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TERMITES IN NEW SOUTH WALES

PART 2. TERMITE INFESTATIONS: INSPECTION, DETECTION AND TREATMENT



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The discovery of a termite infestation in or around the home understandably causes alarm. People often react by taking hasty, ill-advised actions such as removing damaged timber or spraying exposed termites with household insecticides. Counter productive action of this sort drives the termites away from where they were discovered and makes ultimate eradication much more difficult. Effective methods of initial treatment rely on termites remaining active and accessible, so it is vital that infested areas should not be disturbed unnecessarily. Upon discovering an infestation, householders should stay calm, leave the infested area alone and quickly seek expert advice.

Information presented in this publication is intended as an outline only. For more information on the procedures for the inspection, detection and treatment of termite infestations, reference should be made to the appropriate Australian Standard (referred to below).

HOW INFESTATIONS OCCUR IN BUILDINGS

Termites will attack and eat virtually all cellulose-containing material, including timber used in man-made structures. All subterranean termite attack originates from a nest, usually situated outside or underneath the building. In rare cases termites have been known to construct nests inside buildings without soil contact when a permanent source of moisture is available (e.g. from leaking plumbing).

Underground foraging galleries are used by termites to reach timber in direct contact with the ground, while timber above ground may be reached either through galleries constructed inside timber supports or through mud shelter tubes constructed on the surface of concrete, brick or other foundation materials. Termites build shelter tubes over and around obstacles. Over

short distances (generally less than 450 mm) termites may also build free-standing stalagmite-like structures to access timber. Shelter tubes and 'stalagmites' can be constructed to by-pass termite caps, so little reliance should be placed on these without regular inspection.

Entry into buildings constructed on concrete slabs may be gained through shelter tubes built over the edge of the slab and through gaps between bricks or through soft mortar or mud bricks. Other routes of ingress used by termites are cracks and defects in concrete slabs, unprotected joints placed between slab elements or gaps around service pipes which penetrate the slab.

On reaching a timber structure, termites may branch off in several directions, forming separate galleries through the timber to different parts of the building. They may work along the full length of one flooring board, and hollow it out thoroughly before extending their activities to the next one. They may build galleries covered with their 'mud' or partly digested wood mixed with clay, over wooden or other surfaces, merely cutting a shallow furrow in them in order to reach the rafters which may consist of more palatable timber such as Douglas-fir (oregon) or radiata pine. In other cases they will start feeding in the centre of hardwood post or pole and gradually enlarge the hole until the structure becomes almost completely hollowed out (Figure 1).



Figure 1. Power pole failure resulting from termite attack.

INSPECTION AND DETECTION OF TERMITE ACTIVITY

Inspection frequency

In areas of high termite hazard, frequent and standardised inspections of all susceptible buildings and structures is essential. Regular inspections every six to 12 months are recommended where termites are known to be active and destructive in the local area. Termite inspections need to be carried out by persons with the appropriate experience and training. They need to be able to recognise at once evidence of termite activity such as typical damage to timber and the presence of 'mud' galleries built over timber and foundation surfaces.

Failure to carry out appropriate inspections exposes the householder to an increased risk of property damage from termite attack. Inadequate inspections may also result in certain warranties and insurances (e.g. of termite control systems or building components) being rendered void. However, such deficiencies will not affect the statutory warranty for a new house, which cannot be removed by contractual agreement (see below).

The objective of an inspection is, first, to determine whether the building is infested and, if so, to discover the extent and nature of the infestation so that suitable points for insecticide treatment can be identified and the need for any necessary timber replacements can be determined. Such an inspection should be carried out with a minimum of disturbance to the termites and their galleries, to enable the full effect to be gained from subsequent poisoning methods.

Procedures for the inspection and detection of termite activity are given in Australian Standards AS 3660.2 and AS 4349.3.

Where to look

The most important part of the building, from the point of view of termite attack, is the part in contact with the ground or "footprint" (e.g. the sub-floor area of suspended timber floors, basements). Any inspection should be directed at examining it if it is at all accessible. It is here that the shelter tubes, which the termites construct over footings and piers, are usually observed. These shelter tubes occupy a vital place in the termites' communication system and in the supply of food to the colony and can be more easily treated than the main galleries in timber. Areas of low clearance, bad ventilation and badly

drained or damp portions should be very carefully examined, as termites favour such areas.

A further check of any building for termite attack can be made by inspection of the above-floor timbers: skirting boards, door and window frames, plates, studs, rafters and battens, rarely disturbed areas such as the back of built in cupboards etc. This will be essential if the under-floor regions are inaccessible or if the building is built on a concrete slab. When this is the case, the inspected areas should include the edges of the slab and the bases and ends of walls and architraves within the building. Termite activity is encouraged by moisture and decayed timber is more attractive to them. Therefore, particular attention should be paid to parts of the house where water pipes run (e.g. kitchens, bathrooms, toilets, laundries) and where there are service penetrations through the slab (i.e. areas around them).

It is important in any inspection, especially in areas with considerable tree-cover, to examine the area in the immediate vicinity of a building or group of buildings for the presence of termites in adjacent timber fences and outbuildings. Termites often nest in living or dead trees and the treatment or removal of such hazards may well remove the need for more arduous work necessary to control an infestation in a building. Regular inspection and early detection of the presence of termites, followed by remedial measures, is the only means of combating the pest under some conditions of high termite hazard and inadequately protected wooden structures.

How to recognise termite damage

Damage by termites is very difficult to detect in a building, owing to their habits of seeking dark and badly ventilated situations. Unless their galleries leading from the ground are discovered accidentally or by inspection, damage is not usually discovered until a piece of timber that has been hollowed out breaks under pressure, such as due to the weight of a door or a piece of furniture.

The presence of a large number of winged reproductives emerging or swarming from the soil or wood may be the first indication of the existence of a termite colony. The discarded wings are often found beneath door or window frames from which the termites have emerged. Unlike wood boring beetles ('borers'), termites do not reduce wood to powder and there are no visible flight holes on the surface of the timber.

Once discovered, the damage is very characteristic and quite easy to recognise. Termites work inside timber, along the grain, eating out large galleries or runways. Some species completely hollow out a piece of timber leaving only loose masses of refuse, while others work in long narrow runways right along a piece of timber. In one board there may be several of these runways, which are gradually widened and extended until only a thin shell of the board remains with a series of flutings inside. The inside of the galleries is frequently covered with greyish specks of excrement and earth. It is possible to follow these galleries right back through the structure of a building e.g. along floor boards, into the joists and bearers and thus down a communication gallery, in the form of a mud covered runway built over a footing. This leads down to the ground and then back to the nest via a passage beneath the surface.

Termite activity is indicated by the presence of 'mud' shelter tubes and any sign of 'mud' plastering in corners, cracks or crevices within the timber or over brickwork (Figure 2). If a shelter tube is located, an attempt should be made to trace it to the point of contact with the ground. Probing, drilling or tapping of the timbers should reveal the presence of weaknesses, in the shape of galleries or hollowed-out timber. Hollow-sounding timber is another indicator of activity. Moisture transferred from accumulations of termite mud behind porous walling materials such as plasterboard can cause paint to lift or produce 'waviness' or other surface abnormalities (Figure 3). Internal walls made of porous materials should thus be closely examined. A torch light directed along the surface of a wall can be used to detect subtle distortions in wall profile.



Figure 2. Main gallery by which termites enter a building. A nearby leaking water pipe probably encouraged termites into this part of the building.

To determine whether termites are still using shelter tubes, a small hole should be made in the tube with a sharp knife. If the tube is active soldier termites will come to the opening which will be resealed within a few hours. Timber may also be probed firmly to detect cavities left beneath the surface by termite activity. Care should be taken when inspecting to minimise disturbance to termites present in the workings. If termite activity is found, the services of a qualified pest control operator should be obtained.



Figure 3. Sagging cornices and warping plasterboard (top) can be indicative of termite activity underneath (bottom).

Inspections by pest control firms

A written record should be made of the findings of the inspection. The inspection record should include the following:

- The genus and, if possible, the species of termite present.
- The location of all timbers showing termite attack and whether the termites were active or inactive at the time of inspection.
- A list of any timbers requiring replacement or support. Where the inspector is not prepared to make this judgement, he should indicate in his report that a further inspection be carried out by a person qualified to make such judgements.

- Any sections of the building or particular timbers which were inaccessible to either inspection or treatment.

In certain situations, assessment of some of the above details may be difficult or impossible. If this is the case, the pest control firm should make this clear and indicate the reasons for this, as part of the statement provided to the homeowner.

Reports to home buyers by pest control firms ('pre-purchase inspections')

Many lending authorities require a buyer to obtain a report from a pest control firm before lending money for home purchase. The homebuyer or their agent is required to call in a pest control firm and pay for the inspection and buyer report. A report modelled on that described in the previous section is usually sufficient provided it also includes a similar inspection and assessment for timber borers and decay.

Treatment proposals by pest control firms

Where the pest control firm is proposing to carry out a treatment they should supply the following, in addition to their inspection report:

- A statement giving details of the treatment methods proposed and costs involved
- A statement of the firm's obligations concerning the job. This statement should give details of any warranty covering the firm's work including specific information as to what is and what is not covered. It should clearly state whether the warranty applies only to structural components (i.e. timber frames) or to all components, including those that are non-structural ones such as fixtures and fittings. A warranty should provide for the making good of all damage including damage necessarily caused during repairs.
- A description of any action or inaction by the homeowner that may void any warranty pertaining to the treatment.

It is advisable that the homeowner obtains quotes from several pest control firms before making a decision and giving approval for work to commence.

If the pest control firm intends to carry out a toxic dust application (see below) as part of their termite treatment, the homeowner should require reinspection by the firm two to three weeks after treatment to make sure treatment has been effective.

Builders' obligations and warranties

The Building Code of Australia (BCA) sets out technical requirements and guidelines for building construction, including compulsory minimum standards for measures designed to protect buildings from termites. In NSW, compliance with the BCA is made compulsory under the Environmental Planning and Assessment Act (1979).

A number of termite control options exist that may meet the provisions of the BCA. Compliance with AS 3660.1 (2000) is one option. The BCA allows for the use of alternative measures to those included in AS 3660.1. The acceptance of these alternatives is at the discretion of the appropriate local government authority.

Under the BCA, the use of protective measures is mandated for susceptible structural building members only. This means, for example, that the timber frame of a building must be protected, whereas skirting boards, door jams and kitchen furniture do not. However, in NSW legislation requires a higher standard than the BCA. The Home Building Act (1989) makes builders responsible for preventing termite damage to both structural and non-structural timbers and other components as part of an overall requirement to build a defect-free home.

The Home Building Act also provides for a statutory warranty of seven years for residential building work. If termites damage a building during the warranty period, as a result of substandard workmanship by the builder or one of the builder's contractors (e.g. the pest controller), home owners may be able to seek redress under this legislation.

TREATMENT

Once termite attack has been detected, urgent attention is essential. The killing of those termites present in the building does not remove the danger of further attack. The first priority is to eradicate the colony giving rise to the infestation. Once eradication has been achieved or if eradication is unfeasible or repeated attempts at eradication are unsuccessful, the next priority is to establish or re-establish an effective barrier system around the building.

Procedures for the treatment of termite infestations are given in Australian Standard AS3660.2. Treatment often involves the application of hazardous chemicals. Sale of these chemicals is generally restricted to appropriately qualified pest controllers.

Colony eradication

Indirect eradication using toxic dusts

Wherever possible, initial treatments by pest control operators should aim to destroy the colony that is the source of the infestation. Where the nest cannot be located and destroyed directly, it may be possible to eradicate the colony indirectly by the application of slow acting toxic dusts to infested timber. Information on this technique can be found in Australian Standard AS 3660.2.

W. A. Flick pioneered the use of toxic dusts in the early twentieth century, using arsenic trioxide powder obtained as a by-product of silver smelting. Dusting with arsenic trioxide has remained one of the cornerstones of termite control. Until relatively recently, arsenic trioxide powder was the only termite dust available that was capable of achieving indirect eradication of termite colonies. In 2000, a product based on the chitin synthesis inhibitor triflumuron came onto the market (Appendix I). Unlike arsenic trioxide, the toxicity of triflumuron to non-target organisms such as mammals is very low. It acts by blocking the formation of chitin (the foundation of the insect exoskeleton), which is only found in invertebrates.

Both arsenic trioxide and triflumuron are applied in a similar fashion. With a hand puffer (Figure 4) the dust is blown, very lightly and in very small amounts, into termite workings on or in timber or some of the more substantial shelter tubes. The procedure should be repeated in several different places, care being taken to treat as many different galleries as possible. Where possible, the tubes leading from the ground should receive treatment as these are the main routes used by the termites when travelling from the nest to the wood work of a building. Any breach in these tubes is usually sealed quickly so that contact with the food supply can be maintained.

Dust treatment will only work if termites continue to use the galleries in which the powder is placed and the more termites that are exposed to the powder, the greater the chances of success. If termites are disturbed by rough treatment or if shelter tubes are blocked by the use of too much dust, they will leave the treated regions and recommence their attack elsewhere, giving the impression that the treatment is successful. However, if dusting is carried out correctly, the toxic dust introduced into the termite galleries is picked up by termites and carried on their legs

and bodies back to the nest. Dissemination through the colony is believed to occur through the exchange of food between members of the colony, a process known as 'trophallaxis' and also through mutual grooming and cannibalism.



Figure 4. Termite dusting an infested power pole.

Under ideal circumstances a single treatment can eradicate the colony. Treatments are most successful during the warmer months of the year, particularly about the time of their swarming flights. In the Sydney region, swarming often occurs in November ahead of southerly changes.

Areas treated with arsenic trioxide should be left undisturbed for two to four weeks to allow time for the toxin to work. After this period, treated areas should be examined. If termites are still active, the dusting should be repeated. Triflumuron acts more slowly than arsenic trioxide. Reapplication of triflumuron should occur, if necessary, after one to three months.

When no further activity can be found in treated areas, steps should be taken to reduce the hazard from further invasion by termites (e.g. by installing a chemical soil barrier).

Indirect eradication using baits

A form of termite baiting which was based on the use of arsenic trioxide dust has been around for some time. However, this method was in reality a modified form of toxic dusting. True baiting, in which termites consume bait laced with a toxic

chemical, is a relatively recent development. In recent years baiting systems using compounds such as hexaflumuron and chlorfluazuron (Appendix I) have become commercially available for preventing and controlling termite infestations. Like triflumuron (see above), these chemicals act by blocking the formation of chitin and have very low toxicity to mammals.

As is the case with toxic dusting, baiting works through foraging termites being dosed with small amounts of slow-acting toxin, which is distributed throughout the colony by means of grooming and trophallaxis. As is also the case with dusting, the more termites exposed to the toxin, the greater the chances of successful treatment. With baiting, however, the chemical is introduced by encouraging the foragers to feed on attractive cellulose-based substances such as timber and cardboard laced with toxicant.

Commercially available baits are used in two different ways. They can be either placed in the ground and rely upon chance encounters with foraging termites or they can be placed above the ground, close to areas where termites are active.

Ground-based baits are used to control populations of termites foraging in the vicinity of a building. The objective may be to either eliminate a colony responsible for an infestation or suppress termite activity in the area as much as possible and reduce the hazard of future termite attack.

Once they are deployed, baits are encountered more or less at random by foraging termites. It is critical therefore that baits are located strategically and in sufficient numbers to maximise the likelihood of 'hits'. Commercially available baiting systems use an innocuous material in baits initially, until contact is established. The toxic ingredient is added once termites are found feeding on the bait. The advantage of this two-step approach is that the toxin is at its best when deployed. However, the regular monitoring required to detect activity can add significantly to the cost of treatment.

Above-ground baits are used for treating active infestations in buildings and come already laced with toxin. They are placed in areas to maximise the chance of termites contacting them, such as near infested timbers or mud shelter tubes.

Pest control companies are increasingly marketing termite baits as a 'stand alone' option

for controlling termite infestations. The use of baits may be worth considering in chronic re-treatment situations where other methods have been unsuccessful or where the use of chemicals inside a building is unacceptable. Overall, baiting is much less disruptive than conventional chemical barrier treatments. On the other hand, baiting is generally more expensive. Householders must also be aware that baits can be slow acting and that baiting systems do not impede concealed termite access into a building or structure.

Eradication of infestations in living trees

By boring holes approximately 15 mm in diameter sloping slightly downwards into the tree at several levels above ground, it may be possible to gain some idea of the extent of the damage and from this to decide whether the tree should be treated or removed.

Activity can usually be detected by leaving the bore holes open for five to ten minutes to allow soldier termites to congregate at the opening. Sometimes a fine brush or grass stem inserted at this stage will pick up soldier termites, which may be reluctant to come to the outside of the holes.

Nests in trees can be destroyed using toxic dusts as described above. An extension tube fitted to the outlet of the puffer may be necessary to deliver the dust to an area where termites are most active. Alternatively, from five to 20 litres of an approved liquid termiticide can be introduced into the infested area of tree trunk through one or more of the holes drilled through to the hollow 'pipe', or nest, near the centre. Such treatments may sometimes be unsuccessful due to channelling over the nest area. Wetting and penetration may be greatly improved by adding a surfactant to the chemical mixture (see product label or contact chemical manufacturer for details).

Removing the nest or the entire affected branch can control some species of termites, which build conspicuous nests in the branches of trees.

After application of the termiticide through the holes bored into the tree, it is desirable to seal them to prevent the entry of moisture, other insects and decay fungi. This is usually best done by driving a small tight-fitting hardwood plug or dowel into each hole. The plug is then sawn off level with the surface of the tree. Alternatively, holes may be sealed with a silicon caulking compound.

Direct destruction of termite nests

If a termite nest is discovered in or close to the property, it could be a hazard to timbers in buildings and fences: action should be taken to affect eradication.

With termite mounds, stumps and posts, activity is usually detected by boring several 10-20 mm holes into the nest with an auger bit, sloping them downwards at an angle of 45° to reach the centre of the mound at ground level. If the nest is active, live termites will be found in the inner portion and soldier termites will usually come to the opening made in the nest.

Sometimes removal of the nest and breaking it up will kill all the termites without the use of any chemical treatment. However, the introduction of chemical termiticide in the form of a toxic dust or an approved liquid termiticide offers the greatest prospect of success. After an appropriate period the nest is reinspected to determine whether activity has ceased. Following successful treatment the nest can be broken up.

Chemical barrier treatments

Chemical barriers are installed to establish an impenetrable barrier of a long-lasting insecticide between a vulnerable structure and the soil. They are not intended to control or eradicate termite populations.

When toxic dusting has been used as an initial treatment, the installation of chemical barriers should be delayed sufficiently to allow the dust to act. Premature application of chemical may diminish the effectiveness of dusting by cutting off access for termites to areas where dust is present.

Chemicals approved as barrier treatments (Appendix II) are chlorpyrifos (organophosphate), bifenthrin (pyrethroid), alpha-cypermethrin (pyrethroid), imidacloprid (chloro-nicotinyl) and fipronil (phenyl pyrazole). These chemicals vary significantly in important features such as mammalian toxicity, mode of action and stability in the soil. Some of this information is presented on Material Safety Data Sheets (MSDSs) available from manufacturers. Concentrations and rates of application are specified on product labels.

In some situations installing chemical soil barriers would be ineffective or impracticable, for example, where the substructure or part of the substructure has been constructed in direct

contact with a rock outcrop or within a rock cutting, or where there are zero setbacks to an allotment boundary. In these refractory situations expert advice should be sought regarding alternative control measures that may be effective.

Suspended floor buildings

In most suspended floor buildings, a timber floor has been laid on flooring joists which, in turn, rest on bearers supported by walls and piers. As subterranean termites normally gain access to the building by way of the surrounding soil, an unbroken trench of chemically treated soil against all supporting piers and walls can form an effective barrier. Where floor clearance is high, this is a relatively easy action to take. A trench of soil is dug out against the piers and walls and the soil saturated with chemical mixture as the trench is refilled (Figure 5). With low floors trenching may be difficult or impossible. Under such circumstances the surface soil around piers and walls should be loosened, if possible, and chemical should be applied to the underfloor soil over the whole area.



Figure 5. Termiticide application to a building perimeter by trenching and treating the backfill.

Concrete slab buildings

Successful treatment of concrete slab-on-ground buildings can be extremely difficult. Termites can gain entry at any number of points in the slab including vertical construction joints, service pipe penetrations, as well as over the edge of the slab. As a consequence, localising the point of entry is

often impracticable. Therefore a significant portion of the soil under and around a slab may need to be treated if the barrier treatment is to stand any chance of success.

With raft-slab and footing-slab constructions barriers are installed by treating the soil around the entire slab perimeter down to the top of the footings, either by trenching and treating the backfill as described above or by introducing the chemical into the soil, under pressure, by way of a pointed, hollow metal rod. To form a complete perimeter barrier, pest control operators must sometimes drill through the slab and apply the chemical under pressure to the soil underneath. Chemical is commonly applied in this way where slab elements abut, such as where a patio or driveway meets the main slab (Figure 6), and around internal walls where termite activity has been observed.



Figure 6. Injecting termiticide through holes drilled in a slab. Holes are sealed after treatment.

Although drilling holes through the slab is sometimes the only way chemical can be applied to the soil, it can have a number of serious drawbacks:

- Drill holes are an indelible sign of past termite infestation, which may have an impact on the resale value of the house.
- Drilling disrupts the plastic vapour barrier underneath the slab and dampness in the vicinity of drill holes may be experienced.
- When floor coverings cannot be removed prior to drilling e.g. with tiled floors and floating timber floors, permanent damage is inevitable.
- Uncertainty of coverage by the chemical.

Given these drawbacks, alternatives to this form of treatment, e.g. baits, may warrant consideration.

Treatment of dwellings built using slab-on-fill construction can be problematic and effective protective treatment may be impossible after construction. Where the fill is comprised entirely of soil, treatments may be possible by drilling through the slab and introducing a suitable chemical by 'rodding'. Where the fill is comprised of materials other than soil (rock, builder's debris, etc.), even thorough drilling and 'rodding' may prove unsuccessful in curtailing termite attack.

Fences, poles and posts

Chemical soil barriers can be used to protect fences, poles and posts from termite attack. The limitation of treating structures already in the ground is that they cannot be treated to their full embedded depth, leaving the unprotected part exposed to ongoing attack. However, experience has shown that treatment of the soil abutting the upper in-ground portion of posts and poles can control infestations. Soil around the pole should be treated by digging a trench 15 cm wide by 35 cm deep and treating the backfill. Depending on the diameter of the post or pole, five to 10 litres of chemical mixture should be used.

Sometimes a hollow 'pipe' created by termites is present inside poles and posts. If one is encountered and, provided the structure has sufficient residual strength, internal treatment with liquid termiticide can increase treatment effectiveness.

Where fence palings come in contact with the soil they are at greater risk not only from termite attack but from fungal decay as well. Soil should be removed from beneath the palings, leaving at least a 5 cm gap. Where this is not possible, protection from termite attack may be achieved by treating the soil beneath the palings with a liquid termiticide.

FURTHER READING

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APPENDIX I. CHEMICALS FOR ERADICATION OF TERMITE INFESTATIONS

Toxic dusts

Active Ingredient	Poison Schedule	Application Rate (grams per infestation)
Arsenic trioxide	S7	1-2
Triflumuron	S5	5-10

Bait toxicants

Active Ingredient	Poison Schedule
Hexaflumuron	Unscheduled
Chlorfluazuron	Unscheduled

APPENDIX II. CHEMICALS FOR SOIL BARRIERS

Active Ingredient	Poison Schedule	Active Ingredient Concentration in Solution Applied to Soil (%)*
Alpha-cypermethrin	S7	0.5
Bifenthrin**	S6	0.025-0.1
Chlorpyrifos**	S6	1.0
Fipronil	S5	0.06
Imidacloprid	S5	0.05

* Concentrations appropriate to New South Wales

** Bifenthrin and chlorpyrifos are the only chemicals approved for use under concrete slabs

Explanation of Table Contents

Active Ingredient:

The constituent of the product that is toxic to the target pest.

Poison Schedule:

Classification of concentrate according to the *Standard for the Uniform Scheduling of Drugs and Poisons* (Therapeutic Goods Administration).

Active Ingredient Concentration in Solution Applied to Soil:

Soil termiticides are formulated at various concentrations and are usually diluted on site. They are used at concentrations which experimentation has shown to be effective under certain conditions. For all chemicals, rates of the finished mix applied are the same i.e. for surface application, five litres per square metre; for trenching and treating the backfill or rodding, 100 litres per cubic metre. The quantity of water used to dilute the concentrate may be reduced if the soil used in the barrier is very moist or increased if it is very dry. However the quantity of concentrate used to treat a given area or volume of soil always remains the same.

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