Australian Subterranean termites – Otorohanga New Zealand incursion 1990.

OUTLINE FOR CASE-STUDIES ON ALIEN SPECIES

To the extent possible, case-studies should be short and succinct summaries of experience on alien species at the country and regional levels A case-study should focus on the prevention of introduction, control, and eradication of alien species that threaten ecosystems, habitats or species. Case-studies should include the following sections (a summary of the information may be provided under each heading, and a more detailed paper may be attached; if the information were not available, this should be indicated in the appropriate section):

1. Description of the problem
(a) Location of the case-study

Otorohanga New Zealand

Subterranean termites were first reported at the Otorohanga house site in November 1990 when tenants reported to the local district council that winged insects were emerging from a doorjamb. The insects were subsequently identified as the Australian subterranean termite *C. acinaciformis*. The infestation was linked to two hardwood utility poles imported from Australia in the late 1950's. Otorohanga is a rural town with around 3000 residents located south of Hamilton in the upper North Island of New Zealand. The initial site of the incursion was around 1 km south of the town centre and encompassed an area of approximately 3.5 hectares. Sealed roads and ditches bounded three sides of the site while the fourth side was exposed to open pastureland. The site was a mixture of residential houses, trees, shrubs, fences, sheds, poles, general landscape materials, and swimming pools. The houses were mostly constructed from untreated native timber. The terrain was undulating with natural and built-up features.

(b) History (origin, pathway and dates, including time-period between initial entry/first detection of alien species and development of impacts) of introduction(s)

Exotic termites were first reported entering New Zealand in the late 1930s. Colonies of *Glyptotermes breviconis* Froggatt (Isoptera: Kalotermitidae*), Kalotermes banksiae* Hill (Isoptera: Kalotermitidae), *Porotermes adamsoni* Froggatt (Isoptera: Termopsidae), *Coptotermes acinaciformis* and *C.frenchi* Hill (Isoptera: Rhinotermitidae) have all been confirmed from within New Zealand.

Infestations have mainly been found in the North Island. All species recorded have arrived from Australia, with the subterranean termite *C. acinaciformis* the most commonly recorded incursion. Various researchers have commented that all recorded infestations of Australian subterranean termites in New Zealand were introduced in rail or tramway sleepers or in wooden utility poles, and could be traced back to their original source.

Figure 1. *Coptotermes acinaciformis* nest found concealed within imported Australian utility pole.

There is no suggestion that colonies of subterranean termites in New Zealand have resulted from alate flights. As a means of detecting infestations, preventing spread and eliminating colonies between 1940 and 1980, up to 50,000 properties within the North Island were inspected for invasive termites, with around 110 infested sites found and treated. Treatment most often involved destruction of host material in which the termites lived, trenching around the site using insecticides such as Dieldrin and arsenic dusting in the termite runways. Treatment was, and still is, carried out at the government's expense.

Otorohanga find

Initial actions on discovery of *C. acinaciformis* involved destruction of utility poles adjacent to infested properties, removal of host material, fumigation of wooden products with methyl bromide, and trenching around areas of known activity. However, treatment failed to eliminate the infestation and activity continued throughout the 1990s. As no formal research studies have been carried out on *C. acinaciformis* in New Zealand, it was not known if the infestation was primary or secondary.

A delimiting survey, carried out in March 1999, detected subterranean termite activity on eight properties in a concentrated area of 1.4 hectares south of the township. The infestation was causing considerable damage and impacting on power poles, residential homes, vegetation, fences, retaining walls, and landscaping timber. It was noted that the residents' property prices had reduced in value by up to 30% and that some buildings and trees were structurally unsafe.

(c) Description of the alien species concerned: biology of the alien species (the scientific name of species should be indicated if possible) and ecology of the invasion(s) (type of and potential or actual impacts on biological diversity and ecosystem(s) invaded or threatened, and stakeholders involved)

The Australian subterranean termite is similar in appearance to a white ant about 4-7mm in size. This pest lives in colonies that have a social structure similar to ants with several castes, namely king, queen, workers, soldiers and (at particular times of the year – usually November to February) alates (flying reproductive termites).

The body length of the alate is about 7.5 mm long. They have two sets of slightly brownish wings. At rest the wings lie flat and are about 11.5mm long.

There are three species of native New Zealand termite that look similar to the Australian subterranean termite. New Zealand natives are generally non-invasive and are usually found in rotting timber, tree stumps and firewood. However, they have also been found in houses that are damp or have rotten timber.

General information on this species in Australian
Australian subterranean termites evolved more than 250 million year ago. Meaning they inhabited Australia long before flowering plants. Their survival success depends on living in a protective underground environment. In some species, their colony nest has a hardened shell, exposed above ground level. In most destructive species in NSW their nest is totally out of sight, below ground level.

The worker termites build mud-tubes over hard objects. The tubes or "galleries" are made up of partly digested timber and mud excretions, and is moist if currently in active use. The termites keep its colony nest and galleries at 25 to 35oC with high humidity. If they are exposed to light or open air they will desiccate (dehydrate) and die. They live in constant darkness, excepting for the annual summer swarms of the winged reproductives.

A million termites in the nest: In some destructive species, a termite colony nest may contain more than a million termites, consisting of a queen, king, young immature nymphs, workers, soldiers and winged reproductives (called alates). They are delicate, soft bodied and small in stature, about half the size of match-head. They are highly efficient timber recyclers.

The worker termites are blind and forage in a largely random criss-cross fashion looking for new timber food sources. However, they may encounter and follow moisture zones and trail along solid objects, such as, the concrete slab edge of your home. The soldiers accompany the workers in their constant search for new timber food sources. If you find termites active in timber framing, it is the soldiers that rush out to defend the workers.

Workers feed the rest of the colony: Only the worker termite caste can digest timber by the use of symbiotic flagellated protozoa in their digestive tract. The worker termites digest and then regurgitate the partly digested timber as a semi-liquid food for the other termite castes. The workers excrete anal liquid which is then eaten by the other termites as it has a high cellulose content. This unique form of anal liquid exchange (trophallaxis) means that the intestinal microorganisms needed to break down the cellulose are transmitted from one individual to another.

Nest Location - ***Coptotermes acinaciformis*** are a very secretive termite species; they build their nest out of sight, often within the base of eucalyptus or other susceptible trees, or completely under the ground; often within an enclosed patio or under concrete on ground flooring which is ideal for moisture retention, temperature and humidity control within the termite colony's central nest. *C. acinaciformis* can also construct subsidiary nests away from the main colony nest. A subsidiary nest can be contained in a wall cavity of a building where there is a reliable moisture source, for example, from a leaking shower recess or faulty guttering or rusted down pipes.

Destructive Nature – ***C. acinaciformis*** are highly destructive to buildings and other timber structures. They are the most widely distributed and destructive timber pest in Australia, accounting for more than 70% of the serious damage to buildings in New South Wales. A single colony may consist of more than one million termites.

(d) Vector(s) of invasion(s) (e.g. of deliberate importation, contamination of imported goods, ballast water, hull-fouling and spread from adjacent area. It should be specified, if known, whether entry was deliberate and legal, deliberate and illegal, accidental, or natural.)

Invasive Australian subterranean termites, specifically *C. acinaciformis* and *C. frenchii* had previously hitchhiked (were accidentally introduced) into New Zealand unnoticed several decades ago (prior to the 1970's), within wooden utility poles, rail or tramway sleepers and wooden packaging.

There was no suggestion that colonies of subterranean termites in New Zealand had resulted from alate flights from Australia.

Due to the number of termite incursions, New Zealand border controls were enhanced around this time. Discussions were held between Australian and New Zealand forest authorities and controls were formulated to prevent termite importation. Controls included compulsory fumigation, creosote treatment of wood, and removal of all bark. Timber exports from Australia were prohibited unless these criteria had been met.

(e) Assessment and monitoring activities conducted and methods applied, including difficulties encountered (e.g. uncertainties due to missing taxonomic knowledge)

Monitoring of Alate Flights.
During the Australasian summer of 2001/02 a total of 53 alate traps were placed within the Otorohanga urban area in a 2 kilometre radius of the infested site. Forty four proprietary sticky traps were mounted on utility poles and accessed using a modified fibreglass telescopic pole. Traps were located at a minimum height of 2.5 metres above ground level and approximately 1.5 metres from the light source. A further 9 purpose- built light traps (6 x 12 volt and 3 x solar powered) were established in locations where utility poles were absent, such as under houses. Traps

were established in December and removed in late February. Trap distribution was stratified according to identification of prime risk locations.

Criteria used to define a risk location included history of previous infestation, records of alate flight and locations of suitable host material. All light pole traps were monitored daily. The traps were removed, visually inspected, and condition/catch data lodged. The inspection period was extended to 3 days for the under-house light traps and solar traps.

Inspection of Utility Poles.
As a risk existed that other wooden utility poles in Otorohanga could be colonised by *C. acinaciformis*, all poles within a 2 kilometre radius of the infested site were identified. A visual inspection of 238 poles was completed looking for evidence of termite activity including mud trails, nests, cracks where alate flights might have occurred, and insects. Any cracks and fissure were scraped out and searched using a flashlight.

Visual Surveillance.
A delimiting survey was carried out annually to assess the extent of activity. Inspection was carried out of the 28 residential properties in the infested area and all wooden structures within a 100 metre radius. Surveys involved external and internal inspection of buildings, timber in contact with the ground, trees and wooden structures, and random ground inspection throughout the infested area using a probe or spade. Methods used included visual assessment, banging of timber for noise effects and drilling of a selection of trees.

2. Options considered to address the problem

(a) Description of the decision-making process (stakeholders involved, consultation processes used, etc.)

MAF followed procedures outlined in the MAF Policy statement on responding to an exotic incursion August 2001 (note this was still to be signed off at this time). This policy statement is predicated on that of the Biosecurity Council as detailed in the link below. http://www.biosecurity.govt.nz/bio-strategy/library/policy-incursion.htm

Recommendations on response actions were made to the MAF Chief Technical Officer – Forest Biosecurity.

Termite Forum – Technical Advisory Group
This forum involved MAF staff participating in the response, four invited overseas termite experts (two from Australia, one from the United States, and one from Malaysia), and a Forest Research entomologist was held in January 2001. The forum convened by MAF Forest Biosecurity Group focused on known New Zealand termite infestations, including Otorohanga, and sought advice on developing strategies for future termite management.

International technical advice
Technical advice was provided by the international science community (as noted above in the Termite Forum) as a number were well recognised as experts in this particularly in relation to control and eradication.

Advice from Pestforce (an Australian Environmental Pest Management Company) played an important role in the response in recognition of their day to day operational experience with termites and Sentricon® the chemical bait used for control.

Operating plan development
An Operating Plan was developed in November 2000 to enable effective cohesion and linkage with the Otorohanga District Council. The plan also ensured that local concerns were addressed and this increased the programmes acceptability with the community

Media and Stakeholder Management
Regular newsletters to local residents, community meetings and direct mail outs facilitated effective stakeholder management. Media statements were utilised as necessary. A Residents Against Subterranean Termites Group was set up. This group provided a direct link between the community and the operation.

Residents were notified before property inspections took place and were kept well informed by staff operating on the ground. A senior MAF investigator was identified as the first point of call for all communications during the programme, thereby ensuring consistency of message.

(b) Type of measures (research and monitoring; training of specialists; prevention, early detection, eradication, control/containment measures, habitat and/or natural community restoration; legal provisions; public education and awareness)

A response programme (aimed at eliminating the population of *C. acinaciformis) was* developed in late1999/early 2000. Response decisions were based on the results of the delimiting survey, an analysis of options, and the recommendations of a Termite Forum-Technical Advisory Group (TAG) formed specifically to review the Otorohanga incursion.

Options used in selection of treatments were linked to actual historic and current subterranean termite treatments used in eradication operations in New Zealand. Considerations included:

- whether the proposed treatment had registration status in New Zealand;
- whether the proposed treatment had been used in overseas subterranean termite control programmes but was not registered in New Zealand;
- if there were new treatments being researched overseas that might be suitable in a response programme;
- and finally the technical soundness of each treatment option was assessed.

The methods chosen to achieve colony elimination were:

- placement of above-and below-ground Sentricon® bait stations at seven identified residential properties where activity was present;

- placement of wooden stakes at 21 properties not monitored by the bait stations;
- annual visual surveillance of wooden debris, trees and 28 residential properties;
- sticky traps on utility poles during the predicted alate flight season; inspection of all old untreated utility poles in the immediate Otorohanga area for activity; and
- placement of restrictions on the movement of host material out of the response area.

The TAG recommended the continuation of monitoring for residual *C. acinaciformis* activity for a period of five years after the last activity was detected before elimination could be declared.

Treatment

Placement of Bait Stations and Wooden Stakes.

Baiting was considered the most suitable for elimination at the Otorohanga site (see section 2c for further information on the analysis of treatment options). The Sentricon® baiting system (developed by Dow AgroScience), utilises bait stations to concentrate termite feeding in specific locations. The active ingredient in the bait station is hexaflumuron, which has been proven to prevent termites from moulting, resulting in death and eventual elimination of the colony. As the bait system was not registered for use in New Zealand, a temporary permit was organised for the Otorohanga response. During November 1999, a total of 285 below-ground and above-ground bait stations were placed at seven residential properties with known termite activity. Target sites included the exterior and interior of buildings, fences, decking and vegetation. To increase coverage, low cost wooden stakes were placed at 21 residential properties within the infested zone.

The stakes (Monterey pine, *Pinus radiata*, at 350 mm length with a top width of 50 mm2) were placed more or less in the corner of each residential property. Stakes were inserted into the ground so that no more than 30 mm was visible. Monitoring involved lifting and visually inspecting the wooden stakes every six months for evidence of subterranean termite activity.

Annual Surveillance and Inspection of Utility Poles

Five annual delimiting surveys were carried out at the site between 2000 and 2005, with no new *C. acinaciformis* activity detected. Additional evidence of termite activity was, however, found with the number of colonised properties increasing from seven to eleven. All the evidence found from 2001 onwards was classified as historical. Evidence included dried-out mud-covered termite runways, damaged timber, alate cracks in poles, and secondary nests. Utility pole inspection resulted in no termite activity being detected. A total of 238 poles were inspected. Despite intensive monitoring, there has been no new evidence of *C. acinaciformis* activity detected at the Otorohanga site since 18 February 2000. Results indicate that the population of *C. acinaciformis* was probably eliminated after consuming up to 950 mg of hexaflumuron during a 4-month treatment period.

Legal provisions
Australian Subterranean Termites *C. acinaciformis* were declared an unwanted organism under section 164c of the Biosecurity Act 1993 on 21 September 2000 by a MAF Chief Technical Officer. At the same time this species was also made a notifiable organism under section 45 of the Biosecurity Act 1993.

Note: A Chief Technical Officer is an independent statutory decision maker appointed under section 101 of the Biosecurity Act 1993.

Implementation of Controlled Area Restrictions.
A controlled area (Controlled area notice - section 131 of the Biosecurity Act 1993), was established at 28 residential properties in Otorohanga to restrict movement of host material from the infested area, to prevent the unwanted spread of termites. All residents and commercial operators were notified and regular monitoring was carried out to ensure compliance. Approximately 60 requests were received to remove restricted material, including vegetation and wooden host material. These were transported from the site by an approved operator and disposed of by burning.

Public Awareness
Public awareness activities included the production of a fact sheet, information updates, and general mail outs and media statements. Public meetings were held at night to facilitate attendance. These meetings were well received. The support of the Otorohanga District Council and Mayor was an integral component of the successful result. MAF provided regular updates of the response at council meetings.

There was significant international interest in the response. A MAF staff member presented information on the response in Singapore 2005 at a International Conference. **http://www.biosecurity.govt.nz/pests-diseases/forests/subterranean-termite/incursion-responses.pdf**

Biosecurity Magazine Issue 60
http://www.biosecurity.govt.nz/files/publications/biosecurity-magazine/issue-60/biosecurity-60.pdf

(c) Options selected, time-frame and reasons for selecting the options

Response options
A number of international response options to control and manage subterranean termite infestations were considered. Possible treatment options for Otorohanga are summarised in the tables below.

The selection of possible response options was based on;

- Actual historic and current subterranean termite treatments used in eradication operations in New Zealand
- Registration status of the proposed treatment product in New Zealand.
- Used in overseas subterranean termite control programmes though not registered in New Zealand
- New treatments being research overseas that may have been suitable in a response programme

- Technical soundness

Table 1: Comparison of Treatment Options for Responding to the Otarohanga Site

OPTIONS & MODE OF ACTION	ANALYSIS OF OPTIONS	SUITABILITY RATING * (1 TO 10)
Baiting Involves a susceptible substance being placed in an aggregation device (bait station). Once the termites are actively feeding the substance is replaced with toxic bait. The bait is transferred amongst the colony through trophallaxis. The colony is eventually eliminated.	Bait stations are new systems that have become the major method used internationally to control and manage termites. There are several companies marketing similar systems. At this stage, only one system is available for use in New Zealand and a trial is currently in place. Extensive scientific research has been, and continues to be, carried out on the bait system with successful results reported. Bait stations have advantages in that they are non-destructive, have reasonably low set-up costs, have minimal environmental risks, don't rely on physically locating the nest, are non-obtrusive, and can be slow to take effect, are susceptible to disturbance, and on-going monitoring is required at a cost.	**8** **Medium to high**
Trenching A trench or trenches are constructed around the infested site. An insecticide is placed in the trench and the trench is refilled with soil. The trench acts as a barrier and isolates the infestation slowly eliminating the colony	Trenching has been used as the main response tool in previous eradication operations. Carried out properly, and if infestation is isolated to one property, it can be very effective. However, the natural and built-up features of the Otorohanga site make the use of trenching an expensive and technically difficult operation (as highlighted in 1990). Treatment using currently registered insecticides lasts no more than 5 to 10 years and is environmentally hazardous. Research shows that termites are known to penetrate the barrier by going underneath it.	**3** **Low**
Soil Termiticide Injection Involves injection of a termiticide into the soil with a probe to	Has been used in the past with limited success. Equipment and methods are available for use in New Zealand. Treatment must be complete. Any gap in the barrier can be exploited by	**3** **Low**

form a chemical barrier.	surviving termites. Nature and spread of site would make treatment high cost. Environmentally hazardous	

Fumigation Structure or infested item is covered with a tarpaulin and gassed with methyl bromide. Termites in fumigated structure are killed instantly.	Tent fumigation with methyl bromide has been used effectively in the past (Matamata 1998) to kill active termite colonies where the nest has been detected and the site is isolated. Fumigation kills termites in houses/structures instantly and helps allay the concern of residents, but will not have a major impact on below ground termite populations. It is costly and is viewed as an environmental hazard. Treatment has short-term effects only	**3** **Low**
Groomable Coatings A specific dust is puffed into the nest/runways directly or onto as many occupied galleries as possible using a suitable handblower.	Very successful in past eradication programmes (Pre 1960). However, the only suitable material for dust treatments, arsenic trioxide, is a banned substance in New Zealand. The Pesticide Board will not consider registering any arsenic based products. There is a process for appealing the decision but it is long and very costly.	**1** **Not an option**
Heat Treatment Propane heating unit is connected to a tent covering infested structure by a large flexible hose. Hot air is blown around to heat the walls from both the interior and exterior.	Limited scientific information to support its use. A system is available in New Zealand but not considered large enough for house treatment. More research is required. Involves removing all heat affected materials. Quick action but no long-term benefits. Would be costly to use on a large structure. No environmental effects.	**1** **Not an option**
Microwave Microwave generators are mounted against wall. The heat generated by the microwaves kills the termites.	Not used or available in New Zealand and minimal scientific research to support its use. Only effective on termites located in structures. Not viewed as effective for Otorohanga.	**1** **Not an option**
Freezing Liquid nitrogen is pumped into the infested area chilling it to 20F freezing	Limited scientific information available on system. Not practical for large areas or where glass is involved. No long-term residual effect.	**1** **Not an option**

termites.		
Electricity Electric shock of low current and high frequency jumps into termite galleries and ends at the ground.	System not scientifically proven. Relies on being able to detect live termites. Works only with wood and not soil.	**1** **Not an option**
Host Material Removal All infested and potentially infested material is removed from the site.	Difficulties in accessing parts of the site. Infested material includes houses, living trees, wood underground, fences. Expensive and time consuming. Require large residential involvement. Problem of what to do with the removal material.	**3** **Low**
Excavation of Site Removal of whole houses and excavation of the site to find and eliminate the termite colony.	High cost envisaged. Technically has many complications. Compensation will need to be paid to all affected parties. Residents will need to be re-housed and so on.	**1** **Not an option**
Do nothing Leave the site as is.	Decision anticipated to create a hostile environment for MAF from residents, FOA, DOC, Farm Foresters and many New Zealand citizens. Would require strong justification. Long-term consequences to New Zealand as a whole need to be considered. Trade implications could be an issue. However, if no suitable options are available for eradication then may be only option.	**2** **Low**
Other	No other options were considered as suitable for the Otorohanga site.	**Not considered**

NB: Rating is based on suitability to site, availability, cost, scientific research and environmental hazard (1 is low: 10 is high)

Future response objectives

The Termite Forum –TAG provided advice on the objective of future response actions. This advice was to determine whether a residual population of termites remains in the Otorohanga area. The summary of the recommendations put forward by the participants at the termite forum for future response actions in Otorohanga were:

- Monitoring to determine whether a residual population of termites remains within the infested Otorohanga area to continue for a further five years. At the end of the five year monitoring period, and with no new termite activity being detected, MAF could consider termites to have been eliminated from the Otorohanga area.

- The current array of bait stations at the seven residential properties is maintained, with inspections conducted quarterly, rather than monthly (or two-monthly during the winter months) as at present.

- Wooden stakes to be placed at the 221 residential properties not currently monitored by the bait stations. The stakes are to be placed more or less in each corner of the residents' houses in conjunction with large piece of wooden material. Like the bait stations these will be inspected quarterly.

- Annual visual surveillance of wooden debris, trees and residential homes to continue.

- The placement of sticky traps on utility poles with a fluorescent light during the predicted alate flight season (1 December to 31 January) within a two kilometre radius of the infested area. The traps may require servicing every 1-2 days.

- All other reported sites of potential termite activity in the Otorohanga area to be followed up and surveyed as necessary.

- All old untreated wooden utility poles within the immediate Otorohanga area to be inspected for evidence of termite activity.

(d) Institutions responsible for decisions and actions

MAF Biosecurity Authority – now known as MAF Biosecurity New Zealand lead biosecurity agency.

Recommendations on response actions were made to the MAF Chief Technical Officer – Forest Biosecurity.

3. Implementation of measures, including assessment of effectiveness

(a) Ways and means set in place for implementation

The use of bait stations as the main component of the elimination strategy succeeded where previous attempts over a 10 year period in the 1990s failed. Over 82 days in early 2000, the slowly acting toxin (hexaflumuron) placed in the bait stations was transferred throughout the colony by trophallaxis, leading to colony elimination. The bait stations had advantages over previously implemented methods in that they were non-destructive, did not rely on locating the main or secondary nests, and were environmentally safe and non-obtrusive to residents.

The attributes which made the programmes successful include the rigorous technical analysis of implemented strategies, the level of commitment and leadership shown during the programme by team members, readily available operational field capacity, and community support from councillors and residents. The Otorohanga District Council in particular was an integral component of the successful result.

Another noteworthy factor that contributed to the success of the programme was the continuous international cooperation received for the duration of the operation. International termite specialists provided advice on response options and background information at very short notice.

(b) Achievements (specify whether the action was fully successful, partially successful, or unsuccessful), including any adverse effects of the actions taken on the conservation and sustainable use of biodiversity

The continuing lack of termite activity at the Otorohanga site confirms that the integrated elimination programme implemented in November 1999 has been successful in exterminating the population of *C. acinaciformis*. Five years after termite activity and feeding were last observed in the bait stations no further activity has been found, despite intensive monitoring. Eradication at this site was declared in 2005.

(c) Costs of action

No separate Cabinet appropriations were made for this incursion response. The response was funded from MAF's baseline and operational research (for the alate trapping) monies. The programme cost approximately $750,000.

4. Lessons learned from the operation and other conclusions

(a) Further measures needed, including transboundary, regional and multilateral cooperation

Due to the number of termite incursions, New Zealand border controls were enhanced. Discussions were held between Australian and New Zealand forest authorities and controls were formulated to prevent termite importation. Controls included compulsory fumigation, creosote treatment of wood, and removal of all bark. Timber exports from Australia were prohibited unless these criteria had been met. Australian subterranean termites are now listed in New Zealand as unwanted organisms. Currently, all wooden material entering New Zealand is inspected and, if necessary, treatment is carried out at the border. The main risks now from Australia as far as termites go is from second-hand imported railway sleepers which are used for landscaping purposes. Fumigation at the port of entry is mandatory for these sleepers.

Preborder measures – treatment of at risk goods
Australian subterranean termites are now listed in New Zealand as unwanted organisms (declared under section 164c of the **Biosecurity Act 1993**).

Import health standards are now in place requiring treatment of at risk goods. The main risks now from Australia as far as termites go is from second-hand imported railway sleepers which are used for landscaping purposes. Fumigation at the port of entry is mandatory for these sleepers.

Import Health Standard Poles, Piles, Rounds, and Sleepers from All Countries issued 16 April 2003.

http://www.biosecurity.govt.nz/imports/forests/standards/non-viable-forest-produce/poles-piles-rounds-sleepers.htm

Note: For USED poles, piles, rounds, and sleepers the following treatment options are required:

- fumigation with methyl bromide or sulphuryl fluoride of filleted or otherwise separated layers, must be at 240 g/m^3 for more than 24 continuous hours, and in a minimum temperature of 10°C.
- Heat treatment for more than 4 hours at a minimum continuous core temperature of 70°C.
- Chemical preservation to full sapwood penetration as specified in the following table:

Chemical	**Minimum Retention**
Boron compounds *(insecticidal and limited fungicidal protection)*	0.1% Boric Acid equivalent minimum loading in the sapwood core
Copper + didecyldimethyl ammonium chloride (DDAC) *(insecticidal & fungicidal protection)*	0.35% mass/mass OR 2.8 kg/m^3 in softwood timbers, 5.60 kg/m^3 in hardwood timbers.
Copper azol *(insecticidal & fungicidal protection)*	0.27% mass/mass OR 1.35 kg/m^3 in softwood timbers, 2.7 kg/m^3 in hardwood timbers.
Copper Chrome Arsenic (CCA) *(insecticidal & fungicidal protection)*	0.27% mass/mass OR 3kg/m^3 minimum preservative retention
Arsenic *(insecticidal protection only)*	0.04% minimum preservation loading in sapwood core
Permethrin *(insecticidal protection only)*	Minimum retention of not less than 0.06% mass/mass

(b) Replicability for other regions, ecosystems or groups of organisms

A further two incursions of termites has occurred in New Zealand since this find. One in Richmond Nelson, South Island New Zealand in 2006 and another more recently in Coatesville Auckland in 2007. Again both finds are believed to have resulted from the importation of Australian railway sleepers (which have been used for landscaping purposes) prior to the increase treatment standards now in place for such imports. The response activities, including delimiting, treatment and post treatment surveillance are similar to those identified for this response. Indication are that both finds will be successfully eradicated using these methods. It therefore seems likely that these methods are suitable in a range of habitats/regions. These methods are also likely to be successful at eradicating a number of other termite species.

(c) Information compilation and dissemination needed

Sentricon® Active ingredient Hexaflumuron.
http://www.dowagro.com/sentricon/us/index.htm

Hexaflumuron is an insect growth regulator that works by stopping the insect's growth. It interferes with chitin synthesis, which termites need to form a new exoskeleton.

Hexaflumuron is part of a pest monitoring system and is used selectively in bait stations where termite activity is present. Termites are social insects that share food and feeding sites. Foraging termites recruit nest mates to feeding sites by leaving a chemical trail to the site. After a few termites feed on the Hexaflumuron bait, it is expected that other members of the colony will also feed on the bait.
Note: Information on this treatment system can be obtained via a number of websites.

Information relevant to this case study

Article Biosecurity New Zealand website.
Australian Subterranean Termites Eradicated
http://www.biosecurity.govt.nz/pests-diseases/forests/subterranean-termite/eradication.htm

Responding to Incursions of Australian Subterranean Termites in New Zealand
Mark G. Ross
Surveillance and Incursion Response Division, Ministry of Agriculture and Forestry, 101-103 The Terrace, Wellington, New Zealand.
http://www.biosecurity.govt.nz/pests-diseases/forests/subterranean-termite/incursion-responses.pdf

Subterranean termite fact sheet
http://www.biosecurity.govt.nz/files/pests-diseases/forests/subterranean-termite/subterranean-termites-fact-sheet.pdf

Australian Subterranean Termite *Coptotermes acinaciformis*
Notice to Residents -From early December 2001 to the end of January 2002, MAF contractors placed insect traps to assist in determining if the Australian subterranean termite remains in the Otorohanga area.
http://www.biosecurity.govt.nz/pests-diseases/forests/subterranean-termite/subterranean-termite.pdf

Subterranean Termite Infestation Otorohanga – Technical Discussion Document July 1999. Mark Ross. Forest Biosecurity Authority, Ministry of Agriculture and Forestry.