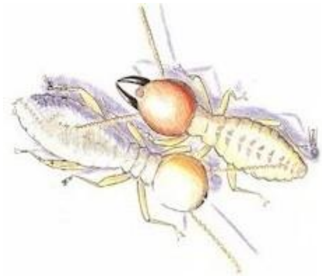
TERMITE RISK MANAGEMENT AND TIMBER TREATMENT



by

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Abstract

Australia has a long history of largely ineffective termite risk management!

We can forgive our pioneer builders whose wooden constructions were continually destroyed by termites in the 1780s and 90s. At that time, they knew nothing of termite biology, habits or potential risk, let alone how to manage that risk.

However, we have since then, developed a proud record of achievement in the acquisition of knowledge about termites through practical experience as well as extensive and effective research. This has resulted in the on-going, innovative development and establishment of efficient termite management systems.

How then, do we forgive our present-day authorities when termite infestation of timber and susceptible materials in our buildings is costing us more than $1 BILLION every year?

This paper will discuss Australian termites and the history of termite R & D in Australia as well as past and present termite risk management and timber treatment strategies.

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INTRODUCTION

"The termites in the colony kept on doing what they as a species, had always done ─ find wood, protect their access to it so they could, in security, chew off fragments and return with this sustenance to feed the others in the colony.

The circumstances may have changed but their method of foraging was always just a variation on an ancient and proven theme.

Crate-wood on the ground surface in Sydney Cove way back then in 1788, was little different from any fallen dead branch. What was attached to the other side of the crate wood was really quite like compressed bark, except there was much more of it in a nice, dark, temperature-controlled environment.

Then in a sudden loss of climate control, the crate and contents were gone. The instinctive response was immediate. Soldiers would guard the small defendable access hole at the soil surface, while workers used a soil and saliva mixture to seal the opening as quickly as possible. Too bad for any of their mates sealed off outside the new closure. The only concern now was the loss of a significant food source, an alternative for which must be sought — and soon.

This loss was little different from a log being washed away in a flash flood or destroyed by a bushfire. Survival was always the main objective. This had been so for millions of years. In those somewhat formative eons of the evolutionary process when termites were adapting in a new specialised direction from cockroaches, the ones that multiplied most successfully were those which sought multiple food sources.

Termites had long since worked out that there was more wood above ground level than under it. Sure, foraging and finding wood in the ground meant that security against ants, echidnas and lack of humidity control was a given. However, the vast majority of edible cellulose for Coptotermes was in the form of trees, logs and fallen dead branches, above ground level.

Now, in Sydney Cove, there was another form of food source. Buildings and their contents!

The mia mias, gunyahs and other short-term abodes of the semi-nomadic aboriginals were really just tree branches placed by humans instead of by natural events. The new fangled so-called government buildings made of sandstone included solid timbers without any contact with the ground.

To termites, this was not all that different from the fallen branches lodged on any number of sandstone rock shelves where termite scouts had discovered that timber of quality and quantity was worth the effort of building protective galleries through which to transfer this food back to the nest.

Scouting above soil level was a high hazard job. Termites that found a desirable food and reported back, were fewer than those who didn't. In the big instinctive scheme of things, those that failed were expendable — and not even the termite equivalent of a brass plaque to memorialise their valour!

So it was that termite tunnels and galleries provided secure access to the interiors of buildings through gaps in the scarce and sparingly applied mortar between the bricks and blocks. Often, the first-found timber was a door frame just above the entrance step. From there, it was up the frame into the lintel, then on up into the all-joined-together timbers of the roof. Not all that different from a dead tree, really. Humans seemed not to notice attack until a strong wind or some other sudden, unpredicted load caused failure — and pioneer swearwords!" (Howick & Staunton In prep.) **§**

EARLY DEVELOPMENT OF AUSTRALIAN TERMITE RISK MANAGEMENT

The Introduction above, fancifully describes the unveiling of Australian buildings to termites and the circumstances necessitating the application of termite risk management (TRM) strategies.

Just because it was slowly realised that that some sort of preventative measures should accompany the use of timber and other susceptible cellulose-based materials, it didn't mean that those measures were effective. The battle hadn't been won, it had only just started. Over the years however, it became clear that there were at least three different approaches to the problem, which, when used either singly or in conjunction with each other could at least ameliorate the problem.

Indeed, just before the end of the 1800s, Froggatt (1897) observed that many remedies had been tried and *"when the insects are get-at-able some are effective"*. However, he went on to say that when building, the best methods to adopt to deal with termites was to *"construct the house on strong piles clear of the surrounding ground, and each covered with a larger zinc plate round the protecting edges of which they cannot crawl"* or to *"treat all the timber used with some preservative fluid or chemical"*. Froggatt also explained that arsenic and soda dissolved in mineral oil were *"... the chief ingredients of the patent "anti-ant" liquid sold in Sydney which had been found, if thoroughly applied, to be a great preventive"*.

Dressed in more modern clothes, these are the three approaches that we use today: Physical or chemical strategies and the use of naturally termite resistant or preservative treated timber.

TRM in Australia is likely to continue to utilise and develop the installation of appropriate precautions (physical, chemical, cultural or a combination thereof) to protect new structures.

§ Howick, Doug and Staunton, Ion (In preparation) "Colonies in Collision – A Concatenated Chronicle of Termites and Termiteers in Australia 1788 – 2016".

EARLY CONSTRUCTION TECHNIQUES AND MATERIALS

Brick and stone were used from the beginning of the Australian Colony. However, the shortage of time and skills available, and the lack of lime, resulted in their limited use. Timber log construction with interstices filled with pipe clay was the first walling construction commonly attempted. Its use was curtailed by limits to the supply of Cabbage Tree palms available and the rapidity with which they decayed, or were attacked by termites, in a wall. Wattle and daub became the standard low cost alternative. (Lewis 2015).

The most available timbers were the eucalypts: Sydney blue gum, stringy bark, box, ironbark, spotted gum and others. The maximum-security penal colony of Norfolk Island also had pines, straight grained, easy to saw and plane and shipments of this timber were brought to Sydney. The Sydney *"Coptos"* loved it! Never had they tasted anything as good — or so it seemed.

Then someone found and cut down a red cedar and there began the equivalent of a gold rush. The first joy came from how soft and easy it was to work. Then it was eventually noticed that the termites showed little interest in it. They would build their tunnels over it but they did not destroy it. A timber that was naturally termite-resistant. **What a good way to manage the termite risk!** It was at least, a partial solution to a big problem but it was the first Australian venture into TRM and a new industry was born. Cedar-getting!

The rush for cedar quickly spread from the Sydney region to the Hawkesbury, then to the Illawarra, the Hunter, the Shoalhaven and Kangaroo Valley, then to the northern rivers, and into Queensland. In an analogy to a gold rush, men went to great extremes to find and extract the red gold (McKinnon 2015) .

Cedar-Getters

Though at first seemingly limitless, cedar was cut so rapidly that as early as 1795, and again in 1802, the then Governor, John Hunter issued regulations to control its cutting on the Hawkesbury. Later, in 1819 Governor Macquarie attempted to restrain illegal cedar-getting in the Illawarra district, though more for the protection of government revenue than as a conservation measure.

Interestingly, a free settler who emigrated from Alsace, Germany in 1858 went north to the Richmond River area working as a cedar-getter. His name was **Jacob Flick** and his grandson William was responsible for their family name becoming a household word in Australia! (White 1996).

TREATMENT OF ACTIVE TERMITES

Eradicative treatments

In 1908 the Bain's White Ant Extermination Company of Sydney claimed to be contractors to the Commonwealth, New South Wales and West Australian governments, the Sydney Harbour Trust and the Federated Malay States. By the 1920s they called their product 'Bainal' and claimed that it killed both termites and their eggs. (Lewis 2015).

In the 1920s, a farmer in New South Wales, **William Albert Flick**, began experiments to rid his Tyagarah dairy farm of termites. With his experience of bee-keeping, he saw the possibility of using working termites to poison the queen. Eventually he developed an arsenical compound, a 'secret' red powder, fine enough to be carried, eaten and spread by grooming throughout a colony. The powder effectively exterminated termites on his own and surrounding properties. His process was first patented in 1922.

Current commercial non-repellent dust formulations for colony elimination include compounds of arsenic, triflumuron, fipronil, and the repellent permethrin which is used for injection into nests (Ewart and Cookson 2014).

Modern soil termiticides fall broadly into two categories, repellent formulations (pyrethroids) and non-repellent formulations (chlorantraniliprole, fipronil, imidacloprid etc.). Termites are able to detect and avoid areas of repellent pyrethroids whereas, as they enter zones treated with non-repellent termiticides, they may collect and share a lethal dose before symptoms appear (Ewart and Cookson 2014). Today's termiticides must be applied according to the approved label, at the correct recommended strength, in the correct manner, according to AS 3660 Standards ─ and then they work !

Following their development, the market found its own level and the welcome return of many of those pest managers who had been unwilling to participate in the poor pre-treatment regimes of the organochlorine era (see page 7), to offer much improved services.

Baiting Systems: Termite baiting is not new! In 1921, Gerald Hill, the founder of CSIR(O) termite research in Australia, devised a recipe for "poisoned baits", which used arsenical solutions as the active ingredient in a matrix made of four materials.

The use of baits has been reviewed by Lenz and Evans (2002) who commented that it is illuminating and humbling to realise that such pioneering work existed more than 90 years ago. More recently, Evans and Iqbal (2014) recognised that the rise of environmental concerns created the conditions for research into and the consequent development of 'trap and treat' monitoring and baiting systems.

However, deliverance still depends critically on the successful combination of the three factors of active chemical, matrix, and biology. Baits provide opportunity for colony control where no central nest can be found, where observed termite activity is too low for direct termiticide application and where building 'features' prevent the installation of a sub-floor termite treatment. Baiting has become the method of choice for many pest managers, replacing other options. Successful bait toxicants fall roughly into two classes: insect growth regulators and inhibitors of energy production, and all to date are slow-acting and non-repellent (at the levels employed). The major commercial toxicants include chlorfluazuron, hexaflumuron, noviflumuron, and bistrifluron (Ewart and Cookson 2014).

Baiting systems are here to stay!

PRECAUTIONS

(Dictionary definition of precaution:
"A prudent measure warding off impending danger, damage or injury etc.")

Physical Precautions

It really didn't take very long for our pioneers to work out that most of the termite damage to their early buildings and structures was from termites coming up out of the ground. Early Australian builders therefore devised and adapted the so-called "ant cap" without wasting any of their time quibbling about whether it was a "barrier", a "monitoring device" or a "management system". It was undoubtedly the first Australian attempt at TRM.

(Testing of physical barriers by the CSIR(O) began more than eighty years ago and a variety of devices and systems have subsequently been tested over the years.)

Chemical Precautions

Various chemicals or chemical combinations were used with varying success rates in the early years. Later, in Australia and elsewhere, soil treatments were considered to be a desirable method of termite management but no insecticidal compounds were thought to be termiticidally effective. However, for other pests, prevention and control methods were focused on organochlorine (OC) insecticides. There was a big break-through in the mid 1940s, when it was found that they gave excellent protection to timber structures from subterranean termite attack. Dusting of existing infestations was therefore largely replaced by precautionary chemical soil treatments at that time. Dieldrin was among the first OCs used for this purpose. Other widely used OC products included aldrin, chlordane and heptachlor, related compounds with good residual efficacy as they bound well to soil particles.

For our industry, the fact that the OCs were so effective and efficient was not necessarily a blessing. Although they were deemed to be ecological "nasties" they were excellent termiticides! Consequently, builders and pest managers discovered that when the recommended minimum dose was watered down, the treatments were still effective and even if the job was done sloppily, with watered-down organochlorines, it still worked! This resulted in the adoption of poor application practices by some pest managers – and a cessation of involvement in termite pre-treatments by other, more ethical pest management organizations.

Because chemical soil treatments aimed to prevent termite access into buildings, they were perceived to be simple, safe and persistent. Chemical soil treatments were completely dominant in termite pest management for over 50 years, yet their use declined due to environmental concerns arising from the use of large quantities of synthetic insecticides.

Without question, the publication of Rachel Carson's *"Silent Spring"* in 1962 had given rise to the American environmental movement and brought to light the use and abuse of chemicals in agriculture and pest control. The book sold hundreds of thousands of copies and stayed on the best seller list for thirty-one months. By 1975 every one of the pesticides named in the book was either banned or severely restricted in the US – and later, in Australia.

A complete review of standard termite pre-treatment practices in Australia became necessary in the lead-up to July 1995, when the use of organochlorine chemicals was finally suspended for termite pre-treatment in all parts of Australia (except the Northern Territory for a further six months). In less than a year – the blink of an eye in historical termite terms – the spectre of ineffective chemical pre-treatment of buildings reinvented itself.

Fed remotely by the sensationalism of the media in reporting the inadequacies of our industry, it demolished the tyranny of distance, allowing terror to sprout and flourish in our gum-tree suburbs half a world away from the battlefields of the EPA in the US where the "harmful" toxicity and longevity of the organochlorins had previously been trumpeted.

BUT the Australian suspension of organochlorines was twenty years ago and we're still talking about it as though it only just happened !! This means that there are people who have been pest managers for 20 years but have never worked with aldrin, dieldrin, chlordane or heptachlor!

Those first insecticides from the 1940s were then replaced by organophosphate (OP) insecticides (e.g. chlorpyrifos) and later by synthetic pyrethroids (SPs) (e.g. deltamethrin and bifenthrin). These replacement chemicals were effective, efficient and proven by laboratory and field trials ─ but……..they were not as "forgiving" as the organochlorines !

The toxic effects of OPs had been noticed in the 1930s, with subsequent development of general purpose variations. Chlorpyrifos was developed in the 1960s but wasn't used against termites until much later, when the toxicity of the OCs was being questioned and other termiticides were being sought (Howick and Creffield 1981). However, OPs are actually even more toxic than OCs but because they degraded rapidly when exposed to air, light and soil microorganisms, their use continued.

Material Precautions

In 1906 'Solignum Wood Preserver and White Ant Destroyer' was being sold in Australia by Henry Books & Co. In the 1920s the Borer & White Ant Exterminating Co of Victoria, was marketing 'Borantibane', with which they had treated nearly two thousand houses built by the State Savings Bank of Victoria. (Lewis 2015).

In the 1930's, research in CSIRO's Division of Forest Products was largely mission oriented towards forest resource development. Research in the areas of preservative treatment, sawing and drying practices, veneer and plywood manufacture and paper science, dramatically improved the utility value of many indigenous forest species.

Timber treatment has a long history, having become the basis of an important industry since the development of vacuum-pressure impregnation techniques 150 years ago and the successful formulation of copper-chrome-arsenic (CCA) waterborne preservatives in the 1930s.

There is no doubt that in the twenty years since the oganochlorines were withdrawn from use in Australia, the issue of termite infestation of building materials has increased in importance and public concern. However, properly treated timber frames will not be attacked by termites. Increasingly, house frames are now treated and several new products and processes have been developed to meet the demand. They provide a cost effective means of protection.

Not only are house frames treated, there are many other applications for treated timber – fencing, decking, flooring, pergolas, lattice, cladding, landscaping timbers, retaining walls, poles, piles and more.

The AS 1604 suite of Australian Standards provides details of all approved preservatives and the level of treatment required for the various "hazard levels" (see Tables below)

The Main Preservation Standards

AS/NZS 1604 series

Specification for preservative treatment

AS1604.1-2012 Part 1: Sawn and round timber

AS/NZS1604.2-2012 Part 2: Reconstituted wood-based products

AS/NZS1604.3-2012 Part 3: Plywood

AS/NZS1604.4-2012 Part 4: Laminated veneer lumber (LVL)

AS/NZS1604.5-2012 Part 5: Glued laminated timber products

AS 1604 Hazard Classes:

H1 - Inside above ground: Lyctids

H2 - Inside above ground: Borers and termites

H2F - Inside above ground: Borers and termites*

H3 - Outside above ground: Moderate decay/termites

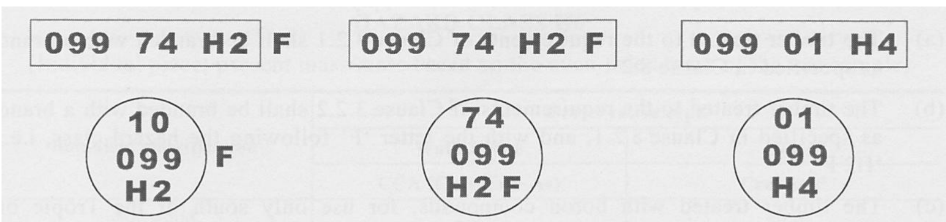
H4 - Outside in ground: Severe decay/borers/termites

H5 - In ground contact, with or in fresh water: Very severe decay/borers/termites

H6 - Marine water exposure: Marine wood borers, decay

*envelope treatment for framing used south of Tropic of Capricorn

A Register of Treatment Plants and the issuing of Plant Numbers are required for conformance with the Standard AS 1604.1, which lists approved preservatives and stipulates that products that claim to conform to that Standard shall be branded with a code number made up of : a Treatment Plant Number – (from the Register); a Preservative Number – (from the Standard and approved by the APVMA); a Hazard Class Number – (from the Standard and to which level which that Plant is registered to treat)



By maintaining a regulated system of brand registration, there is some control over the supply of treated timber products coming to the Australian marketplace whether they be of Australian, Australasian or overseas origin. There are several further regulatory requirements that flow on from the AS 1604 suite of Standards. These include the Building Code of Australia (BCA) which, through AS 1684.2 requires that structural timber "shall be adequately treated with preservative in accordance with the AS/NZS 1604 series ".

If a novel building material with all the properties of treated timber had just been invented, it would be hailed as the wonder product of the 21st Century.

It is – and it grows on trees. THAT'S EXCITING!

REGULATING AGAINST TERMITES

Because Standards are simply voluntary agreements containing technical specifications, an Australian Standard has no binding legal status unless it is called up by a regulation or is written into a contract.

Codes are systematic statements of law and for building in Australia, the all-important regulation is the National Construction Code (NCC) which incorporates the Building Code of Australia (BCA) to which all buildings must conform. The BCA becomes law by being called up or referenced through each state government's particular building legislation.

Our termite Standard "AS 3660.1 - Termite management Part 1: New building work" is a so-called "BCA primary referenced Standard". This means that termite management products and processes which conform to that Standard are deemed to satisfy the requirements of the BCA with regard to "Termite Risk Management". Because it is adopted by its reference in the BCA, compliance with this otherwise voluntary Standard therefore becomes mandatory.

State legislation can impose additional statutory requirements to those mentioned previously. This is mainly in the form of fair trading legislation relating to the home building industry. For instance, the NSW Office of Fair Trading publication, '*Protect Your Home From Termites'* (OFT 2003, page 4) requires protection of the whole house, not just primary structural elements.

Local councils provide yet another impact on termite management requirements. Councils do not necessarily accept all systems, especially those perceived to adversely impact on the environment – this is sometimes the case where chemicals are involved.

The National Registration Scheme for Agricultural and Veterinary Chemicals impacts via the Australian Pesticides and Veterinary Medicines Authority (APVMA) which evaluates the safety and performance of chemicals where used in treatment systems. It constantly monitors the market for compliance, and also stipulates the life expectancy of chemicals used, thus determining when reapplication is required.

Over the years, the rights and obligations of builders, sub-contractors and consumers have been identified, broadened and spotlighted to the point where they have become a major issue for the building industry.

Aside from statutory requirements, contractual stipulations create obligations between the builder and customer and because of the emphasis on obligations, builders have been required to become experts in all areas relating to the construction of the building. In relation to termite control, this is further complicated by the fact that there are numerous products and systems on the market claiming to provide an effective treatment. As a result of this, it is now not uncommon to find builders who have taken the trouble to become qualified to undertake timber pest inspections. This also enables them to specify appropriate termite risk management strategies for their construction projects.

TRM Requirements of the Building Code of Australia

The purpose of the BCA regulations is to ensure the safety and structural integrity of buildings. The Code contains explanatory information to the effect that the termite requirements of the BCA are minimum requirements and owners of buildings may choose to incorporate additional termite management systems in their buildings.

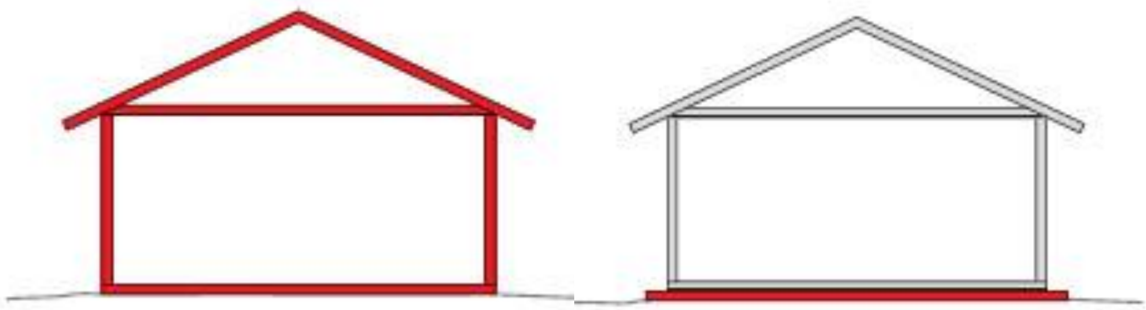
The Code states that protective measures must be taken if primary building elements in new building work (including extensions) are susceptible to termite attack. If there is no potential risk, then no protective measures are necessary.

Primary elements are those designed to take building loads. If these elements are constructed of one or a combination of termite resistant materials, then no other termite risk management is required by the BCA (although of course, this leaves other parts of the building unprotected). This means that a new house using naturally resistant or preservative treated timber can conform to the BCA while having no termite management systems installed.

Try telling the owner of a one year old house that there is no need to worry about the termites eating out the skirting boards, architraves, cupboards, joinery, books and carpets because the building is still structurally sound!

Amusingly, building bureaucrats in Queensland recognised this problem and "solved" it by officially inserting a State Variation into the BCA to the effect that (just in that State), ***"Primary structural elements include door jambs, window frames, reveals, architraves and skirtings".***

Materials deemed to satisfy the requirement of being "termite-resistant" include concrete, masonry, steel (and other metals) as well as preservative-treated timbers and naturally termite-resistant timbers. It is not always in the best interests of timber as a building material to pretend that the effects of insect attack are unlikely to be of a serious nature. A far more realistic approach is to improve the understanding of the incidence, habits and ecology of those insects which attack wood. It is then possible to ensure that appropriate preparation is provided when timber is used in situations where attack is likely. The cost of such precautions generally represents only a fraction of the total cost of the structures they protect and, like insurance, may be regarded as good value for money.



Resistant materials approach — Termite management systems approach

Termite management systems are another method accepted under the BCA. This approach is to prevent or at least, to deter the concealed entry of termites into buildings. It is generally more popular than the use of termite resistant materials because of its ability to address "the whole of the house" and not just the primary structural elements.

The BCA requires that a notice be fixed permanently to the building in a prominent location (e.g. the meter box) giving information about the termite management system used. The notice must be of durable material, and include the specific method, date of installation, the registered life expectancy of chemicals (if used), and the installer's recommended frequency and scope of termite inspections.

In addition to the above, variations to the BCA occur due to state/territory specific requirements. The Northern Territory and Queensland are two such cases where variations place extra conditions on the use of termite-resistant materials, treatment systems, and the requirements for termite management notices.

The CodeMark Scheme

CodeMark is a product certification scheme operating under the auspices of the Australian Building Codes Board (ABCB). Building products and systems displaying the CodeMark logo have building approval in all states and territories in Australia, as their certification is dependent on conformance to the BCA.

The first step for organisations that produce building products and systems is to contract the services of one of the three certification bodies accredited for the CodeMark scheme. If the product meets the CodeMark requirements after an audit process, then the certification body will award the product with a CodeMark certificate which is valid for three years in Australia and can be renewed through regular reassessments.

However, some people will search for reinterpretations or ambiguity to suit their preferred outcomes. Furthermore, as Ewart (2012) warned in his timely consideration of the subject, *"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"*.

THE REAL COSTS OF POOR RISK MANAGEMENT STRATEGIES

It is essential to realise that the prime TRM strategy is the organisation of competent, prior to purchase and regular, post purchase timber pest inspections by appropriately qualified and experienced timber pest inspectors.

Chemical soil treatments are easily bridged by the usual homeowner activities such as gardening, landscaping and adding features such as pool pump houses, pergolas and screens. Even though termites may not be able to get through effective soil treatments, some of these can be relatively easily bridged by a new layer of soil washed over them by heavy rains.

Earlier Australian Standards have stressed that *"the purpose of termite barriers is to deter concealed entry by termites into a building, above the termite barrier"* and even the latest (2014) version states that it is primarily concerned with providing *"measures to reduce the risks of undetected subterranean termite attack on buildings"*. The implication is quite clear: **regular, competent inspections are essential!**

Quite obviously, inadequate termite risk management can have expensive results. However, these can go much further than just the costs of pest management, building repairs and maintenance services.

When considering the ultimate cost of termite infestations, it is also necessary to take into account the additional cost of mutually dependent occurrences. There are many historical examples of this and details of just three are now given to demonstrate the enormous potential cost escalations which might have been avoided by the application of appropriate risk management strategies at the planning stages of these projects.

Golden Pipeline Project

In the 1890s, prospectors rushed to what became known as Coolgardie and Kalgoorlie following rich gold discoveries, with many literally dying of thirst in the arid gold fields, or from diseases spread by lack of sanitation and clean water. Water was also needed so the gold mining industry could develop. Attempts to obtain water from local underground sources and dams proved unsustainable and finally a pipeline was built from a dam to the east of Perth. The Scheme was an engineering feat that attracted worldwide attention at the time, and has subsequently been declared an Australian national engineering landmark.

The scheme cost £2,655,220 — only slightly more than the original estimate made seven years earlier (which did not include the extension to Kalgoorlie). Water has flowed to the Goldfields ever since. (The Golden Pipeline Information Sheet Number 1, http://www.kalgoorlietourism.com/downloads/The_Golden_Pipeline.pdf)

By 1932-33, a quarter of the water being pumped from Mundaring Weir, 1.7 million cubic m, was being lost along the route. At the height of the Great Depression, which affected the entire developed world in the 1930s, the Western Australian Government was under pressure to use wood stave pipes, not only to repair the pipeline but also to help stimulate the local economy, including the timber industry, and to create jobs. It was cheaper to use a ready supply of local timber than to import expensive materials such as steel.

But was there a termite risk management strategy? Of course not!

It is noteworthy that in recalling his family history for *"The Way We Were"* thirteen years ago, Jack Flick recalled that his father Bill (W A) Flick was awarded a contract by the Western Australian Water Board for termite treatment to what was almost certainly this very pipeline.

Although those pipes were laid on supports above ground, termites attacked them and leaks were caused by the staves drying out and by breaks in the wire binding.

Wild donkeys were also said to kick holes in the timber pipes to get at the water within. Despite their unsuitability, the last wooden pipes were only replaced in 1971.

IMAGINE THE COST OF THAT!

Northwestern Australian Iron-Ore Rail Line Projects

The Giant Northern Termite, *Mastotermes darwiniensis* Froggatt has greater powers of destruction than any other Australian termite. However, because it occurs abundantly only north of the Tropic of Capricorn, the economic magnitude of the damage it causes is exceeded by that of less voracious species which occur in the more populous parts of the continent.

Increasing settlement of the more remote areas and particularly the development and exploitation of the vast mineral resources of northern and northwestern Australia brought about a closer confrontation with *Mastotermes*, an increase in its pest status, and a new realisation of its potential to create disaster.

Typical fully laden iron-ore rail truck

Conditions for wooden railway sleepers in the Pilbara were amongst the worst in the world (Creffield, Dale and Lowe 1978). Very high axel loads, tonnages exceeding 60 million gross a year, and ground-surface temperatures exceeding 70ºC for months on end were encountered. Astute engineers took all that into consideration when designing their iron-ore lines in Western Australia.

But was there a termite risk management strategy? Of course not!

The conventional methods used in the protection of buildings are less readily applied to other structures and materials such as wooden sleepers in iron-ore railway lines that stretch for miles through country where people are scarce but *Mastotermes* is ever present.

It is interesting that this species, one of the most primitive living termites, has survived only in tropical Australia where it co-exists and competes for food with a large fauna of more advanced, tropical termites. One reason for its survival may be the ability of the species to produce numerous supplementary reproductives, or neotenics. Indeed, primary reproductives are rare. Many neotenics can provide enormous reproductive capacity and when conditions become favourable, small colonies can grow rapidly and spread, achieving populations more than a million strong. They also enable new colonies to form by a process of "budding-off" from parent colonies, localised groups with neotenics then becoming isolated and independent.

Thus, the adaptability of *Mastotermes* presented an unexpected challenge to Australia's developers. Where areas of sparse vegetation which had supported small numbers of termites for very many years were linked by iron-ore lines containing susceptible rail sleepers, the existing colonies of *Mastotenres* could expand rapidly, forming sub-colonies, to take advantage of the new food source. Having thus developed and having virtually no alternative food, they were then forced to attack material they did not normally infest.

Indeed, attack by *Mastotermes* on jarrah (*Eucapyptus marginata*) sleepers in their iron-ore lines was first reported by the Goldsworthy Mining Company in 1970. Attack also occurred in a number of places in the Mt Newman Mining Company line in 1972.

It was only then that termite risk management strategies were instituted. All attacked sleepers and all those for 90 metres either side of the attack were replaced with creosote/furnace oil treated Malaysian timbers, mainly keruing (*Dipterocarpus* spp.) with some kempas (*Koompassia malaccensis*).

No recurrence of attack occurred at any of those sites. The company also initiated field tests to find an economic solution to the problem. Without those strategies, it was realised that this situation could have resulted in sufficient termite damage to treated or usually non-susceptible wooden sleepers to cause derailment of iron-ore trains, with consequent delays to shipping and mining operations.

IMAGINE THE COST OF THAT!

Danger Death Damage

It may not happen every day, but what about those unusual and dangerous situations that can sometimes occur as a result of termite attack?

The ramifications of such occurrences for pest managers are both complex and complicated. And it is the complex and complicated ones which are the most newsworthy, with the resultant press coverage often detrimental to the pest management industry.

There have, for example been instances where a timber pest inspection report indicated that a property was free of termites and shortly thereafter a falling tree in the front garden demolished half the house and flattened the neighbour’s garage – with car inside!

Such events have recently highlighted the way dangerous trees are managed by councils, other organisations and property owners. Property owners are responsible for a tree if it is on private property, whereas councils are responsible if it is on council land.

Taking that a little further, a person who had complaints brought to them regarding a tree and did not do anything about it could be liable if the tree subsequently caused damage or injury. The same goes for councils and their risk management strategies should include termite inspections by appropriately qualified members of our industry.

Equally dangerous and sometimes tragic are injuries or even death as a result of a balcony collapse due to termite attack.

IMAGINE THE COST OF THAT!

REFERENCES

Creffield, J. W., Dale, F. A. and Lowe, H. W. G. (1978). Protection of Sleepers Against *Mastotermes darwiniensis* (The Giant Northern Termite). Rail Track **2,** 24-28.

Evans, T. A. and Iqbal, N. (2014). Termite (order Blattodea, infraorder Isoptera) baiting 20 years after commercial release. Pest Manag. Sci. 2014. (wileyonlinelibrary.com) DOI 10.1002/ps.3913.

Ewart, D. (2012). Managing Termite Risks ‑ An Australian Perspective and a Cautionary Tale. *The International Research Group on Wood Protection*; Document No. IRG/WP 12-20482. 12 pp.

Ewart, D. M. and Cookson, L. J. (2014). Termites and Timber. Chapter 9. In: Deterioration and Protection of Sustainable Biomaterials; Schultz, T., et al.; ACS Symposium Series; American Chemical Society: Washington, DC, 159-181.

Froggatt, W. W. (1897). White Ants, with Some Account of their Habits and Depredations. Ag. Gazette NSW **8,** 297-302.

Howick, C.D. and Creffield, J.W. (1981). Laboratory Bioassays to Compare the Efficacy of Chlorpyrifos and Dieldrin in Protecting Wood from Termites. Int. Pest Control **23**, 40-52.

Lenz, M. and Evans, T. A. (2002). Termite Bait Technology: Perspectives from Australia. In: Jones, S. C., Zhai, J. and Robinson, W. H. (eds.) Proc. 4th Internat. Conf. Urban Pests, Charleston, Pocahontas Press, 27-36.

Lewis, M. B. (2015) Australian Building – A Cultural Investigation. http://www.mileslewis.net/australian-building/

McKinnon, R. (2015) Kiama Pilot's Cottage Museum http://kiamamuseum.com/Cedar/index.htm

White, R. (1996). Flick, William Albert (1890 – 1980). Australian Dictionary of Biography **14,** (MUP). http://adb.anu.edu.au/biography/flick-william-albert-10203/text18031

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CONCLUDING REMARKS

In this paper, I have approached the subject of Australian Termite Risk Management from an historical viewpoint in an attempt to follow the development of current strategies and to evaluate their effectiveness or lack of it. To do this, I have had the benefit not only of my years of involvement in government sponsored termite research and development, but also of my close association and involvement with the pest management industry. Furthermore, the paper has also benefited from constructive comments by Ion Staunton and Dr Michael Lenz.

There have been many achievements in the acquisition of knowledge about Australian termites through practical experience as well as extensive and effective research. This has resulted in the on-going, innovative development and establishment of efficient termite management systems, many of them technologically excellent.

Termite Risk Management strategies in Australia are likely to continue to utilise and develop systems ─ physical, chemical, cultural or a combination thereof ─ to avoid the preventable and unnecessary cost of inadequate preparedness which, when added to the normal twenty five year mortgage is daunting.

Nowadays, we have the National Construction Code (NCC), the Building Code of Australia (BCA), the suite of Termite Management Standards (AS 3660), the suite of Timber Treatment Standards (AS 1604), the State/Territory specific requirements, a whole lot of consumer requirements and an ever-increasing choice of termite management systems to help us keep them out. And still we sometimes fail – because our termite risk management strategies are not foolproof ─ and there are still plenty of fools.

I'm sure that the majority of delegates to this Risk Management Conference are quite capable of building a house for themselves that termites will never be able to get into. But the statistics prove that they don't do it for everybody else! If we don't plan our clients' treatments the same way we would plan our own, are we really adhering to one of the first principles that should guide a pest management professional?

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Howick, Doug (2015). Termite Risk Management and Timber Treatment.
Proc. Rapid Solutions 9th Risk Management Conf. Gold Coast, 14-15 August, 19 pp.