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Managing termite risks – An Australian perspective and a cautionary tale

Don Ewart

Consulting Entomologist
PO Box 1044
Research, VIC 3095
Australia

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IRG SECRETARIAT
Box 5609
SE-114 86 Stockholm
Sweden
www.irg-wp.org

Managing termite risks – An Australian perspective and a cautionary tale

Don Ewart

[1] PO Box 1044, Research, VIC 3095, Australia

drdons.net

ABSTRACT

The management of the risks of termite attack on new buildings in Australia falls to a range of agencies and is mostly achieved through controlling the process by which structures are certified as complying with the Building Code of Australia. Australian Standard AS3660 parts 1, 2 & 3 have historically been the core of this function but now the Building Codes Board's own certification scheme, Codemark™, is making inroads. Subterranean termites are a threat to structures across the whole of mainland Australia but the risk is lower towards the south and is zero in Tasmania. Management of the termite risk for new buildings is required wherever there is deemed to be a threat. In parts of Victoria, some areas are deemed not to be at risk even though these endemic pests are active. Australian Standard AS3660 parts 1, 2 & 3 is currently being updated and the revisions are expected to be published in early 2013. The peak structural timber pest manager group, the Australian Environmental Pest Managers' Association, has begun a series of industry Codes of Practice which set out industry practice an so exceed Australian Standards which necessarily set minimum criteria. This paper discusses the regulatory system in Australia and current industry trends.

Keywords: termite, barrier, risk management, standard, code, Australia

1. INTRODUCTION

Termite attack, if it is located during regular annual inspections, rarely threatens the structure of a building, but often leaves the occupants feeling violated and insecure and the costs and disruption of repairs usually makes termite attack a significantly stressful event.

There is often a difference between theory and practice. Managing termite risk in buildings requires consideration and action before, during and after construction. The main actions taken are (1) the removal of trees and stumps from the building footprint that might house termite colonies, and (2) the installation of barrier systems that work to prevent termites gaining concealed access from the ground. Deficiencies in planning and construction can both increase the ongoing termite risk and also increase future costs. It is sometimes difficult to ensure quality in construction and adherence to specifications. In Australia, the small builder has given way to large companies, so where a builder might have previously built a handful of houses for individual clients each year, large building companies now build hundreds or thousands of homes to standard designs, many of which are speculative constructions, built without a specific client. Sub-contractors to the large building companies are under considerable pressure to reduce costs which greatly affects both the type and quality of termite barriers installed. Thus the level of protection afforded to building timbers becomes less than what is otherwise economically possible.

This paper arises from my experience working on termite management, 15 years on the Standards Australia termite committee BD-074 (of which I am now Chair), forensic work on disputes and insurance claims and, more recently, being one of the authors of an industry Code of Practice.

2. DISCUSSION

2.1 *The Termite Hazard*

The main risk to timber in structures across Australia comes from subterranean termites of the families Rhinotermitidae. Mastotermitidae and Termitidae. The drywoods (Kalotermitidae) and dampwoods (Porotermitidae) are of limited economic interest. Attack by drywoods is rare and mostly along the northern half of the eastern seaboard and in the tablelands of north Queensland where timbers may be constantly warm and moist. Dampwood termite attack is almost uniformly a function of poor construction and plumbing practices that put susceptible timbers at or close to ground contact in damp conditions.

In Australia, subterranean termites are a threat generally across the mainland with the risk declining in the far south to zero in Tasmania where none apparently made it back after the last ice age. The cost of termite infestation has grown over time, from an estimated $100 million (French 1986) to $780 million in 2002 (Archicentre 2003). Termites are often reported to do more damage to housing that fires and floods put together. Given the widespread flooding of the last two years and the increasing proportion of homes with built-in termite management systems, I'm not sure if that statistic still holds true - we might be back towards parity. Nevertheless, the losses are significant and can be individually devastating.

2.2 The Building Code

Where subterranean termites are a risk, efforts are meant to be made in new construction to manage the risk of structural damage. Australia has a supposedly uniform building code (the Building Code of Australia or BCA) which suffers from regional variations. The *BCA* is a project of the Australian Building Codes Board (ABCB). Requirements are more stringent in Queensland and the Northern Territory while Victoria permits local governments to discount the risks (Howick 1966, Creffield 2005) and build without any consideration of termite risks. This policy has resulted in a illogical patchwork of areas, unrelated to the actual termite risk (Figure 1).

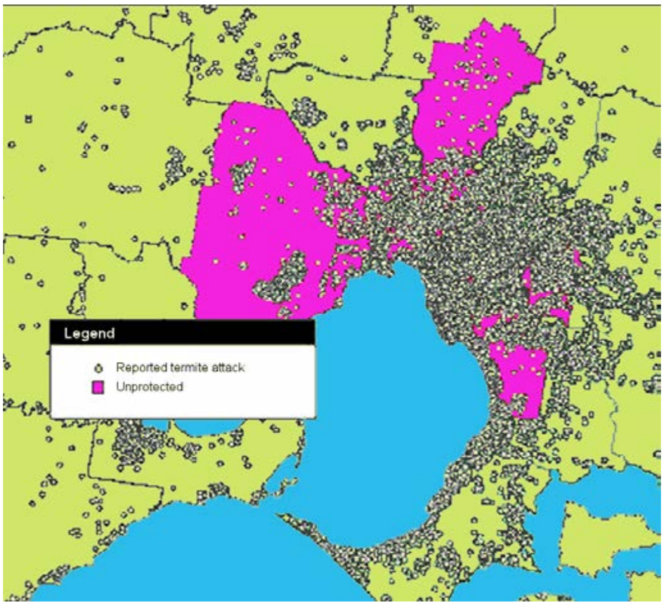

Figure 1. Termite infestations reported around Melbourne in 2004 ~ after Creffield 2005

Although specifying an expected service life of 50 years, *BCA* documents do not seriously address durability issues and in some parts of Australia, non-replenishable termite barriers can be used for inaccessible areas. The Queensland amendments specifically address this issue, requiring a full service life for inaccessible or non-replenishable barriers. It is expected that this same requirement will be taken up in the revised Australian Standard 3660.1-2013.

2.3 Whole of building protection versus not having it fall down

The *BCA* requires the termite risk to be addressed and allows this to be done in two ways. If a structure is built of termite resistant framing and load-bearing members such that even if it is attacked by termites, the risk of collapse is not increased. Yet termites do attack these buildings and damage their contents. This is most unsatisfactory for unsuspecting purchasers as structural repair costs are commonly less than half the total cost of a termite attack, and after an attack their contents and fittings remain at risk of future damage. Acceptable construction materials for the resistant framing and load-bearing members include metals, concrete, preservative treated timbers and naturally resistant timbers. While this would seem to provide an opportunity for preservative treated timbers, industry does not promote the resistant framing option, preferring the second option, the installation at construction of termite barriers. The resistant structure solution is also unpopular with builders and designers, 81% of whom preferred the barrier option (Forsythe 2004).

The advantage of the barrier method is that it seeks to exclude termites from the structure and as such protect all fittings and contents. The principal means for meeting this *BCA* requirement is the Australian Standard AS3660.1 which is called up by the *BCA* as a *primary referenced document* providing *deemed-to-satisfy solutions.*

2.4 Australian Standards

Australian Standards are guidance documents produced by an independent not-for-profit organisation, Standards Australia, (http://http://www.standards.org.au). Standards are not laws. Standards gain legal value when used as part of a contract. Standards Australia develops the Standards but has no direct role in ensuring compliance.

2.5 Australian Standard AS3660.1 – for new construction

AS3660.1 details the use of barrier systems deemed to meet BCA requirements. The barriers are split between physical and chemical methods. Physical barriers include concrete slabs (with other termite barriers fitted to joints and penetrations), crushed stone (Granitgard™), woven stainless steel mesh (Termi-Mesh™) and sheet metal strip shielding. Chemical barriers include hand-sprayed soil termiticide, termiticide delivered by a sub-soil pipe system (*reticulation*) and *chemical in a non-soil matrix* which was added pro-actively to include the local Kordon™ impregnated sheet material, first released just after the drafting committee's deadline. AS3660.1 is written to meet the requirements of the BCA which began in 1996 and so, lacks the durability and maintenance advice of its predecessor, AS3660-1993.

Termite barriers are intended to stop termites entering the building from the ground. The preferred wording for this is to *deter concealed access,* a phrase chosen to avoid the problems of a term that in law is absolute. Essentially, the barriers are placed so that any attack by termites is forced to the building perimeter where their earthen shelter tube constructions will be clearly visible and thus readily detected. This seems to be an inadequate provision, since it takes a single termite less than a minute to travel from the ground and up the exterior wall to a weep-hole in masonry or some similar entry point. The perimeter barriers typically define an inspection zone of 75 mm height (or width) that is expected to remain clear for observation. The 75 mm inspection zone is not experimentally based, but was arbitrarily chosen to include a safety margin, allow for accumulated debris and be easy to use. Hence it was set to be the same as the regular height of a fired clay brick. This has been remarkably successful with several hundred thousand houses relying on such inspection zones. Essentially, the inspection zone defines an exposed area that subterranean termites are reluctant to cross. Only where it is defeated such as by raised soil levels or items placed against the wall, are the termites likely to cross the zone. Where shelter tubes are observed joining masonry weep-holes to the ground below, it is common for the termites to have previously exploited other access points through barrier breaches, and rather than coming up from the soil, have actually built down into it.

That termites can build around barriers has lead to the barrier systems being titled *termite management systems* so as to avoid the legal absolute implied by the term *barrier*. Australia does not permit the application of baiting systems as a protection measure for new construction. Objections have been based around two issues: (1) baiting requires continual actions and expense and (2) the uncertainty of performance and as Grace & Yates (1999) wrote *the possibility always exists that foraging termites will not intercept the bait or station as they tunnel toward the structure*.

2.6 Australian Standard AS3660.2 – after handover

AS3660.2 provides guidelines for the management of termite risk in buildings post-construction. It was based on those parts of AS3660-1993 excluded from AS3660.1 but was expanded. It recommends inspections at least once a year and more frequently for high risk sites. It also deals with termite barrier maintenance, inspection requirements and the elimination of infestations. AS3660.2 is written as guidelines rather than as a prescriptive document, which allows is to cover all possible forms of termite management.

2.7 Australian Standard AS3660.3 – for appraising new systems

AS3660.3 provides criteria for the assessment of termite management systems. It was primarily written to provide a pathway for new systems to prove compliance with the design criteria of AS3660.1 and as such is aimed at system proponents, scientists and appraisal organisations. Though prescriptive, it was intended to provide useful criteria for the assessment of all imaginable termite management systems and so is much more comprehensive than the equivalent USA document (USEPA 1998). It was written in a time where assessments were almost always carried out by the CSIRO and State Forestry organisations. These groups have since withdrawn from such work. It has proved useful to the work of the pesticide registrar, The Australian Pesticides and Veterinary Medicines Authority (APVMA) and the ABCB's Codemark™ system (see Figure 2). Nevertheless, systems have been certified by appraisers, based on bioassays and/or installation details that clearly do not meet the requirements of AS3660.1/AS3660.3. The current draft for AS36603-2013 attempts to both make the prescriptions easier to follow and to also tighten up the wording to prevent such mistakes. It is based around the requirements of a compliant assessment report and the means to produce such a report. The draft is expected to be open for public comment in the middle of 2012.

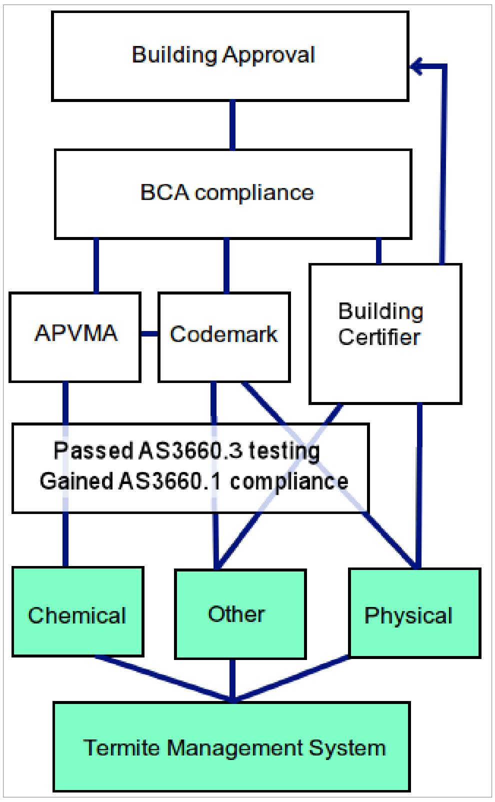

Figure 2. Pathways to building approval. Modified after Peters (2007)

2.8 Dealing with Standards past their use-by date.

Australian Standards in the past have been expected to be updated roughly every four years. The termite Standards took the best part of four years for their last revision and few participants were keen to revisit the task well beyond the usual revision was expected to have begun. This left anomalous clauses such as Clause 5.4.1 of the still current 2000 version of AS3660.1, that specifies soldering of sheet galvanised iron, a skill that barely existed in 1999 and is now an effectively unknown building practice. Similarly AS3660 does not adequately describe the market-leading termite management systems. The strong market share of non-toxic physical termite barriers has been eroded in favour of cheaper or more profitable chemical solutions – impregnated sheets or pipes in the soil. This widening gap drove a push to revise the Standard in 2009.

2.9 Codemark™

Australia has long had systems to allow novel building solutions to be appraised as suitable for use. The original system from 1978 was the Australian Building Systems Appraisal Council (ABSAC) a broad group with industry links. This was replaced in 1999 by CSIRO Appraisals, essentially the same system under the protection of CSIRO. The CSIRO Appraisals scheme thrived for six years until fading out between 2005-2008. CodeMark™, a different approach to a certification scheme was introduced by ABCB in 2005. The ABCB provides its name and credibility, but relies on third-party certification bodies. It is very hard to see where, legally, the responsibility for these certifications lies. These independent certification bodies are assessed and monitored by the Joint Accreditation System of Australia and New Zealand (JAS-ANZ). As with the earlier schemes it replaced, ABCB intends for CodeMark™ to assist the building industry to quickly adopt new and innovative construction technology and practices. In practice, the high costs of certification limit its use. An interesting feature of the ABCB's adoption of Codemark™ is that a building surveyor must approve any Codemark™ certified installation so long as the conditions on the certificate are met. There is a potential for this automatic acceptance to permit an installation that clearly does not comply with the AS3660.1 on which the Codemark™ appraisal was based. For most consumers, the only available information about a Codemark™ certification is what can be read on a downloaded PDF version of the certificate.

2.10 Revising Standards

The global financial crisis hit Standards Australia rather heavily and application for funding a revision was not possible until 2011, even then, the available drafting time was cut by about three quarters. So, after a kick-off meeting in the last week of October 2011, the drafts for revisions of AS3660.1, AS3660.2 and AS3660.3 were all submitted early in March 2012.

Standards written in the 1990s could include proprietary information and carry a warning of patent protection over some of the provided details. This worked well, with manufacturers looking to quickly gain market share quite happy to have technical committees review the minutiae of their systems. That has changed, and while Australian Standards are still expected to supply recipe-book, deemed-to-satisfy detail, the removal of all proprietary information is a severe limitation to the documents' ability to cover the various systems in use. Further, inclusion in the Standard is no benefit to a company with a Codemark™ certificate, and therefore no benefit from having the details of system installations made public.

The future of Australian standards for termites is by no means clear. The absence of CSIRO and State Government employee participation due to retrenchments and institute closures puts pressure on volunteers to carry increased committee loads. Timber industry input has been cut back to one, the Timber Preservers' Association of Australia. Further, the penetration of the Standards has not kept up with modern expectations of document delivery. They are available both in print and in highly-priced Portable Document format (PDF) files. Purchased on-line as a PDF, AS3660.1 costs A$155.82. The publisher for all Standards Australia's documents, even drafts for public comment, is SAI-Global, a multinational which vigorously defends copyright and does not permit most forms of reproduction beyond the minimal quotation specified in law. Compounding this access barrier, Standards Australia no longer maintains free access libraries in capitol cities. Nevertheless, these Standards serve a vital role, even if high prices means that they are becoming less widely read. AS3660.1 is the main document quoted by architects and specifiers for termite management specifications. It is also relied upon by the BCA and the APVMA as a guide to how termite management can be provided. The APVMA and Codemark™ rely heavily on AS3660.3 for assessment criteria.

2.11 Codes of Practice

Industry codes of practice are a voluntary system following the guidelines of the Australian Competition and Consumer Commission (ACCC 2011). Contrasting the high cost of Australian Standards are industry-driven Codes of Practice which typically cost nothing to download. The peak structural timber pest manager group is the Australian Environmental Pest Managers' Association and in late 2011 year it published a *Code of Practice for Prior to Purchase Timber Pest Inspections* (Clarke et al. 2011), intending to *assist potential property purchasers in making an informed purchase decision*. Essentially the aim of the timber inspection code is to promote the Association-mandated industry practice which is set higher than the levels required for timber pest inspection in AS4349.3 and to reduce mismatched expectations by fully informing clients. They set the performance bar a little higher than the Standard. Codes of practice are no constrained by the convoluted language of Standards, which cannot specify roles or training requirements. Similar codes mirroring AS3660.1 & AS3660.2 are being drafted.

To be effective, a code of practice must have the backing of a strong industry association, and be used by a significant proportion of the industry. Like Standards, codes undergo a public comment period and gain their credibility from the juxtaposition of the sponsoring organisation's dominance, the depth and representation of the drafting committee and status of organisations contributing public comment. Codes are regarded as *living documents* that are regularly updated[1]. The general perception is that, when tested in a court of law as a benchmark for competent performance of duties, industry codes are one step above Australian Standards. The organisation proposing a code is required to provide an effective complaint handling system, something that Standards Australia doesn't admit to having.

2.12 The Management Systems

As given earlier, the management systems allowable under AS3660.1 exclude baiting and aggregation systems and to date, neither the Codemark™ system nor the APVMA have certified any such systems in defiance of this position. The systems detailed in AS3660.1 are all aimed at preventing concealed access from the ground and are expected to provide service for the intended life of the structure. Inspections, at least once each year, are specified. AS3660.1 splits termite management (=barrier) systems for new construction neatly into physical and chemical systems (see Ewart 2000). The chemical systems come in three forms, (1) hand-sprayed termiticides applied to

1 For example, the AEPMA bed bug CoP introduced in 2005 had been revised four times by late 2011. This compares with eleven years between the publication of AS3660.1-2000 and the beginning of its first revision.

the ground, (2) termiticides delivered into the ground via pipes and (3) termiticides in a "non-soil matrix" which covers impregnated chemical sheets. The physical systems, which all rely on the innate characteristics of their materials, were split between (1) concrete slabs, (2) sheet metal, (3) woven stainless steel mesh (Termi-Mesh™) and, (4) graded stone (Granitgard™).

Marketing people have since confused this clear division by promoting impregnated sheet products as physical termite barriers and it is these, plus the reticulated (piped) chemical systems that have taken over most of the market share of the Termi-Mesh™ and Granitgard™ physical barriers. The price of stainless steel has risen steeply in recent years, reducing Termi-Mesh's competitiveness. Impregnated sheet installations sometimes get a saving by leaving final placement to bricklayers – thus avoiding both a work-stoppage for the bricklayers and a second visit for the barrier technicians. The reticulation systems offer a soil termiticide barrier with the shortest residual life and often require the addition of more termiticide well before the time that a regular label-rate application would have degraded. By applying very low doses more frequently, the providers of these barriers gain an ongoing income stream, often sufficient to allow deep discounting of the initial installation price (paid by the builder) while securing the building owner as a long-term client. The low installation price of reticulation systems comes with another benefit to the builder. Builders are generally required to guarantee their work for 6+ years but are unlikely to be pursued if the homeowner has not kept up annual inspections and regular chemical re-applications. Table 1 gives a taxonomy of termite management systems that encompasses all those currently in use while providing scope for new and alternative methods.

Table 1. A taxonomy of termite management systems and components

Class	**Category**	**Sub-Category**
Barriers to concealed entry	Physical Barriers	Resistant sheet materials
		Resistant granular materials
		Extrusions and moulded and shaped components
	Chemical Barriers	Impregnated sheet
		Reticulation to soil
		Hand application to soil
		Impregnated extrusions and moulded and shaped components (including granules)
	Other	
Colony elimination	Physical	Physical removal
		Temperature extremes
		Desiccation
	Chemical	Termiticide delivered by a baiting system
		Dusts
		Slow-acting, non-repellent termiticide
	Biological	
	Cultural and	

Class	Category	Sub-Category
	alternative systems	
Resistant materials	Concrete	
	Metal	
	Plastic (rigid organic polymers)	
	Masonry	Bricks and blocks
		Mortar
	Timber	Naturally durable timber
		Preservative treated timber
	Mineral	
Other	*A catch-all class*	

2.13 A place for treated timbers

Preservative treatment of timber is important for both the effective use of the timber resource and to meet the needs of specific commodities (Norton 2005). Challenges facing the industry were reviewed nearly a decade back (MacKenzie 2003) and while the challenges essentially remain, industry is clearly adapting as required. Trends have LOSP *Pinus radiata* gaining a growing share of the framing market, especially north of the Queensland/New South Wales border with most of the LOSP housing having termite barriers. H3 treated timbers are often seen where termite damage has been repaired but in new construction are favoured, along with LVL bearers, where sub-floor clearance is poor.

2.14 Specification versus reality

Having spent countless hours creating a regulatory document, there is a natural tendency to expect a reasonable level of compliance. The opposite can be true. Some people will search for reinterpretations or ambiguity to suit their preferred outcomes. Others will simply claim compliance without having checked their product against the requirements. Not actually checking the requirements is common with architects and builders who would rather just tick the brief specifications in their contract clauses, but I have also observed it to lesser degrees with appraisers and researchers.

It is one thing to look at simple plans and schematics drawn up to be representative of common building details and use these to plan construction works but what the technicians encounter on a building site is often quite different. Late changes, scheduling problems and a general lack of interest from site supervisors and other trades, can mean that technicians have to adapt systems without notice. Sometimes this means irregular installations that are not fully noted in the installation documentation. There is also a proportion of jobs where, in order to keep prices down, the system is short-changed, with termiticide doses less than specified on the product label or with barrier components installed below specification or even left out. If these faults occur too often, they can quickly destroy the reputation of a system.

2.15 Lessons learned

It is important to spend time observing what is actually done as this can greatly help in the development of effective termite management systems. It is better to spend time among real workers so as to gain a proper understanding of how systems and processes are being used. It is even better to do forensic work, finding out how and why systems and processes didn't work as intended. Here are five of the important lessons I've learned:

- *Everything changes.* Rules, expectations, construction techniques, legal requirements, prices and even the background termite hazard, will all change with time. For an example of the latter, when I began looking at termite damaged houses in Brisbane around 15 years ago, *Coptotermes* and *Schedorhinotermes* were common pests, with *Coptotermes* dominant. Between February 2011 and March 2012, I inspected at fifteen houses and fourteen of these had *Schedorhinotermes* and only one had *Coptotermes*.
- *It doesn't matter how good the system is if there isn't a big enough market for it*. I once spent years developing and proving a multi-modal graded-stone barrier for Granitgard™ to use in the tropics which could exclude both the largest and smallest termites (Ewart *et al* 1997) only to find after appraisal and successful delivery of all specifications, that there wasn't a large enough of a market for the system to ever be profitable. The bulk of that market has gone to impregnated sheet materials and reticulated soil termiticides.
- *People will bend rules to their perceived advantage*. This now affects how I draft rules but it can be hard to retain flexibility while attempting to ensure compliance.
- *The best system doesn't always win*. While the homeowner is advantaged by paying a few dollars extra for a long-term, preferably physical barrier system, the actual choice is often made by the builder who increasingly chooses an initially cheaper reticulation system with high ongoing maintenance costs. In the absence of regulatory restrictions, profit and risk-reduction are stronger drivers than overall efficiency or increased service life.
- *Imperfect system installations may work well enough*. Working on physical barriers, I became accustomed to searching for absolute performance. The 90% rule applied in the Florida (*e.g.* Daiker 2010) is well below the acceptable performance levels required in Australia. This probably indicates over-specification on our part. When it comes to actual use in the field, termiticide delivery by hand or pipe is rarely even or continuous and yet call backs are uncommon. With installed barrier systems of many different forms, I have observed failures to comply with the installation instructions that have left barrier weaknesses. These faults often remain unexploited, sometimes even where the structure is infested by termites. The probability of termite attack is variable and in lower risk areas, a small number of structures will remain un-attacked for many years even though termites are around and there are have no management systems in place. This is quite a dilemma.

3. CONCLUSION: MOVING INTO THE FUTURE

Codes of practice are readily accessible, low-cost and able to be copied and circulated at will. They are friendly to display on the small screens of cell phones and tablet computers. It is likely therefore, that these codes will soon be preferred by Australians seeking to protect structural timbers from timber pests. While the revised 3660 Standards should be published in early 2013 and are expected to remain useful for at least 5 years, the future of termite management in Australian building could well be dominated by (poorly-understood) Codemark™ certified systems installed and maintained according to industry codes of practice. Importers, inventors and charlatans will continue to propose new forms of termite management systems and regulatory systems must stay current in order to meet the public need sorting the good from the bad and ensuring quality installations.

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