and are also vectors for parasites and pathogens. There are many species of snails and slugs not present in Australia, the most significant of these is GAS. GAS is considered by most authorities to be a most damaging land snail. This snail can consume over 500 varieties of plants, can act as a vector of various human diseases, and has the ability to reproduce in large numbers very quickly. Snails can aestivate and emerge when weather conditions are more favourable. GAS can carry the rat lungworm parasite *Angiostrongylus cantonensis*, which can infect humans and cause meningitis.

## **Plant Pathogens**

These include fungi, bacteria, viruses, nematodes and various other micro-organisms that can infect any part of the plant from the roots to the leaves, fruit, seeds and even pollen. While the pathogen itself may not always be visible, signs of infection include leaf spots/lesions, colour mottling of leaves and flowers, distorted growth, stunted plants etc. Timber can also be infected by wood rotting fungi, fungal pathogens and sap staining fungi.

Many pathogens cause severe crop losses, reduce or prevent fruit and vegetable production or they may pose a risk to our natural vegetation and forest industries.

### **The Risks of Plant Pathogens**

Australia is relatively free from most of the world's serious pathogens. Exotic fungi, bacteria, viruses, nematodes, etc could wreak havoc on Australia's environment, horticultural, agricultural and forest industries as well as urban landscapes, if quarantine is breached and such organisms enter and/or establish in Australia.

**Some examples of quarantineable pathogens that may be found in imported nursery stock, agricultural products, timber and/or timber products.**

<b>Species name of pathogen</b>	<b>Common name</b>	<b>Evidence</b>
<i>Tilletia indica</i>	Karnal Bunt	All or part of the wheat kernel is replaced by dark powdery spores with a fishy odour
Potviruses: Potyviridae	Plum Pox virus	Fruit is deformed or blemished and marked with spots or rings

<i>Erwinia amylovora</i>	Fire Blight	Cankers on trunks and limbs, dark patches on leaves and blossoms
<i>Xanthomonas axonopodis</i>	Citrus canker	Cankers (spots) on fruit, leaves and stems
<i>Bursaphelenchus xylophilus</i>	Pinewood nematode	Invaded bark tissues turn brown
<i>Ceratocystis fagacearum</i> : Anamorph: <i>Chalara quercina</i>	Oak wilt	Fungal mats under bark
<i>Cryphonectria parasitica</i> : Anamorph: <i>Endothiella parasitica</i>	Chestnut blight	Stem cankers
<i>Fusarium circinatum</i> : Teleomorph: <i>Gibberella circinatum</i>	Pine Pitch Canker	Stem cankers
<i>Phytophthora ramorum</i>	Sudden Oak Death	Stem cankers
<i>Puccinia psidii</i>	Guava/Eucalyptus Rust	Spore contamination on timber
<i>Ophiostoma piceaperdum</i> : Anamorph: <i>Leptographium piceaperdum</i>	Blue Stain	Discolours sapwood; fruiting structures under bark
<i>Ophiostoma novo-ulmi</i> and <i>Ophiostoma ulmi</i> : Anamorph: <i>Pesotum ulmi</i>	Dutch elm disease	Brown streaking in sapwood

### **Plant Material**

Plant material includes material that originates from, or is produced by a plant, such as pollen, spores, flowers, seeds, pods, gum, leaves, branches, roots, stems, bark, wood chips, straw, wood, fruit and fruit pulp.

### **The Risks of Plant Material (excluding Seed risks)**

Plant material can introduce serious exotic plant diseases, insects and snails. Dried plant material may also be infested with insects and plant diseases. In addition, soil may adhere to plant parts which can also harbour exotic pests (both plant and animal).

### **The Risks of Seeds**

Seed contamination may include viable seeds that may be prohibited (due to their weediness) or restricted. Seeds may also be infested with insects or contaminated with soil. Seeds may carry plant pathogens (fungi, bacteria, viruses, nematodes etc) both externally or internally and, in some cases, the infection may not be evident (hence restricted seed requires a permit).

### **Bark**

Bark is the natural outer protective layer of trees, shrubs and perennials, formed by the cork cambium and phloem tissue. It consists of phloem tissues, which occur as

living inner and dead outer zones. This material is distinct and separable from processed timber.

### **The Risks of Bark**

Bark presents a risk in that it can harbour insect pests and plant pathogens. Many insects feed just under the bark of trees while many fruiting structures of fungal pathogens such as bracket fungi are produced through the bark making it a very high risk for introducing exotic pests and diseases. Some fungi such as *Ophiostoma* fruit under the bark.

### **Soil** (for AQIS purposes)

Soil is the upper layer of earth (approximately 2 metres of the earth's surface) and is a mixture of organic and inorganic material. This includes, but is not limited to, surface materials such as river gravel, soil-like surface minerals, stream sediment, old tailings from mining areas and powdered samples without evidence of origin.

### **The Risks of Soil**

Soil and related material have the potential to harbour other quarantine risk material such as plant material (e.g. weed seeds), animal waste (faeces), and animal diseases (e.g. anthrax, foot and mouth disease), plant pathogens (fungi, bacteria, viruses and nematodes) and plant pests (e.g. insects, mites, snails).

### **Water**

Water is a transparent, odourless, tasteless liquid, a compound of hydrogen and oxygen, H<sub>2</sub>O, that in a more or less impure state constitutes rain, oceans, lakes, rivers, etc.

### **The Risks of Water**

Water can carry seeds, plant, human and animal pathogens and provide a pathway for vectors to introduce disease. Water can harbour many mosquito life stages and many micro-organisms as well as water borne diseases. Examples include the mosquito, *Aedes albopictus*, which is a vector of several exotic arboviruses affecting both animals and humans, and didymo (rock snot) which is an invasive freshwater alga that quickly takes over aquatic environments.

### **Disinfection for machinery and similar goods**

Procedures for Disinfecting Machinery and Similar Goods

If faecal material is detected the machinery/goods will require a further disinfection treatment with an AQIS approved disinfectant such as Virkon S.

The faecal material should be removed and destroyed. Treat the surface of the goods where the faecal material was removed with a disinfectant such as Virkon as per manufacturer's directions.

In times of a disease outbreak emergency, consult with the AQIS Brisbane, [National Machinery Co-ordination Centre](#) for alternative sources of information in relation to specific diseases.

Steam cleaning (T9914) is an acceptable method of removing disinfectants and contamination.

Notes:

1. Some disinfectants may cause damage to some metals such as aluminium, chrome and similar alloys. The owner or agent must be warned of any possible damage to surfaces or electrical components from any treatments. The owner or agent must agree to the treatment before it is applied. Disinfectants should be used as per manufacturer's directions and where corrosion or discolouring is of concern, washed off after use.
2. Care must be taken when applying the disinfectant to ensure that the surface or any electrical components are not damaged. The first application should be on a small, less exposed area and should be checked for damage such as paint tainting (colour change), smearing or bubbling before the disinfectant is applied to the rest of the item.
3. Any damage to goods from disinfection procedures should be reported to the AQIS Brisbane, [National Machinery Co-ordination Centre](#).
4. Protective clothing including boots, safety glasses and gloves (preferably disposable) should be worn when handling any chemical disinfectant used for decontamination. Particular care must be taken to avoid contact with skin or eyes, and inhalation of fumes or powders.
5. Acid and alkaline based disinfectants must not be mixed.

### **Approved Remedial Actions**

#### **Destruction**

1. **Deep Burial:** Burial of waste at an AQIS approved location at a depth of greater than 2 metres. Please note: a mitigating treatment is required for the following QRM, prior to deep burial to ensure the risk is mitigated:
  - Insects;
  - Animal material.
2. Incineration

**Re-export** – Risk material requires containment prior to re-export.

#### **References**

[Quarantine Act 1908 and subordinate legislation](#)  
[AQIS Import conditions Database](#)  
[Quarantine Pest and Diseases](#)  
[Animal and Plant Pest and Diseases \(Product Integrity / Animal and Plant Health\)](#)

[Northern Australia Quarantine Strategy \(NAQS\) Fact Sheets](#)  
[Horticulture and Grains \(Plant Pests and Diseases Watch List\)](#)  
[Forestry and Timber \(Pests and Diseases Watch List\)](#)  
[Exotic Plant Pest Fact Sheets](#)  
[Incursion tracking list - emergency plant pests](#)  
[Forests and Timber Pests and Diseases](#)  
[High Risk Pests Found in Commercial Cargo](#)  
[Animal Diseases \(Animal Health Organisation\)](#)  
[Eucalyptus Rust: An Exotic Disease Threat to Australia](#)  
[Pine Pitch Canker](#)  
[Technical Justification for Australia's Requirement for Wood Packaging Material to be Bark Free](#)