STRUCTURAL PEST CONTROL

CONTROL OF WOOD DESTROYING PESTS

Volume IV

(2014 version)

NEVADA STATE DEPARTMENT OF AGRICULTURE

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STUDY GUIDE FOR THE CONTROL OF STRUCTURAL WOOD-DESTROYING PESTS

Volume IV

Preface and Acknowledgments

This study manual was prepared as an introduction to the science of structural wood-destroying pest control. This manual is not intended to act as a complete guide, but is intended to provide basic and practical information about the control of structural wood-destroying pests (insect and fungi) commonly found throughout Nevada. Study sections include a review of common structural wood-destroying pests, inspection and report writing requirements, inspection/treatment tag placement, termite pre-construction treatment practices, including tagging requirements and calculations for proper termiticide use dilution concentration and volume (gallons).

Information contained herein is not intended to substitute for any pesticide label information, direction or requirement. In addition, information contained herein is furnished with the understanding that no discrimination is intended, and any reference to a commercially known product does NOT imply an endorsement by the Nevada Department of Agriculture. No endorsement, guarantee, warrantee or assumed liability of any kind, expressed or implied, is made with respect to the information contained herein. It is the pest control licensee's responsibility to follow all pesticide label directions and regulations pertaining to the control of wood-destroying pest within Chapters 555 of the Nevada Revised Statute (NRS) and Nevada Administrative Code (NAC).

Due to on going pesticide and regulation changes, the Nevada Department of Agriculture assumes no liability for suggested pesticide use, control techniques, or regulation changes.

For Nevada's most current pest control NAC regulations go to:

http://www.leg.state.nv.us/NAC/NAC-555.html

For the most current NRS regulations go to:

http://www.leg.state.nv.us/NRS/NRS-555.html

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For a more in-depth understanding of the pest control industry the Department would urge an operator to read pertinent sections of the *Handbook of Pest Control*, A. Mallis, Editorial Director S. Hedges, 2011 (10th edition), and *Truman's Scientific Guide To Pest Management Operations*, G. Bennett, J. Owens, R. Corrigan, editors, 2012 (7th edition). Pest Control Technology (PCT) also publishes several soft cover field guides which can prove invaluable to an applicator in the day to day operations of the business.

Revised 6/2014

POISON CONTROL CENTER

The American Association of Poison Control Centers (AAPCC) supports our nation's 57 Poison Control Call Centers through a single toll-free phone number. All local poison control centers in the United States use this national number although calls are routed through different centers depending on geographic location. Nevada calls are routed through the **Rocky Mountain Poison Control Center** which also services calls from Hawaii and Montana. This national hotline number will let you talk to experts in poisoning.

National Poison Control

1-800-222-1222

NEVADA DEPARTMENT OF AGRICULTURE
EXAMINATIONS

1. All Pest Control Examinations are monitored and/or video and audio recorded.

2. Anyone who cheats on an examination will be excluded from taking any pest control examination for a minimum of six months (NAC 555.340.7).

3. No cell phones, pagers or other electronic devices may be taken into the examination area or used at any time during an examination.

4. No unapproved study materials, notes or other aids may be taken into the examination area or used during an examination.

5. Tests must be paid for prior to examination.

6. Examinees should bring a sharp pencil, eraser, and simple non-programmable calculator.

7. Any examinee who writes, marks on or otherwise damages an exam booklet will be charged a $5.00 replacement fee. The exam will not be graded until the fee is paid.

NEVADA DEPARTMENT OF AGRICULTURE
EXAMINATION FEES AND SCHEDULING

All Operator examinations must be scheduled and paid for in advance. All fees are **NON-REFUNDABLE** regardless of whether the exam is taken, cancelled, or failed. Exams may be re-scheduled with a minimum of 48 hours notice.

Individuals who “no show” for a *Principal* exam or do not cancel a scheduled *Principal* exam with 48 hours notice, must pre-pay for all future exams.

TABLE OF CONTENTS

INTRODUCTION.. 1
TERMITES... 3
Arid Land Subterranean Termites.. 3
Western Subterranean Termites.. 3
Subterranean Termite Control Techniques............................... 9
Chemical Controls ……………………………………… 14
Soil Pre-treatments……………………………… 15
Wood Pre-treatments…………………………… 21
Bait Systems……..…………………………… 22
Pre-treatment Regulations……………………………………… 23
Subterranean Termite Post Construction Soil Treatments……. 29
Desert Dampwood Termite... 31
Nevada Dampwood Termite.. 32
Western Drywood Termite... 34
Drywood Termite Control techniques............................. 36
CARPENTER ANTS.. 39
Carpenter Ant Control Techniques... 42
POWDERPOST BEETLES... 45
OTHER WOOD DESTROYING INSECTS.. 49
False Powderpost Beetles.. 49
Roundheaded Borers... 50
Flatheaded Borers.. 51
Large Carpenter Bee.. 52
Woodwasps.. 53
Velvety Tree-Ant.. 54
FUNGI INFESTING WOOD (“Wood-rotting fungi”).......................... 55
Decays... 57
Brown Rot………………………………………………… 57
White Rot………………………………………………… 58
Soft Rot…………………………………………………… 58
Stains.. 59
Control.. 61
INSPECTIONS... 63
Statutes / Regulations... 63
Wood-Destroying Pest Inspections... 64
Wood-Destroying Pest Inspection Reports............................... 70
FILLING OUT THE WOOD-DESTROYING PEST INSPECTION REPORT 73
NAC 555.430 ……………………………………………………. 74
Inspection / Application Tags.. 82
TERMITICIDE PRE-TREATMENTS.. 83
Terminology... 85
PRE-TREATMENT CALCULATIONS... 90
SAMPLE PROBLEMS... 97
SAMPLE ANSWERS... 98
STRUCTURAL FORMULAS.. 109
USDA Home and Garden Bulletin 64…………………………………… Appendix A
Termite Pre-Treatment Notification Form……………………………… Appendix B

INTRODUCTION

Like many other states, Nevada requires individuals who actively engage in the inspection of homes or other structures for wood-destroying pests or organisms, or who use pesticides to control these pests or organisms, to be licensed by the Nevada Department of Agriculture:

NRS 555.285 License required to engage in activities concerning control of wood-destroying pests or organisms. A person shall not, for hire, engage in, offer to engage in, advertise or solicit to perform any of the following pest control activities concerning wood-destroying pests or organisms without a license issued by the Director:

1. Making an inspection to identify or to attempt to identify infestations or infections of households or other structures by those pests or organisms.
2. Making or altering inspection reports concerning the infestations or infections.
3. Making estimates or bids, whether written or oral, concerning the infestations or infections.
4. Submitting bids to perform any work involving the application of pesticides for the elimination, extermination, control or prevention of infestations or infections of those pests.

TERMITES

Termites, as a group, are the major wood destroying pests in Nevada. More time, money, and effort are spent on their prevention and control than all other wood destroying pests combined. There are four genera and five species of this pest group that will be discussed.

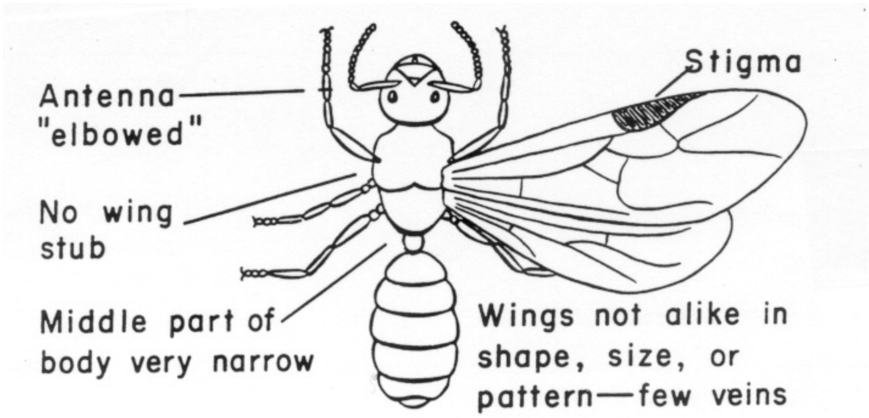
ARID LAND SUBTERRANEAN TERMITE
(Reticulitermes tibialis)

WESTERN SUBTERRANEAN TERMITE
(Reticulitermes hesperus)

GENERAL: The Arid Land Subterranean Termite is found statewide while the Western Subterranean Termite is found primarily in northwestern Nevada. The life cycles, damage, and appearance of each are so similar as to be indistinguishable. As each species has varying appearances of individuals in their colonies, it is almost impossible to distinguish the two species. For practical purposes they will be considered simply as subterranean termites.

DESCRIPTION: There are basically three castes which comprise a subterranean termite colony: reproductives, soldiers, and workers/nymphs. The reproductives are categorized as primary reproductive and supplementary reproductive. The primary reproductive is a winged adult called an “alate”. It is dark-brown to brownish-black with brownish-gray wings. The body length is about 1/3” with wings and 1/5” without wings. The supplementary reproductive is white, about 1/5” long, and lacks wings although it sometimes has wing pads. The queen is a primary reproductive who has lost her wings and has an enlarged abdomen that appears to be striated. The king is also a wingless primary reproductive but does not have an enlarged abdomen. The worker and soldier are white, lack wings and wing pads, and are about 1/2” long. The thorax of the worker is narrower than either its head or abdomen. The soldier has an elongated, yellowish head, and larger mandibles or jaws, than a worker. Both the worker and the soldier are blind.

Winged primary reproductive termites are often mistaken for winged ants (“flying ants”). The following illustration shows the difference between the two in the winged form.



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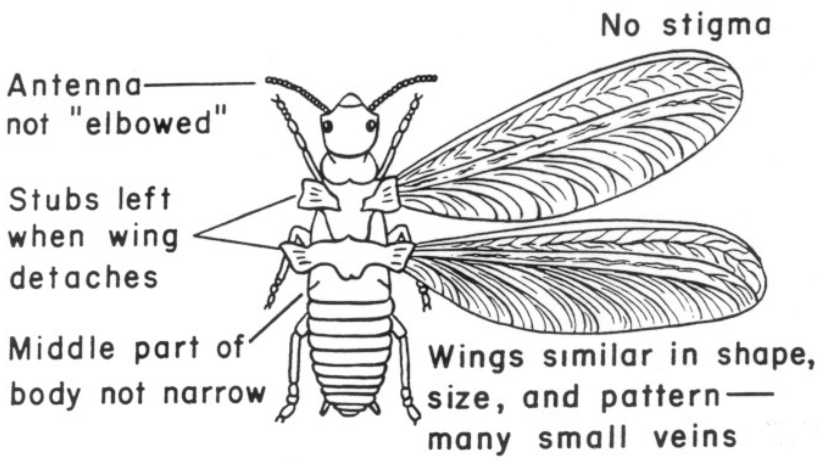
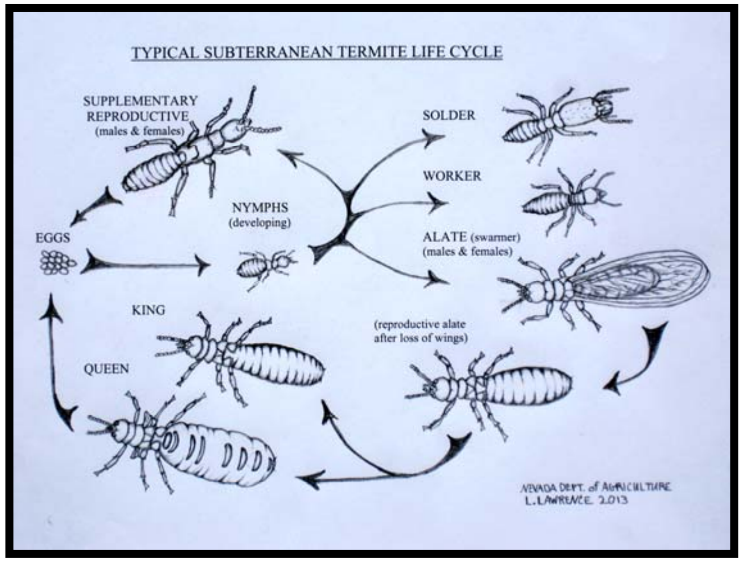


TERMITE

(Curtsey of USDA)



LIFE CYCLE: At certain warm periods of the year, primarily spring and fall, and after favorable environmental conditions, such as adequate moisture, primary reproductives emerge from small exit holes in the soil. These alates perform a short flight, then drop to the ground where they lose their wings (it is during this flight that termites are often mistaken as flying ants). Some alates do not fly but instead run along the ground where they lose their wings. Males and females then pair and attempt to establish a new colony. They feed and groom each other, and after selecting a colony site, copulate within a day.

The growth of the colony from the original primary reproductive pair is slow. Few eggs are laid the first year with these requiring over 50 days to hatch. The first and second instars of the nymph each require 14 - 18 days. The third instar of the nymph requires one month, while the fourth instar of the nymph requires two months. The fifth instar of the nymph is the longest and may last up to two years. In colonies where there is a large amount of fraternal feeding, well-matured workers and reproductive nymphs may develop. There may be a seventh instar of still larger workers. In the seventh instar the perfect reproductive stage is attained in the reproductive caste and male and female alates are formed. Under ideal conditions, it is three or four years before swarms of alates are present. This development is aided by the supplementary reproductives which lay eggs and therefore add to the growth of the colony.

A colony of subterranean termites may range from 5,000 individuals to 500,000 individuals depending on conditions such as age and location. Each colony is ruled by a single queen and a male king. Copulation has been found to occur for several months and probably occurs throughout the life of the mated pair. The queen normally lives much longer than the worker which only lives for three to five years.

HABITAT: Subterranean termites are normally ground-dwelling organisms which live in chambers and tunnels in the soil, or live in contact with the soil. In rare instances, subterranean termites can live without soil contact if food supplies, moisture, and temperature are satisfactory. In most locations the soil acts as a barrier against extreme surface temperatures as well as a moisture reservoir. Subterranean termites have been known to vary the depth of their colony in response to soil temperature and moisture.

“Shelter tubes” also known as “mud tubes” are one of the characteristic signs of subterranean termites. They are commonly built in the gap between the soil and the structure, and are made from sand or soil, or small particles of wood, or both. The particles are coated with a glue-like substance that is secreted by the termites. In addition, fecal matter is used as cement.

It was originally believed that the purpose of shelter tubes was to conduct moisture to dryer areas to increase humidity and encourage activity. Tests have shown however, that the humidity in termite galleries in joists was no higher than the humidity surrounding the joists. There appears to be one minor and one major function of shelter tubes: the minor function is to protect against air movement which desiccates the termite; the major function is to protect against natural enemies, primarily ants. Shelter tubes are not built as a protection against light, as tests have shown termites will exist normally under light if protected.

There are at least 4 types of shelter tube used by subterranean termites:

Utility/Working Tubes

Exploratory Tubes

Suspension/Drop Tubes

1. **UTILITY OR WORKING TUBES:** These are tubes that reach from the ground to the wood where termites are feeding. They are usually wide and flattened, and are used by termites to return to their nest to replenish body moisture.

2. **EXPLORATORY OR MIGRATORY TUBES:** These are similar to utility tubes but are not as strong and have a small exit hole. They are used when seeking a new food source.

3. **SUSPENSION OR DROP TUBES:** These are a type of utility tube but differ from a true utility, or working tube, in that they are built from a structural wooden member downward to the soil. They are lighter in color than any other shelter tube because they contain more wood fiber.

4. **SWARMING TUBES:** These are built at swarming time to provide an exit for the alates. They may exist slightly above ground level or extend 4” to 8” or more above the ground. In homes, these tubes are often found near warm places, such as near a hot water heater.

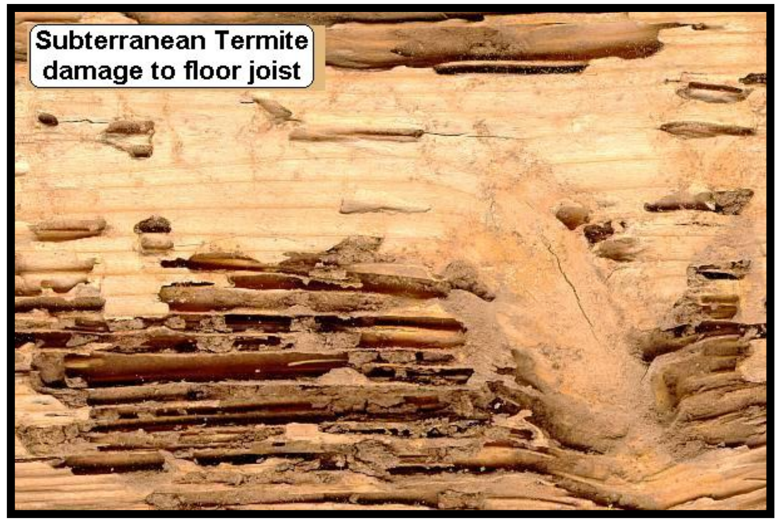
FOOD: Subterranean termites have two types of feeding habits. The first involves the consumption of sound or decaying wood or other cellulose materials (e.g. cardboard, paper, books, etc.). This is the feeding nature of workers and older nymphs. They consume the wood but do not actually digest it. In their enlarged colon (i.e. rectal pouch) is a protozoa which digests the wood for the workers and older nymphs. The second feeding habit involves the feeding of a diet prepared by other members of the colony. Feeding behaviors involving the transfer of salivary secretions, regurgitated intestinal contents and drops from the rectal pouch from one termite to another is known as “trophallaxis”. Soldiers, young nymphs, and reproductives are fed by workers and older nymphs through trophallaxis. Trophallaxis occurs as a result of stimulation caused by touch from the feeding termite.

DAMAGE: Subterranean termites prefer to remove the soft, annual ring layers in wood. The hard layers are penetrated only when moving from one soft layer to another. They may excavate wood to the point where only a thin wood shell remains.

Not all wood excavated by termites is eaten. Some is transported to the rear of excavated galleries and piled in them, or deposited in excavated cavities in the soil. A distinctive feature of the destructive nature of subterranean termite is the presence of a brown mastic-like material called "frass" which lines the galleries in an irregular pattern. Termite frass consists of excavated wood and soil cemented together with saliva and liquid feces. Liquid feces are characteristic of subterranean termites, and can be found as “muddy spots” in their excavated wood galleries. As evident in the photo on the next page (top left,) the surface of newly attacked wood often has an “etched” appearance.

Remember:

Any active termites / inactive termite damage found in/on an inspected structure(s) shall be noted on a graph and the appropriate boxes checked regardless of termite species.



Damage by Subterranean termites, notice area near the bottom that appears to have been etched.

Although not mentioned previously in this manual, there is another subterranean termite that pest control operators in southern Nevada should be knowledgeable about since it is becoming more common in the area. Commonly called the **tube-building desert termite**, its scientific name is ***Gnathamitermes perplexus***. This desert termite is very common in southern and western desert areas in elevations below about 6,000 feet. Irregular tubes and broad earth-like encrustations on cow chips, tree trunks, fences, lawns, hay & straw bales, old decorative wood, and plant debris are most often the work of this termite. Since their feeding is usually confined to superficial layers of bark, dead woody tissue, and fine, dry plant materials, damage is not as severe as the subterranean termites previously discussed. However, recent infestations have occurred locally with damage to wallboard paper, baseboards, decorative wood, and paper (including books). Their flights, often involving hundreds of alates, generally take place during or following afternoon and evening rain showers. There may be as many as 20 flights during a long season extending from mid-June into late September.

SUBTERRANEAN TERMITE CONTROL TECHNIQUES

As technology and building codes change, so do prevention and control measures for subterranean termites. In this section only three basic techniques will be examined to prevent and/or control subterranean termites. These three techniques are: **Sanitation**, **Proper Construction**, and **Chemical Control**.

(1) **SANITATION**: Sanitation is often one of the most overlooked areas of termite control. Areas under or around a structure where excess cellulose debris exists can encourage termite colonization by supplying them with a ready made food source. All scrap wood, form boards, cardboard, buried lumber, tree stumps, roots, and any other cellulose debris above or below ground must be removed from under or around the structure or planned building location. **N.A.C. 555.430.3.k.5**, defines "Cellulose debris" as:

"... any such debris that is of a size that can be raked and in aggregate comprises one-half cubic foot or more, or a stump or any other wood that is imbedded in a footing and constitutes a contact of wood with the earth. The term does not include pressure treated wood that is used to support a manufactured home or the skirting of a manufactured home."

> Since a cubic foot is equal to an object that measures 12" x 12" x 12" (1,728 cubic inches), one-half cubic foot would be an object(s) measuring 12" x 12" x 6" (864 cubic inches).

The meaning of this definition is that any cellulose debris that can be raked up, and in aggregate equals one half cubic foot or 864 cubic inches (in^3), is considered to be "cellose debris" (e.g. a box measuring 6" x 6" x 12"; or **864 in^3**). If this amount or more of cellulose debris is found in a crawlspace, or around a home, it must be removed or the condition reported.

What is the aggregate (total) cubic inch dimension of the following pieces of cellulose debris and is it considered cellulose debris by definition?

1 board measuring 4" x 6" x 20"; 1 board measuring 1/2"x 10"x 48"; 2 boards each measuring 2" x 4" x 24".

4" x 6" x 20"	=	**480 in^3**
.5" x 10" x 48"	=	**240 in^3**
2" x 4" x 24" = 192^3" x 2	=	**384 in^3**

Total cubic inches	=	**1,104 in^3**

The total amount debris constitutes **CELLULOSE DEBRIS**!

(2) **PROPER CONSTRUCTION**: Proper construction techniques must be used to avoid subterranean termite infestations. Improper construction is the largest contributor, not only to subterranean termite infestations, but to all wood destroying pest infestations as a whole, a few examples of improper construction are listed below.

(a) **Earth-to-Wood Contact**: Earth-to-wood contacts in the construction of new homes or existing homes must be avoided at all cost. *"It has been estimated that 90% of all termite infestations in the home can be traced to contact of the wood with the ground"* (Mallis, 1982). Earth to wood contacts are often found under structures in the form of old concrete form boards, scrap lumber or other cellulose debris, or outside where wooden siding, paneling, shakes, planter boxes, fencing or decks attached to the home contact the soil. **N.A.C. 555.430.3.k.l,** defines earth to wood contact as:

"...any support or other structure of cellulose that is less than 3 inches above the soil level and in contact with the inspected structure, whether it is internal or external in relation to that structure. The term does not include:

(I) ***A paling of a fence which is made of wood and which is less than 3 inches above the soil level and in contact with the inspected structure through otherwise acceptable structural elements.***

(II) ***Lattice which is made of wood and which is less than 3 inches above the soil level if the lattice is physically attached to the inspected structure.***

(III) ***An attachment to the inspected structure which is made of wood or cellulose and which is less than 3 inches above the soil level if the attachment is separated from the inspected structure by a flashing which is made of metal.***

(IV) ***A deck which is made of wood and which is less than 3 inches above the soil and in contact with the inspected structure if the deck is separated from the inspected structure by a flashing which is made of metal and the report includes a statement indicating that the deck was excluded from the inspection or application.***

(V) ***Skirting which is installed on a manufactured home and which is less than 3 inches above the soil and in contact with the inspected structure if the skirting is designed by the manufacturer for contact with the ground, is separated from the inspected structure by a flashing which is made of metal or is supported 3 inches or more above the soil level by pressure treated wood."***

If this contact is found it must be corrected. Corrective methods may include complete removal of the wooden members, or supporting them on concrete that is no less than 3" above the soil grade.

The photos below show examples of earth-to-wood contacts. On the left is a redwood deck built directly on the soil that has been severely damaged by carpenter ants. The photo on the right is siding that has been damaged by rot fungi and termites.

(**b**) **Faulty Grade**: Faulty grades between the soil and wooden members also encourage subterranean termite infestations. **N.A.C. 555.430.3.k.2**, defines faulty grades as a condition in which:

(I) ***A floor joist or stringer is less than 12 inches above the soil level;***

(II) ***The top of the foundation is less than 3 inches above the adjacent soil level; or***

(III) ***The drainage is such that there is visible evidence of exposure of surface water on the structure.***

Faulty grades can best be avoided by obeying building codes and insuring proper drainage around structures and proper clearance above the soil in the crawlspace. The minimum clearance in the crawlspace for structural members (e.g. floor joists, stringers, beams, etc.) is 12". The minimum clearance above the top of the foundation (slab and stemwall) and the exterior soil level around the outside of the foundation is 3". The photo of "faulty grade" on the following page shows a planter box that is too high (left); the one on the right shows floor joists that are less than 12" above the soil in the crawlspace.

(c) **Insufficient Ventilation**: Insufficient ventilation is not only a major contributor to subterranean termite infestations, but also to infestations of many wood destroying fungi. The lack of air movement in the crawlspace allows humidity and moisture to build causing a favorable micro climate for these organisms. This condition can also be avoided by closely following building codes regarding ventilation and by installing vents and/or vapor barriers in the crawlspace of existing structures. **N.A.C.555.430.3.k.3**, defines insufficient ventilation in the crawlspace as:

"...less than 1 square foot of ventilation per 300 square feet of crawlspace, less than 1 square foot for every 1500 square feet of ground area covered by a vapor barrier and less than four areas permitting ventilation. The term "insufficient ventilation" does not include a crawlspace which is:

(I) mechanically ventilated; and

(II) Free of wood-destroying fungi and excessive moisture.

Insufficient ventilation is the primary reason why moisture in the crawlspace condenses on rim joists. This problem is especially evident in northern Nevada where high crawlspace moisture, combined with cold temperatures, result in condensation on rim joists, primarily on the north side. It is especially important to closely examine this area when performing a wood-destroying pest inspection. The photos on the next page shows a blocked crawlspace vent which resulted in "insufficient ventilation" (left), which cause the rim-joist and portions of the joists and subfloor to rot as indicated in the photo on the right.

(d) **Excessive moisture**: **N.A.C. 555.430.3..K.4**, defines "**Excessive moisture**" as:
"…actual moisture on the wood or wood products used in the structure." Excessive moisture is most commonly caused by a plumbing leak, but can also exist as a leaky skylight, window, roof, or other feature which allows water to enter or leak onto wood (e.g. leaks inside sink cabinets, leaks onto subfloor, framing, window sills, etc.)

(e) **Cellulose debris:** Care should be taken during construction to eliminate construction lumber remnants that may be in contact with the earth and/or the structure. These may consist of scraps of wood, stumps, form boards, wood stakes, and improper construction techniques all of which result in improper contact of wood with the earth. Cellulose debris can be a condition conducive to an infestation and should be removed when encountered.

(f) **Wood**: Wooden materials used in infestation prone areas should be pressure treated with approved chemicals to prevent or repel attack. Heartwoods of Redwood and some Cypress and Cedar, have some resistant properties, but contrary to popular belief are not immune to termite or fungal attack.

(g) **Reinforcement**: Concrete reinforcement should be considered not only for improving the structural characteristics of buildings but also to reduce the cracking of stemwalls and footings which can create access routes for termites. Cracks of only 1/32 of an inch are large enough for termite travel. Concrete reinforcement should also be considered when designing a slab foundation or a masonry block type foundation. Block foundations can be further protected by a reinforced concrete "cap" along the top of the stemwall. This cap helps block characteristic voids which often develop in block type foundations (see Figure 1).

Termite Shield: Termite shields have been used throughout much of the country with only minimal proven effectiveness due mainly to improper installation or distortion of their 45° degree angle. These shields should not be used as a primary deterrent against termite attack, but may aid in the overall termite proofing of a structure (see Figure 1).

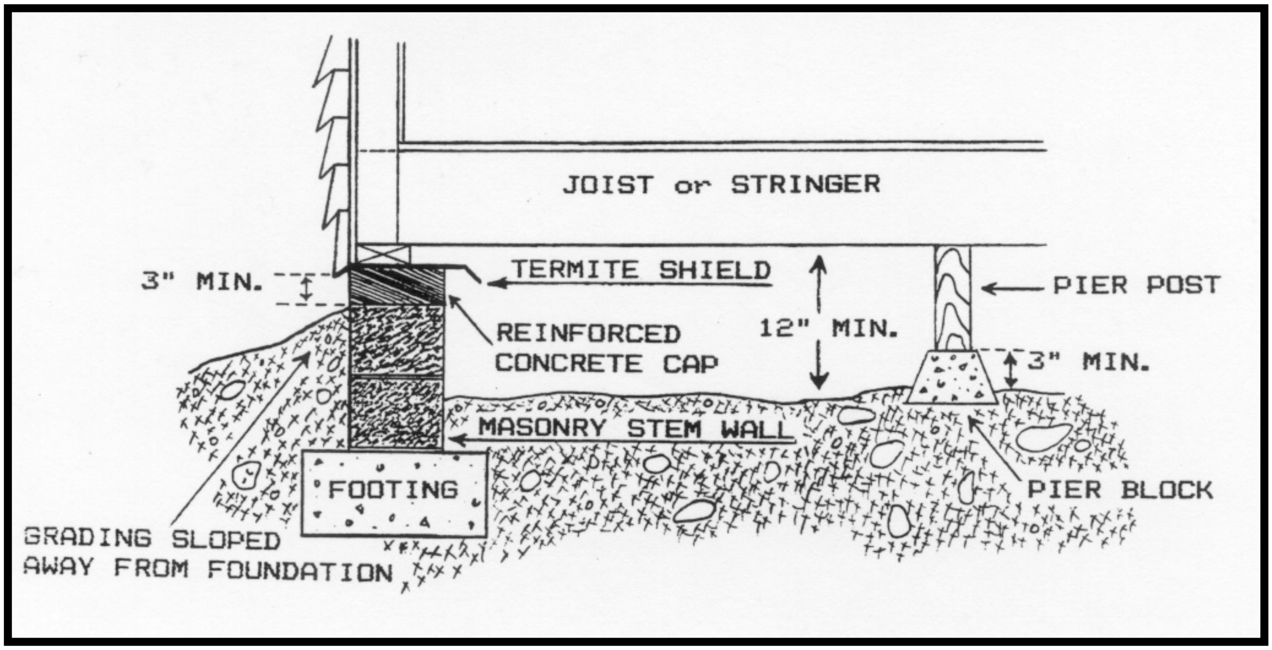


Figure 1. Earth to wood contacts and faulty grading are avoided when the location of the wooden members are no less than these indicated and the grading provides adequate drainage. Reinforced concrete caps and termite shields (when properly installed) help prevent termite attack.

(3) CHEMICAL CONTROLS: To meet Federal Housing Administration (FHA) termite proofing requirements, follow the latest edition of the Housing and Urban Development (HUD) minimum protection standards and USDA Home and Garden Bulletin 64. (See Appendix A - USDA Home and Garden Bulletin 64.).

At the time of this revision, F.H.A., V.A., and HUD, recognize and approve of three methods of pre-treatments: soil, wood, and bait systems. Chemically treated vapor barriers and various metal screens which have been used in Europe and Australia are in the developmental, testing, and approval processes in the United States.

No specific chemicals are recommended or endorsed in this manual for the control of wood-destroying pests; only a few techniques used to control them will be discussed. The information presented in this section should not be substituted for any label requirement or regulation specific to the use of any product or procedure used to control a wood-destroying. Always remember to **READ, UNDERSTAND, AND STRICTLY FOLLOW ALL LABEL DIRECTIONS, IT'S THE LAW!**

Before applying chemicals for the prevention or control of subterranean termites, possible ground water contamination and run-off should be considered. Under no circumstances should soil treatments be made directly over wells (or cisterns). The proximity of treatments to wells depends upon soil characteristics, strata, drainage patterns, well location and label directions.

Subterranean Termite Pre-Construction Soil Treatment, "Soil Pretreatment"

The most commonly used method is the placement of a chemical barrier ("termiticide") between the soil and the new home while the home is being constructed. Another common method of preventing termite attack is to treat the wooden elements of a structure when the framing stage is complete with a boric acid based chemical. Other less often used methods involving termite bait stations, the placement of screens and other physical barriers over the soil, etc., are not discussed in this manual and have specifically excluded them as a pre-treatment method for the purposes of tagging, record keeping, etc. as required for all other pre-treatment methods as defined by the Nevada Administrative Code.

The strategy of a soil pre-treatment is to deny subterranean termites access to the members of the structure that contain cellulose. Chemically, there are two major ways to accomplish this - **repellency** and **toxicity**.

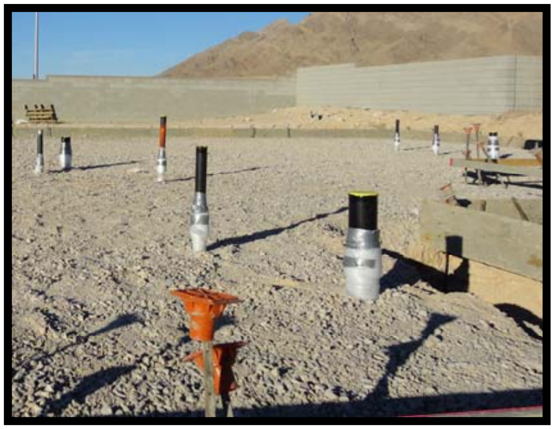
When a repellent type termiticide has been applied properly beneath and/or around the structure, foraging termites will encounter the chemical barrier and are compelled to change the direction of their foraging. Even though the chemicals are toxic to the termites, it is the repellent nature of the chemical that makes it less likely the termites will forage into the treated soil. Mortality is often lower with repellent termiticides.

Some toxic type termiticides kill the termites that forage into treated soil. The toxic effects of these termiticides kill only the termites that forage into the area of the treatment. Other types of toxic termiticides have the same lethal effect but work slowly as the termiticide is passed through the colony during feeding and grooming, eventually eliminating the colony.

(1) "**HORIZONTAL PRETREATMENT"**

There are two basic types of pretreatment application to the soil. The first is a pretreatment application horizontally over the surface of the soil before a slab foundation is poured. This type of treatment is referred to as a "horizontal" treatment. The photo below represents a horizontal treatment over the surface of the soil a few hours before a concrete slab is to be poured over the treated area.

Horizontal pretreatments are to be done after the final preparations for concrete pouring have been made (after final compaction inspection of base material). During a horizontal pretreatment application, the applicator must pay particular attention to any "critical area". These areas are places where termites typically have an easier time entering and infesting a structure. Critical areas in horizontal application sites are recognized as any area that is prone to subterranean termite entrance from below a slab. These areas include any utility entrance location, future slab expansion joint area, places where concrete cold joints will occur, and any other area identified by the label as a "critical area". A good example of a critical area is the void which often develops around plumbing and utility pipes that protrude through the slab. Termites commonly enter structures when the soil/base material and concrete shrink away from around pipes, causing voids large enough for them to pass through. The photos on the top of the next page show plumbing stub-outs where subterranean termites could easily gain access to the inside of the home (left). The soil/base around the stub-outs is considered a critical area and must be thoroughly treated before the slab is poured. The photo on the top of the next page (right) is a concrete cold joint that occurs when two sections of concrete are poured at different times. A gap typically develops between the two sections which allow easy access for termites. The soil below the cold joint must be thoroughly treated before the concrete is poured over this critical area.

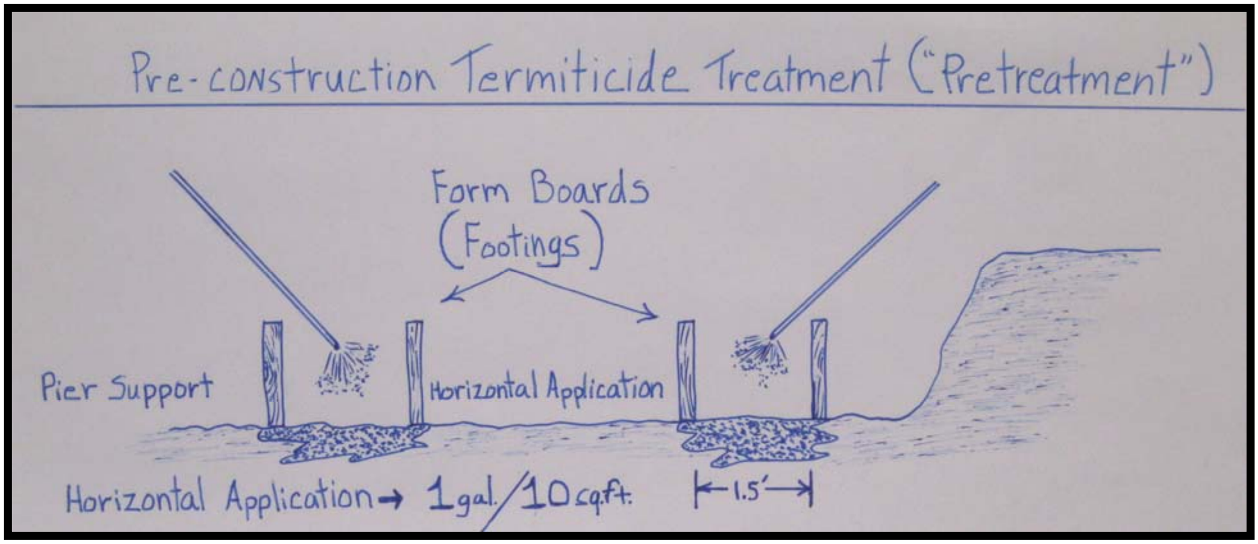


Stub-outs **concrete cold joint**

To avoid run-off from the treatment site, frozen or very wet soils should not be treated; and soils should not be treated when heavy rain is forecast. *"According to E.P.A. instructions, if concrete foundation slabs are to be poured on treated soil, a polyethylene sheeting or other waterproof material shall be placed over the treated soil, unless the concrete is to be poured on the day of the treatment"* (Ruckelshaus, 1972). Label directions may **not** require this if foundation walls have been installed around the perimeter of the treated soil. This label direction is intended to prevent chemical run off from the treatment site.

Pre-treatment for slab foundations should be done after the final preparations for concrete pouring have been made. As mentioned earlier, during a horizontal soil pre-treatment, pay particular attention to any utility entrance or future expansion joint locations. Areas such as these are often referred to as critical areas and usually need additional volumes of dilution. On foundations where the slabs are poured separately from the footings, a careful treatment should be made along the footing due to the characteristic shrinkage of slabs away from the footing, which may leave a sizable void through which termites can gain entrance. <u>Backfill contacting the foundation must also be thoroughly treated and will be discussed in the vertical treatment section.</u>

Another form of horizontal treatment involves the treatment of the soil before the footings for raised stemwall or hollow block masonry type foundations are poured. An effective pretreatment can be done by applying the material between the form boards. To insure adequate protection from a termite infestation, the chemical <u>must form a continuous unbroken barrier</u>.

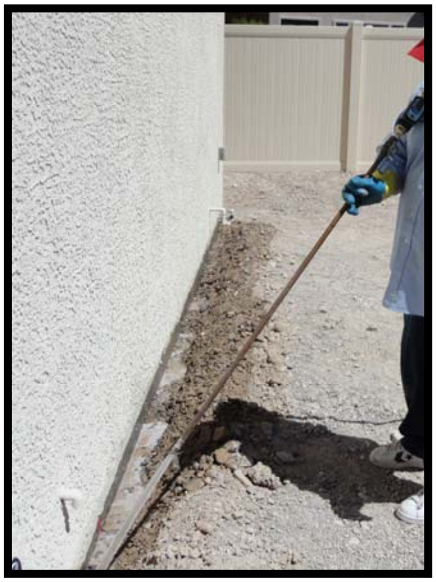


Horizontal pretreatment inside form boards for raised foundation

(2) **"VERTICAL PRETREATMENT"**

The second type of pretreatment application to the soil involves the application of a termiticide into a trench and/or the "rodding" of the termiticide vertically down into the soil around the foundation (stemwall). This type of treatment is known as a "vertical" treatment.

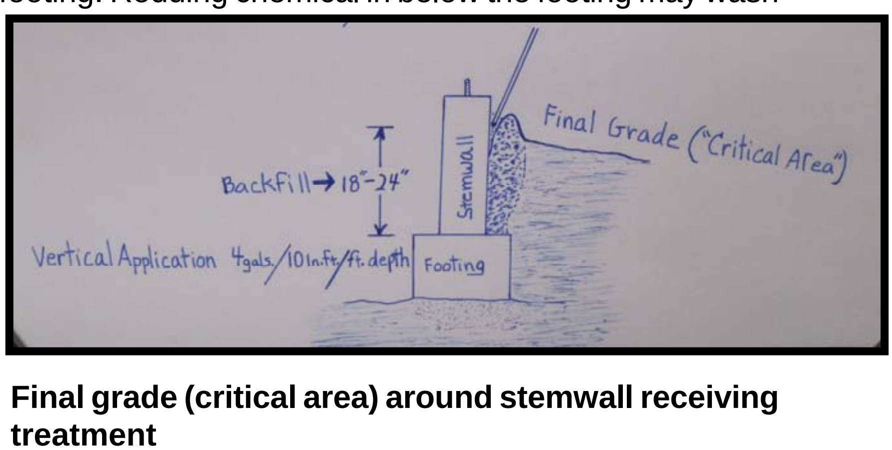
The soil that is backfilled around the outside of the foundation is known as the "final grade". This is considered to be a "critical area" and must be thoroughly treated according to current vertical treatment standards. Treatment of the final grade **requires** a trench to be dug adjacent to the foundation and the termiticide applied into it; and if necessary, rodded down into the trench to help assist dispersion of the chemical. The trench must not extend below the top of the foundation footing and need not be wider than 6", but must be large enough to hold and absorb the volume of dilution applied into it. The photo below on the left shows treatment of the final grade. The soil that was removed from the trench must be treated as it is being replaced back into it. This assures that no untreated soil "bridge" exist that termites could use to pass over treated soil. The photo below on the right shows the soil that was treated as it was replaced into the trench.



Termiticide dilution applied to "final grade" trench (left); and treated soil that was replaced into the trench (right).

When trenching and/or trenching and rodding techniques are used, the application is to be made along the entire stemwall to create an impermeable continuous barrier around the stemwall. Trenches should not extend below the top of the footing and need not be wider than 6" (see Figure 2).

When vertically rodding the termiticide downward, rod placement should be at a distance that will provide an unbroken continuous chemical barrier. A spacing of 12"-24", depending on soil type and label directions, is usually sufficient. As indicated in the photo below, rodding should not extend below the top of the footing. Rodding chemical in below the footing may wash out soil and cause settling problems in the foundation. Soil surrounding piers and pipes should be treated, but not to the point where they could settle into over softened soil.



Final grade (critical area) around stemwall receiving treatment

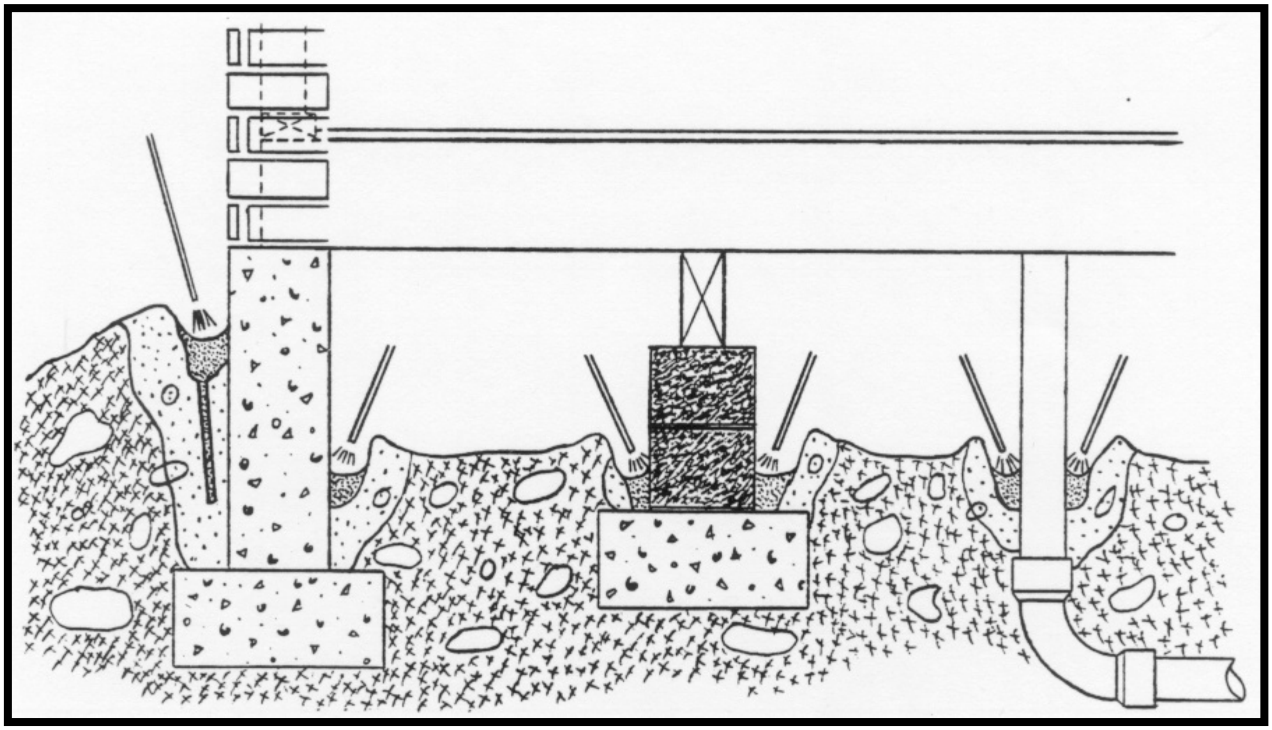


Figure 2. Rodding and trenching techniques are used around stem walls, footings, pier blocks and utilities to create an impermeable continuous barrier to guard against termite attack. A proper application will prevent the washing out of soil from under the support structures and prevents their settling into over soften soil.

For any kind of soil pretreatment, soil that is disturbed during construction must be treated to ensure a continuous, unbroken chemical barrier exists between the structure and the soil.

Flow meters are necessary when performing pretreatment application with liquid termiticides. This ensures that the proper volume of use dilution is applied. Flow meters are required by NAC 555.430.5.

Most termiticide labels have specific volume requirements that must be applied. The standard volume application rate for horizontal applications has been, “1 gallon of dilution per 10 square feet of surface area” (1 gal. / 10 sq. ft.). The standard volume application rate for vertical applications has been, “4 gallons of dilution per 10 linear feet per foot of foundation soil depth” (4 gals. / 10 ln. ft. / 1’ soil depth). The vertical soil depth to be treated should not be deeper than the top of the footing, as previously illustrated.

For structures built on a raised foundation which contain a crawlspace, before applying a termiticide in the crawlspace area, it is important to know if the structure has, or is going to have, a plenum type air circulation system. *"The plenum concept utilizes the area under the sub-floor (crawl space) as a giant heating/cooling duct. There are no vents or access doors in the foundation; thus, termiticide odor can be circulated with heated or cooled air throughout the structure. Therefore, termiticide treatment is not recommended"* (Truman, 1982.).

Wood Pre-Treatments

As mentioned earlier, FHA, VA, and HUD have approved the treatment of wood members as a pre-treatment. The pesticides in this category that the State of Nevada has registered, to date, are borate based compounds. These pesticides can also be used as a post-construction treatment and as a fungicide, if labeled as such, but the discussion here will only pertain to their use in pre-treatments.

Borate based pesticides used in Nevada for the pre-treatment of wood upon slab type foundations is applied directly to wooden members, utility penetrations and in some cases concrete surfaces as specified by the pesticide label. The use dilution of these pesticides is applied as a liquid solution to all exposed wood surfaces “to a point of wetness” by sprayer, brush, or roller. If a wood member has only one or two sides exposed, a second application must be made to the member(s), but only after a minimum 20 minute interval from the first application. The application of borates as a pre-treatment on structures with crawlspaces or basements is more complex and is not covered in this manual at this time. As with any pesticide, all label directions must be followed.

Since pre-treatments to the wood are applied during the construction process, the builder and all subcontractors must be aware of the application(s). If a pre-treatment is applied too early in the construction schedule, untreated wood can be introduced after the initial application. If the application is applied too late in the construction sequence, wooden members may be covered with other construction materials and be inaccessible for proper treatment. Builders and subcontractors who add or change wood members after a borate application is performed must be informed to contact the applicator so treatments can be made to the untreated wood. Builders must understand the importance of treating **all** the required label sites as specified on the pesticide label. After the initial pesticide treatment, good communication between the builder and the applicator is essential to ensure a complete treatment of **ALL** required label sites. Ultimately, it is the responsibility of the pest control company to ensure the application is complete. <u>For these reasons, it has been determined that, in most cases, more than one application trip is necessary to ensure a thorough and complete treatment.</u>

Baiting Systems

As mentioned in the preface of this section, termite baiting systems are an approved method of pre-treatment by VA, FHA, and HUD. Several are registered in Nevada. Bait systems are unique in placement, length of use, active ingredients vs. inactive, inspection intervals, monitoring, etc. Therefore, the Department of Agriculture has chosen, by regulation, not to use the pre-treatment regulations in regard to baiting systems. However, there are reporting regulations that must be followed when baits are used for both pre-construction and post construction.

There are several termite baits now available, including a number of active ingredients. As technology expands, more active ingredients will be registered with the EPA and the State of Nevada. This brief discussion focuses on some basics of termite baiting that can apply to most termite baiting situations.

In comparison to conventional termiticides, termite baits are slower acting materials. This slow action exploits the social nature of termites, allowing the foraging workers to survive and bring the active ingredient back to the colony to share with other termites. In this way, even workers that did not feed on the bait can still be affected. For baiting, this is a crucial part of the strategy. Unlike with chemical soil barriers where the main goal is to prevent termites from entering a structure or from feeding on wood, the main goal for baiting systems is to eliminate as many termite workers from the structural property as possible.

Active ingredients can be slow-acting toxicants such as insect growth regulators (IGR’s), and stations can be placed underground or above ground. Above ground stations are generally used where a known termite colony is located. The stations are usually placed in the path of an active tunnel where part of the tunnel has been removed and replaced with the bait station. Proper placement is important for the termites to accept the station in place of the mud tube. The effects of above ground baiting are generally faster than below ground baiting since the stations are brought to the termites rather than the termites having to find the station.

Below ground baiting strategies are based on the foraging activities of termites throughout the soil. Persistence on the part of the pest control professional is often required, and results may vary from area to area due to many environmental factors. Influencing factors can include the type and degree of compaction of the soil, area of the country, the season, lack of or excessive moisture, and the availability of alternative food sources. In general, the more bait placements made, the better the chances that termites will find the stations.

For structures where termite problems are persistent, baits may provide another strategy to use in termite management. They also provide a treatment alternative for areas where traditional chemical treatments are not available or practical for use such as structures near wells, cisterns, springs, and near bodies of water. They may be of value in an integrated pest management program in and around institutional structures (schools, nursing and retirement homes, hospitals, day care centers, etc.). Other potential areas for baiting systems include inaccessible crawlspaces, structures with plenums or sub-slab heating ducts, and difficult to treat foundations like rubble foundations.

PRE-TREATMENT REGULATIONS

The following regulations pertain to all soil and wood pre-treatments:

NAC 555.427 Preconstruction treatment: Submission of form before performance; application of termiticide. (NRS 555.380, 555.400)

1. Before performing a preconstruction treatment, a licensee must submit an accurate, complete and legible form entitled "Termiticide Pretreatment Notification Form" to the district or subdistrict office of the Department responsible for the region in which the preconstruction treatment will be performed.

2. The form submitted pursuant to subsection 1 must include:

(a) The name and telephone number of the pest control business that will be performing the preconstruction treatment;

(b) The name and address of the person for whom the preconstruction treatment will be performed;

(c) The location or address and zip code of the site at which the preconstruction treatment will be performed;

(d) The expected starting date and completion date of the preconstruction treatment;

(e) The number of sites on which the preconstruction treatment will be performed;

(f) A description of the type of preconstruction treatment that will be performed;

(g) A description of the location where the preconstruction tags will be affixed; and

(h) The date on which the form is completed.

3. A licensee who performs a preconstruction treatment to soil:

(a) Shall, unless otherwise authorized by the Director, apply the termiticide only to the sites and in the specific quantities and dosages provided on the label of the termiticide.

(b) Shall apply the termiticide in a manner that establishes a horizontal barrier before the pouring of each concrete slab that will be under the roof of the structure which will be constructed.

(c) Shall apply the termiticide in a manner that establishes a vertical barrier in each critical area that is identified by the label of the termiticide and visible at the time of the preconstruction treatment.

(d) Shall, within 30 days after grading and any other disturbance of the soil that is related to construction has been completed, apply the termiticide in a manner that establishes a vertical barrier at the exterior of:

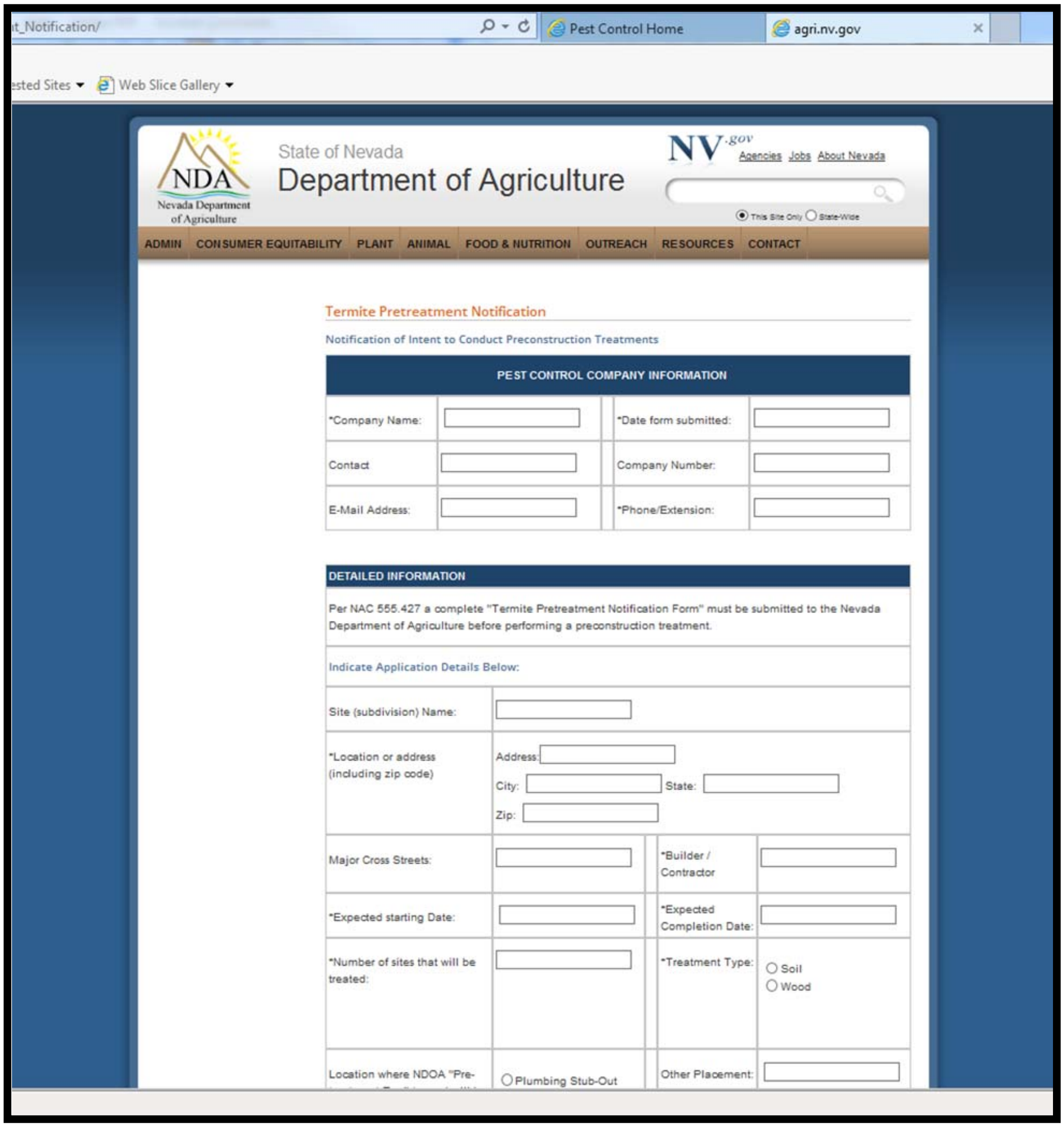
(1) The walls of the foundation for a structure that is being constructed using a raised foundation; or

(2) The concrete slab for foundations that are constructed on the ground.

(e) May, if it is in accordance with the label of the termiticide, apply a termiticide using a higher concentration of the termiticide in a reduced volume if the licensee determines that the absorption of the termiticide by the soil necessitates a reduced volume of the termiticide.

4. A licensee who performs a preconstruction treatment directly to wood shall, unless otherwise authorized by the Director, apply the termiticide only to the sites and in the specific quantities and dosages provided on the label of the termiticide.

(Added to NAC by Dep't of Agriculture by R033-01, eff. 5-1-2002; A by R147-03, 1-22-2004; R052-06, 6-28-2006)



Termite pretreatment Notifications can be submitted via the NDA web site at:
http://agri.nv.gov/Plant/PEST/Termite_Pretreatment_Notification/

NAC 555.428 Preconstruction treatment: Tag. (NRS 555.400)

NEVADA DEPARTMENT OF AGRICULTURE PRE-TREATMENT TAG
THIS PROPERTY HAS BEEN PRE-TREATED BY:
NDOA Authorization No.:________
Company Name: ________
Application Date: ________
Chemical Used: ________
Use Dilution (% Applied): ________ Gallons Applied: ________
☐ Treatment **Incomplete:** ☐ Treatment **Complete:**
Check Below What Was Treated:
☐ Wood
☐ Horizontal Soil Treatment ☐ Vertical Soil Treatment
Printed Name of Applicator: ________
TAGS AVAILABLE THRU THE NEVADA DEPARTMENT OF AGRICULTURE:
LAS VEGAS - 702-486-4690 OR RENO - 775-688-1182

NDOA Soil Pre-treat Tag - Final Treatment
(To be placed in electrical box)
VERTICAL SOIL TREATMENT AROUND OUTSIDE OF FOUNDATION
CO Name: ________
Date Completed: ________
Chemical Used: ________
Used Dilution (% Applied): ________
Gallons Applied: ________
Name of Applicator: ________
DO NOT REMOVE

1. Each tag for preconstruction treatment must be on a form prescribed by the Department. A licensee who performs a preconstruction treatment shall complete a tag pursuant to this section. The tag must include at least the following information:

(a) The name of the pest control business that performed the preconstruction treatment;

(b) The date that the preconstruction treatment was performed;

(c) The brand name and the registration number assigned by the Environmental Protection Agency of the termiticide that was applied;

(d) If the termiticide was diluted, the concentration of the diluted termiticide that was applied, written as a percentage of the active ingredient of the diluted termiticide that was applied;

(e) The total number of gallons of the diluted termiticide that was applied;

(f) The printed full name of the licensee who performed the preconstruction treatment;

(g) A statement indicating whether the licensee performed a preconstruction treatment to soil, a preconstruction treatment to wood, or a combination thereof; and

(h) If the licensee performed a preconstruction treatment to soil, a statement indicating whether the licensee applied the termiticide vertically, horizontally or in both manners

2. The information required to be included on a tag for preconstruction treatment pursuant to subsection 1 must be legible and an accurate and truthful representation of the preconstruction treatment performed.

3. Each tag for preconstruction treatment must be:

(a) Affixed securely at the site of each preconstruction treatment immediately after each application of termiticide; and

(b) Except as otherwise provided in subsections 4 and 5, prominently displayed:

(1) On the pipes for plumbing;

(2) On a board that is located at the site of the construction and includes the permit or records of inspection of the contractor of the structure under construction; or

(3) Any other location approved by the Director.

4. If the licensee performed a preconstruction treatment to soil and the soil adjacent to the exterior of the foundation was not treated during the initial treatment, after its treatment, the portion of the tag containing the information relating to the final treatment must be placed in the electrical box of the structure and must include the following information:

(a) The name of the pest control business that performed the preconstruction treatment;

(b) The full name of the licensee who performed the preconstruction treatment;

(c) The date that the final treatment was applied;

(d) The brand name and the registration number assigned by the Environmental Protection Agency of the termiticide that was applied;

(e) The number of gallons of the diluted termiticide that was applied; and

(f) If the termiticide was diluted, the concentration of the diluted termiticide that was applied, written as a percentage of the active ingredient of the diluted termiticide that was applied.

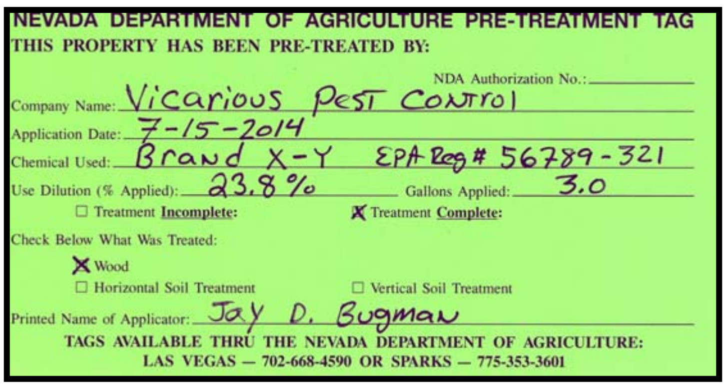
5. If the contractor of the structure under construction on which the preconstruction treatment is being performed requests a tag for preconstruction treatment, the licensee shall:

(a) Prepare a duplicate tag;

(b) Print the word “DUPLICATE” in capital letters on the tag; and

(c) Post the tag on the site in the location requested by the contractor or deliver the tag to the contractor.

(Added to NAC by Dep’t of Agriculture by R033-01, eff. 5-1-2002; A by R062-10, 1-13-2011; R033-15, 6-23-2014)



NEVADA DEPARTMENT OF AGRICULTURE PRE-TREATMENT TAG
THIS PROPERTY HAS BEEN PRE-TREATED BY:

NDA Authorization No.:

Company Name: Vicarious Pest Control

Application Date: 7-15-2014

Chemical Used: Brand X-Y EPA Reg # 56789-321

Use Dilution (% Applied): 23.8 % Gallons Applied: 3.0

☐ Treatment **Incomplete**: ☒ Treatment **Complete**:

Check Below What Was Treated:

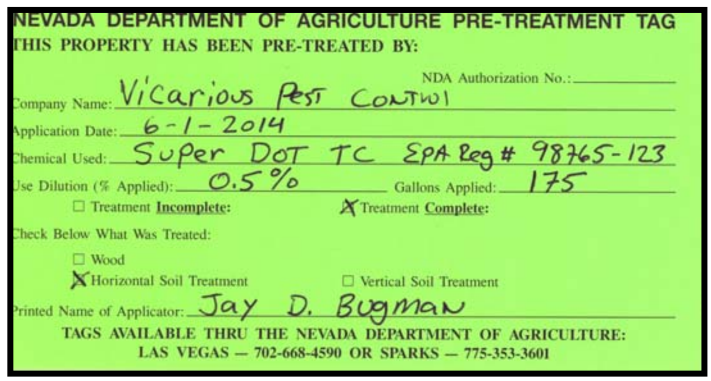
☒ Wood

☐ Horizontal Soil Treatment ☐ Vertical Soil Treatment

Printed Name of Applicator: Jay D. Bugman

TAGS AVAILABLE THRU THE NEVADA DEPARTMENT OF AGRICULTURE:
LAS VEGAS — 702-668-4590 OR SPARKS — 775-353-3601

Pre-treatment Tag used for pesticide applications made directly to structural wood during the building process. This tag indicates a treatment to the wood structure was complete.



NEVADA DEPARTMENT OF AGRICULTURE PRE-TREATMENT TAG
THIS PROPERTY HAS BEEN PRE-TREATED BY:

NDA Authorization No.:

Company Name: Vicarious Pest Control

Application Date: 6-1-2014

Chemical Used: Super DOT TC EPA Reg # 98765-123

Use Dilution (% Applied): 0.5 % Gallons Applied: 175

☐ Treatment **Incomplete**: ☒ Treatment **Complete**:

Check Below What Was Treated:

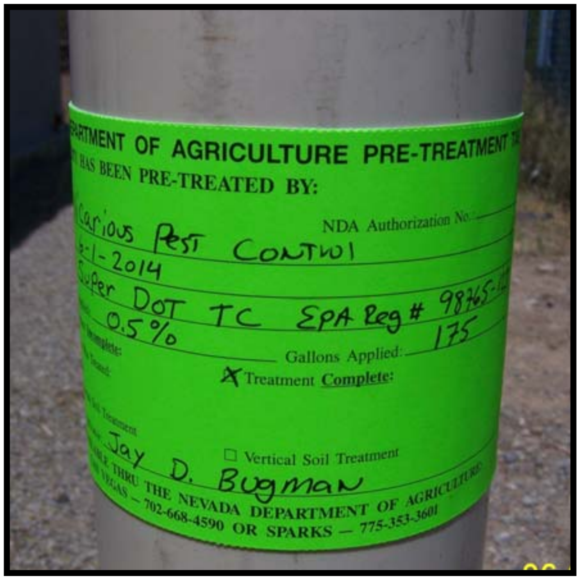
☐ Wood

☒ Horizontal Soil Treatment ☐ Vertical Soil Treatment

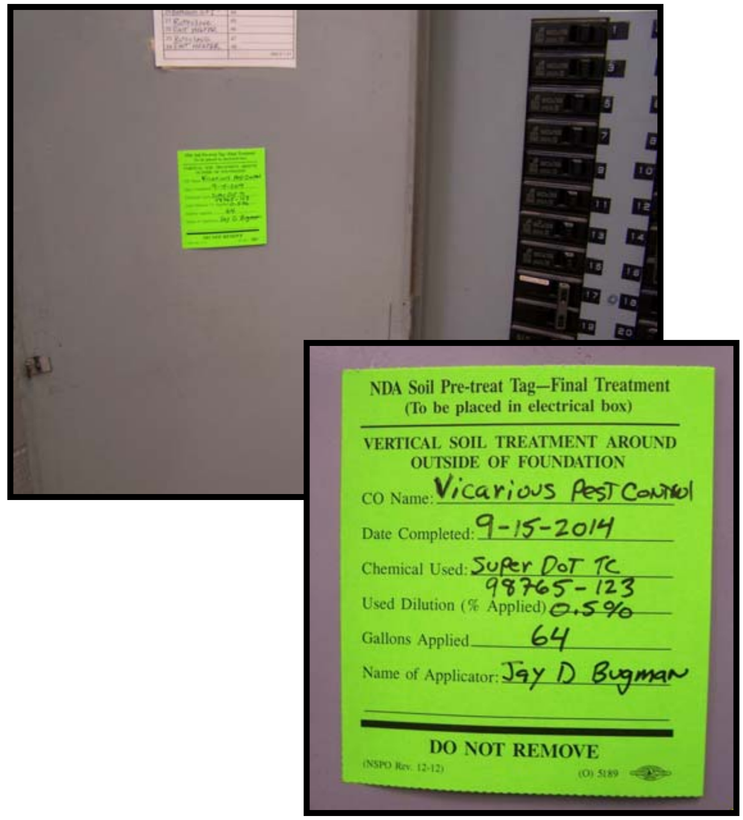
Printed Name of Applicator: Jay D. Bugman

TAGS AVAILABLE THRU THE NEVADA DEPARTMENT OF AGRICULTURE:
LAS VEGAS — 702-668-4590 OR SPARKS — 775-353-3601

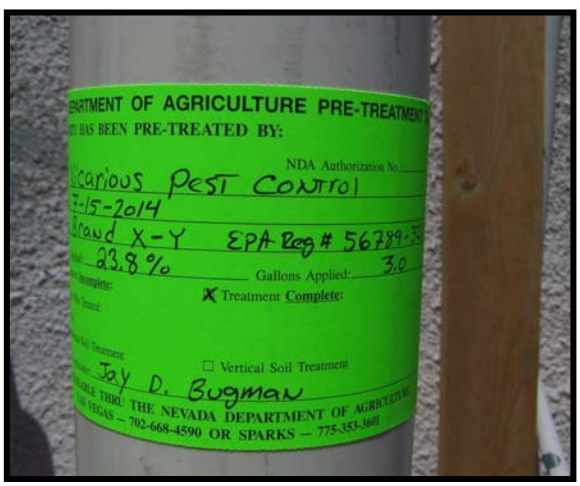
Pre-treatment Tag used for pesticide applications made directly to soil prior to the establishment of a concrete slab, stem wall footing, etc. where a continuous unbroken chemical barrier is desired. This tag indicates a horizontal soil was complete.



Pre-treatment Tag used for pesticide applications made directly to soil prior to the establishment of a concrete slab, stem wall footing, etc. shall be affixed securely at the site of each preconstruction treatment immediately after each application of termiticide.



Pre-treatment Tag used for preconstruction soil applications made to soil adjacent to the exterior foundation of a house. Tag must be placed in the electrical box of the structure after the required treatment is applied.



Pre-treatment Tag used for pesticide applications made directly to wooden structural members which shall be affixed securely at the site of each preconstruction treatment immediately after each application of termiticide.

NOTE: In the event the electrical box mentioned in NAC 555.428(4) is unavailable to the applicator at the time of final treatment, the NDOA has made available an Electronic Final Grade Tag which can be submitted electronically to NDOA in lieu of placement of the actual Final Treatment Tag in the electrical box. The web site is: http://agri.nv.gov/Plant/PEST/Electronic_Final_Grade_Tag/

SUBTERRANEAN TERMITE POST CONSTRUCTION SOIL TREATMENTS

A treatment to control termites in a structure that has already been built is referred to on termiticide labels as a “post-construction” treatment.

Depending on label instructions, when basements are treated, all cracks and any other openings (e.g. utility openings) should be sealed with an approved mortar or sealant to help prevent the escape of odors or dilution into the living area. Labels often suggest that the final grade surround the outside of basements be treated to a depth of 4 feet. (Caution: the label dictates the depths at which this area is to be treated. The suggestion given is only intended to inform the reader that specific methods may be needed to treat basements.)

Post-construction treatment to slab foundations also presents unique challenges for the applicator. Possible contamination of vent/duct-heating/cooling systems is always an unfortunate possibility. In addition, some slab floors contain in-floor (electronic or hydronic-water) heating and cooling systems. If obtainable, blueprints should be examined closely to determine the location of HVAC ducts, Hydronic tubes, water, sewer and electrical lines. Sand or soil inside a duct may indicate that it is permeable to water. (Caution must be mentioned here because the presence or absence of sand or soil is not always an accurate indicator of a system’s permeability; and blueprints are often inaccurate due to design changes during construction).

Another method for avoiding duct contamination is to seal off all vents inside the structure then pre-drill all treatment holes. Air is then circulated at high speed through the system and each hole is checked for escaping air. If air is escaping from any of the drill holes, then the duct has probably been punctured and treatment should be halted. (Caution: this suggestion is only intended to inform the reader of the importance of not damaging or contaminating a vent/duct system.)

If there is a concern regarding contamination of the vent/duct system, the system can be checked for contamination by turning it on and smelling or sampling the air passing through it. If the odor of the termiticide is detected then the system has probably been contaminated and should be thoroughly cleaned. Information on cleaning these systems can be obtained by contacting the product manufacturer.

When drilling and treating the slab from inside the home, contamination can be avoided by pulling back any carpet and padding, drilling the treatment holes, applying the chemical, and sealing each hole before the treatment of the next one begins (a cork or rubber stopper is often used to temporarily plug the previously treated hole). This, combined with low pressure, helps prevent chemical splash-backs from previous treatment holes which could contaminate any flooring or other area inside the home. Any drops or puddles on the slab are to be cleaned up immediately in a manner prescribed by the label.

Vertical treatments down through the slab should be done around all utility entrances, footings, expansion joints, cracks and any interior walls that could hide cracks or grade stakes left during construction. It may be desirable to drill the stemwall at a 45º degree angle to decrease the possibility of damage to existing ducts or utilities (see Figure 3). (Caution: many homes are built on monolithic slab type foundations that use a post-tension cable system. The location of these cables must be considered before any holes are drilled into the slab.)

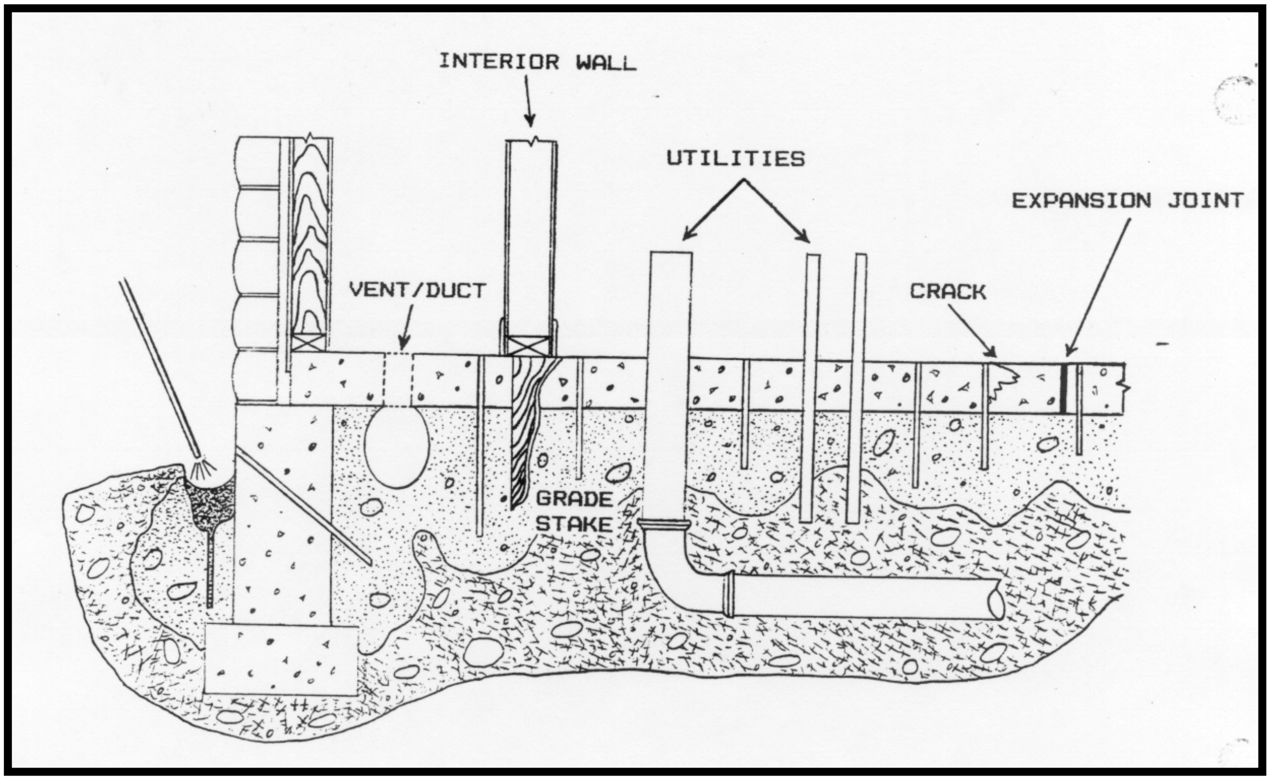
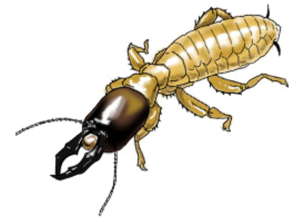


Figure 3. Sub slab injection techniques should be used around all utility entrances, expansion joints, cracks and any interior walls which could hide cracks or grade stakes. Slab footings can be drilled at 45 degree angles to minimize and damage or contamination of utilities or duct systems.



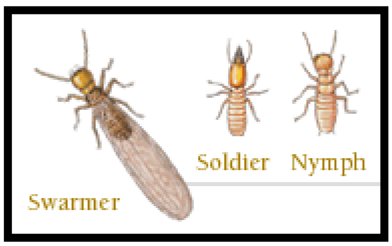
DESERT DAMPWOOD TERMITE

(*Paraneotermes simpliciornis*)

GENERAL: This species is in the same family as the drywood termites and is native to southern Nevada. Nationwide its distribution is narrow, being restricted primarily to the Southwest. It is of minor importance in Nevada.

In Nevada, the Desert Dampwood Termite is found in Clark County. No record of this termite has been found outside Clark County.

DESCRIPTION: This termite looks like a typical drywood termite with some minor differences. The abdomen of the nymph has a spotted appearance due to the fact that the contents of the intestine show through the body wall. The soldiers have a brown or yellow-brown, low flat head with short mandibles that are thick near the base with narrow tips. The alate is dark brown including the wings. As with the Western Drywood Termite there are three castes comprising the colony: reproductives, soldiers, and workers/nymphs.



LIFE CYCLE: Swarming flights, as many as 30, begin in late May and occur periodically through early September. The flights usually consist of very small numbers of alates and begin around 15 minutes after sunset and continue for about 30 minutes. Flights are not associated with rain, and usually occur when temperatures are between 75°F and 90°F.

Colonizing pairs cannot enter wood above ground and do not build "shelter tubes" to reach wood above ground. Colonies are always located in wood that is partly or entirely buried. The galleries are spotted and splattered with fecal material resembling mud and contain dumps of conical fecal pellets. These conical fecal pellets are characteristic of the desert dampwood termite, and derive their color from the color of the wood.

Some colonies have been found containing up to 1400 individuals, while some foraging sub-colonies have been found to contain between 800 and 2100 nymphs and soldiers, indicating large colonies.

HABITAT: The Desert Dampwood Termite infests moist wood in the soil.

FOOD: This termite feeds on moist wood which is digested by protozoa in its rectal pouch.

DAMAGE: The Desert Dampwood Termite attacks untreated poles and posts just below ground level. It attacks the root systems of shrubs and young trees. It has been found attacking baseboards and door frames.

CONTROL: Methods of control are the same as those for the subterranean termites.

NEVADA DAMPWOOD TERMITE

(Zootermopsis nevadensis)

GENERAL: The Nevada Dampwood Termite is found in northwestern Nevada forests. The appearance, life cycle, and habitat of this termite is very similar to the Common or Pacific Dampwood Termite.

DESCRIPTION: There are basically three castes which comprise a Nevada Dampwood Termite colony: reproductives, soldiers, and workers/nymphs. The reproductives are categorized as primary reproductive, supplementary reproductive, queen and king.

The primary reproductive is a winged adult called an alate. It is dark brown with dark brown leathery wings and an overall length of 3/4". The nymphs are whitish to cream colored with a dark abdomen (due to the intestinal contents) and have larger and more numerous hairs on the head and body parts than does the Common or Pacific Dampwood Termite. The nymphs that are to become primary reproductives have wing pads in their more advanced stages. The soldier has long mandibles and a longer head with straighter sides than the Common Dampwood soldier. The anterior end of the soldier is black, generally shading to a dark reddish-brown toward the anus. The thorax and abdomen are a light caramel color with the abdomen being darker due to the intestinal contents.

LIFE CYCLE: Alates normally leave the colony from July through October but may be found flying in warm weather during any month. They usually emerge in late afternoon or early evening after a rain. This frequent appearance after a rain has earned them the nickname "rainbugs". They are strong fliers and are greatly attracted to artificial light.

After flight the alates drop to the ground, lose their wings and the queen excavates an opening in a piece of damp or wet wood. Later the king enters and the opening is sealed with a mixture of fecal pellets, wood chips, and liquid feces. Copulation occurs within two weeks, and 14 - 18 days later the white, translucent, long slender, bean shaped eggs are laid. Initially the queen lays from 6 - 22 eggs with the average being 12; the second batch is laid in the spring. Colonies are known to contain up to 4000 termites.

HABITAT: The Nevada Dampwood Termite does not require contact with damp or moist ground but does require wood with a high moisture content. Wood is excavated forming tunnels that have a velvety surface appearance and that are sometimes covered with liquid feces that have dried. Fecal pellets are found throughout the tunnels and are small, hard, and oval. The color of the pellets depends on the wood eaten, and may have a hexagonal shape. If the wood is extremely damp, the pellets are often spherical or irregular, and usually stick to the sides of the tunnels. In drier wood, the pellets collect in the bottom of the tunnels.

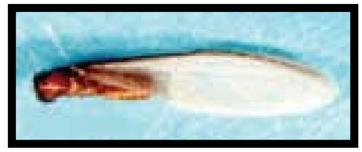
FOOD: Alates in the process of forming a new colony feed on sound wood with a high moisture content. In attacking sound wood, the softer spring wood grain is preferred. Mature colonies prefer sound wood, but will invade and feed on rotten wood. As with other termites, protozoa in the rectal pouch digest the wood.

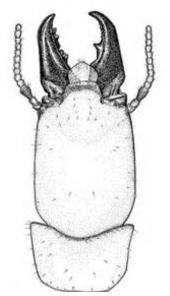
DAMAGE: The Nevada Dampwood Termite usually attacks sound wood and damages it by excavating tunnels and chambers. They have more of a tendency to work "upward" from the foundation to the roof than do subterranean termites. In their intestinal tract they carry spores of wood destroying fungi that are spread to healthy wood. Because they do not build "shelter tubes", they usually need an earth-wood contact to move "upward" into a structure.

CONTROL: The control methods are the same as for the subterranean termites.

WESTERN DRYWOOD TERMITE

(*Incisitermes minor*)





GENERAL: The Western Drywood Termite was originally classified under the scientific name *Kalotermes* minor. Older publications use the genus *Kalotermes* while the newer publications use *Incisitermes*. This termite is native to southern Nevada. In northern Nevada it has been found in furniture and mobile homes moved northward. Due to the cooler climate in northern Nevada it is not known to have become established there. This termite does not live in the soil and therefore is **NOT** one of the subterranean termite species. It lives above ground level and derives all of its moisture directly from the **dry**, **sound** wood that it eats.

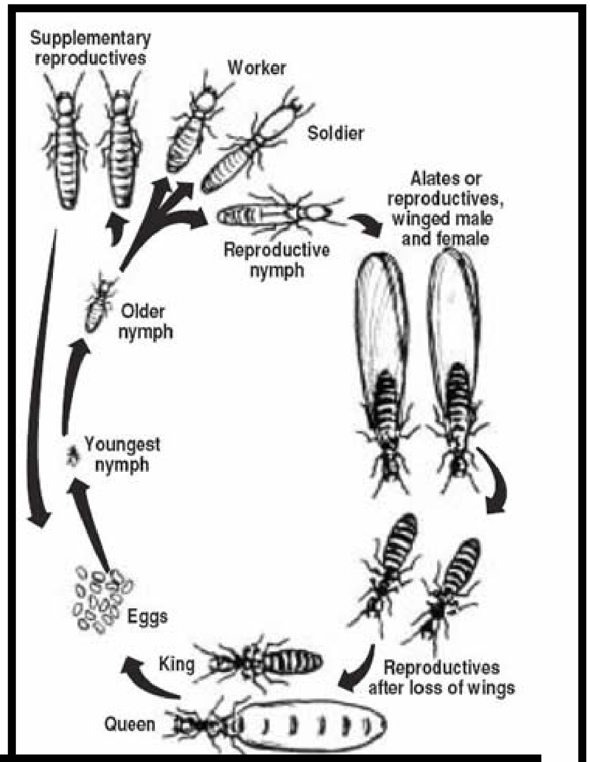
DESCRIPTION: There are basically three castes which comprise a drywood termite colony: reproductives, soldiers, and workers/nymphs. The reproductives are categorized as primary reproductive, supplementary reproductive, queen and king. The primary reproductive is a winged adult called an alate. It is dark brown with a reddish-brown head and thorax, has smoky-black wings with black veins and is overall approximately 1/2" long including the length of the wings. The supplementary reproductive is white, about 1/4" long and lacks wings although it sometimes has wing pads. The queen is a primary reproductive that, after losing her wings, has an enlarged abdomen that has a striated appearance. The king is a primary reproductive with a normal abdomen. The worker and soldier are white, blind, lack wings, and are about 1/2" long. The soldier has an elongated, amber head, and large mandibles (jaws).

As presented in the photographs below, Drywood termites produce distinct fecal pellets that are small, seed-like, usually straw colored, elongated with rounded ends and have six flattened or roundly-depressed surfaces.

Drywood termite fecal pellets

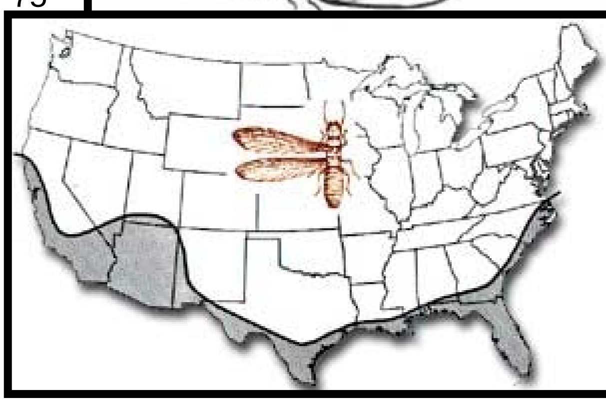
LIFE CYCLE: Swarming normally occurs in bright sunlight when the temperature is 80°F or higher. Some swarming may occur at lower temperatures and/or under an overcast sky. Moisture does not stimulate swarming. The nymphs make emergence holes 1/16" – 1/8" in diameter for the alates; and after swarming plug the holes with cement, feces, and partially chewed wood.

The alates can fly up to one mile when aided by the wind but normally fly only a few feet. They then cast off their wings, mate, enter a crack in wood and bore into sound wood making a small tunnel. They plug the tunnel with a brownish material and excavate a pear shaped chamber where the queen lays her first eggs. Normally, two to five nymphs hatch from these eggs; these nymphs enlarge the chamber. The queen then lays more eggs in the enlarged chamber.



The nymphs pass through seven instars; soldiers and supplementary reproductives may emerge from the fourth through the seventh instar; alates emerge from the seventh instar. Egg to maturity takes approximately one year.

Toward the end of the second year the colony consists of one queen, one king, one soldier, and 6 - 40 nymphs. Three year old colonies have 40 - 165 termites; four year old colonies have 75 - 700 termites. The ratio of soldiers to nymphs in these colonies varies from 1:15 (one solder per every 15 nymphs) to 1:60 (one solder per every 60 nymphs). Colonies over four years old can reach 2750 termites, which is probably the maximum. Alates swarm when the colony is four years old.



From late spring to late fall the queen will lay between 1 - 12 eggs each day for 7 - 10 days. She then rests for a month or longer before laying eggs at the same rate. Her maximum egg laying occurs in her 10th to 12th year, from there it declines rapidly.

HABITAT: The Western Drywood Termite infests any dry wooden portion of a structure, furniture, wood pile, or similar item. They attack Redwood, English Walnut, and ornamental trees and shrubs. They do not require contact with soil.

FOOD: The feeding habits of the Western Drywood Termite are the same as those of the subterranean termites with one exception. Whereas subterranean termites will feed on sound or decaying wood, the Western Drywood Termite feeds primarily on sound, dry wood.

DAMAGE: Drywood termites will consume wood up to the paint itself. They excavate wood indiscriminately across and with the grain, forming chambers and tunnels. Fecal pellets and debris are either stored in chambers or cast out through small openings in the wood.

DRYWOOD TERMITE CONTROL TECHNIQUES

Preventing a drywood termite infestation is best accomplished by denying all accessible areas to the reproductive alates. The reproductive pair usually enters the structure through voids in or between wooden members, such as knotholes, cracks, crevices between siding and rafter ends, between building paper and studding, or directly through unscreened attic vents, to name only a few.

Exposed wood can sometimes be protected by a heavy coating of paint, or preservative containing alkaline copper quaternary (ACQ) or a borate based insecticidal spray/stain approved for such application. (Topical applications of insecticides usually have very little effect on termites below the surface of infested wood.) In addition, exposed voids should be filled with an approved putty or caulking (due to the cracking and peeling nature of many of these products, there is no 100% guarantee for their success). All attic and foundation vents should be covered with a 20 mesh non-corrodible metal screen, and checked periodically to prevent clogging from spider webs or excessive dust and debris.

Wood products used in the construction of buildings can be chemically treated before or after construction to <u>repel</u> termite attack. This procedure is often very costly and its effects may be limited if the lumber cracks and exposes an untreated area; or if the chemical loses its residual characteristics over time.

Attic areas can be protected by a dusting with a silica aerogel. Silica aerogels are extremely light particles formulated to control termites chemically, or by using a combination of chemicals and finally ground materials (diatomaceous earth) to breakdown the waxy coating on their exoskeletons. This waxy coating prevents them from losing water; once this coating has been removed, the termites desiccate and die. Silica aerogels are easily injected or blown into attics and wall voids. The tiny particles settle throughout the structure and are intended to kill any reproductive alates that may enter. *"The particular advantage of a silica aerogel is that it's inorganic and not subject to decomposition and should protect the dusted wood against termite attack for the life of the building"* (Ebeling, 1975).

When treating wall voids with a silica aerogel, holes are simply drilled through the sheetrock, or other wall coverings, and the silica aerogel, or dust, is injected into this area. The application should cover the bottom wooden sill upon which the studs rest. If insulation bats between these studs block the injection, injection tips should be pointed downward between the paper on the insulation and the wall to insure the dusting of these sills. If permitted by the label, silica aerogels may also be dispersed into the crawlspace in the same manner as that described for attics to prevent drywood termites from becoming established in beams, pier posts, subfloor and other structural elements.

Chemical controls for drywood termites are best accomplished when the location and extent of the infestation is known; especially when localized treatments are used instead of fumigating an entire structure. Locating the colony(s) is usually the most difficult task when trying to control this pest. A thorough inspection must be conducted throughout the structure. Inspect all exposed areas, such as the attic, garage, trim, window frames, crawlspace (if present) and other areas where exposed or cracked wood exists.

As mentioned earlier, drywood termites will consume wood right up to the paint itself, often leaving it with a blistered appearance. Inspections are best done by probing exposed wooden members of the structure with a screwdriver, geologist pick, or any semi-pointed instrument.

When probed, hidden galleries will usually break open spilling fourth the termite’s seed-like fecal pellets. The breaking open of these galleries should be avoided if possible. There disturbance often disrupts the normal activities of the colony and may result in a less effective treatment.

Probably the most effective technique for finding a drywood termite colony is to look for an accumulation of fecal pellets. Drywood termites use "kick outs" to expel fecal pellets from the colony. These pellets often accumulate in small piles directly below the termite galleries (depending upon the location from which they have been expelled). Once these fecal pellets have been found, it is much easier to locate the colony and to begin treatment.

Chemical controls for drywood termites are usually done by localized treatments or whole-house fumigation. When localized treatments are used, infested wood should be drilled into only far enough to enter the gallery. Hole sizes may vary from 1/8" – 1/2" depending on the size of the infestation and convenience to the applicator. Hole spacing may also vary from 8" to 24" inches apart depending upon the extent of the infestation and the type of termiticide used (label directions may have more specific treatment standards).

When applying a dust, silica aerogel or aerosol, special attention should be given to the nature of the chemical. Dusts, that use clay particles as carriers may absorb moisture, and if applied too heavily may clog the galleries. Drywood termites often respond to this by walling off that section of the gallery, thus limiting the effectiveness of the application. Silica aerogel are usually not associated with this problem, but should be applied cautiously. For aerosols, plastic injection tips should be used to decrease the possibility of electrocution from any frayed or damaged wire. Plastic tips can also be bent to conform to the galleries, increasing the area that can be treated.

Once the application for a hole is complete, it should be filled with a wooden or plastic dowel, wood putty or other approved material.

When furniture or other movable items are infested, four methods of control are available:

- The item can be fumigated in a vault or chamber.
- Pesticides can be injected into the termite chambers (as previously discussed).
- The item can be placed in a chamber with an internal temperature of 150°F for 1½ hours, or 140°F for 4 hours.
- The item may be cooled to at least 15°F for 4 days.

NOTE: Due to the extreme caution that must be used for structural or chamber fumigation, it is not addressed here because it goes beyond the scope of this manual. Fumigation involves another pest control license category and is therefore examined in a separate manual available at the Nevada Department of Agriculture.

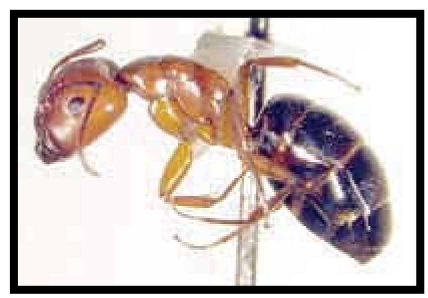
CARPENTER ANTS

(*Campontus* spp.)

GENERAL: There are 12 species of carpenter ants in Nevada, of which 8 are of economic importance. Carpenter ants are found throughout Nevada from the highest to the lowest elevation. The life cycles, damage, etc., of carpenter ants are similar so as to be indistinguishable except for ant size and color. For practical purposes they will be considered as a single entity.

DESCRIPTION: Carpenter ants have complete metamorphosis (i.e. egg, larva, pupa, and adult). The white egg is smaller than the head of a pin and either oval or sausage shaped. The larvae are white, grub-like, without legs, and have very small heads. The pupa develops in a white-to-brown, parchment like cocoon. Adult carpenter ants have three castes; queen, male, and worker. These castes have the common appearance of all ants. A winged queen may reach from 1/6" - 2/5" in length depending on whether or not they are "major," "intermediate," or "minor". The color of the adults ranges from amber through red through reddish-brown to black. Wings are formed on both males and females that swarm. When crushed, these ants emit a strong formic acid odor. They do not sting but may bite, and sometimes inject formic acid into the bite wound.





As shown in the photo below, carpenter ants are distinguished from termites by the narrow constriction between their body segments, termites are “broadly segmented”; the antenna of carpenter ants are “elbowed”, the antenna of termites have “beaded” appearance.

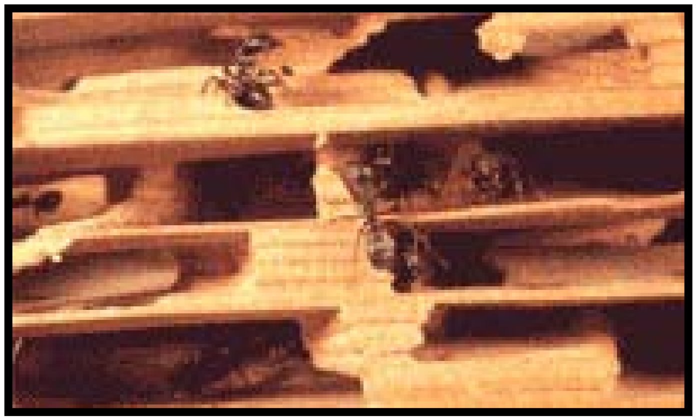
Termite on left, carpenter on right.

LIFE CYCLE: From May to July the winged males and females emerge from a colony which is at least two years old. The 200 - 400 winged individuals pair-up and mate in flight, after which the male dies. The female drops to the ground where she chews her wings off. This fertile female, called a queen, normally then enters wood through a crack, crevice or a tunnel bored by an insect; but may excavate a tunnel herself. She makes or finds a small chamber and seals it. In the chamber she lays her eggs and remains there until her first brood of workers reaches the adult stage, normally in two to ten months. After that it usually takes a total of 66 days from egg to adult: 24 days in the egg stage, 21 days in the larval stage, and 21 days in the pupal stage.

There may be more than one queen in a colony. The largest workers may lay eggs which will produce only male ants. Reproductive individuals are not produced in a colony until it contains approximately 2000 workers. It usually requires three to six years, or longer, to reach this size.

HABITAT: Carpenter ants do not use wood for food but rather for nesting. As shown in the photo below, carpenter ants excavate galleries in wood which resembles termite galleries but can be distinguished from termites by the fact that their galleries are entirely clean, contain no debris, and have an almost "finished" appearance. The galleries extend in all directions, but tend to be excavated within the softer wood grain. Some of the harder wood layers remain as walls separating the tunnels. At intervals, openings are cut in these harder walls providing passageways. Access to the outside may be through cracks or other natural openings. Often these ants cut openings to the outside called "windows" through which they deposit some of their chewed up “sawdust”. Occupied galleries are kept clean of excavated wood, dead ants, soil, etc. Rather than being pushed out a window, most of the debris is carried from the nest and deposited outside. Usually the nests are found in moist, unsound, or partially decayed wood but can be also be found in sound wood.

Carpenter ant galleries in excavated wood



Carpenter ants and excavated galleries

FOOD: Carpenter ants feed on both plant and animal material. They will feed on both living and dead insects, and anything humans eat. Items found in the kitchen such as syrup, honey, jelly, sugar, meat, grease and fat are particularly attractive.

DAMAGE: Carpenter ants contaminate food and are a nuisance with their movement inside and outside of structures. However, their primary damage is done in their excavation of wood, which if unchecked, can be quite extensive.

The ants have shown some preference for moist, rotting wood that can be commonly found in a poorly ventilated crawlspace, a leaking roof or skylight, an exposed deck and areas where sprinklers contact a structure. Their excavation of wood and the formation of galleries and tunnels often weaken structures making them unsound.

CARPENTER ANT CONTROL TECHNIQUES

Carpenter ant infestations are best prevented by removing any cellulose from around or in contact with the structure, and correcting any structural design flaws that may encourage infestation.

Stumps, hollow and rotted portions of trees, wood piles and any other cellulose near a structure are a few obvious sites that carpenter ants may inhabit. Carpenter ants commonly forage up to 100 yards from their nests. Any possible nesting location within this distance from a structure should be removed or closely monitored. Tree limbs or overhanging branches in contact with the structure may encourage infestation and should be trimmed away. Overhead utility lines often act as an avenue for carpenter ants to gain access to a structure.

Structural design flaws which encourage carpenter ant infestation include, poorly installed flashing around skylights, chimneys, roof vents, leaking or improperly installed rain gutters, plumbing leaks or any other flaw that allows for an occasional, or constant, soaking of a structure's wooden members. Timbers pressure treated with an insecticidal compound may be desirable when designing a structure in areas prone to carpenter ant infestation.

Nest locations may be pinpointed, and control measures implemented, if the applicator recognizes the following clues that may lead to the hidden nest.

- **Sawdust Shavings**: Sawdust shavings found in small piles or in spider webs outside a gallery "window".
- **Ant Trails**: Ant trails leading to or from an area may indicate a nest's location.
- **Infested Firewood**: Infested firewood is often the source of infestation in areas not normally associated with carpenter ant problems. Any firewood should be closely inspected for activity.
- **Water-Stained or Damp Wood**: Water-stained or damp wood should be examined with great care. Suspected areas can be probed in the same manner as that described for drywood termites, or a stethoscope may be used to listen for rustling activities inside suspected timbers.
- **The Homeowner**: The homeowner is often the most reliable and accurate source of information when searching for an infestation. Homeowners may be familiar with the carpenter ant's habits and where they can be found. Before controls (especially chemical controls) are initiated, the applicator should thoroughly question the homeowner about the nature of the infestation.

Chemical controls for carpenter ant infestations may vary depending upon the nature, location and extent of the infestation(s). Nests in sub-flooring or attic portions of a structure may be treated by drilling into the affected timbers and applying a dust, aerosol or silica aerogel as previously described in the drywood termite control section of this manual.

Nests which cannot be found, or ones in locations that make it impractical to drill and treat, may be successfully eliminated by periodically applying a pesticide that will be transported back to the nest. These pesticides should be applied to areas the ants frequently visit, in conjunction with an external barrier application around the structure's foundation and to any potential nesting areas. When using a pesticide to control any pest in different locations, be sure all application sites are listed on the label.

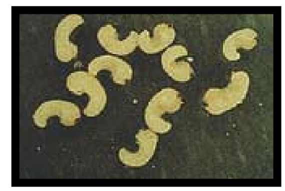
Severe infestations may require fumigation of the entire structure; however, most fumigants have no residual characteristics, thus making re-infestation a possibility. After fumigation, a preventative treatment or a preventative control program may be needed to avoid a re-infestation.

POWDERPOST BEETLES

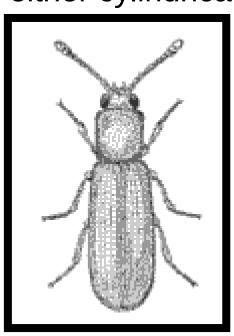
(*Lyctus* spp.)
(*Trogoxylon* spp.)

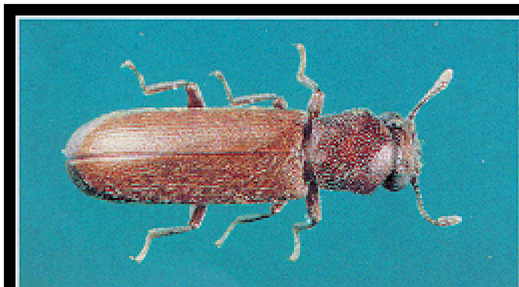
GENERAL: Both genera are native to Nevada but have not been found in all Nevada counties. At least two species of each genera have been found in Nevada. They get their name from the powder-like dust they produce from the wood they bore into.

DESCRIPTION: Powderpost beetles have complete metamorphosis (i.e. egg, larva, pupa, and adult). The eggs are long (i.e. about .04 inch), translucent, white, cylindrical, with rounded ends and a threadlike appendage at the tip. The emerging larva is white and straight-bodied with a pair of small spines at the rear. After the first molt, the larva assumes a curved form. A mature larva is less than 1/5" long, curved, with an enlarged thorax and three distinct pairs of legs. It is white with a dark brown head. The pupal chamber is a tunnel that was excavated when the pupa was in the larval form. It is sealed at one end by sound wood and the other by excavated frass.

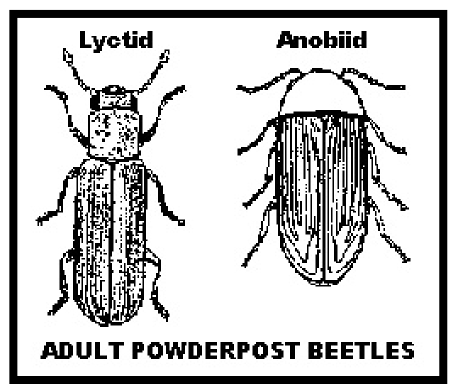


The photos below are of adult powderpost beetles. They range in color from reddish-brown to brown to dark brown to black. They are flattened, elongated, and range in length from 1/8" – 1/4". The head is prominent, not being covered by the prothorax, with a pair of 11 segmental antennae, each with a 3 segmented terminal club. They are hard shelled, and either cylindrical or short and stubby.





True powderpost beetles are only ⅛ to ¼ inch in length and range in color from reddish-brown to black. *Photo courtesy Van Waters & Rogers, Inc.*

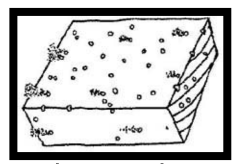


Views of the adult powderpost beetle

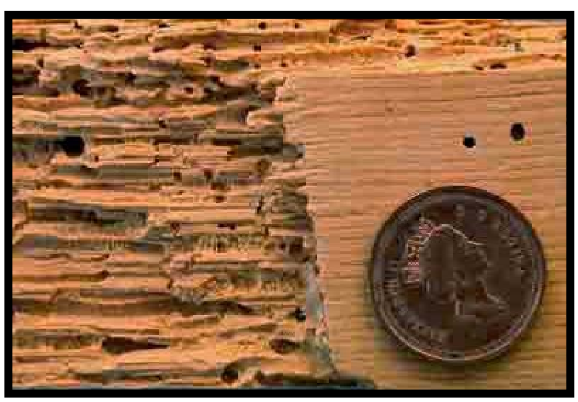
LIFE CYCLE: In unheated sites, powderpost beetles overwinter in the larval stage in trees or lumber. In the spring, the larva bores near the surface and pupates for two to four weeks. The adult beetle then makes a 1/16" – 1/4" exit hole and emerges from the wood, pushing powdered wood ahead off it. Mating takes place shortly after emergence and the female commences egg laying one or two days thereafter. Egg laying can continue for up to two weeks but most eggs are laid in 7 - 8 days. The female inserts her long, flexible ovipositor into the pores of the wood and lays one or several eggs. Over her lifetime she will lay from 15 - 21 eggs. The eggs hatch in from 1 to 3 weeks, depending on temperature. After hatching the larvae immediately bore into the wood. Outdoors the larvae grow primarily during spring and summer. From egg to adult normally requires 9 to 12 months but under ideal conditions (e.g. in a home) may be only 6 or 7 months.

HABITAT: Powderpost beetles primarily infest the sapwood of hardwoods because of its high starch content, but on occasion may infest the heartwood of hardwoods; and have been known to infest pine and fir. As their-chief nutrition is starch, the beetles will not oviposit in sapwood where the starch content is less than 3%. They prefer recently dried wood to old wood because over a period of time the starch is converted to lignin. The percent of water in wood also determines whether or not ovipositing will occur. The beetles can live in wood with a water content between 6% and 32%. The greatest beetle activity is found when the wood has a moisture content from 10% to 20%. Green wood normally has a moisture content of 50% which explains why the beetles prefer to attack partially or wholly seasoned wood. Finally, pore diameter of the wood determines whether ovipositing can occur. The ovipositor diameter of powderpost beetles is around .003 inch. If the pores of the wood are smaller than this, the eggs cannot be laid.

FOOD: The beetles main source of food is starch, and any sugar or protein that may be present in the wood. They cannot digest plant cell walls because the larvae cannot digest cellulose.



DAMAGE: The larvae burrow in wood following the grain and the tunnels are usually somewhat parallel without any branching. The larvae reduce the interior of the wood to a fine powder, eventually reducing the wood to a hollow shell. The adults bore 1/16" – 1/4" exit holes in the wood and also push the powdered wood onto the floor, etc. If infested wood is brought into a home, there is the possibility of reinfestation, or infestation of untreated furniture, studs, etc.



Powderpost beetle damaged wood

CONTROL: Control methods are directed toward prevention of an infestation and then elimination of an infestation.

Prevention can be accomplished by:

- Finishing all surfaces with varnish or paint, thus preventing egg laying.
- Treating lumber with a pesticide prior to building, preferably at the mill or lumber yard.

Elimination can be accomplished by:

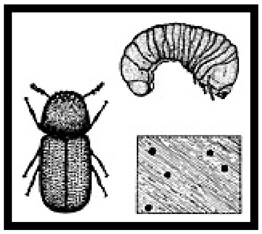
- Fumigation of the infested item.
- Heat treatment at a temperature of 130°F for 1½ hours for wood up to ½" inch thick. Thicker wood requires a longer period of treatment. Humidity should be at the saturation point.
- Removal and destruction (e.g. burning) of infested wood.
- Pesticide applications consisting of spraying, brushing, or injection.

OTHER WOOD DESTROYING INSECTS"

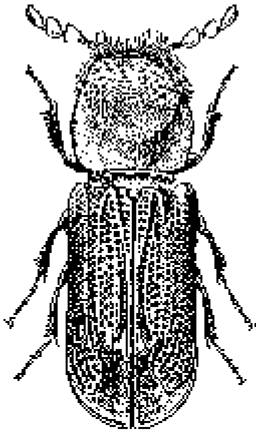
The following insects are minor pests of wood in Nevada. They will occasionally be found when a wood-destroying pest inspection is conducted and may require treatment.

FALSE, POWDERPOST BEETLES

(Family Bostrichidae)



GENERAL: These beetles normally occur in warmer areas of the state. They are larger than the powderpost beetles ranging from 1/8" - 1", and are elongated and cylindrical. As shown in the photos below, the head is hidden from view beneath a large thorax giving the beetle a humpbacked appearance; and the antenna ends in three distinct club-shaped segments.



False, powderpost beetle (Bostrichid)

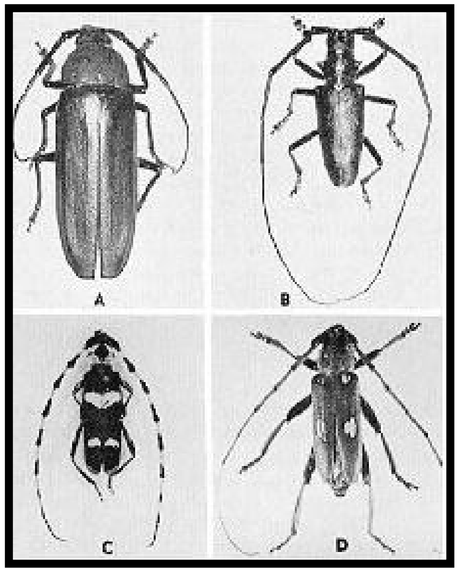
DESCRIPTION: Unlike powderpost beetles, the adult Bostrichid beetles bore into wood where the female lays her eggs in the pores or in lateral tunnels. These sites are known as "egg tunnels." When hatched the larvae bore into the wood and, along with the adult, form galleries varying in size and shape. The exit and entrance holes do not contain frass but the galleries contain a tightly packed frass that tends to stick together.

CONTROL: Same as for powderpost beetles.

ROUNDHEADED BORERS

(Family Cerambycidae)

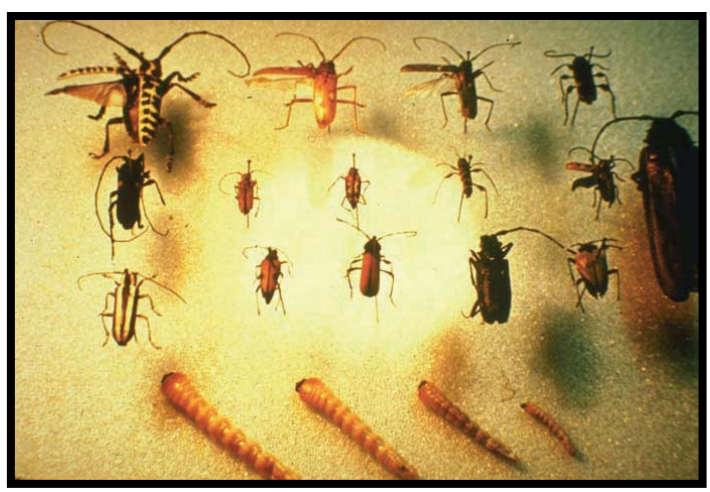
GENERAL: The adults are large, ranging in length from 1/4" - 3" and usually have antennae that are as long or longer than their bodies, which gives them the name "long horned" beetles.



Adult round headed bores also known as “long horned” beetles

DESCRIPTION: The mature larvae range from 1/2" - 4” and are cream-colored. The rear portion of the head is partly drawn into the body so that only the dark brown mandibles and other mouthparts are visible. The larvae are legless and constricted by rings or segments.

These beetles breed primarily in dead, dying, or weakened trees. The larvae burrow into the wood forming a cylindrical hole, hence the name “round headed borer”. The galleries are packed with frass varying from a fine dust to a coarse sawdust. Exit holes are broadly oval and range from 1/4" - 3/8" in diameter.



LIFE CYCLE: The life cycle of this insect in trees normally ranges from 2 - 3 years. This insect is frequently found in firewood. Often the first indication is a loud "munching" sound made by the boring of the larvae.

CONTROL: Control in structures is normally not required.

FLATHEADED BORERS

(Family Buprestidae)

GENERAL: Adults are hard-shelled, boat-shaped, flattened, with a brilliant, metallic color, hence the name **Metallic Wood Borers**.

DESCRIPTION: The larvae are eyeless, legless, white to yellow, and flattened with distinct segments. A wide thorax just behind the small head, leads to the name "flatheaded borer". The tunnels made by the larvae are winding, about 3 times broader than high and tightly packed with sawdust like frass.

Adult and larval Flatheaded borer (i.e. Metallic Wood Borer)

The adults do not infest dry or aged wood, instead preferring green or recently fire damaged wood (trees).

LIFE CYCLE: The life cycle is normally completed in one or two years and is usually completed before the lumber is used.

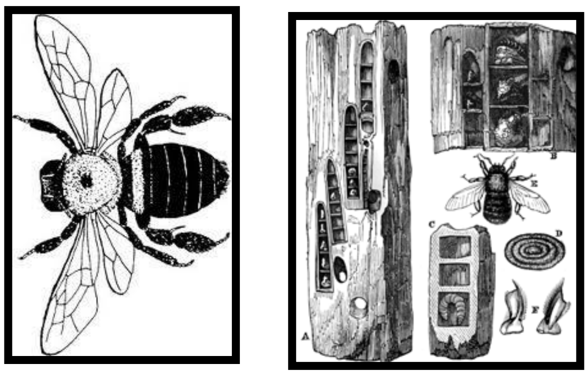
CONTROL: Active infestations are rare in structures and control is not normally required.

LARGE CARPENTER BEE

Xylocopa spp.)

GENERAL: North of Mexico, the subfamily Xylocopinae is composed of two genera, Ceratina (small carpenter bees) and Xylocopa (large carpenter bees). These bees obtain their common name from their nesting habits. The large carpenter bee chews nesting galleries in solid wood, in stumps, logs, or dead branches of trees.

DESCRIPTION: The adult bee is around 4/5" long and resembles a bumblebee, except the top of the abdomen is largely hairless whereas the bumblebee's is hairy. The carpenter bee ranges in color from black, green or somewhat purplish, and can be marked with white, yellow or red hair.



Large Carpenter Bee and its life cycle

LIFE CYCLE: The queen of this genus bores a hole inward for a short distance and then turns sharply and bores with the grain of the wood, forming a tunnel from 4" to 12" long. She is capable of tunneling one inch in six days. She then deposits an egg on a ball of pollen and regurgitated nectar, and seals it up with a mass of wood pulp. She repeats this until an average of six cells is formed. The larvae and pupae develop during the summer and the adult bees emerge in late summer. The adults return to old tunnels to overwinter.

The adults attack dry, dead wood and lumber, preferring soft woods but attacking many types of wood. Hardwoods and treated, or painted woods, are less susceptible to attack than non-treated or unpainted woods.

In Nevada it is a pest primarily in southern Nevada but is found as far north as Highway 50.

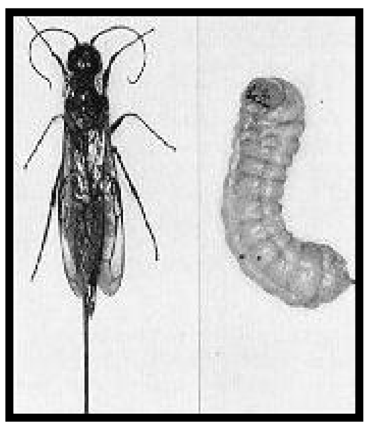
CONTROL: Each hole should be treated with an insecticide and then plugged with a dowel or plastic wood.

WOODWASPS

Family Siricidae)

GENERAL: This insect appears to be a true wasp but whereas a true wasp has the abdomen joined to the thorax by a narrow petiole, the Woodwasp has a thorax and abdomen uniform in width and closely joined together.

DESCRIPTION: The adults are large, usually one inch or more in length, with the females being larger than the males. They are usually black or metallic dark blue, sometimes with combinations of black, red, and yellow. The female has a long ovipositor above which is a hornlike projection on the last segment of the abdomen. This projection gives Woodwasps the common name "Horntails." The larva is cylindrical, whitish cream or yellow and slightly "S" shaped. It has a small, horny spine on its rear-end that is retained through all instars. This spine is used to pack the frass in the larva's cylindrical tunnel. The larva has three pairs of non-functional legs.



Woodwasps and woodwasp larva

LIFE CYCLE: The female lays eggs in trees that are weakened or dying. The larvae hatch and bore tunnels one to two feet long. Pupation occurs and the adult chews a 1/4" diameter emergence hole. The life cycle is normally completed in two years, but may take from three to five years. Therefore the adult may emerge for as long as two or three years after a structure is built. In a structure, infestations most commonly occur in the poorer grades of lumber used in studs, joists, and subflooring.

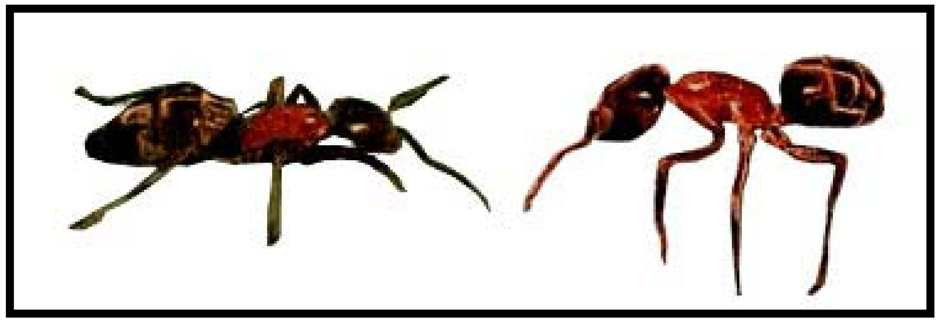
CONTROL: Control is not normally required.

VELVETY TREE-ANT

(*Liometopun occidentale luctuosum*)

GENERAL: This ant is found between 4000 ft. and 8000 ft. and in the wild, under bark and in cavities of trees.

DESCRIPTION: The worker is from 1/10" – 1/4" in length and appears to the naked eye to be black. Under microscopic examination the ant has brownish-black head, a velvety black thorax, and a red abdomen. This ant kills and eats other insects.



Adult Velvety Tree Ant

This ant occasionally invades homes and makes a nest in cracks in wood or where two pieces of wood are joined. There it excavates the wood to expand the nest, but it does not bore into wood. When present inside a home it can usually be found seeking out a sweet food source.

Pieces of sawdust carried out of the nest indicate where the nest is located. These sawdust piles resemble those of carpenter ants.

CONTROL: It can be controlled with pesticides registered for indoor use.

<u>FUNGI INFESTING WOOD ("Wood-rotting fungi")</u>

Health Related Molds

Licensed wood-destroying pest inspectors in Nevada are not required nor encouraged to report the presence or absence of health related molds or fungi. If an inspection for health related molds is needed, it is suggested that a qualified professional be contacted to perform the inspections.

The organisms that cause nearly all wood rots, decays, and stains are fungi (singular, fungus). Fungi are not plants, but some feel they resemble plants because many have rigid cell walls. Some characteristics that distinguish fungi from plants are:

- No chlorophyll; and therefore,
- No photosynthesis.
- Growth of the body by filamentous threads called hyphae.
- Reproduction by spores.

Because fungi lack chlorophyll they cannot make their own food and must feed on living or dead organisms. In this section, fungi which feed on trees (living or dead) and wood products made from them are examined. These are commonly referred to as the "Wood-rotting fungi".

Most fungi have a vegetative body called a thallus, consisting of elongated, continuous or septated (i.e. hollow tube like) filaments called hyphae (singular hypha). The individual hypha are hollow tube-like structures that secrete enzymes that digest wood. The liquid wood slurry that is created is absorbed back into the main body of the fungus. As the wood is digested and removed, the hypha grow into the void that is left. This process is how wood is "rotted" by fungi.

The hyphae collectively are called "mycelium". Mycelium is commonly recognized by people as the "fuzzy stuff" on moldy bread.

At times these fungi produce fruiting structures in the form of mushrooms, shelf-like brackets or flattened crust-like structures.

Fungi mainly reproduce by specialized reproductive bodies called spores. Spores are formed at or near the surface of the fruiting structure enabling wide dispersion under favorable conditions. Spores can survive a broad range of environmental conditions, including large temperature and moisture variations. Spores <u>do</u> require a specific temperatures and moisture range to germinate.

Wind is the most common means by which spores are dispersed but water and insects also aid in their dispersal.

When a spore contacts a susceptible host (wood), and growth conditions are favorable (adequate temperature, moisture, air), it germinates and begins invading the host. This invasion can be achieved in several ways including direct penetration from the surface, entrance into the host through natural openings, or entrance through wounds. Once the fungus has entered the host, the host is considered to be infested. The fungus then grows vegetatively using the host as a food source.

In order for fungi to grow in and on wood, four conditions must be favorable: temperature, moisture, air, and food.

TEMPERATURE: The optimum temperature for growth for wood-destroying fungi ranges from 70°F to 85°F, but it has been found that these fungi will grow from 50°F to 100°F. These temperatures are common in crawlspaces under homes. Very high or low temperatures will kill fungal mycelium, but unfortunately these temperature extremes are difficult to achieve in existing structural wood.

MOISTURE: Wood must be moist before the wood destroying fungi spores can germinate. Once the spores germinate, optimum decay occurs when the moisture content is between 25% and 32%, but is known to occur on susceptible wood species with a moisture content as low as 15%. Due to a lack of air inside the wood, decay fungi can not grow into it if the moisture content is 75% or higher. Both the optimum growth and the inhibition points (temperature, moisture and air) vary with the type of wood.

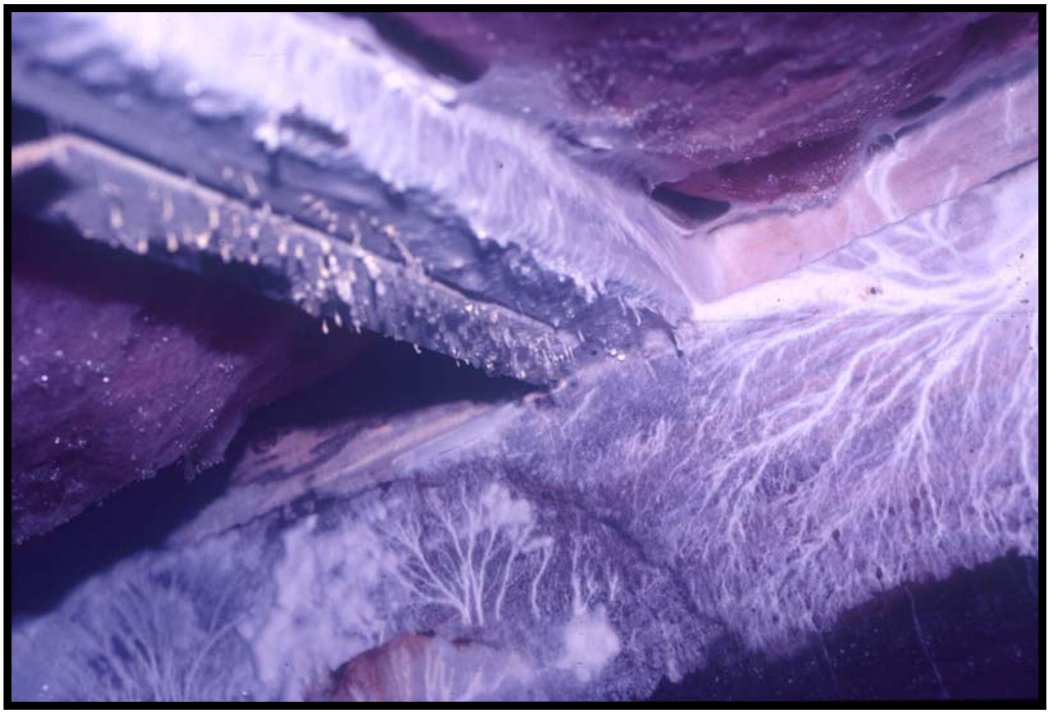
AIR: In order for wood decay to occur, there must be more than 20% air by volume in the wood. The more dense a wood, the less water it will hold before the air supply is reduced below the minimum decay requirement. Water soaked wood or immersed wood will not decay due to lack of air.

FOOD: Wood destroying fungi reproduce and grow most rapidly when starch, sugars, and nitrogenous materials are present in wood. The primary concern with earth-to-wood contact is that it allows moisture to be absorbed directly by wood creating a suitable habitat for fungal development. In soils having a high nitrogen content, wood decay is accelerated where there is earth-to-wood contact. Because chemical preservatives only penetrate pressure treated wood an inch or so, if the wood is cut, or cracks, exposed untreated wood is susceptible to attack.

Wood destroying fungi can be classified into two major categories: Decays and Stains. The decays can be sub-categorized as Brown Rot, White Rot, and Soft Rot, while the stains can be sub-categorized as Sapstaining and Mold. Each of these sub-categories has distinguishing characteristics with other characteristics being common to the category.

DECAYS

Wood destroying fungi that cause decay can infest both sapwood and heartwood of most trees if conditions are favorable. These fungi can appear on the surface of the wood as fan shaped patches of fine, threadlike, cottony growths or root-like structures. The color of their mycelium may range from white to tan to dark brown.



"Active infestation" of Decay fungi on joists in crawlspace

Early decay is sometimes accompanied by discoloration which may be confused with staining. Early decay is more noticeable on fresh exposed surfaces of unseasoned wood then on weather exposed wood.

As stated previously decay can be categorized as the following:

BROWN ROT: Fungi which cause Brown Rot are able to infest and breakdown hemicellulose and cellulose for food. In their final stage of infestation, Brown Rots can be identified by:

- the brown color of the wood.
- excessive shrinkage of the wood.
- cross grain cracking of the wood.
- a cubical pattern of surface checking on the wood.
- a crumbly wood texture that results in a fine powder when crushed.

Brown rot in a dry, crumbly condition is sometimes incorrectly referred to as “Dry Rot" as wood must be moist to decay. This term is used because the features described above become most apparent after the wood has dried, thus the term “dry-rot” has been incorrectly used to describe the condition. Brown Rot fungi are the major cause of decay of wood products in Nevada.

There are some fungi that can transport moisture from damp soil to wood, and thus are able to decay "dry" wood. These fungi are sometimes called cubical brown rot or "water conducting fungi" and in some areas are considered as a separate category of decay fungi. Water conducting fungi in the genus *Poria* attack dry wood by using mycelial root-like structures called “rhizomorphs” to transport water from damp soil to the fungal body.

WHITE ROT: Fungi which cause White Rot are able to infest and breakdown both cellulose and lignin for food. These fungi have a bleaching effect on the wood causing it to appear whiter than normal, thus the name, white rot. Damaged wood may shrink slightly but usually does not collapse or crack across the grain. It does gradually lose its strength until it becomes spongy to the touch. In advanced stages the remaining wood often becomes "stringy." White Rot primarily damages hardwoods but some species do damage softwoods.

White Rot fungus on wood in crawlspace

SOFT ROT: Fungi which cause Soft Rot use the lignin and starch in wood as their food source. These fungi normally damage wood that has continuously high moisture content. They cause the formation of microscopic cavities inside the wood which leads to a gradual softening of the wood from the surface inward. Damaged wood is often soft when wet but firm beneath the rot. Soft Rot occurs in wood exposed to fresh or salt water, and wood exposed to the weather in damp climates.

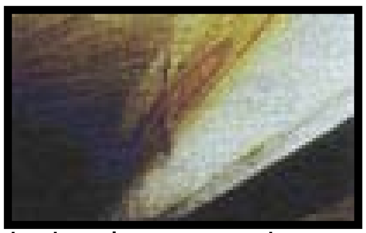
STAINS

Wood destroying fungi that cause staining are categorized as Sapstaining Fungi and Molds. The distinction between the two is made on the basis of depth of discoloration. Sapstaining fungi normally discolor wood at a greater depth than do molds. Both these fungi develop mainly in sapwood where they feed on starches, sugars, proteins, and fats stored in wood cells. They do not feed on cellulose or lignin of wood. Wood must normally have a moisture content of at least 20% percent before infestation to can occur. These fungi do not affect the strength properties of the wood but do affect the impact resistance.

The two major types of stains in Nevada are:

SAPSTAINING FUNGI: These fungi penetrate and stain sapwood. The color of the stain depends on the fungus and the moisture content of the wood. There may be stains of blue, brown, brick-red, pink, yellow, green, grayish-olive, and grayish-black. The stain may completely cover the sapwood or may appear as specks, streaks, or patches of varying color shades. The stain is often too deep to be removed by planing. The strength of wood is not significantly reduced by staining but the wood may not be fit for uses where appearance is important. Sapstaining fungi increase the wood's permeability to liquids and results in low retention of preservatives.

Not all stains of wood are caused by fungi. Stains are commonly found where water from a past leak has leached wood “tannins” through the wood, forming a distinctive dark band out around where the leak occurred. Some stains result from oxidation of the enzymes in wood, similar to an apple turning brown after exposure to air. Others result from excessive heating during seasoning or kiln drying of wood, preheated wood during processing, or dull knives in a high speed wood processing machine. Finally, unpainted wood surfaces show discoloration when exposed to weather.



MOLDS: Mold fungi usually develop on cut surfaces of wood and normally can be brushed or planed off lumber. They are often recognized on the surface of wood as fuzzy, fluffy, or powdery growths, varying in color from green to yellow to brown to black. Their color is due predominantly to the color of their spores. These fungi do not reduce wood strength but can increase the capacity of wood to absorb moisture. Because molds develop at a moisture content around 20% percent, and wood-rotting fungi begin to develop around 25% percent, the presence of mold is often a precursor to the development of wood-rotting fungi. When mold is present in a crawlspace, extreme diligence should be use to determine the presence or absence of wood-rotting fungi.

SURFACE MOLD IS NOT CLASSIFIED AS A WOOD-DESTROYING INFECTION/PEST AND THEREFORE DOES NOT COME UNDER THE SCOPE OF THIS STUDY MANUAL. SURFACE MOLD IS ONLY MENTIONED HERE DUE TO ITS DEVELOPMENT IN ENVIRONMENTS WHICH ARE OFTEN CONDUCIVE TO THE DEVELOPMENT OF WOOD-DESTROYING FUNGI.

CONTROL

Control of wood destroying fungi can be broadly divided into two areas: non-chemical and chemical.

NON-CHEMICAL CONTROL: is directed toward altering the environment in which fungi exist and is considered to be the most permanent control practice. The primary environmental alteration to control fungi is to decrease or increase moisture. If the moisture content of wood can be reduced and maintained below 15% percent or raised and maintained above 75% percent, (depending on the wood species) then the fungi will not be able to survive. Reduction of moisture in newly cut lumber can be accomplished by kiln or oven drying, or by air drying. Structures are primarily kept dry by properly ventilating moist air outside the home, such as in the use dryer and bathroom vents, and by maintaining adequate air movement through areas prone to moisture development, such as in a poorly ventilated crawlspace or attic. If proper construction practices are followed then a structure should never be able to develop moisture levels favorable to fungal growth. If this is not the case then changes to the structure must be made to insure low humidity is maintained through proper venting/ventilation and that no leaks occur. The practice of controlling fungi by using very high moisture levels is common in lumber mills where logs are kept saturated by sprinklers or in holding ponds. This is done to keep air levels low inside the wood which prevents fungi from developing. Obviously this practice is not possible for structures.

Temperature is the second most important environmental alteration used to control fungi. Lower temperatures are not normally used to kill fungi and therefore are not examined here. High temperatures are effective in killing fungi. Lumber kilns use high temperatures to dry wood. These high temperatures are effective in killing fungi. The temperature of the kiln and size of the wood determines how long the wood is to be dried. Air drying at normal ambient temperatures is common and will kill fungi if the wood is allowed to thoroughly dry. This process usually involves placing wood on drying racks. This method is effective, but usually takes much longer to accomplish.

It must be realized that after fungi in wood are killed by heat or by drying out (desiccation), the wood is still subject to re-infestation if moisture and temperature conditions become suitable again (re-infestation in this manner is very common).

CHEMICAL CONTROL: can either be preventative or eradicative. Preventative is usually directed toward the treatment of lumber prior to it being used. Wood preservatives should not leach from treated wood when the wood becomes moist. It should be mentioned that the toxicity level of preservatives and methods used to apply them varies greatly, thus some are more effective and long lasting than others. Preservative application techniques include topical (painting or brushing), heat (soaking in hot solution), wolmanization (small incisions to aid absorption) and pressure treatment which is considered to be the most effective.

Eradication is directed toward elimination of an infestation. As with preventive treatments, it is necessary to insure proper coverage, penetration and absorption. If the wood is badly damaged it should be replaced.

IT IS IMPORTANT TO REALIZE THAT WHETHER CONTROL OR ERADICATION IS THE GOAL, IN EITHER INSTANCE THE ENVIRONMENTAL CONDITIONS MUST BE CORRECTED TO INSURE THAT RE-INFESTATION DOES NOT OCCUR!

<u>INSPECTIONS</u>

STATUTES / REGULATIONS

The 1973 Nevada Legislature amended Chapter 555 of the Nevada Revised Statutes (NRS) mandating that a license is, "…*required to engage in pest control activities concerning wood-destroying pests or organisms.*" These pest control activities relate to the inspection of structures for the reporting of wood-destroying pests or organisms and conditions conducive to infestation by wood-destroying pests or organisms; as represented in the following Nevada Revised Statute:

> ***NRS 555.285 License required to engage in activities concerning control of wood-destroying pests or organisms**. A person shall not for hire engage in, offer to engage in, advertise or solicit to perform any of the following pest control activities concerning wood-destroying pests or organisms without a license issued by the Director:*
>
> 1. *Making an inspection to identify or to attempt to identify infestations or infections of households or other structures by those pests or organisms.*
> 2. *Making or altering inspection reports concerning the infestations or infections.*
> 3. *Making estimates or bids, whether written or oral, concerning the infestations or infections.*
> 4. *Submitting bids to perform any work involving the application of pesticides for the elimination, extermination, control or prevention of infestations or infections of those pests.*

From this statute, regulations called the Nevada Administrative Code (NAC) were adopted to specify specific wood-destroying pest inspection reporting requirements. Copies of those requirements are available on line at http://www.leg.state.nv.us/NAC/NAC-555.html then go to section 430.

WOOD-DESTROYING PEST INSPECTIONS

Most would agree that the single greatest investment for most people is their home. The wood-destroying pest inspection, or as they are commonly called "pest inspection", is a fundamental part of most new home purchases. It is absolutely imperative that inspectors be ethical, well trained and experienced. Unfortunately the opportunity for fraud exists for inspectors who are afraid of losing clients (real estate agents), by not reporting evidence of pests or conditions conducive to their development. This practice is unethical and unfair to buyers who, in good faith, employ the services of a licensed professional for the sole purpose of truthfully reporting notable conditions.

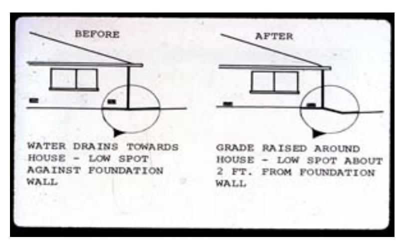
Prior to inspecting a structure for wood-destroying pests or organisms, the inspector will need specific items: flashlight, tape measure, wood probe, gloves, kneepads, hardhat, coveralls, ladder, and other equipment may be necessary. (Photographs are currently not required, but many inspectors use digital photos to help describe their findings.) The flashlight should be bright and if possible have a holding strap or stand which will leave the inspector's hands free. The tape measure can be a steel tape or a rolling measure wheel. The probe should be metal and have a scraping edge (a metal paint scraper often makes a good probe).

The actual inspection can be divided into two primary areas: **pest infestation** and **conditions conducive to pest infestation**.

- Pest infestation can be further divided into two areas: "**active infestation**" or "**inactive infestation**".
    - An infestation is considered to be "active" if the pest is present and alive, even though it may not be actually causing damage to the structure. For instance, termites present in a piece of scrap wood left in the crawlspace, or carpenter ants in a woodpile stacked against the house. The proximity of these pests to the house constitutes an active infestation. NAC 555.430.3.j.1, defines "Active infestation" as, ***"…the presence of living wood-destroying pests***." Examples of "active infestation" include termites in or on the structure; in cellulose debris in the crawlspace or in cellulose debris adjacent to the exterior of the foundation; fresh swarming tubes or wings from reproductive alates; mycelium from wood-destroying fungi; carpenter ants in or on the home, or nesting near it; etc.

- o NAC 555.430.3.j.2, defines "inactive infestation" as, ***"…evidence of infestation by wood-destroying pests, without the presence of such pests."*** Examples "inactive infestation" include, abandoned or deteriorating termite tubes; abandoned termite, carpenter ant and powderpost beetle galleries in wood; wood that rotted from past plumbing leaks or a previous moisture problem that has been repaired.

Structures normally have four primary areas that need to be inspected: external, internal, attic and crawlspace (if present). Depending on the scope of the inspection, other areas such as outbuildings, decks and other structures or structural components may need to be inspected. A clear understanding of what is to be inspected is important when representing the condition of a property for a buyer, seller or lending institution. Whether the home is built on a slab foundation or one with a crawlspace, this should be noted on the inspection report. (Due to building codes, it is understood that garages are built on slab foundations and therefore it is not necessary to report their foundation type in that part of the home.) Each of the primary inspection areas have similarities and differences regarding infestation and the conditions conducive to infestation.



Listed below are a few situations that when found on the **outside of a home, or in a crawlspace**, need to be inspected closely. Some of these conditions are required to be reported. These conditions can hide the presence of wood-destroying pests, or create a favorable environment for their development. (Reporting requirements will be examined shortly.)

- Soil up to or covering the siding.
  (Reported as: "faulty grade" and/or "earth-to-wood contact".)
- Blocked ventilation ducts.
  (Reported as: "insufficient ventilation".)
- Fence posts, decks, steps or other items made of wood attached to the structure and in contact with the soil without a metal flashing between them.
  (Reported as: "earth-to-wood contact".)
- Planter box attached to the structure without a sufficient metal barrier between the soil and the structure.

- Improper holes or other openings which allow for moisture or pests to enter (e.g. large foundation crack, leaking window and skylights, etc.).
- Stains on the foundation originating from beneath siding, or stains inside or below a structure where plumbing or a plumbing fixture is located.
- Bulging walls or floor, particularly where a shower or tub is located.
- Crawlspace insulation which blocks the visual inspection of rim-joist, sub-floor, plumbing, or any area normally accessible to inspection.
- Stumps or other buried wood near the foundation.
- Firewood or other wood stacked against the home.
- Sprinklers hitting the side of the structure.

Listed below are a few situations that when found on the inside of a home need to be inspected closely for evidence of wood-destroying pests, or conditions conducive to their development:

- Water stains, moist wood, or cracked tile relative to sinks, dishwashers, or water heaters.
- Water stains or moisture that would indicate a leaking water pipe.
- Walls, floors, or ceilings that have an abnormal condition or color.
- Wood that when "sounded" has a different "sound" than the adjacent wood. (Moisture meters are available and are often used by many inspectors.)
- Frass, wings, or sawdust found.
- Holes in exposed wood where holes would not normally exist.
- Loose or missing caulking around sinks, tubs, shower stalls, or faucets.
- Loose or damp flooring in bathrooms, particularly around toilets and next to tubs and shower stalls.
- Wood that has cross-grain checking/cracking, or is spongy, springy, or soft when pressed.
- The type of pests trapped in spider webs or in window sills.

If any of these items are found they should be investigated further to determine why they exist and if there is a threat to the structure. These conditions may be caused by a structural defect (e.g. plumbing leak), poor maintenance or upkeep, a wood destroying pest, etc. The condition causing the problem may need to be corrected, or may have been corrected without the damage being repaired. In some instances it can be seen where the condition was corrected and the damage repaired. The inspector must determine if there is still a problem, what caused the problem, and whether or not treatment or other option will remedy the problem.

Listed below are a few situations that when found in the crawlspace need to be inspected closely for wood-destroying pests, or conditions conducive to their development:

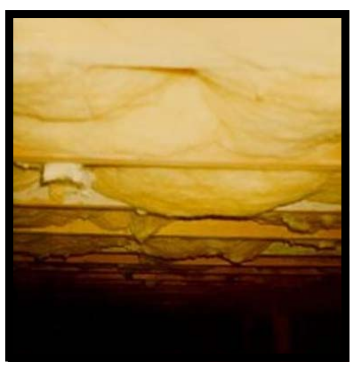
- Earth-to-wood contact of any pier post, brace, beam, joist, hanger, form board, etc.
- Any plumbing leak onto wood or onto the soil.
- Blocked ventilation ducts, or lack of sufficient ventilation ducts to provide the minimum required ventilation.

- Stored or discarded cellulose material (wood, books, cardboard, etc.).
- Standing water or unnaturally damp areas.
- Joists, beams, pier posts, sub-flooring, etc., that have an abnormal condition or color.
- Wood that has a different “sound” than the adjacent wood, when “sounded”. (A moisture meter may assist in determining the moisture content of structural components.)
- Any area in the crawlspace that cannot be inspected due to low hanging plumbing, HVAC, or other utility which blocks entry; or areas where there is not enough clearance between the soil and the structure to allow access; or areas such as the rim-joist, or sub-floor that are blocked by insulation. Inspectors should realize that in

cooler parts of Nevada it is not uncommon for wood-destroying fungi to develop on rim-joists covered by insulation; especially along the north side of a poorly ventilated crawlspace. This occurs when un-circulated moist air in the crawlspace is trapped between the insulation and the rim-joist. Once the moist air is trapped it condenses on the cool surface of the rim-joist, creating a condition conducive to fungal development.

- Frass, wings, sawdust, or mud tubes found.
- Wood that has cross-grain checking/cracking, or is spongy, springy or soft when pressed.
- Type of pests trapped in spider webs.
- Form boards left in place, scrap wood, roots, cardboard or other cellulose debris left in the crawlspace.
- Dryer ducts vented into the crawlspace (hot, moist air from a dryer can dramatically increase crawlspace humidity).

If any of these conditions exist, they should be noted (or may be required to be noted) and need to be inspected/investigated further to determine their cause. There may be a structural or construction defect, design flaw, or other reason. If there is evidence of damage by a wood-destroying pest, the problem may need to be corrected, or may have been corrected without the damaged area being repaired or replaced. In some instances it can be seen where the condition was corrected and the damage repaired, such as when a fungal rotted board is replaced by a new board. The inspector must determine whether or not there is an ongoing problem, and if so, must determine what pest or condition is causing it, and the measures necessary to correct it.



Finally, when inspecting the attic, the following, among other things, should be noted:

- Blocked attic vents.
- Unnaturally damp areas.
- Missing shingles, flashing, roof-jacks, and unsealed areas.
- Rafters or trusses that have an abnormal condition or color.
- Wood that has a different "sound" than the adjacent wood, when "sounded". (A moisture meter may assist in determining the moisture content of structural components.)
- Areas normally visible to inspection but which cannot be inspected due to obstruction by insulation, or other feature which blocks visible accessibility.
- Frass, wings, sawdust, etc., found.
- Holes, gaps, cracks, etc., where they would not normally be, that allow water or pests to gain entry.
- Wood that has cross-grain checking/cracking, or is spongy, springy, or soft when pressed.
- Types of pests trapped in spider webs.

As with the other inspected areas, these items may need further investigation to determine why they exist and the extent of any damage that may have occurred as a result. There may be structural defects, poor maintenance or upkeep, or a wood destroying pest causing a problem. The condition may need to be corrected or may have been corrected. The damage may or may not have been repaired. It's up to the inspector to make these determinations.

WOOD-DESTROYING PEST INSPECTION REPORT

An inspection report must be completed after every inspection for wood destroying pests or if a pesticide is applied to a structure for the control of any wood destroying pest. There may be two types of reports written; a clear report or a report which indicates an infestation, a condition conducive to an infestation, or an inaccessible area. Each report type is discussed below.

If no infestations or conditions conducive to infestations are found, then an all clear report can be prepared. Neither diagrams nor explanations are required, simply a statement indicating a clear report.

When an infestation, condition conducive to infestation, or inaccessible area is found, then an explanation of the finding and diagram of the structure's foundation are necessary. The diagram of the foundation needs to give a visual representation of the location and extent of any infestation (active/inactive) or condition conducive to infestation. The diagram should be drawn to scale and should include all parts of the structure that need treatment or amendment (e.g. where to apply termiticide, location were crawlspace vents are needed, etc.). Each place where there is an infestation, a condition conducive to an infestation, or an inaccessible area, must be indicated on the diagram. Symbols or keys used should be consistent for all reports. The explanation should be brief but clearly explain the situation or problem. There should be an explanation for each situation or problem. If a treatment to the structure is performed then the lower portion of the Wood-destroying Pests Inspection Report must be filled out to accurately reflect the treatment conducted.

MISCELLANEOUS

Wood-destroying pest inspectors are not required to determine structural damage or soundness, but are responsible for determining if evidence of active or inactive infestation exists, and if any condition conducive to infestation is present. The terms used to describe conditions conducive to infestation are often similar to terms used by general contractors, but their meanings should not be confused with each other.

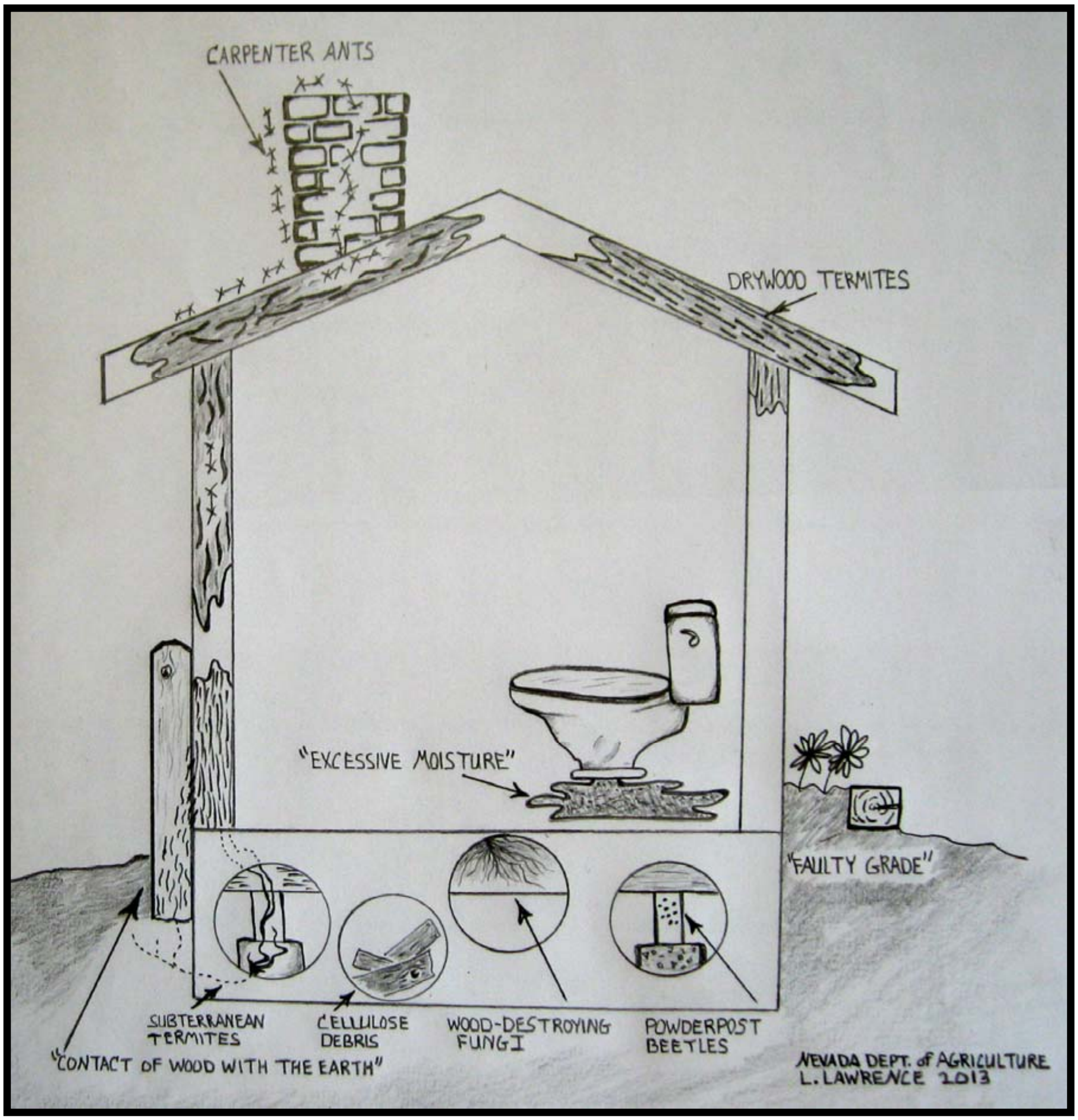
The time it takes to perform an inspection depends on:

- the size of the structure (e.g. single bedroom, no garage).
- the type of construction (e.g. slab on ground, crawlspace).
- determining the presence or absence of an infestation.
- determining the extent of an infestation (active/inactive, location(s), etc.)
- determining if conditions conducive to infestation exist (e.g., earth-to-wood contact, faulty grade, excessive moisture, insufficient ventilation, etc.)

Ideally, it takes 3 days to complete an inspection. The first day the inspection is requested and scheduled; the second day the inspection is performed and the report prepared; the third day the report is delivered. Reporting requirements will be examined in the next section of this manual.

Miss Jones, "I'm from the pest control company here to do a wood infestation report. I brought along my insurance agent, my attorney, the real estate agent, the banker, a building inspector and my preacher. I'd like to turn it over to my preacher at this time to pray that everything is alright with our report."

FILLING OUT THE WOOD-DESTROYING PEST INSPECTION REPORT



It is important for inspectors to realize that the reporting requirements presented below are the minimum reporting requirements regulated by the Department of Agriculture. Inspectors are encouraged to include in their wood-destroying pest inspection reports any condition or factor which they believe is relevant to creating an accurate and truthful report. Before inspectors can correctly write a wood-destroying pest inspection report, they must be familiar with the procedures and terminology set forth under Nevada Administrative Code (N.A.C.) **555.430 Report of inspection for wood-destroying pests.**

NAC 555.430 Inspection or application of pesticide for wood-destroying pests: Report; tag; restriction on application. (NRS 555.380, 555.390, 555.400)

1. Each person who:

(a) Makes an inspection for wood-destroying pests;

(b) Gives any oral or written statement relating to such an inspection; or

(c) After the construction of a structure, makes an application of a pesticide to eradicate wood-destroying pests, shall write and deliver a report of the inspection or the application of a pesticide to the person requesting the inspection or application, or a designated agent thereof, not later than 5 days after the inspection or the application. The report must be on a numbered form supplied by the Department or an electronic form approved by the Department which includes a unique number obtained from the Department.

2. A person who prepares a report pursuant to subsection 1 must:

(a) File a legible copy of the report with the district or subdistrict office of the Department not later than 15 days after the inspection or the application of a pesticide is made; and

(b) Keep a copy of the report for at least 3 years after preparation of the report.

3. The report must contain:

(a) The name, license number and mailing address of the pest control business performing the inspection or the application of a pesticide and the date of the inspection or application.

(b) The number assigned to the escrow or mortgage by the Federal Housing Administration or the Department of Veterans Affairs, if applicable and obtainable.

(c) The street address, city and zip code where the property is located.

(d) The name of the person who requested the inspection or the application of a pesticide.

(e) The name of the person to whom the original of the report is being sent.

(f) The name and address of the owner of the property.

(g) The name and address of the buyer or other interested person, if applicable and obtainable.

(h) If an application of a pesticide was made:

(1) The date of the treatment.

(2) An identification of any area to which a pesticide was applied.

(3) The pesticide name and the registration number assigned by the Environmental Protection Agency.

(i) A statement of whether there is or is not evidence of active or inactive infestations of termites, other wood-destroying insects or wood-destroying fungi. Mold must not be reported as wood-destroying fungi. As used in this paragraph:

(1) “Active infestation” means the presence of living wood-destroying pests.

(2) “Inactive infestation” means evidence of infestation by wood-destroying pests, without the presence of such pests.

(j) A statement of whether there is or is not any condition conducive to infestation, including contact of wood with the earth, a faulty grade, insufficient ventilation, excessive moisture or cellulose debris. As used in this paragraph:

(1) “Contact of wood with the earth” means any support or other structure of cellulose that is less than 3 inches above the soil level and in contact with the inspected structure, whether it is internal or external in relation to that structure. The term does not include:

(I) A paling of a fence which is made of wood and which is less than 3 inches above the soil level and in contact with the inspected structure through otherwise acceptable structural elements.

(II) Lattice which is made of wood and which is less than 3 inches above the soil level if the lattice is physically attached to the inspected structure.

(III) An attachment to the inspected structure which is made of wood or cellulose and which is less than 3 inches above the soil level if the attachment is separated from the inspected structure by a flashing which is made of metal.

(IV) A deck which is made of wood and which is less than 3 inches above the soil and in contact with the inspected structure if the deck is separated from the inspected structure by a flashing which is made of metal and the report includes a statement indicating that the deck was excluded from the inspection or application.

(V) Skirting which is installed on a manufactured home and which is less than 3 inches above the soil and in contact with the inspected structure if the skirting is designed by the manufacturer for contact with the ground, is separated from the inspected structure by a flashing which is made of metal or is supported 3 inches or more above the soil level by pressure-treated wood.

(2) “Faulty grade” means a condition in which:

(I) A floor joist or stringer is less than 12 inches above the soil level;

(II) The top of the foundation is less than 3 inches above the adjacent soil level; or

(III) The drainage is such that there is visible evidence of exposure of surface water on the structure.

(3) “Insufficient ventilation” means less than 1 square foot of ventilation per 300 square feet of crawlspace, less than 1 square foot for every 1500 square feet of ground area covered by a vapor barrier and less than four areas permitting ventilation. The term “insufficient ventilation” does not include a crawlspace which is:

(I) Mechanically ventilated; and

(II) Free of wood-destroying fungi and excessive moisture.

(4) “Excessive moisture” means actual moisture on the wood or wood products used in the structure.

(5) “Cellulose debris” means any such debris that is of a size that can be raked and in the aggregate comprises one-half cubic foot or more, or a stump or any other wood that is imbedded in a footing and constitutes a contact of wood with the earth. The term does not include pressure-treated wood that is used to support a manufactured home or the skirting of a manufactured home.

(k) A diagram or sketch of the foundation or part of the inspected structure indicating the location of any condition likely to lead to infestation or infection or any area showing infestation or infection.

(l) A diagram or explanation, or both, of the inspected structure or part of it showing:

(1) The location of any inaccessible area or subarea and any area or subarea not inspected;

(2) Any portion of the structure normally visible which cannot be inspected without mechanically altering the structure, including, without limitation, subflooring or a rim joist that is concealed by insulation; or

(3) Any area where normal conditions have been altered so an inspection is not possible, such as storage in a closet.

(m) The full name, license number and signature or, if an electronic form is used, a digital signature of the licensee performing the inspection and application of a pesticide if an application is performed. If an electronic form is used, the report must include the number obtained from the Department pursuant to subsection 1 and a digital signature of the licensee which complies with the applicable requirements of chapter 720 of NRS.

4. Upon completion of an inspection or the application of a pesticide, the person making the inspection or application shall:

(a) If the structure has a crawlspace beneath it, affix a tag supplied by the Department to the structure in an area in which the tag is visible from the entrance to the crawlspace;

(b) If the structure does not have a crawlspace beneath it, affix a tag supplied by the Department to the structure in an area in which the tag is visible from the access area under the kitchen sink; or

(c) If the inspection or application is performed at a structure with multiple units for occupancy, deliver the tag to the office of the manager of the structure or to the owner of the structure if there is no office of the manager of the structure.

5. The tag affixed pursuant to subsection 4 must contain:

(a) The license number and name of the pest control business that performed the inspection or application.

(b) A statement indicating whether an inspection or application was performed. If an application was performed, the tag must contain a statement of the name, amount and concentration of the pesticide applied.

(c) The date on which the inspection or application was performed.

6. Unless otherwise authorized by the Director, each person who, after the construction of a structure, applies a termiticide or other pesticide to eradicate wood-destroying pests shall apply the termiticide or other pesticide only to the sites and in the specific quantities and dosages listed on the label of the termiticide or other pesticide.

7. As used in this section, “pressure-treated wood” means wood or wood products that:

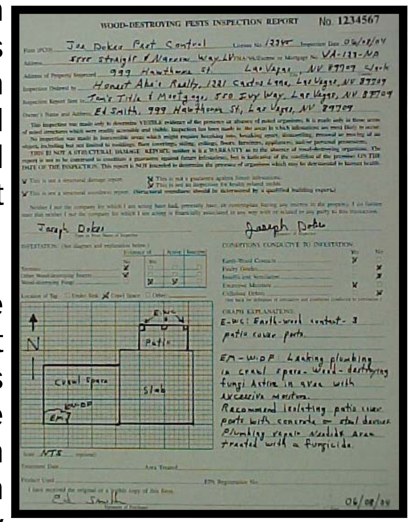
(a) Are pressure-treated or certified by the Board of Review of the American Lumber Standard Committee, Inc.;

(b) Are designed by the manufacturer for contact with the ground;

(c) Are guaranteed against structural damage by termites or fungal decay; or

(d) Are described in paragraph (a), (b) or (c) and have surfaces which have been cut, if those surfaces have been treated with a preservative for wood and the wood or wood products have been inspected and determined to be free of infestation.

[Dep’t of Agriculture, part No. 55.34, eff. 6-1-59; A 7-1-69; 5-22-72; + part No. 55.37, eff. 8-1-74; A 1-17-77; 6-11-80]—(NAC A 2-5-82; 1-19-84; 11-7-84; 12-10-92; A by Div. of Agriculture, 11-12-93; A by Bd. of Agriculture, 8-9-94; A by Dep’t of Agriculture by R033-01, 5-1-2002; R147-03, 1-22-2004; R062-10, 1-13-2011; R033-15, 6-23-2014)



WOOD-DESTROYING PESTS INSPECTION REPORT No. 1234567

Joe Dokes Pest Control — 12345 — 06/08/04

5555 Straight & Narrow Way, LV — VA-123-NP

999 Hawthorne St, Las Vegas, NV 89709 Clark

Honest Abe's Realty, 1221 Cactus Lane, Las Vegas, NV 89709

Tom's Title & Mortgage, 550 Ivy Way, Las Vegas, NV 89709

Ed Smith, 999 Hawthorne St, Las Vegas, NV 89709

Joseph Dokes — Joseph Dokes

CONDITIONS CONDUCIVE TO INFESTATION

GRAPH EXPLANATIONS

E-WC: Earth-wood contact - 3 patio cover posts.

EM-WDF Leaking plumbing in crawl space. Wood-destroying fungi active in area with excessive moisture.

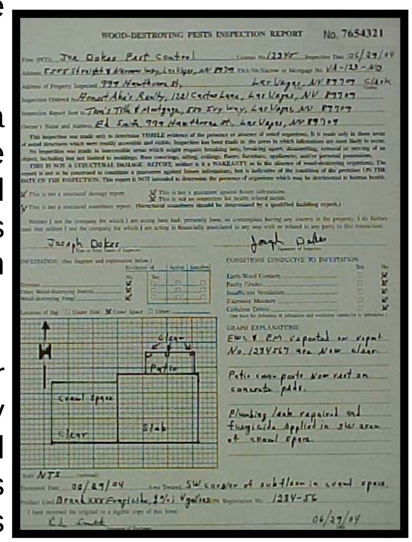
Recommend isolating patio cover posts with concrete or steel devices. Plumbing repair needed & area treated with a fungicide.

NTS

Ed Smith — 06/08/04

When filling out a wood-destroying pest inspection report, make all locations of notable problems and diagrams as accurate as possible. Any situation requiring documentation on the report should be done in a manner that is easily understood by the party requesting it. If at any time an incomplete or partial inspection is performed, make sure to indicate on the report that it is an incomplete or partial inspection.

If no problems are apparent, an all clear report can be given. As previously indicated, if a problem is detected it must be noted on a graph prepared by the inspector. Comments about the inspection and issues listed in the graph can be stated in that section of the report designated for “graph explanations”. When clear accurate comments are used in conjunction with an accurate graph, problems can be easily understood and corrective measures can be discussed. See sample reports #00001, #00002, and #00003.



WOOD-DESTROYING PESTS INSPECTION REPORT No. 7654321

Joe Dokes Pest Control — 12345 — 06/29/04

5555 Straight & Narrow Way, Las Vegas, NV 89709 — VA-123-NP

999 Hawthorne St, Las Vegas, NV 89709 Clark

Honest Abe's Realty, 1221 Cactus Lane, Las Vegas, NV 89709

Tom's Title & Mortgage, 550 Ivy Way, Las Vegas, NV 89709

Ed Smith, 999 Hawthorne St, Las Vegas, NV 89709

Joseph Dokes — Joseph Dokes

CONDITIONS CONDUCIVE TO INFESTATION

GRAPH EXPLANATIONS

EWC & EM reported on report No. 1234567 are now clear.

Patio cover posts now rest on concrete pads.

Plumbing leak repaired and fungicide applied in SW area of crawl space.

NTS

06/29/04 — SW corner of subfloor in crawl space.

Brand XXX Fungicide, 1% 1 gallon — 1234-56

Ed Smith — 06/29/04

Sample report #00001 is a single story home built on a raised foundation with a crawlspace, a two car garage containing an earth-to-wood contact, faulty grading and excessive moisture on the wood subflooring. The moisture was caused by a leaking water pipe under the kitchen sink, which resulted in a wood-destroying fungi infestation.

Sample report #00002 is a split level home with a two car garage containing a partial basement constructed of masonry blocks. The home has no (or too few) foundation vents and should have 8 vents installed or a combination of 4 vents installed with a (visqueen) vapor barrier. The home has cellulose debris in excess of ½ cubic foot and an active and inactive termite infestation.

Once any work has been completed (rotten wood replaced, earth-to-wood contacts removed, vents installed, etc.) the home needs to be re-inspected before an "all clear" report can be given. The re-inspection ensures that no new problems have developed since the last inspection. The all clear report needs to contain the original report number which cited the problem(s) and any recommendations that were made. If a chemical treatment was used to correct any problem, the bottom few lines of the report need to be filled in, as shown on report #00003.

Important

When filling out the Nevada WOOD DESTROYING PESTS INSPECTION REPORT it is imperative that the inspector conducting the inspection ensures that the report is filled out legibly, accurately, and completely as this document is considered a legal document. Not only does the NDOA review these reports for accuracy, but they are used by other individuals and agencies to complete their regulatory obligations. **Therefore, it is important that these reports are legible, accurate, truthful and complete.**

NOTE

The following Wood-Destroying Pests Inspection Reports are for educational purposes only. From time to time the report design changes as regulations are added, deleted or amended. The following Wood-Destroying Pests Inspection Reports do not include

(1) the disclaimer statement on the presence of organisms which may be detrimental to human health; and

(2) the location of tag ("Wood-Destroying Pest Inspection / Pesticide Application Tag").

NOTE

Pursuant to NAC 555.430.1, the Nevada Department of Agriculture prohibits the use of any form other than the Nevada WOOD DESTROYING PESTS INSPECTION REPORT for reporting wood-destroying pests within the state. To view NDOA - HUD/FHA correspondences go to the NDOA web site at: http://agri.nv.gov/Plant/PEST/Correspondence_FHA/VA_HUD/ for copies of these documents.

WOOD-DESTROYING PESTS INSPECTION REPORT

No. 000001

Firm (PCO) Joe Dokes Pest Control License No. 12345 Inspection Date 07/30/02

Address 5554 Nevada Lane, Las Vegas, NV 89705 FHA/VA/Escrow or Mortgage No. FHA - 276A7

Address of Property Inspected 76 Tortoise Way Las Vegas 89707 (City) Clark (County)

Inspection Ordered by John Brown's Realty, 1220 Cactus Lane, Las Vegas, NV 89709

Inspection Report Sent to Tom's Title & Mortgage, 520 Ivy Way, Las Vegas, NV 89709

Owner's Name and Address Mr. Edward Smith, 76 Tortoise Way, Las Vegas, NV 89707

This inspection was made only to determine VISIBLE evidence of the presence or absence of noted organisms. It is made only in those areas of noted structures which were readily accessible and visible. Inspection has been made in the areas in which infestations are most likely to occur.

No inspection was made in inaccessible areas which might require breaking into, breaking apart, dismantling, removal or moving of an object, including but not limited to moldings, floor coverings, siding, ceilings, floors, furniture, applicances, and/or personal possessions.

THIS IS NOT A STRUCTURAL DAMAGE REPORT, neither is it a WARRANTY as to the absence of wood-destroying organisms. The report is not to be construed to constitute a guarantee against future infestations, but is indicative of the condition of the premises ON THE DATE OF THE INSPECTION.

☒ This is not a structural damage report. ☒ This is not a guarantee against future infestations.

☒ This is not a structural soundness report. **(Structural soundness should be determined by a qualified building expert.)**

Neither I nor the company for which I am acting have had, presently have, or contemplate having any interest in the property. I do further state that neither I nor the company for which I am acting is financially associated in any way with or related to any party to this transaction.

JOSEPH DOKES — Type or Print Name of Inspector

Joseph Dokes — Signature of Inspector

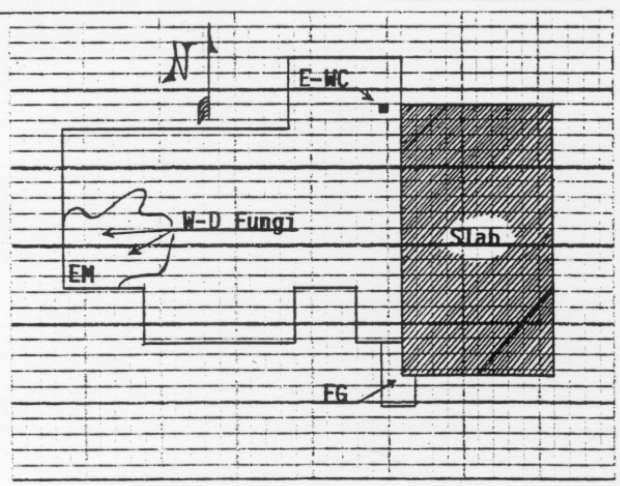
INFESTATION: (See diagram and explanation below.)

	Evidence of: No	Evidence of: Yes	Active	Inactive
Termites	☒	☐	☐	☐
Other Wood-destroying Insects	☒	☐	☐	☐
Wood-destroying Fungi	☐	☒	☒	☐

CONDITIONS CONDUCIVE TO INFESTATION:

	Yes	No
Earth-Wood Contacts	☒	☐
Faulty Grades	☒	☐
Insufficient Ventilation	☐	☒
Excessive Moisture	☒	☐
Cellulose Debris	☐	☒

(See back for definition of infestation and conditions conducive to infestation.)



GRAPH EXPLANATIONS:

E-WC: Earth-wood contact between soil and pier post. Recommend pier block under pier post.

EM: Excessive moisture, due to leaking water pipe under kitchen. Recommend plumbing repairs as soon as possible

W-D Fungi: Active wood-destroying fungi on subflooring. Recommend fungicide treatment.

FG: Faulty grading between entry way and garage. Recommend lowering soil level in planter 3" below top of foundation.

Scale NTS (optional)

Treatment Date ____ Area Treated ____

Product Used ____ EPA Registration No. ____

I have received the original or a legible copy of this form.

Thomas M Brown — Signature of Purchaser

07/30/02 — Date

WOOD-DESTROYING PESTS INSPECTION REPORT

No. 000002

Firm (PCO) Uncle Bob's Bug Bombers License No. 6789 Inspection Date 08/06/02

Address 235 W. Washoe St., Reno, NV 89500 FHA/VA/Escrow or Mortgage No. #6539V02

Address of Property Inspected 627 Gallian Way, Reno (City) Washoe 89505 (County)

Inspection Ordered by Mr. Frank Jones, 805 Crickett Way, Reno, NV 89501

Inspection Report Sent to Mr. Frank Jones ------------------------------

Owner's Name and Address Mr. Donald Davis, 627 Gallian Way, Reno, NV 89505

This inspection was made only to determine VISIBLE evidence of the presence or absence of noted organisms. It is made only in those areas of noted structures which were readily accessible and visible. Inspection has been made in the areas in which infestations are most likely to occur.

No inspection was made in inaccessible areas which might require breaking into, breaking apart, dismantling, removal or moving of an object, including but not limited to moldings, floor coverings, siding, ceilings, floors, furniture, applicances, and/or personal possessions.

THIS IS NOT A STRUCTURAL DAMAGE REPORT, neither is it a WARRANTY as to the absence of wood-destroying organisms. The report is not to be construed to constitute a guarantee against future infestations, but is indicative of the condition of the premises ON THE DATE OF THE INSPECTION.

☒ This is not a structural damage report. ☒ This is not a guarantee against future infestations.

☒ This is not a structural soundness report. **(Structural soundness should be determined by a qualified building expert.)**

Neither I nor the company for which I am acting have had, presently have, or contemplate having any interest in the property. I do further state that neither I nor the company for which I am acting is financially associated in any way with or related to any party to this transaction.

Will B. Competent (Type or Print Name of Inspector) — Will B. Competent (Signature of Inspector)

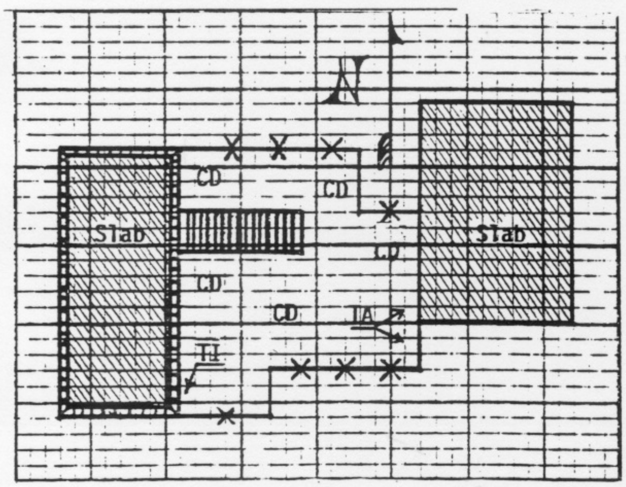
INFESTATION: (See diagram and explanation below.)

	Evidence of: No	Yes	Active	Inactive
Termites	☐	☒	☒	☒
Other Wood-destroying Insects	☒	☐	☐	☐
Wood-destroying Fungi	☒	☐	☐	☐

CONDITIONS CONDUCIVE TO INFESTATION:

	Yes	No
Earth-Wood Contacts	☐	☒
Faulty Grades	☐	☒
Insufficient Ventilation	☒	☐
Excessive Moisture	☐	☒
Cellulose Debris	☒	☐

(See back for definition of infestation and conditions conducive to infestation.)



GRAPH EXPLANATIONS:

X: Insufficient ventilation. Recommend installation of 8 vents in areas marked "X" or a visqueen barrier with 4 vents.

CD: Cellulose debris. Recommend removal.

TI: Termites inactive, in S-W corner in CD.

TA: Termites active, in S-E corner in joists. Recommend termiticide treatment around entire foundation area and drilling and treating of masonry blocks and slab in basement and slab in garage.

Scale N-T-S (optional)

Treatment Date ______ Area Treated ______

Product Used ______ EPA Registration No. ______

I have received the original or a legible copy of this form.

Frank Jones (Signature of Purchaser) 08/06/02 (Date)

WOOD–DESTROYING PESTS INSPECTION REPORT

No. 000003

Firm (PCO) Joe Dokes Pest Control License No. 12345 Inspection Date 08/07/02

Address 5554 Nevada Lane, Las Vegas, NV 89705 FHA/VA/Escrow or Mortgage No. FHA - 276A7

Address of Property Inspected 76 Tortoise Way Las Vegas 89707 Clark
City County

Inspection Ordered by John Brown's Realty, 1220 Cactus Lane, Las Vegas, NV 89709

Inspection Report Sent to Tom's Title & Mortgage, 520 Ivy Way, Las Vegas, NV 89709

Owner's Name and Address Mr. Edward Smith, 76 Tortoise Way, Las Vegas, NV 89707

This inspection was made only to determine VISIBLE evidence of the presence or absence of noted organisms. It is made only in those areas of noted structures which were readily accessible and visible. Inspection has been made in the areas in which infestations are most likely to occur.

No inspection was made in inaccessible areas which might require breaking into, breaking apart, dismantling, removal or moving of an object, including but not limited to moldings, floor coverings, siding, ceilings, floors, furniture, applicances, and/or personal possessions.

THIS IS NOT A STRUCTURAL DAMAGE REPORT, neither is it a WARRANTY as to the absence of wood-destroying organisms. The report is not to be construed to constitute a guarantee against future infestations, but is indicative of the condition of the premises ON THE DATE OF THE INSPECTION.

☒ This is not a structural damage report. ☒ This is not a guarantee against future infestations.

☒ This is not a structural soundness report. **(Structural soundness should be determined by a qualified building expert.)**

Neither I nor the company for which I am acting have had, presently have, or contemplate having any interest in the property. I do further state that neither I nor the company for which I am acting is financially associated in any way with or related to any party to this transaction.

JOSEPH DOKES — Type or Print Name of Inspector

Joseph Dokes — Signature of Inspector

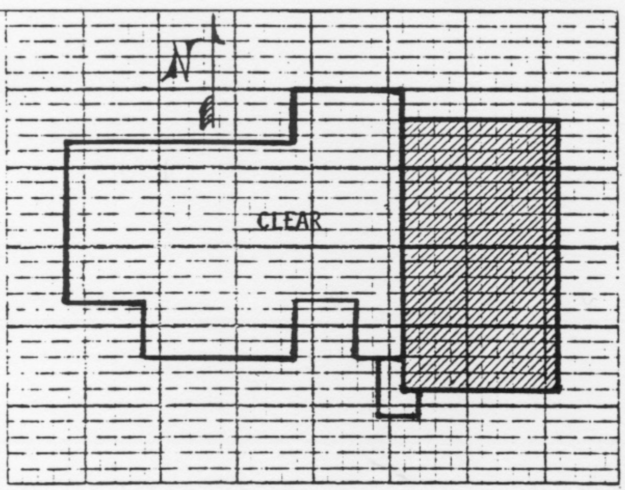
INFESTATION: (See diagram and explanation below.)

	Evidence of: No	Evidence of: Yes	Active	Inactive
Termites	☒	☐	☐	☐
Other Wood-destroying Insects	☒	☐	☐	☐
Wood-destroying Fungi	☒	☐	☐	☐

CONDITIONS CONDUCIVE TO INFESTATION:

	Yes	No
Earth-Wood Contacts	☐	☒
Faulty Grades	☐	☒
Insufficient Ventilation	☐	☒
Excessive Moisture	☐	☒
Cellulose Debris	☐	☒

(See back for definition of infestation and conditions conducive to infestation.)



GRAPH EXPLANATIONS:

All recommendations have been followed as listed on report #00001, structure is now **CLEAR.**

Scale NTS (optional)

Treatment Date 08/07/02 Area Treated Subflooring under kitchen area.

Product Used Brand XXX Fungicide, 1%, 5 gallons EPA Registration No. 1234-56

I have received the original or a legible copy of this form.

Thomas M Brown — Signature of Purchaser 08/07/02 — Date

DA-PD 2 (Rev. 10-01) (O)-442

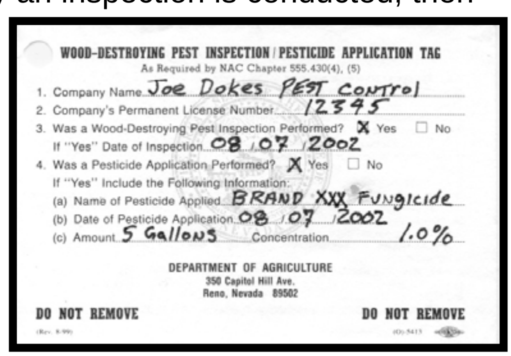
INSPECTION / APPLICATION TAGS

Upon completion of an inspection, or pesticide application for the control of wood-destroying pests, the placement of an “inspection/application tag” is required (per NAC 555.430.4.5). The tags are available from the Nevada Department of Agriculture.

In structures containing a crawlspace, the tag must be placed inside the crawlspace and in a location that is visible from the crawlspace entrance area (e.g. tag nailed or stapled to a joist under the home that is visible from the crawlspace entry hole).

With structures built on slab foundations, the tags must be visible from the access area under a sink (e.g. tag tide to "permanent" plumbing under a sink).

As the name implies, the inspection/application tag has two parts, one regarding inspections and the other regarding applications. If only an inspection is conducted, then only that portion of the tag referring to inspections needs to be filled out. If an inspection is followed by an application then the entire tag must be filled out, as shown in the example that would be completed for report #00003.



WOOD-DESTROYING PEST INSPECTION / PESTICIDE APPLICATION TAG
As Required by NAC Chapter 555.430(4), (5)

1. Company Name Joe Dokes PEST CONTROL
2. Company's Permanent License Number 12345
3. Was a Wood-Destroying Pest Inspection Performed? X Yes ☐ No
   If "Yes" Date of Inspection 08 / 07 / 2002
4. Was a Pesticide Application Performed? X Yes ☐ No
   If "Yes" Include the Following Information:
   (a) Name of Pesticide Applied BRAND XXX Fungicide
   (b) Date of Pesticide Application 08 / 07 / 2002
   (c) Amount 5 Gallons Concentration 1.0%

DEPARTMENT OF AGRICULTURE
350 Capitol Hill Ave.
Reno, Nevada 89502

DO NOT REMOVE DO NOT REMOVE

(Rev. 8-99) (O) 5413

TERMITICIDE PRE-TREATMENTS

In virtually every ecosystem which sustains plant growth, termites are essential recyclers of the biomass locked-up in wood, playing a vital role in returning carbon and nitrogen to forms usable to plants and animals. They occur in vast numbers in tropical regions, and in arid and infertile environments they are probably the most important animals contributing to decomposition processes.

Buildings and other wooden structures are subject to attack because termites do not distinguish between dead wood and wood litter in their environment, and wood in homes. On each block of land cleared for new homes, we replace naturally occurring dead wood and cellulose debris in the environment with truckloads of very edible pine timber wrapped in masonry and plasterboard so the wood remains hidden from view. Some building sites pose a greater risk of termite attack than others. High risk building sites include those near large and established sources of termite food and nesting, persistently wet sites, and basically anywhere termites are currently doing what they have done since prehistoric times, recycling fallen wood and eating dead trees and shrubs. If, or when, termites find a way into a home, they typically remain hidden from view until damage is advanced, and costly.

New homes are less threatened as a result of termiticide pre-treatments reducing the number of colonies under the building site. Yet, the balance between providing an effective chemical barrier between the building's wood and termites in the soil includes considerations about consumer health and economics, and ecological impacts. Generally, the dangers of termite control agents are similar to the dangers inherent in the use of all insecticides. Under federal law, it is illegal to state that the use of any pesticide is safe. Chemical termiticides are not intended to remain effective indefinitely because health and ecological concerns increase in proportion to pesticide efficacy and persistence in the environment. Thus, chemical barriers fail eventually either through degradation, physical disruption or by-passing around modifications to the building or its setting. Protecting buildings against termite attack is an ongoing battle beginning with initial termiticide pre-treatments and continuing with routine inspections, especially when homes are refinanced by new owners.

When properly applied, termiticide pre-treatments protect new homes from termite damage by setting up a chemical barrier between the building's wood and tunneling termites in the soil. If application standards are followed, the barriers will either prevent the passage of subterranean termites from the soil into the timberwork of the buildings for a defined period of time, or at least force subterranean termites to build their mud-like access tunnels out in the open where they can be seen during an inspection. Currently, new buildings insured by many conventional lending institutions and all government mortgage banks must be constructed with termite barriers under building codes based on various state standards and "enforced" by local government.

In order to register a pesticide as a termiticide, EPA standards require efficacy data from field tests conducted by the United States Department of Agriculture, Forest Service. Proposed termiticides must provide 100% control of subterranean termites for a minimum of 5 years in at least 3 of 5 different field sites. While Forest Service tests and independent studies indicate that there are differences in the persistence and efficacy of the termiticides depending on environmental factors such as soil type, temperature, and rainfall, all testing is done according to label specified concentrations and parameters. Any use of termiticides outside of their specific label directions compromises efficacy demonstrated and approved within the testing and registration parameters. Thus termiticides used for conventional soil treatments received EPA registration within exactly specified parameters and any use outside these parameters compromises demonstrated effectiveness.

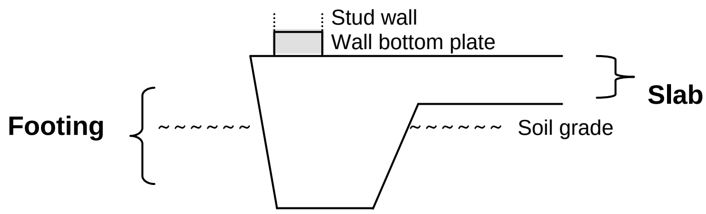
Use of termiticides for pre-treatments is highly regulated and tells of the fact that effectiveness depends on strict adherence to label directions. In the case of termiticides used for conventional soil treatments, pre-construction applications are prohibited at less than minimum concentration rates. This restriction is explicit on the product's label. Any deviation from required volumes and concentrations compromises efficacy of the termiticide, usefulness of the endeavor, and reliability of warranties offered to new home buyers. Just as effective pre-treatment of building sites requires a large quantity of precisely mixed chemical applied at concentrations which vary with application site; it also demands special equipment and application techniques, knowledge of termite behavior, and an understanding of the way a house is built.

A properly-done soil pre-treatment is not a one-time application. It is done in stages coordinated with all building activities from foundation construction through final grading of the soil around the building's exterior. Soil below slabs and under structures should be treated, and in order for the treatment to be effective, a final phase of the application is done after final grading has been set around the completed structure, sometimes after landscaping is completed so that the treated soil is not disturbed. Pre-treatment of foundation and slab sites are traditionally referred to as horizontal treatments while pre-treatment of perimeters of completed structures after final grading are called vertical treatments. Any exterior concrete slabs that will be covered with a roof and abut the structure's main slab complicate pre-treatment because they require additional horizontal and vertical treatments (NAC 555.427.3.b).

Final grade treatments to the building's perimeter and cold joints are as critical as horizontal treatments to slab sites because a myriad of cellulose fragments remain in and around the soil surrounding new buildings. These fragments are then covered with turf and irrigated landscaping where they can decay slowly giving off carbon dioxide which attracts the next wave of would-be termite kings and queens flying in to set up a new colony in the ground. Effective pre-construction treatment for subterranean termite prevention thus requires the establishment of continuous vertical and horizontal barriers in the soil next to and under the foundation to achieve termite control for a long period of time.

TERMINOLOGY

Monolithic Slab Foundation: A continuous unbroken foundation slab established in one single concrete pour. A monolithic slab includes the concrete slab under the building, plus any raised stem walls and thicker footings, typically around all perimeter edges. Additional footings may also occur within the slab where extra support under load bearing walls are needed. Clark County building code requires a minimum 12 inch footing and a 3.5 inch slab. In northern Nevada the minimum depth for a footing is 30 inches because of frost heaving concerns.

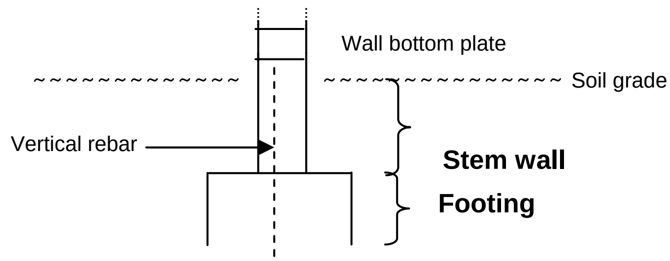


Concrete has great compression strength which allows it to hold a great deal of weight directly. However, concrete does not have a tremendous amount of tensile strength. Large slabs usually require post-tension or steel reinforcement and special compounds in order to support any substantial weight. Concrete slabs are set on compacted earth with a gravel base and are basically supported by the ground. If soil expands a great deal there is the potential for moisture loss and shrinking. Expansion may result in voids underneath the building site and ultimately cracks in the concrete. The probability of moisture loss is diminished by placement of a vapor barrier (see below).

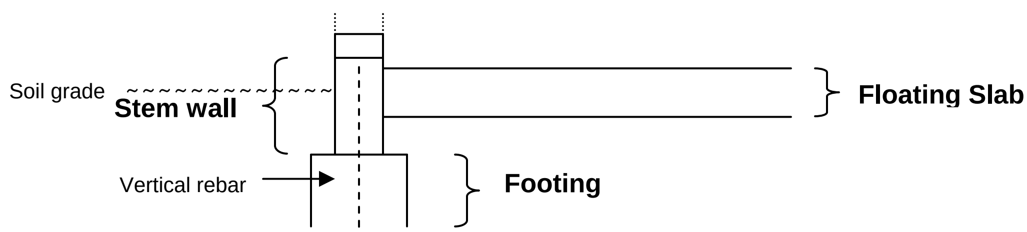
Vapor Barrier: A polyethylene or approved vapor retarder placed under the concrete slab. The use of a vapor barrier is common but its location within the slab site varies. Some designs require a soil matrix over the vapor barrier. Others insist the vapor barrier be placed directly under the slab. Termiticide may be applied to the soil matrix overlying the vapor barrier if present, or, in the case of a vapor barrier directly under the slab, to the soil under the barrier.

Before a concrete slab is poured a horizontal pre-treatment chemical barrier is made to the soil matrix directly below the slab area and within the graded area enclosed by form boards. When a soil matrix is present above a vapor barrier, termiticide is applied to this matrix. The volume of applied termiticide depends on the square foot area within the form boards, the linear footage of any cold joints, and the compactness of the soil matrix. Extremely compact soil matrices which do not allow the absorption of larger volumes are typically treated with a doubled termiticide concentration and halved dilution volume depending on label directions. Regardless of the concentration rate, the first step to determine how much termiticide is needed is to measure the size of the site to be treated and calculate square footage. Measurements of the lengths of the outer-most form boards outlining the concrete slab to be poured are used to calculate square footage. Irregularly shaped sites can be reduced to a combination of rectangles, circles and triangles which can then be added together to obtain the total area.

Stem Wall Foundation: Foundations constructed in two parts. Stem walls may be used to create a crawl space or basement beneath a wood floor. Soil is dug out below grade or frost level for the placement of footing which transfers weight to the underlying soil. A masonry or poured concrete foundation wall is then built above grade, on top of the footing. Vertical rebar usually provides continuity between footing and stem walls. Stem wall foundations require vertical pre-treatments on both their interior and exterior walls.



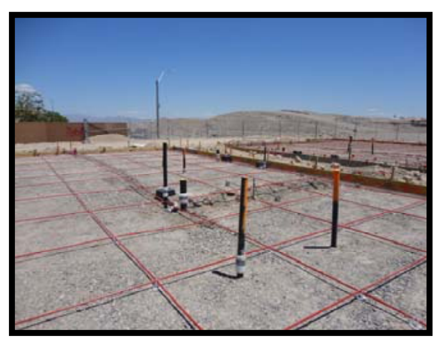
Floating Slab Foundation: A floating slab foundation is similar to a stem wall foundation but it has a concrete slab attached to the separate foundation. The concrete slab fits inside the stem wall with expansion material attached to the wall. The floating slab is in contact with the ground and is independent of the foundation. The floor of the building is thus underlain by a concrete slab. This design is the most vulnerable to termite attack because the concrete slab floor and the foundation wall are separate units with an expansion joint between them through which termites may gain access to the woodwork above. Stem walls require vertical pre-treatment along the inside of the stem wall when the horizontal pre-treatment is applied underneath the slab. A vertical final grade pretreatment is also required after soil grading is complete outside of the completed structure.



Horizontal Barrier: A horizontal barrier refers to the continuous barrier to termite infestation which is created when termiticide or a physical barrier is applied to the entire area underlying a concrete slab, including all footings and **critical areas** such as bath traps, and utility conduits which will penetrate through a poured slab. Horizontal barriers are typically treated at one gallon of use dilution per 10 square feet although a doubled concentration and halved volume may be used on highly compact soil matrices. To create the horizontal barrier underneath the building slab, the soil is saturated with a termiticide. The rate of application of one gallon for every 10 square feet is equivalent to 0.1 gallon per square foot. Thus a 2000 square foot building would require a minimum of 200 gallons of termiticide under the slab. Physical horizontal barriers are sometimes used in place of, or in addition to, chemical barriers.

Conventional soil treatments rely on creating a chemical barrier in the soil that is toxic or repellent to termites contacting it. Stem-wall sites, including floating slab sites (left) and monolithic slab sites (right) both require horizontal pre-treatment on the exposed soil surface underlying the structure.

Vertical Barrier: After the slab has been poured and the exterior grading has been finished, an additional vertical soil barrier is provided along the exterior foundation wall, often called the final grade treatment. Vertical barriers are also required along junctions where slabs meet, expansion joints where slabs abut stem walls, and around utility conduits that penetrate through the slab. Vertical barriers block termite pathways through the vertical plane of a building at ground level, especially via wall floor junction gaps, where there is increased vulnerability of termite entry. Vertical termite barriers necessitate a greater volume of termiticide than horizontal barriers. The application rate of a vertical treatment, typically four gallons of use dilution per 10 linear feet per foot of depth, is equivalent to 0.4 gallons per liner foot of depth. The "per foot of depth" is the depth of the slab or penetration below final grade.



Effective termite control requires termiticides be applied as a continuous barrier in the soil next to and under the foundation. Establishment of vertical barriers adjacent to vertical surfaces includes treatment of the soil adjacent to the perimeter of the structure, cold joints where two slabs abut, and utility penetrations which protrude through cement slabs.

Critical Areas: Some areas, such as around plumbing and utility conduits which penetrate through the slab, support posts, borders of adjacent slabs poured at different times, the sides of stem walls and exterior walls of foundations are called critical areas and require a higher level of treatment, that is, more termiticide per square foot. Critical areas are typically treated at a rate of four gallons of dilution per 10 linear feet for each foot of depth from grade level to footing, or more simply, an additional gallon (or ½ gallon of doubled use dilution for compact soils) per each cubic foot of soil.

Utility penetrations, junctions where two slabs meet, exterior perimeter of the completed structure, and the interior of stem wall foundations, all constitute critical areas because they are entry ways to foraging termites.

Cold Joints: Cold joints are junctions where two concrete slabs meet or where a concrete slab meets a stem wall. The resulting seam can work like a control joint for expansion. Cold joints are treated before concrete is poured at the same concentration as the critical areas that penetrate a monolithic slab. Cold joints are a type of critical area and are treated at the higher vertical pre-treatment rate of four gallons per 10 linear feet per foot of depth.

Form Boards: Wood boards which form a frame to hold concrete in place until it has set up and become hard. After the concrete has cured the boards are removed.

Final Grade: Once the structure is completely built and the final soil grade has been established around it, a vertical barrier to termites, referred to as a “final grade”, is performed. In a final grade the exterior perimeter is trenched and treated at the vertical barrier label rate, typically four gallons of dilution per 10 linear feet. A vertical barrier is created in the soil by either trenching or trenching and rodding along all the sides of the elements mentioned above and applying termiticide to the trench and backfill.

Flatwork: Flatwork is a general term that refers to any concrete slabs in the interior or exterior of a structure that require finishing, such as patios, entryways, driveways, sidewalks, and exposed concrete floors. Pavers are a popular alternative to concrete flatwork. When they are underlain by concrete or bonded together by mortar pavers are considered part of a structure’s flatwork.

Flatwork concrete is reinforced based on projected loads and traffic and is usually comprised of a finer matrix than slabs overlain by structures. The finer concrete matrix of patio and entryway slabs is usually poured as construction of the main structure nears completion. Driveways are typically poured at the same time as patios and walkways. The driveway is the usually the most important area of concrete flatwork but unless it is covered by a roof it does not receive a pre-treatment. Flatwork underneath the structure’s roof must receive pre-treatment.

Scheduling pouring of flatwork towards the end of construction, usually just prior to landscaping, minimizes the chance that it will be damaged or marked-up during the structure’s construction.

PRE-TREATMENT CALCULATIONS

The two biggest problems in controlling wood destroying pests are determining the amount of concentrate and the amount of finished spray that are required. In most instances the extent or degree of the infestation will determine these two amounts. In the pre-treatment of a structure, however, the size of the structure, the utility entrances, voids in hollow masonry units, and type of construction determine the amounts needed. Both of these amounts can be determined mathematically.

Two methods are commonly used to determine the amount of concentrate and the amount of finished spray required. With these formulas and simple algebra all calculations can easily be done. It will only be necessary to become familiar with one of these methods. Examine methods **"A"** and **"B"** and determine which is right for you.

METHOD "A"

$$\textbf{Total Gallons of Concentrate} = \frac{\text{Total Gallons of Spray} \times \text{\% Active Ingredient (a.i.) Desired} \times 8^{*}}{\text{Pounds of Actual Per Gallon} \times 100}$$

GALLONS OF CONCENTRATE: The number of gallons of a manufacturer's concentrate (which is mixed with a petroleum or water carrier). An example of a concentrate is Termidor® SC termiticide/insecticide which has 9.1% active ingredient (fipronil).

TOTAL GALLONS OF SPRAY: The result of mixing the concentrate with a diluent, usually water. This is the total amount of the finished product that is applied to the site.

% ACTIVE INGREDIENT DESIRED: The amount of **active ingredient (a.i.)** that is contained in the finished spray. Normally the label will state what percent this should be. It is always expressed as a whole number when used in the formula above (ex.: 1% is 1, not 0.01; 0.5% is 0.5 not 0.005).

*** 8**: The weight of one gallon of water expressed in pounds. **NOTE: When performing calculations involving the weight of water, weights from 8.0 to 8.35 pounds per gallon of water are commonly used. For simplicity's sake, 8.0 pounds per gallon of water is used in this manual. Use 8.0 pounds per gallon of water when taking the examination.**

POUNDS ACTUAL PER GALLON: The amount of active ingredient in one gallon of concentrate. It is always expressed in pounds and is usually found on the label.

100: The constant that enables the formula to work. It is always 100.

METHOD "B"

For this method we use a slightly different formula to determine the amount of the manufacturer's concentrate that will be required. We assign the manufacturer's product an **"X"** value and solve for this value through cross multiplication.

$$\frac{\textbf{Gallons of Concentrate}}{\textbf{Total Volume}} = \frac{\textbf{X Total Gallons of Concentrate}}{\textbf{Total Gallons of Spray}}$$

GALLONS OF CONCENTRATE: The number of gallons of a manufacturer's concentrate which is mixed with a specific volume of a petroleum or water carrier in accordance with label instructions. An example of a concentrate is Premise® Pre-Construction Insecticide, which has 21.4% active ingredient (Imidacloprid).

TOTAL VOLUME: The sum of the amount of concentrate and the amount of diluent (usually water) that is mixed with the manufacturer's concentrate to produce a desired use solution.

X TOTAL GALLONS OF CONCENTRATE: The total gallons of the manufacturer's concentrate that is required to produce the total gallons of spray.

TOTAL GALLONS OF SPRAY: The result of mixing the concentrate with a diluent, usually water. This is the total amount of the finished product that is applied to the site.

<u>There will be a minor variation in the answers between method A and method B</u>. On the <u>test questions</u> this variation will be given as a range which will include the correct answers for method A and B (see question #4 page 97 and again on pages 104 and 105).

CHEMICAL BARRIERS

Chemical barriers which are used to control subterranean termites are usually of two types, horizontal and vertical.

(1) HORIZONTAL (area): To establish a horizontal barrier, gallons of spray are applied to square feet. The product label will state the rate of application such as 1 gallon per 10 square feet or 1½ gallons per 10 square feet.

To determine the square footage of a structure, the length (L) of the structure is multiplied by the width (W) of the structure (L x W = sq. ft.). For example, if a home is 170 feet long and 60 feet wide, the square footage encompassed by the home would be: 170 ft. (L) x 60 ft. (W) = 10,200 square feet.

To determine the gallons of spray for the home mentioned, first read the label. In this case, the label states to apply the spray at the rate of 1½ gallons per 10 square feet. Then divide the square footage of the home (10,200 square feet) by the square footage given on the label (10 square feet) and multiply by the gallons given on the label (1½ gallons). The problem would then look like this:

$$\frac{\textbf{10,200 sq. ft.}}{\textbf{10 sq. ft.}} \times \textbf{1½ gals. = gallons of spray}$$

1,020 x 1½ gals. = gallons of spray

1,530 gals. = gallons of spray

It therefore takes 1,530 gallons of spray to establish a horizontal barrier for a home that is 170 feet long and 60 feet wide.

To determine the gallons of concentrate that are needed for the spray, additional information is required: the pounds actual per gallon and the percent active ingredient desired. Again this information is available from the label. The label states the concentrate contains 4 lbs. actual per gallon, and to mix 2 gallons of concentrate in 98 gallons of water to produce a 1% solution. Using the formulas previously given we have the following.

METHOD "A"

$$\text{Gallons of Concentrate} = \frac{\text{Gallons of Spray} \times \%\ \text{a.i. Desired} \times 8}{\text{Pounds Actual/Gallon} \times 100}$$

$$\text{Gallons of Concentrate} = \frac{1530 \text{ gallons} \times 1 \times 8}{4 \text{ lbs. / gallon} \times 100}$$

$$\text{Gallons of Concentrate} = \frac{12{,}240}{400}$$

Gallons of Concentrate = 30.6 gallons

METHOD "B"

$$\frac{\text{Gallons of Concentrate}}{\text{Total Volume}} = \frac{\text{X Total Gallons of Concentrate}}{\text{Total Gallons of Spray}}$$

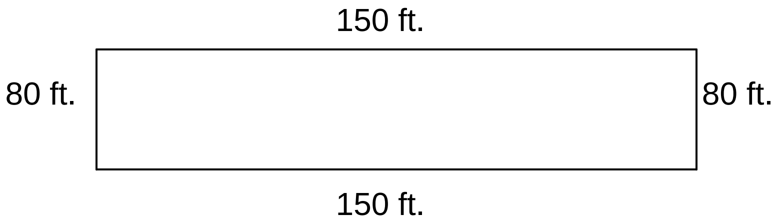
$$\frac{2}{100} = \frac{X}{1530}$$

$$X = \frac{3060}{100}$$

X = 30.6 gallons of concentrate

It therefore, takes 30.6 gals. of 4 lbs. actual/gallon concentrates to make 1,530 gallons of spray to establish a horizontal barrier for a home that is 170 feet long and 60 feet wide using a 1% solution.

(2) VERTICAL: To establish a vertical barrier, the gallons of spray are applied to linear feet. To determine the linear feet of a foundation add all the sides together. If both sides of the foundation are to be treated, add all the sides together and multiply by 2. This will give the total linear feet to be treated both inside and outside the foundation wall. For example, if a foundation is 150 feet long and 80 feet wide then the diagram of the structure would be like this:



The linear feet to be treated would then be:

(150 ft. + 80 ft. + 150 ft. + 80 ft.) x 2 = total linear feet

460 ft. x 2 = total linear feet

920 ft. = total linear feet

To determine the gallons of spray for the structure mentioned, first, read the label for the application rate. In this case, the label states to apply the spray at 4 gallons per 10 linear feet. Then divide the linear footage of the structure (920 ft.) by the linear feet given on the label (10 ft.) and multiply by the gallons on the label (4 gallons). The problem would then look like this:

$$\mathbf{\frac{920\ ft.}{10\ ft.} \times 4\ gallons = gallons\ of\ spray}$$

92 x 4 gallons = gallons of spray

368 gallons = gallons of spray

It therefore takes 368 gallons of spray to establish a vertical barrier for a structure that is 150 ft. long and 80 feet wide.

To determine the gallons of concentrate that are needed for the spray, additional information is required: the pounds actual per gallon and the percent active ingredient (a.i) desired. Again this information is available from the label. The label states the concentrate contains 4 lbs. actual per gallon and to mix 2 gallons of concentrate in 98 gallons of water to produce a 1% solution. Using the formula previously given we have the following:

METHOD "A"

$$\text{Gallons of Concentrate} = \frac{\text{Gallons of Spray x \% a.i. Desired x 8}}{\text{Pounds Actual/Gallons x 100}}$$

$$\text{Gallons of Concentrate} = \frac{\text{368 Gallons x 1 x 8}}{\text{4 lbs. / gallon x 100}}$$

$$\text{Gallons of Concentrate} = \frac{2944}{400}$$

Gallons of Concentrate = 7.36 gallons

METHOD "B"

$$\frac{\text{Gallons of Concentrate}}{\text{Total Volume}} = \frac{\text{X Total Gallons of Concentrate}}{\text{Total Gallons of Spray}}$$

$$\frac{2}{100} = \frac{X}{368}$$

$$X = \frac{736}{100}$$

X = 7.36 gallons of concentrate

It therefore takes 7.36 gals. of 4 lbs. actual/gal. concentrate to make 368 gals. of spray to establish a vertical barrier for a structure that is 150 feet long and 80 feet wide using a 1% solution.

When applying a vertical barrier around only the outside of a foundation or around a utility entrance such as a plumbing or electrical line or pier post, <u>there is no doubling of the total linear feet as there will not be an inside application</u>. For example if the concrete support posts beneath a home are 1 foot long per side and there are 24 such post, then there would be 96 linear feet to be treated.
[4 sides per post x 1 foot = 4 feet for each post
4 feet for each post x 24 posts = 96 feet.]
<u>(The "per foot of depth" rate does not normally apply to these applications).</u>

Some foundations are built with hollow masonry blocks. In these types of structures the stem wall is treated on both sides as stated earlier but an additional application may be needed in the voids or hollow areas within the blocks. This application is also gallons per linear feet; there is no doubling of the total linear feet.

SAMPLE PROBLEMS

1. How many gallons of a termiticide with 42.8% active ingredient (a.i.) (4 lbs./gal.) are needed to treat both sides of a structure's 3 ft. foundation 180 ft. by 120 ft.? The label states to mix 2 gallons of concentrate in 98 gallons of water to produce a 1% solution applied at the rate of 4 gallons per 10 linear feet per foot of foundation depth.

2. How many gallons of a termiticide with 25.6% active ingredient (a.i.) (2 lbs./gal.) are needed to treat the area of a structure 160 ft. long by 60 ft. wide? The label states to mix 2 gallons of concentrate in 98 gallons of water to produce a .5% solution applied at the rate of 1½ gallons per 10 square feet.

3. How many gallons of a termiticide with 36.8% active ingredient (a.i.) (3.2 lbs./gal.) are needed to treat both sides of a structure's 3 foot foundation 135 ft. by 45 ft. with 36 support post each 1 foot square? The label states to mix 2.5 gallons of concentrate in 97.5 gallons of water to produce a 1% solution applied at the rate of 4 gallons per 10 linear feet.

4. How many gallons of a termiticide with 65% active ingredient (a.i.) (6 lbs./gal.) are needed to treat both sides of a structure's 1 foot foundation 165 ft. by 60 ft and the horizontal treatment of the interior area? The label states to mix 1 gallon of concentrate in 96 gallons of water to produce a .75% solution applied at the rate of 1½ gallons per 10 square feet and 2 gals. per 5 linear feet.

5. How many gallons of a termiticide with 25.3% active ingredient (a.i.) (4 lbs./gal.) are needed to treat both sides of a triangular structure's 2.5 foot foundation 96 ft. x 128 ft. x 160 ft.? The label states to mix 2 gallons of concentrate in 98 gallons of water to produce a 1% solution applied at the rate of 4 gallons per 10 linear feet per foot of foundation depth.

SAMPLE ANSWERS

1. How many gallons of a termiticide with 42.8% active ingredient (a.i.) (4 lbs./gal.) are needed to treat both sides of a structure's 3 ft. foundation 180 ft. by 120 ft.? The label states to mix 2 gallons of concentrate in 98 gallons of water to produce a 1% solution applied at the rate of 4 gallons per 10 linear feet per foot of foundation depth.

METHOD "A"

a. (180 + 120 + 180 + 120) x 2 = total linear feet

600 x 2 = total linear feet

1,200 ft. = total linear feet

b. $$\frac{1{,}200 \text{ ft.}}{10 \text{ ft.}} \times (4 \text{ gals.} \times 3 \text{ ft.}) = \text{gals. of spray}$$

120 x 12 gals. = gals. of spray

1,440 gals. = gals. of spray

c. $$\text{Gallons of Concentrate} = \frac{\text{Gallons of Spray} \times \text{\% a.i. Desired} \times 8}{\text{Pounds Actual/Gallon} \times 100}$$

$$\text{Gallons of Concentrate} = \frac{1{,}440 \times 1 \times 8}{4 \times 100}$$

$$\text{Gallons of Concentrate} = \frac{11{,}520}{400}$$

Gallons of Concentrate = 28.8

METHOD "B"

a. (180 + 120 + 180 + 120) x 2 = total linear feet

600 x 2 = total linear feet

1,200 ft. = total linear feet

b. $\frac{1,200 \text{ ft.}}{10 \text{ ft.}}$ x (4 gals. x 3 ft.) = gals. of spray

120 x 12 = gals. of spray

1,440 = gals. of spray

c. $$\frac{\text{Gallons of Concentrate}}{\text{Total Volume}} = \frac{\text{X Total Gallons of Concentrate}}{\text{Total Gallons of Spray}}$$

$$\frac{2}{100} = \frac{X}{1,440}$$

$$X = \frac{2,880}{100}$$

X = 28.8 gallons of concentrate

2. How many gallons of a termiticide with 25.6% active ingredient (a.i.) (2 lbs./gal.) are needed to treat the area of a structure 160 ft. long by 60 ft. wide? The label states to mix 2 gallons of concentrate in 98 gallons of water to produce a .5% solution applied at the rate of 1½ gallons per 10 square feet.

METHOD "A"

a. Sq. Ft. = L x W

Sq. Ft. = 160 ft. x 60 ft.

Sq. Ft. = 9,600 sq. ft.

b. $$\frac{\text{9,600 sq. ft.}}{\text{10 sq. ft.}} \times 1\tfrac{1}{2} \text{ gals.} = \text{gals. of spray}$$

$$960 \times 1\tfrac{1}{2} \text{ gals.} = \text{gals. of spray}$$

$$\text{1,440 gals.} = \text{gals. of spray}$$

c. $$\text{Gallons of Concentrate} = \frac{\text{Gallons of Spray} \times \text{\% a.i. Desired} \times 8}{\text{Pounds Actual/Gallon} \times 100}$$

$$\text{Gallons of Concentrate} = \frac{1{,}440 \times .5 \times 8}{2 \times 100}$$

$$\text{Gallons of Concentrate} = \frac{5{,}760}{200}$$

Gallons of Concentrate = 28.8

METHOD "B"

a. Sq. Ft. = L x W

Sq. Ft. = 160 ft. x 60 ft.

Sq. Ft. = 9,600 sq. ft.

b. $\dfrac{9{,}600 \text{ sq. ft.}}{10 \text{ sq. ft.}} \times 1\frac{1}{2} \text{ gals.} = \text{gals. of spray}$

$960 \times 1\frac{1}{2} \text{ gals.} = \text{gals. of spray}$

$1{,}440 = \text{gals. of spray}$

c. $\dfrac{\text{Gallons of Concentrate}}{\text{Total Volume}} = \dfrac{\text{X Total Gallons of Concentrate}}{\text{Total Gallons of Spray}}$

$$\frac{2}{100} = \frac{X}{1{,}440}$$

$$X = \frac{2{,}880}{100}$$

X = 28.8 gallons of concentrate

3. How many gallons of a termiticide with 36.8% active ingredient (a.i.) (3.2 lbs./gal.) are needed to treat both sides of a structure's 3 foot foundation 135 ft. by 45 ft. with 36 support post each 1 foot square? The label states to mix 2.5 gallons of concentrate in 97.5 gallons of water to produce a 1% solution applied at the rate of 4 gallons per 10 linear feet.

METHOD "A"

a. (135 ft. + 45 ft. + 135 ft. + 45 ft.) x 2 = total linear feet

360 ft. x 2 = total ln. ft.

720 ft. = total ln. ft.

b. (1 ft. x 4) x 36 = total ln. ft. (posts)

4 ft. x 36 = total ln. ft.

144 ft. = total ln. ft.

c. $\dfrac{720\text{ ft.}}{10\text{ ft.}}$ **x (4 gals. x 3 ft.) = gals. of spray**

72 x 12 gals. = gals. of spray

864 gals. = gals. of spray

d. $\dfrac{144\text{ ft.}}{10\text{ ft.}}$ **x 4 gals. = gals. of spray (posts)**

14.4 x 4 gals. = gals. of spray

57.6 gals. = gals. of spray

e. $$\text{Gallons of Concentrate} = \frac{\text{Gallons of Spray x \% a.i. Desired x 8}}{\text{Pounds Actual/Gallon x 100}}$$

$$\text{Gallons of Concentrate} = \frac{(864\text{ gals.} + 57.6\text{ gals.}) \times 1 \times 8}{3.2 \times 100}$$

$$\text{Gallons of Concentrate} = \frac{7{,}372.8}{320}$$

Gallons of Concentrate = 23.04

METHOD "B"

a. (135 ft. + 45 ft. + 135 ft. + 45 ft.) x 2 = total ln. ft.

360 ft. x 2 = total ln. ft.

720 ft. = total ln. ft.

b. (1 ft. x 4) x 36 = total linear feet (posts)

4 ft. x 36 = total linear feet

144 ft. = total linear feet

c.
$$\frac{720 \text{ ft.}}{10 \text{ ft.}} \times (4 \text{ gals.} \times 3 \text{ ft.}) = \text{gals. of spray}$$

72 x 12 gals. = gals. of spray

864 gals. = gals. of spray

d.
$$\frac{144 \text{ ft.}}{10 \text{ ft.}} \times 4 \text{ gals.} = \text{gals. of spray (posts)}$$

14.4 x 4 gals. = gals. of spray

57.6 gals. = gals. of spray

e.
$$\frac{\text{Gallons of Concentrate}}{\text{Total Volume}} = \frac{\text{X Total Gallons of Concentrate}}{\text{Total Gallons of Spray}}$$

$$\frac{2.5}{100} = \frac{X}{921.6}$$

$$X = \frac{2{,}304}{100}$$

X = 23.04 gallons of concentrate

4. How many gallons of a termiticide with 65% active ingredient (a.i.) (6 lbs./gal.) are needed to treat both sides of a structure's 1 foot foundation 165 ft. by 60 ft and the horizontal treatment of the interior area? The label states to mix 1 gallon of concentrate in 96 gallons of water to produce a .75% solution applied at the rate of 1½ gallons per 10 square feet and 2 gals. per 5 linear feet.

METHOD "A"

a. Sq. Ft. = L X W

Sq. Ft. = 165 ft. x 60 ft.

Sq. Ft. = 9,900 sq. ft.

b. $$\frac{9{,}900 \text{ sq. ft.}}{10 \text{ sq. ft.}} \times 1\tfrac{1}{2} \text{ gals.} = \text{gals. of spray (area)}$$

990 x 1½ gals. = gals. of spray

1,485 gals. = gals. of spray

c. (165 ft. + 60 ft. + 165 ft. + 60 ft.) x 2 = total ln. ft.

450 ft. x 2 = total ln. ft.

900 ft. = total ln. ft.

d. $$\frac{900 \text{ ft.}}{5 \text{ ft.}} \times (2 \text{ gals.} \times 1 \text{ ft.}) = \text{gals. of spray (linear)}$$

180 x (2 gals. x 1 ft.) = gals. of spray

360 gals. = gals. of spray

e. $$\text{Gallons of Concentrate} = \frac{\text{Gallons of Spray} \times \text{\% a.i. Desired} \times 8}{\text{Pounds Actual/Gallon} \times 100}$$

$$\text{Gallons of Concentrate} = \frac{(1{,}485 \text{ gals.} + 360 \text{ gals.}) \times .75 \times 8}{6 \times 100}$$

$$\text{Gallons of Concentrate} = \frac{11{,}070}{600}$$

Gallons of Concentrate = 18.45

METHOD "B"

a. **Sq. Ft. = L x W**

Sq. Ft. = 165 ft. x 60 ft.

Sq. Ft. = 9,900 sq. ft.

b. $$\frac{9{,}900 \text{ sq. ft.}}{10 \text{ sq. ft.}} \times 1\tfrac{1}{2} \text{ gals.} = \text{gals. of spray (area)}$$

990 x 1½ gals. = gals. of spray

1,485 gals. = gals. of spray

c. (165 ft. + 60 ft. + 165 ft. + 60 ft.) x 2 = total ln. ft.

450 ft. x 2 = total ln. ft.

900 ft. = total ln. ft.

d. $$\frac{900 \text{ ft.}}{5 \text{ ft.}} \times (2 \text{ gals.} \times 1 \text{ ft.}) = \text{gals. of spray (linear)}$$

180 x (2 gals. x 1 ft.) = gals. of spray

360 gals. = gals. of spray

e. $$\frac{\text{Gallons of Concentrate}}{\text{Total Volume}} = \frac{\text{X Total Gallons of Concentrate}}{\text{Total Gallons of Spray}}$$

$$\frac{1}{97} = \frac{X}{1{,}845}$$

$$X = \frac{1{,}845}{97}$$

X = 19.0 gallons of concentrate

*Note: On occasion there are minor variations when calculating Methods **A** and **B**. The test questions will depict these variations by giving a range which will include the correct answer for methods **A** and **B** (e.g. as seen here for question #4, Method **A** = 18.45, Method **B** = 19.0. A test question would depict this as 18.45 to 19.0.

5. How many gallons of a termiticide with 25.3% active ingredient (a.i.) (4 lbs./gal.) are needed to treat both sides of a triangular structure's 2.5 foot foundation 96 ft. x 128 ft. x 160 ft.? The label states to mix 2 gallons of concentrate in 98 gallons of water to produce a 1% solution applied at the rate of 4 gallons per 10 linear feet per foot of foundation depth.

<u>METHOD "A"</u>

a. **(96 ft. + 128 ft. + 160 ft.) x 2 = total linear ft.**

384 ft. x 2 = total linear ft.

768 ft. = total linear ft.

b. $$\frac{768 \text{ ft.}}{10 \text{ ft.}} \times (4 \text{ gals.} \times 2\tfrac{1}{2}) = \text{gals. of spray}$$

76.8 x 10 gals. = gals. of spray

768 gals. = gals. of spray

c. $$\text{Gallons of Concentrate} = \frac{\text{Gallons of Spray} \times \% \text{ a.i. Desired} \times 8}{\text{Pounds Actual/Gallon} \times 100}$$

$$\text{Gallons of Concentrate} = \frac{768 \times 1 \times 8}{4 \times 100}$$

$$\text{Gallons of Concentrate} = \frac{6{,}144}{400}$$

Gallons of Concentrate = 15.36

METHOD "B"

a. (96 ft. + 128 ft. + 160 ft.) x 2 = total linear ft.

384 ft. x 2 = total linear ft.

768 ft. = total linear ft.

b. $\frac{768 \text{ ft.}}{10 \text{ ft.}} \times (4 \text{ gals.} \times 2\frac{1}{2}) = \text{gals. of spray}$

76.8 x 10 gals. = gals. of spray

768 gals. = gals. of spray

c. $\frac{\text{Gallons of Concentrate}}{\text{Total Volume}} = \frac{\text{X Total Gallons of Concentrate}}{\text{Total Gallons of Spray}}$

$$\frac{2}{100} = \frac{X}{768}$$

$$X = \frac{1{,}536}{100}$$

X = 15.36 gallons of concentrate

STRUCTURAL FORMULAS -- REMINDER SHEET

Method "A"

$$\text{Total Gallons of Concentrate} = \frac{\text{Total Gallons of Spray} \times \text{\% a.i. Desired} \times 8}{\text{Pounds of Actual Per Gallon} \times 100}$$

Method "B"

$$\frac{\text{Gallons of Concentrate}}{\text{Total Volume}} = \frac{\text{"X" Total Gallons of Concentrate}}{\text{Total Gallons of Spray}}$$

NOTE:
When performing calculations involving the weight of water, weights from 8.0 to 8.35 pounds per gallon of water are commonly used. For simplicity's sake, 8.0 pounds per gallon of water is used in this manual. Use 8.0 pounds per gallon of water when taking the examination.

$$\textbf{Cubic feet of cellulose debris} = \frac{\text{Length} \times \text{Width} \times \text{Height}}{\text{1 cubic foot}}$$

One cubic foot = 1,728 cubic inches

$$\textbf{\% Active Ingredient} = \frac{\text{Gallons of Concentrate added} \times \text{Lbs. Actual Per Gallon} \times 100}{\text{Gallons of Spray} \times 8}$$

$$\textbf{Pounds} = \frac{\text{Gallons of Spray} \times \text{\% Active Ingredient Desired} \times 8}{\text{\% Active Ingredient in Pesticide Used}}$$

$$\textbf{\% Active Ingredient} = \frac{\text{Pounds} \times \text{\% Active Ingredient in Pesticide Used}}{\text{Gallons of Spray} \times 8}$$

$$\textbf{Pounds} = \frac{\text{\% Active Ingredient Desired} \times \text{Lbs. of Dust Desired}}{\text{\% Active Ingredient in Pesticide Used}}$$

$$\textbf{Pounds/Tankful} = \frac{\text{Tank Capacity (Gal.)} \times \text{Lbs. of Pesticide/Acre}}{\text{Distribution Rate}}$$

Appendix A

USDA Home and Garden Bulletin 64

☆U.S. GOVERNMENT PRINTING OFFICE: 1989—231-911

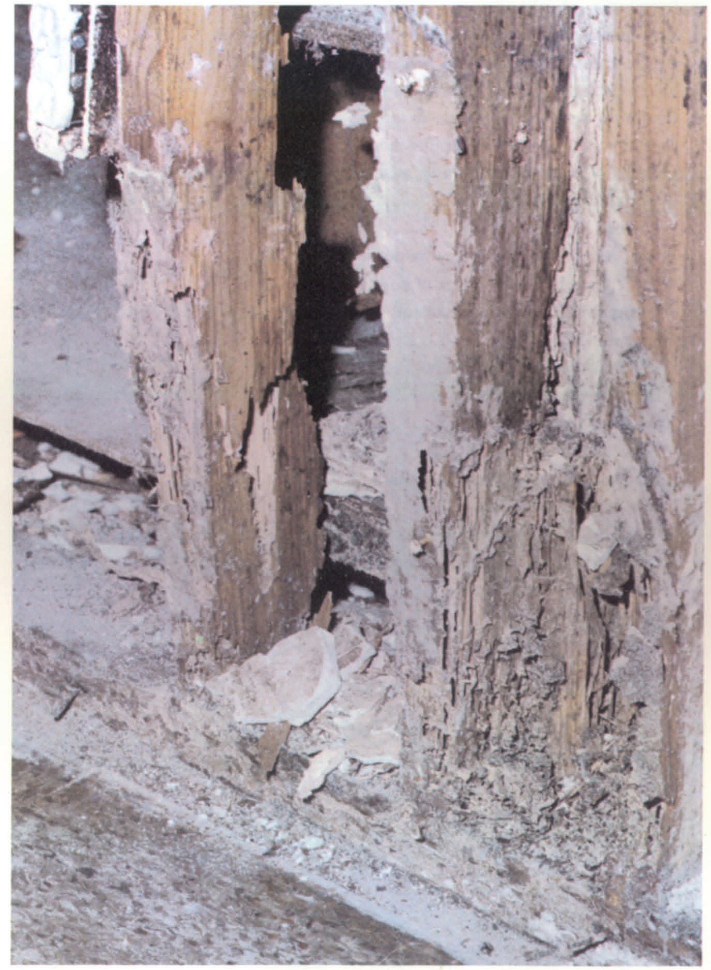
United States
Department of
Agriculture

Forest
Service

Home and
Garden
Bulletin 64

Subterranean Termites—

Their Prevention and Control in Buildings



Contents

	Page
Introduction	2
Termites—biological consideration	4
Termite ecology	4
Distribution of subterranean termites	4
Biological and physical characteristics of the subterranean termite colony	6
Materials damaged by subterranean termites	9
Conditions favoring subterranean termite infestation	9
Detection of subterranean termite damage	10
Prevention of subterranean termite attack during construction	13
Good building practices	13
The building site	13
Wall and pier (crawl-space) foundations	14
Raised porches and terraces of concrete or masonry	15
Clearance between wood and soil	16
Termite shields	16
Ventilation beneath buildings	17
Exterior woodwork	18
Wood used in basements	19
Water pipes and conduits	19
Concrete slab-on-ground foundation	19
Direct control methods	23
Chemical soil treatment	23
Considerations when treating new construction	28
Naturally resistant woods	29
Chemically treated woods	29
Control of subterranean termites in existing buildings	30
Inspection	30
Sanitation	31
Chemical control	31
Other insects that damage wood in buildings	34
Precautions for use of pesticides	35
Checklist for termite problems	36

For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington, D.C. 20402

Subterranean Termites — Their Prevention and Control in Buildings

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Home and Garden Bulletin 64

U.S. Department of Agriculture
Forest Service

Washington, D.C.

Revised February 1989

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Introduction

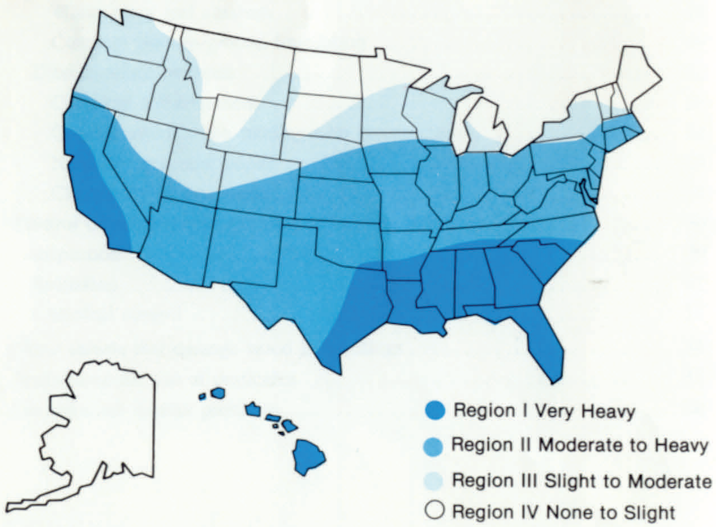
Subterranean termites are the most destructive and economically important insect pests of wood and other cellulose products. They attack wood throughout most of the United States with the exception of Alaska. They are most common, and hence cause the most destruction, in the warmer regions (fig. 1).

Although several distinct types of termites occur in the United States, the vast majority of the loss due to termites is caused by subterranean species.

Termites have a great economic impact on wood used in and around buildings. They also do considerable damage to wood used as utility poles, fence posts, or similar products. Although it is difficult to establish the exact cost of termite control, estimates range from $100 million to $3.5 billion yearly. Costs for damage repairs and chemical treatments are important considerations in any such dollar figure. Furthermore, undetected or unchecked termite damage may result in large, unreported monetary losses. The annual cost from termite damage and control efforts probably exceeds $750 million. As more houses are built, there is a greater opportunity for economic losses due to termites.

The rising costs of termite control are attributed to several factors. Poorly designed slab-on-ground construction and greater use of concrete and masonry terraces adjacent to foundation walls favor termite attack and result in increased damage to buildings. Repairs, remodeling, and landscape changes made without regard to termite prevention and control often lead to termite problems and impair the effectiveness of any prior chemical treatment.

Figure 1. — Relative hazard of subterranean termite infestations in the United States.



Preventive efforts in the planning stage and during construction may save the future homeowner much anxiety and expense. However, a cooperative effort to safeguard against termite attack is required by architects, builders, pest control operators, and homeowners in the initial stages of housing construction. Buildings should be designed and constructed to minimize moisture uptake and retention by wood. Additions or repairs to buildings or changes in landscape also should be designed to minimize the chances of termite infestation.

A combination of nonchemical and chemical prevention and control techniques offers the most effective program for subterranean termite control. Sanitation measures and chemical treatments are recommended. Proper sanitation involves removing all stumps and wooden debris from a building site before and after construction. Chemical protection involves pretreating the soil with an approved chemical. Chemical pretreatment is very important because it provides a barrier against termite movement into wooden housing parts.

Only a small percentage of the approximately 75 million single family dwelling units in the United States have been treated to control termites. Few homes are treated during construction, although this is the best and most economical course. It often is more difficult and costly to apply effective control measures after a building has become infested with termites, but a control program usually can be successfully implemented. An infested building should be examined to determine which type of termite is causing the damage, the extent of termite infestation, and the measures needed to prevent further damage. Some structures require simple physical changes, repairs, or chemical treatments that can be made by the owner. Others need major changes or complicated chemical treatments that require the services of a professional who has knowledge of termite habits and is experienced in termite control.

This bulletin suggests methods for preventing subterranean termite attack in new construction. When building or buying a new home or remodeling, you may want to check these termite prevention measures with the contractor. This publication also tells where to look for termites in existing buildings, how to recognize their damage, and how to control them by both structural and chemical means.

Termites—biological considerations

Proper termite identification and a knowledge of the species' biology are essential elements in termite control. This information provides a foundation for control methods based on the habits and behavior of the termites.

Termite ecology

In their natural habitats, termites are considered beneficial insects because they break down dead or dying plant materials, and thus they are an important part of the nutrient cycle. However, when termites feed on wooden structures, they become pests.

Based on ecological considerations, three types of termites occur in the United States: (1) drywood, (2) dampwood, and (3) subterranean. Drywood termites build their nests in sound, dry wood above ground. Dampwood species initially locate their nests in moist, decaying wood but can later extend tunnels into drier parts of the wood. Subterranean termites are more dependent on an external moisture source, and they typically dwell in the soil and work through it to reach wood above ground.

The soil provides several advantages that make it suitable as the dwelling for subterranean termites. It serves as a source of moisture that protects termites against drying out, shields termites from predators, and is used as a building material for construction of shelter tubes above ground. Termites can excavate passageways through the soil to reach food sources. If moisture is available from a source other than soil, subterranean termites may not require connection to the soil. Thus, isolated, aboveground infestations may occur in homes where subterranean termites have access to water from condensation, leaking pipes, roofs, or other sources.

Distribution of subterranean termites

Subterranean termites are found throughout the tropical and temperate parts of the world but they predominate in the tropical and subtropical regions. In the United States, they occur in greatest numbers throughout the Southeastern States and in southwestern California. The relative hazard of termite infestations tends to decrease as one moves northward (fig. 1). In any specific locality, however, termite hazard may vary greatly depending on factors such as soil type, moisture, and construction practices.

Subterranean termites probably have existed throughout their present range for millions of years. Most of the termite damage in the United States is caused by native species. There is no evidence of the general introduction or spread of termites from the tropics to the United States or of widespread movement of any of our native species from the Southern to the Northern States. Infestations in buildings, particularly in the Northern States, have become more common with the general adoption of central heating units; heated basements also enhance termite activity around struc-

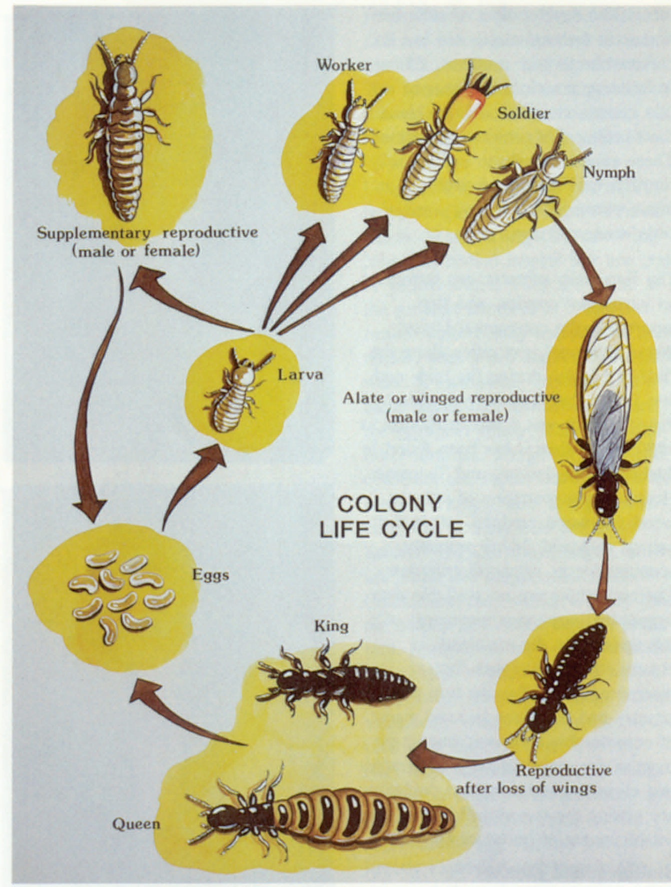


Figure 2. — Typical subterranean termite life cycle.

tures. The development of suburban homes in forested areas also has increased the termite problem. Changes in building practices and uses of certain construction materials increase the likelihood of termite infestations. These situations help to explain why termites have become a problem in areas where formerly they were of little economic importance.

The Formosan subterranean termite, an introduced species, was first reported in the continental United States in several port cities along the Gulf of Mexico during the mid- and late-1960's, but it is not yet widely distributed. It was found in Florida in 1980. Since then it has been found in Alabama, Mississippi, and Tennessee. However, transportation of infested wood and wood products rather than natural dispersal flights probably accounts for its patchy distribution. Currently there are no available data suggesting long-range movement of this species on the mainland. In Hawaii, this termite was first discovered soon after the turn of the century and has since become a pest of considerable economic impact on most of the major islands. Geographic and climatic conditions and predators are among the factors influencing the establishment of introduced species.

Biological and physical characteristics of the subterranean termite colony

Termites are social insects that live in highly organized colonies. Each colony is composed of individuals that have different physical features (fig. 2) and/or behavioral

3(A)

3(B)

Figure 3. — Three castes are found in colonies of the eastern subterranean termite: (A) worker, (B) soldier, and (C) winged reproductive

3(C)

4

Figure 4. — The body of the female reproductive is greatly expanded with developing eggs.

roles. Three major types of individuals are found in this caste system: workers, soldiers, and reproductives. The species of termite can be determined by physical characteristics of the soldier and winged reproductive.

Behavioral and physical characteristics distinguish the different termite castes. Workers (fig. 3A) are wingless, soft-bodied insects that are gray or yellow-white. They are found in the greatest numbers in a subterranean termite colony and are the ones usually seen when a piece of infested wood is examined. The duties of these sterile individuals are to care for eggs and young, feed and clean other termites, forage for food, and construct and repair shelter tubes and other workings. This is the termite caste that actually eats the wood. Soldiers (fig. 3B) have larger, brownish heads and longer mouthparts (mandibles) than workers. They guard the colony and defend against predators. Reproductives, or sexual adults, have black or yellow-brown bodies. They have two pairs of long, whitish, translucent wings of equal size at the time they disperse from a colony (fig. 3C), but they shed their wings soon after flight. With increased age, the body of a functioning female reproductive (fig. 4) may become greatly expanded with developing eggs and she will attain a size several times that of workers.

Winged ants often are mistaken for winged termites, but characteristics that can be seen with the unaided eye will help differentiate the two insects.

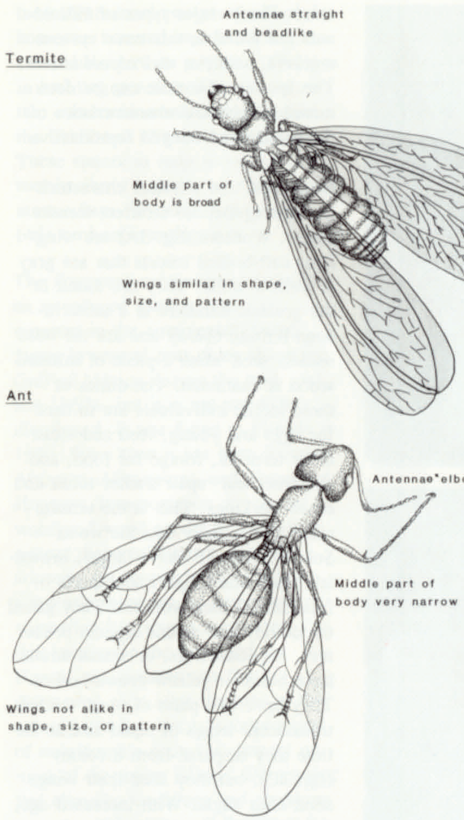


Figure 5. — Physical characteristics distinguish winged ants and termites.

Ants have two pairs of transparent wings of unequal size; termites have four equal-sized wings. Also, the region of the body behind the wings is "pinched" in ants but broader in termites. These and other distinguishing features are pictured in figure 5.

Ants generally have harder bodies than termites.

A subterranean termite colony is essentially self-perpetuating. When the colony is composed of a large number of individuals, a relatively

small percentage of the workers develop into winged reproductives that then fly from the workings in swarms to establish new colonies. Most winged reproductives perish during flight because they are eaten by predators such as other insects, birds, and lizards, or they die from desiccation. The time of day and year when flights occur varies with the species of termite and its geographic location. Flights often occur after the first warm days of spring following a rain, but they may occur any time of the year. In buildings with heated basements, termites occasionally fly during winter.

Males and females in the flights are referred to as kings and queens, respectively. They shed their wings after flight, and a pair excavates a cell in or near wood in the ground and then mate. Most subterranean species that occur in this country lay fewer than a hundred eggs during the first year, but egg laying increases with time. In some colonies, workers may develop into supplementary reproductives (fig. 4), which supplement the egg laying of the original queen. A colony more than 5 or 6 years old may contain several thousand termites and produce winged reproductives each year.

Materials damaged by subterranean termites

The principal food of subterranean termites is cellulose, obtained from wood and other plant tissues. Termites, therefore, feed on wooden portions of buildings, utility poles, fence posts, or any other wood product. They also damage paper, fiberboard, and various types of fabrics derived from cotton and other plants. They occasionally are found in living plants. As termites search for food, they may penetrate and damage many noncellulose materials, including plastics, although these do not serve as food sources. However, the greatest economic impact is to the wood in buildings.

Conditions favoring subterranean termite infestation

Understanding biological requirements and conditions that favor termite activities better prepares one to inspect buildings and identify potential problem areas. An important consideration is the termites' dependency on moisture. Their high moisture requirement increases the likelihood that they will maintain contact with the soil and/or locate near areas where water collects.

Subterranean termites become most abundant in moist, warm soil containing a large supply of food in the form of wood or other cellulose material. Such conditions often are found beneath buildings where there is inadequate site drainage or poor ventilation and where scraps of lumber, formboards, grade stakes, stumps, or roots are left in the soil. Once termites locate such an area, they can move into aboveground housing parts in a variety of ways. Termites invade most buildings through wood close to or in contact with the soil, particularly at porches, 6

Figure 6. — Surface of wood removed to show damage done by termites and the specks of excrement on the gallery walls.

7

Figure 7. — Wood attacked by subterranean termites has a honeycombed appearance because the workers tunnel along the softer grain of the wood.

steps, terraces, fences, or planters. Termites can easily enter small cracks or voids in foundations and concrete floors to reach wood that does not touch the soil. Termite activity is increased and prolonged, even in northern areas, when soil within or adjacent to heated basements is kept warm throughout most of the year.

Termites may eliminate their contact with the soil in cases where an aboveground moisture source is available. Damp wood near sinks, toilets, and leaking pipes and wood kept moist by runoff water, as from the roof or gutters, are prime locations for termite infestation.

Detection of subterranean termite damage

Early detection of the signs of termite infestations and subsequent control measures should enable homeowners to protect their dwellings against termites. A relatively simple, careful inspection of one's home may reveal previously undetected signs of termite activity.

Termite damage to wood often is not noticeable on the surface because workers avoid exposure to air by constructing galleries within the materials they attack. The exterior surface of the wood must be stripped away in order to see the extent of

8(A)

8(B)

Figure 8. — Shelter tubes allow termites to tunnel across exposed areas: (A) shelter tubes constructed over foundation, (B) termites within a shelter tube.

damage. Severely damaged wood may have a hollow sound when tapped. Wood attacked by subterranean termites typically is recognized by the extensive tunnels that run along the grain (figs. 6 and 7). These galleries often are covered with yellow-brown or gray specks of excrement and soil. Occasionally, termites completely honeycomb wooden timbers, leaving little more than a thin wooden shell. Subterranean termites do not reduce the wood to a powdery mass or push wood particles to the outside as do many other wood-boring insects.

In exposed areas, termites must protect themselves from the drying effects of air. Thus, earthen shelter tubes constructed over the surface of foundation walls are a typical sign of termite infestation (fig. 8A). These tubes are usually about 0.25 to 0.5 inch (0.6 to 1.2 cm) wide, and termites use them as passageways between the wood and the soil (fig. 8B). To determine if an infestation is active, shelter tubes may be broken or scraped off surfaces; then observations should be made to determine whether termites repair the damaged tubes or build new ones.

9

Figure 9. — Carton nest produced by the Formosan subterranean termite.

10

Figure 10. — Discarded termite wings may be the most obvious sign of a nearby colony.

Most subterranean termite species found in the United States usually do not construct a clearly defined nest. However, the Formosan subterranean termite often builds ''carton'' nests within walls. This carton nest is a honeycombed mass composed of chewed wood, saliva, and feces (fig. 9), which functions to retain water and protect the termites from predators. It allows this species to build aboveground nests. Although an occupied carton nest is relatively moist and pliable, abandoned nests dry and harden to a concrete-like consistency.

Large numbers of winged termites swarming from the soil or wood are often the most obvious sign of a nearby termite colony. Although flights may not be observed, discarded wings on the floor beneath doors or at window sills (fig.10) suggest that winged termites have either emerged within a building and have been unable to escape, or have emerged nearby and were attracted to lights in the house. A subterranean termite colony producing winged reproductives is considered to be well established and usually contains at least several thousand colony members. In six field colonies collected during April 1981 in Mississippi, the mean number of subterranean termites was approximately 240,000, and all colonies contained winged reproductives.

Prevention of subterranean termite attack during construction

The best and least expensive time to protect against subterranean termites is during the planning and construction of a building. This has been learned through research on the habits and behavior of termites and through experience in their control.

Improper design and construction of buildings, resulting either from a lack of knowledge of or indifference to the termite problem, are favorable to infestation. It is therefore important to use good building practices and chemical soil treatments during construction.

Good building practices

The building site—All roots, stumps, and other wood debris should be removed from the building site before starting construction. Burying such material will only increase the probability of an infestation. Wooden spreader sticks and grade stakes should be removed before the concrete hardens. Formboards and scraps of lumber also should be removed before filling or backfilling around the completed foundation. Wood should not be buried beneath porches and steps (fig. 11). No scraps of lumber should be left on the soil surface beneath or around the building after construction.

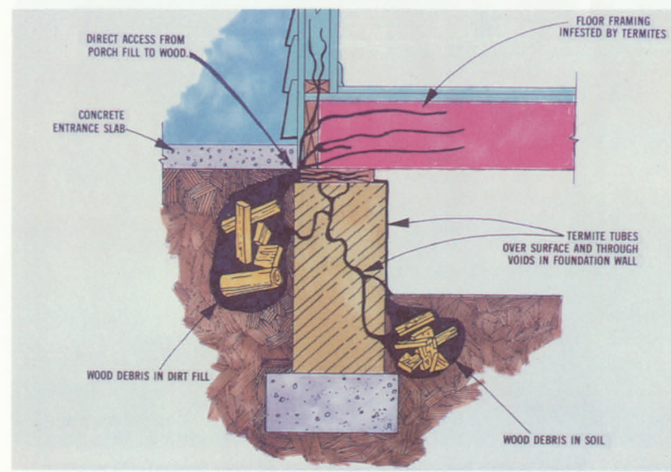


Figure 11. — Termite colonies can develop in wood debris or soil and gain entrance into a building, particularly at the concrete entrance slabs of porches.

To prevent an unfavorable moisture buildup in the soil beneath a building, the soil surface around the building should be sloped so that surface water will drain away from it. Gutters and downspouts attached to eaves can help remove water quickly. Where there are problems of poor surface drainage, as on flat sites or around buildings with basements, the use of drainage tile around the outside of the building foundation may prove helpful.

Wall and pier (crawl-space) foundations—All foundations should be made as impervious to termites as possible to prevent hidden attack on the wood above. The proper construction of foundations is one of the most important measures that can be taken to protect against termites and should be considered very carefully. Crawl-space foundations may be rated in the decreasing order of relative resistance to penetration by termites as follows:

1. Poured concrete wall and pier foundations (fig. 12), properly reinforced to prevent large shrinkage or settlement cracks. Cracks 0.03 inch (0.8 mm) or more in width permit the passage of termites.

2. Hollow block or brick wall and pier foundations:

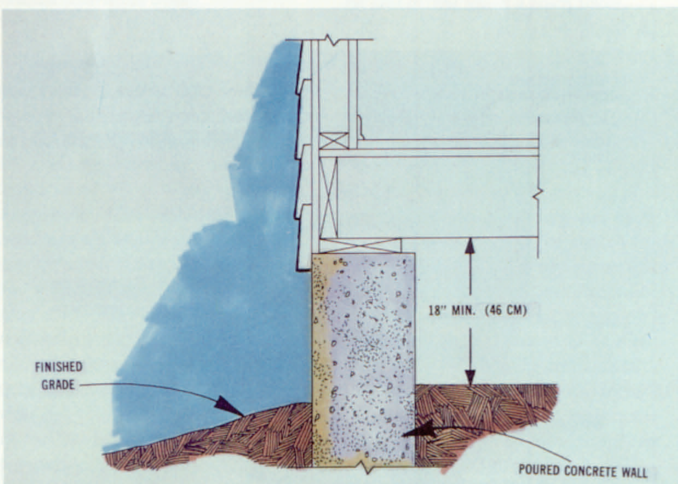


Figure 12. — Poured concrete foundation walls or piers that are easily inspected offer protection against hidden termite infestations.

   a. Capped with a minimum of 4 inches (10 cm) of reinforced poured concrete (fig. 13).
   b. Capped with precast solid concrete blocks, all joints completely filled with cement mortar.
   c. Top course of hollow blocks and all joints completely filled with concrete. Where hollow blocks remain open no protection is provided unless all voids are chemically treated.

3. Wooden piers, or posts used for foundations or piers, pressure-treated with an approved preservative by a standard pressure process.

Raised porches and terraces of concrete or masonry—Dirt-filled porches and terraces contribute to a large proportion of all termite infestations in buildings. Therefore, spaces beneath concrete porches, entrance platforms, and similar raised units should not be filled with soil. Such spaces should be left open with access doors for inspection. If this cannot be done, or if the spaces beneath such raised units must be filled, leave 6 inches (15 cm) of clearance between soil and wood and thoroughly treat the soil with an approved chemical (see section on chemical soil treatment, pages 23–28).

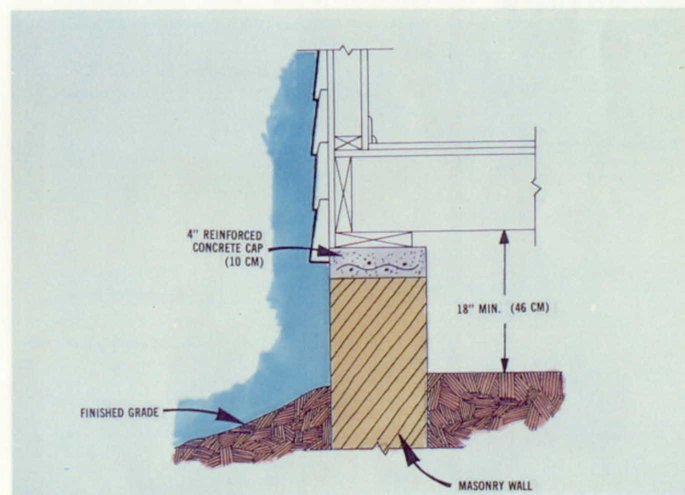


Figure 13. — A reinforced poured concrete cap on masonry walls or piers prevents hidden attack by termites. A minimum clearance of 18 inches (46 cm) under the floor joists will allow inspection for termite tubes or possible cracking of the cap.

Clearance between wood and soil—The outside finished grade should always be equal to or below the level of the soil underneath the structure (fig. 12, 13, 14) so that water is not trapped underneath the house and the foundation wall is exposed and can be inspected. Outside siding should not extend more than 2 inches (5 cm) below the top of foundation walls, piers, and concrete caps, and should be at least 6 inches (15 cm) above the outside grade. This will force termites into the open where their tunnels can be seen before they reach the wood. In crawl spaces the minimum clearance between the ground and the bottom of floor joists should be 18 inches (46 cm); such clearances for beams and girders should be 12 inches (30 cm) (fig. 14).

Termite shields—Metal termite shields (fig. 15) have been used to prevent hidden termite entry, particularly as a replacement for the concrete cap or other methods of sealing unit masonry foundations. If properly designed, constructed, installed, and maintained, shields will force termites into the open, revealing any tunnels constructed around the edge and over the upper surface of the shield. Experience has shown that very few shields are properly constructed and installed and that homeowners usually fail to inspect shields frequently enough to detect termite infestations. Therefore, termite shields are not presently recommended for detection and prevention of termite infestations.

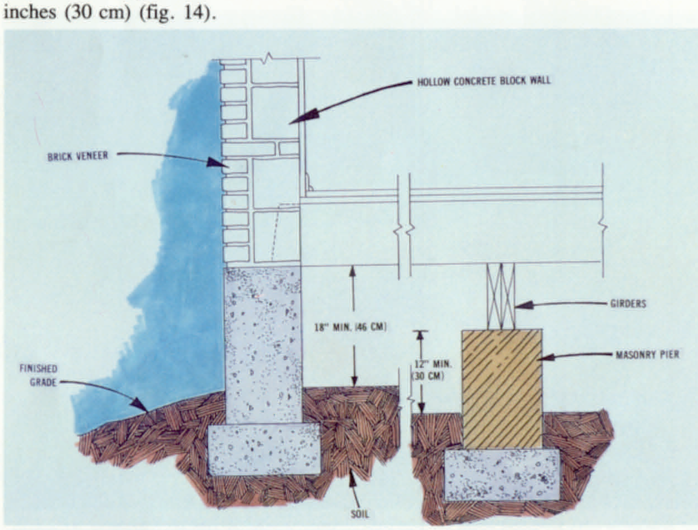


Figure 14. — Where the superstructure of a building is masonry, provide for adequate clearance between wood and soil both outside and inside the building.

Current research is aimed at the possibility of using certain plastics as shields. Termites tunneling over the shields, the need for frequent inspections, and improper construction and installation of shields are problems to be solved.

Ventilation beneath buildings—Ventilation openings in foundation walls beneath buildings with crawl spaces should be large enough and distributed so as to prevent dead air pockets from forming. Such pockets would give rise to humid conditions conducive to termite activity and wood decay. Openings placed within 10 feet (3 m) of the corners of buildings usually give the best cross ventilation. The openings need not be placed on the front side of a building if unventilated areas can be avoided. The size and number of openings depend on soil moisture, atmospheric humidity, and air movement. In general, the total area of ventilation openings should be equivalent to 1/150th of the ground area beneath dwellings. Shrubbery should be kept far enough from the openings to permit free circulation of air, and far enough from the foundation to allow inspection of wall surfaces for the presence of termite tubes.

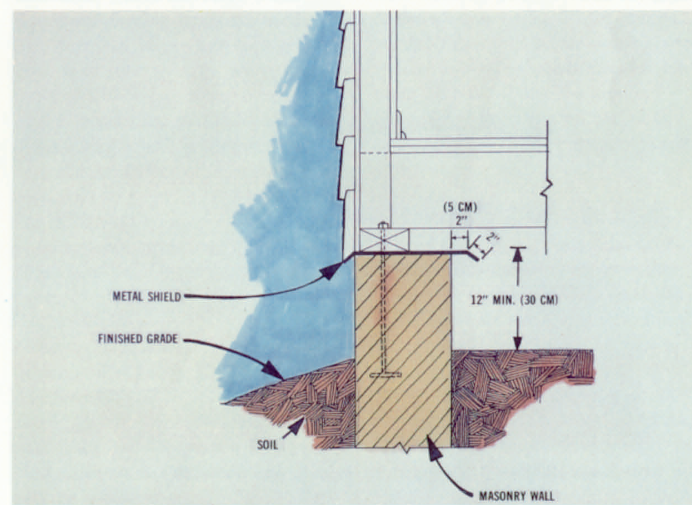


Figure 15. — Termite shield over uncapped masonry wall showing minimum clearance from ground on both inside and outside of foundation.

Exterior woodwork[1]—

Wooden porches and steps.—Porch supports, such as piers, adjacent to a building should be separated from the building proper by 2 inches (5 cm) to prevent hidden access by termites. Wooden steps should rest upon a concrete base or apron which extends at least 6 inches (15 cm) above the grade (fig. 16).

Door frames.—Door frames or jambs should never extend into or through concrete floors.

Windows below grade.—Where window frames or other openings near or below outside grade are made of wood, the foundation wall surrounding the wood should be made impervious to termites. The bottom of the window well should be at least 6 inches (15 cm) below the nearest wood.

Skirting between foundation piers.—Where pier foundations are used, it is sometimes desirable to close the spaces between the piers wih lattice or wooden skirting. If this is done, the woodwork should be separated from the piers and soil by at least 2 inches (5 cm).

[1]Certain units of exterior woodwork are susceptible to decay and should be treated with a preservative. For information on wood preservation see pages 29 and 30.

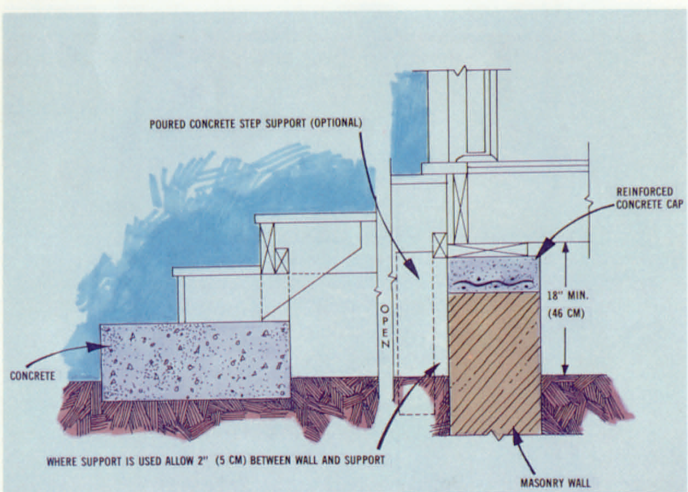


Figure 16. — Construction of wooden steps of porch to prevent hidden termite attack.

Wood used in basements—

Partitions and posts.—Install wooden basement partitions, posts, and stair carriages **after the concrete floor is poured**. They should never extend into or through the concrete. Concrete footings that extend at least 3 inches (8 cm) above the floor level should be used under wood posts, partitions, stair carriages, and under heating units and other load-bearing points. Use reinforced concrete because the concrete may crack, providing entrance points for termites.

Basement rooms. — Termite infestations in basement rooms are very difficult to detect and control. Such situations exist commonly in finished basements where untreated wood floors and furring strips are used. The best way to prevent such infestations is to treat the soil below the basement floor and along the outside of the foundation, preferably before the foundation and basement floor are constructed. Effective termiticides are discussed on page 23. Pressure-treated lumber should be used for wood screeds, subflooring, and furring strips because of the danger of decay (see pages 29 and 30).

Girders, sills, and joists. — Wooden girders, sills, and joists that are in or on foundation walls in basements should not be placed below the outside grade level. Termites may find hidden access to this wood and it may be subject to decay. Because of the difficulty of replacing girders, sills, and joists, it is a good practice to use preservative-treated lumber for these structural members. Termites generally will not eat wood treated with preservatives, but they will tunnel over treated wood to reach untreated wood.

Water pipes and conduits — Keep all plumbing and electric conduits clear of the gound in crawl spaces. Suspend them from girders and joists where possible. Do not support them with wooden blocks or stakes connected to the ground because termites will tunnel through these wood supports or construct tubes over them to the sills, floors, and joists above. Chemically treat the soil around plumbing extending from the ground to the wood above. Where pipes or steel columns penetrate concrete slabs or foundation walls, fill the spaces around them with either dense cement mortar or roofing grade coal-tar pitch after the soil around the pipe or column has been treated chemically. See pages 23–28 for treatment procedures.

Concrete slab-on-ground foundation — One of the most susceptible types of construction, and one that often gives a false sense of security, is the concrete slab-on-ground foundation. Termites can gain access to the building over the edge of the slab, through expansion joints, openings around plumbing, and cracks in the slab. Infestations in buildings with this type of construction are very difficult to control.

Because slab-on-ground construction is extremely susceptible to termite attack, and infestations are very difficult to control, **treat the soil with chemicals before pouring the concrete**. Such soil treatments, properly applied, will protect a building for many years and are much less expensive than remedial treatments at a later date. Foundations with sub-slab duct work should be treated by a professional pest control operator.

Do not leave any untreated wood such as forms, scraps, grade stakes, or wood plugs in or beneath the slab. Reinforce the slab at all points where it is likely to crack.

Termites can penetrate some types of slabs more easily than others. The **monolithic type** (fig. 17) provides the best protection against termites. In this type of construction the floor and the footing are poured in one continuous operation, eliminating joints or other structural features which permit hidden termite entry.

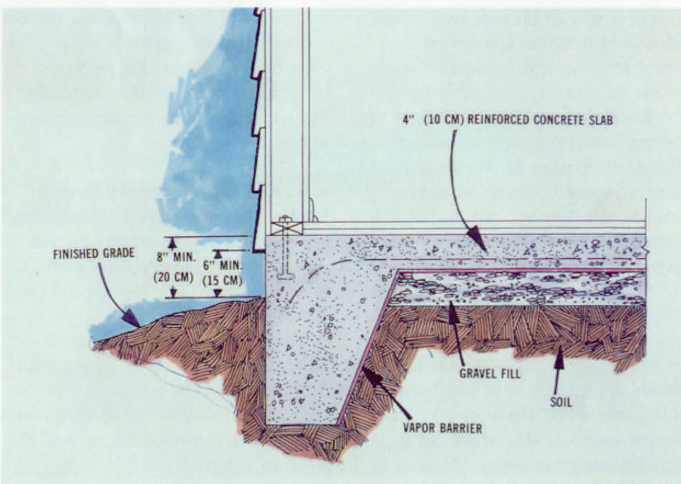


Figure 17. — Monolithic concrete slab-on-ground construction.

A second type is the **suspended slab** (fig. 18) which extends completely across the top of the foundation. Here the slab and the foundation are constructed as independent units. This prevents hidden termite attack because even though a vertical crack may develop in the wall, termites still must tunnel over an exposed part of the concrete slab. The lower edge of the suspended slab should be open to view. With the monolithic and suspended slabs, the top of the slab should be at least 8 inches (20 cm) above grade.

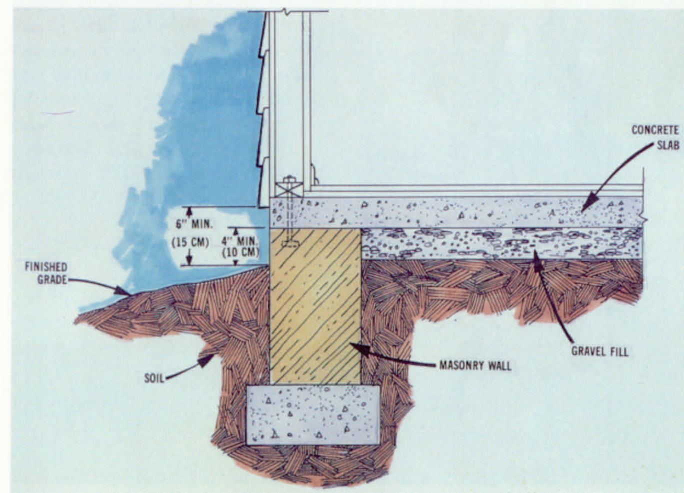


Figure 18. — Suspended concrete slab-on-ground construction.

A third type is the **floating slab** (fig. 19). It may either rest on a ledge of the foundation or be independent of it. In both instances the slab is in contact with the ground. This is the most hazardous of the three types of slabs because the slab edges come in contact with the foundation walls, and termites may gain hidden access to the wood through expansion joints.

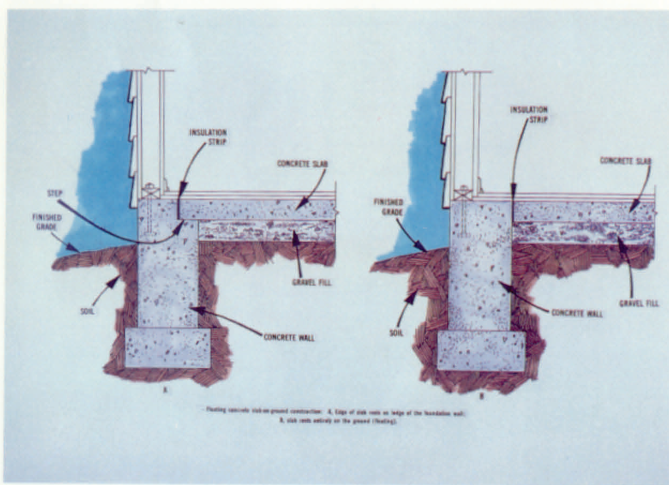


Figure 19. — Floating concrete slab-on-ground construction: (A) edge of slab rests on ledge of the foundation wall, (B) slab rests entirely on the ground (floating).

Direct control methods

Chemical treatment of the soil around and under the foundation is one of the prime methods of preventing termite attack. This should not be used as a substitute but should supplement good building practices. Chemically treated and naturally resistant woods can reduce the susceptibility of wooden structures to termite attack.

Chemical soil treatment — Insecticide-treated soil serves as one of the most important means of isolating a building from termites. Soil treatment is most effective when done before and during construction of the foundation. It is particularly important when using concrete slab-on-ground construction.

Several chemical formulations are registered with the Environmental Protection Agency for treating soils to prevent or control subterranean termite infestations. The termiticides currently most often used are: chlorpyrifos (Dursban® TC), cypermethrin (Demon® TC), fenvalerate (Tribute®), isofenphos (Pryfon™ 6), and permethrin (Dragnet® or Torpedo®). All of these termiticides can be purchased by certified pesticide applicators and used under their supervision, but only chlorpyrifos can be purchased and used by homeowners in some States.

Preparation of chemical solutions. A soil chemical is economical and most easily prepared when purchased as a **liquid concentrate.** The concentrate is formulated according to the percentage, or weight in pounds per gallon, of the toxicant it contains. Each concentrate contains an emulsifier to make it mixable with water and *must be diluted before use.* Directions are given on the container for diluting the concentrated solution to the desired strength. The label should be followed carefully.

The recommended concentrations of the final dilutions are: chlorpyrifos, 1.0 percent; cypermethrin, 0.25 to 0.5 percent; fenvalerate, 0.5 to 1.0 percent; isofenphos, 0.75 percent; and permethrin, 0.5 to 1.0 percent.

Rates and methods of application. The objective of chemically treating soil is to provide a continuous barrier in soil surrounding the building foundation. The chemical must be applied thoroughly and uniformly to block all routes of termite entry. This requires that treatment be applied around all pipes and utility conduits that contact the soil or wood. Any of the previously mentioned termiticides is effective. The rates and methods of application vary with the type of construction and the area to be treated as follows:

1. Slab-on-ground construction. — This type of construction should be pretreated. Soon after the dirt or gravel fill has been put in place and tamped, treat the fill with the chemical **before the concrete slab is poured**. The chemical may be applied either with a power sprayer or a tank-type garden sprayer using low pressure to avoid misting.

a. Apply 1 gallon (4 liters) of diluted chemical per 10 square feet (1 m^2) of area as an overall treatment under slab and attached slab porches, carport, garage, and terrace where the fill is soil or unwashed gravel (fig. 20).

b. Apply 1.5 gallons (6 liters) of diluted chemical per 10 square feet (1 m^2) of area where the fill is washed gravel or other coarse absorbent material, such as cinder.

c. Apply 4 gallons (15 liters) of diluted chemical per 10 linear feet (3 m) to the fill in critical areas under the slab, such as along the inside of foundation walls, along both sides of interior partition walls, and around plumbing.

d. Treat voids in masonry blocks or foundations. If voids are inaccessible, drill holes near the footing and inject a chemical to form a continuous barrier. Apply 2 gallons (8 liters) of diluted chemical per 10 linear feet (3 m) of wall or foundation (fig. 21).

20

Figure 20. — Chemical treatment of the fill material prior to pouring a concrete slab protects wood in the building from termite attack.

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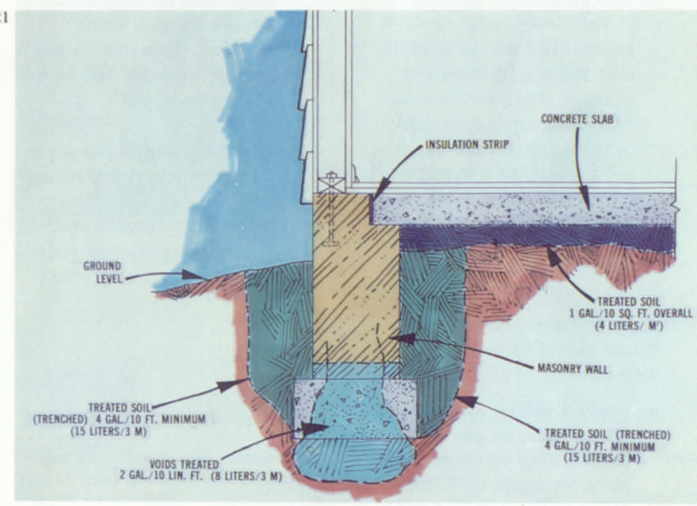


Figure 21. — Application of chemical to slab construction.

e. After the slab is poured, dig a trench 6 to 8 inches (15 to 20 cm) wide along the outside of the foundation including porches and patio (fig. 22). Where the top of the footing is more than 12 inches (30 cm) deep and where large volumes of chemical must be applied, make holes about 12 inches (30 cm) apart in the bottom of the trench to the top of the footing, using a crowbar, metal rod, or grouting rod. These holes will permit better distribution of the chemical by providing access to the soil at depths below the trench. The holes may need to be closer together in hard-packed clay soils than in light sandy soils. Apply 4 gallons (15 liters) of diluted chemical per 10 linear feet (3 m) of trench for each foot (0.3 m) of depth from grade to footing. Refill the trench and saturate the soil with chemical. Finally, place a thin layer of untreated soil on top of the treated soil.

2. ***Crawl-space houses.*** — The soil under and around crawl-space houses should be treated as follows:

a. Apply 4 gallons (15 liters) of diluted chemical per 10 linear feet (3 m) of trench along the inside of all foundation walls (including porches and patio) and along all sides of interior supports and plumbing (fig. 23).

b. Dig a trench 6 to 8 inches (15 to 20 cm) wide along the outside of the foundation including porches, patio, etc. Where the top of the footing is more than 12 inches (30 cm) below the surface, rod to the top of the footing (fig. 24). The holes may need to be closer together in hard-packed clay soils than in light sandy soils. Apply 4 gallons (15 liters) of diluted chemical per 10 linear feet (3 m) of trench for each 12 inches (30 cm) of depth from grade to footing. After rodding, refill the trench and saturate the soil with chemical. Then place a thin layer of untreated soil on top of the treated soil.

c. Apply 1 gallon (4 liters) per 10 square feet (1 m²) of soil surface as an overall treatment only where the attached concrete platform and porches are on fill or ground.

22

Figure 22. — Application of a chemical to soil around the foundation.

23

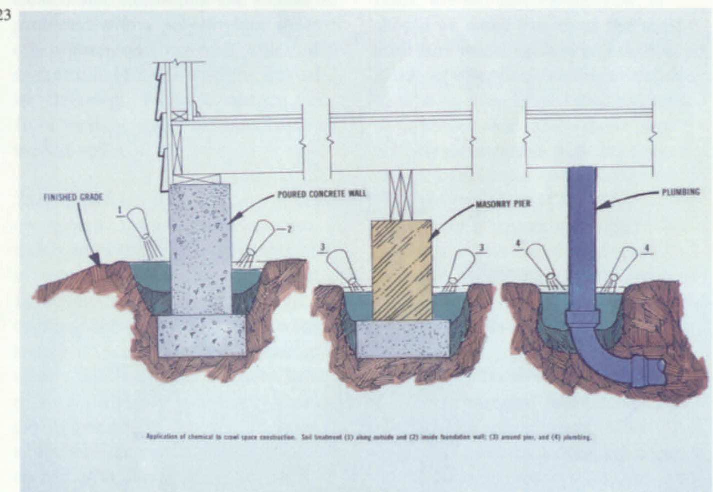


Figure 23. — Application of chemical to crawl-space construction. Soil treatment: (1) along outside and (2) inside foundation wall; (3) around pier and (4) plumbing.

***3. Basement houses.* —**

a. Treat the soil under and around basement houses with chemicals applied in the same manner as recommended for slab-on-ground construction (fig. 24).

b. Voids in masonry foundations should be treated at or near the footing with 2 gallons (8 liters) of chemical per 10 linear feet (3 m) of wall.

***4. Other types of construction.* —**

It is not possible to list in detail all the various types of construction available. However, treatments should be done according to the individual component parts, using the specifications which apply to each.

Considerations when treating new construction — The type of soil encountered at the building site and the amount of moisture present in the soil just prior to treatment will have an effect on the acceptance of liquids at the recommended rates. A soil fill will best accept a treatment when it is damp but not excessively wet or dry. If excessively wet, there is a chance of runoff, and the chemical will not penetrate the soil. In frozen or excessively dry soil the chemical solution is repelled and puddling occurs, resulting in poor distribution of the termiticide.

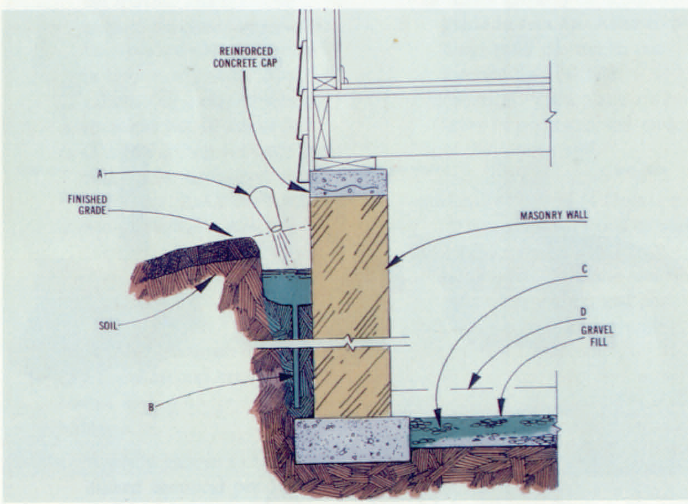


Figure 24. — Application of chemical to soil in and around a house with a full basement: (A) treatment along outside of foundation, (B) rodding from bottom of trench to top of footing, (C) treatment of fill or soil beneath a concrete floor in basement, (D) concrete slab poured after chemical has been applied.

Mechanical disturbance of treated soil breaks the continuity of the insecticide barrier and increases the possibility of termite penetration. The treatment of fill under slabs is probably less than 2 inches (5 cm) deep and the majority of the material is in the top 0.75 inch (2 cm); therefore very little disturbance to the treated soil can be tolerated. The final treatment on the ouside of foundation walls should be done **after all grading and other soil disturbance has been completed**. A freshly treated slab foundation site should be protected with a polyethylene sheet or other waterproof material, unless the concrete is to be poured the day of the treatment. This will prevent rain from washing away the insecticide or treated soil.

The termiticide is stable once it dries on the soil. Because the most commonly used termiticides are insoluble in water, leaching is not a problem. However, there is a slight risk of contaminating a well or other water supply if insecticides are applied to nearby soil that either contains layers of gravel or tends to severely crack during periods of drought. In these situations, the soil should not be treated with chemicals.

Naturally resistant woods — Untreated sapwood is usually highly susceptible to termites and has a short service life when termites are allowed access to it. However, the slow-growing heartwood of some wood species has varying degrees of termite resistance. This resistance is attributed to chemical components that are toxic and/or repellent to termites. The practice of using resistant woods in construction has been almost completely replaced in the United States by using chemicals to protect wood.

Precise ratings for termite resistance of heartwood are not possible because of differences within wood species. However, some of the most resistant species are: baldcypress, eastern red cedar, chestnut, Arizona cypress, black locust, redwood, osage orange, black walnut, and Pacific yew. It should be noted that **even the most resistant wood cannot be considered a termite barrier**. Termites are able to tube over resistant wood to attack susceptible wood. Only those parts actually constructed from such wood can be considered resistant. Generally, the use of resistant wood throughout a structure can be economically justified only when drywood termites and decay are considered serious problems and protection from them is necessary.

Chemically treated woods — Chemically treated wood safeguards against both termites and decay. The degree of protection obtained depends on the kind of preservative, the penetration achieved, and the retention of the chemical in the wood.

There is a difference in the treatability of various species and types of wood, and heartwood resists treatment more than sapwood.

The life of wood structures can often be increased five times by applying wood preservatives at standard retention rates and assuring that the wood is satisfactorily penetrated. For maximum protection, the wood should be pressure-impregnated with an approved chemical by a standard process. In less severe conditions, a vacuum treatment usually gives adequate protection. Brush, spray, or short-period soak treatments only give limited protection of wood above ground and should not be relied on to give long-term protection from termite attack.

Wood preservative chemicals and their uses are given in: (1) Federal Use Specification TT–W–571J, (2) Standard T1–49 of the American Wood Preservers Association, and (3) Standards of the National Woodwork Manufacturers' Association. As with the naturally resistant woods, termites are usually able to tube over chemically treated wood and attack untreated wood. Again, only where drywood termites and decay are major concerns should chemically treated wood be used throughout a structure.[2]

[2]Minimum Property Standards for One- and Two-Family Dwellings, HUD Manual 4900.1.

Control of subterranean termites in existing buildings

Ridding existing structures of termites and making them resistant to future infestation are major problems in termite control. Generally, buildings become infested because little or no attention was given to the preventive measures during construction that would have made the structures resistant to termites. It is in such buildings that termites cause heavy losses each year.

When controlling termites in existing buildings, observe the same principles that are recommended for the prevention of infestations during the construction of new buildings. That is, eliminate conditions favoring the development of termite colonies in the soil and permitting passage of termites to the wood within the building. Subterranean termites in the wooden parts of a building will die if they are unable to maintain contact with the soil or another source of moisture.

Inspection

Wooden structures that are in areas where subterranean termites occur should be inspected periodically for evidence of active infestation regardless of previous preventive measures. If no preconstruction measures were employed, the structure should be inspected more frequently. The best physical barriers can be breached by termites, and under certain circumstances, even insecticides may be ineffective in stopping termites. The continuity of the chemical barrier may be broken, and maintenance or repair personnel may leave a termite-prone condition after working underneath or around the structure. Even the homeowner can inadvertently disturb the treated soil or place wood on the soil against or under the building. If not cautious, the homeowner may overlook vegetation that has grown over or through the chemical barriers, providing access for termites. Settlement cracks may occur in foundation walls or concrete slabs and allow termite entrance.

With proper inspection, usually anually, very little termite damage should result before discovery. Termites typically work slowly and can be detected and controlled before causing structural weakness to the timbers. Although extreme haste is not required, **once an infestation is discovered, treatment should be applied within a few months.**

Sanitation

Sanitation and structural control measures should be given consideration in the control of existing infestations. In addition to chemical treatments, the following control measures should be used:

1. Remove all wood, including formboards and other debris containing cellulose, from underneath and adjacent to buildings with crawl spaces.
2. Remove exterior wooden structures, such as trellises, that connect the ground with the woodwork of the building. Any wood remaining in contact with the soil should be treated with preservative.
3. Replace heavily damaged (structurally weakened) sills, joists, flooring, etc. with sound wood. Where possible, remove all soil within 18 inches (46 cm) of floor joists and 12 inches (30 cm) of girders (fig. 13).
4. Fill voids, cracks, or expansion joints in concrete or masonry with either cement or roofing-grade coal-tar pitch.
5. Provide adequate drainage (see page 14).
6. Provide access for inspection of vulnerable areas (see page 15).
7. Provide adequate foundation ventilation. In some cases, a moisture barrier (polyethylene or similar material) placed on the soil can be used instead of providing additional ventilation.

Chemical control

Chemicals used to prevent subterranean termite infestations are also used to control existing infestations in buildings. The recommended chemicals, concentrations, rates of application, method of preparation, and necessary precautions are discussed on pages 23–28.

The many variations in construction prevent a detailed discussion of exact procedures for chemical treatment in all situations. However, in applying treatments, remember that **the purpose is to establish a chemical barrier between termites in the soil and wood in the structure.** Some procedures for treatment of existing buildings are as follows:

1. ***Slab-on-ground construction.*** — Termite infestations in buildings with a slab on the ground present serious control problems. It is difficult to form an effective chemical barrier in the soil beneath such floors. One way to treat under the slab is to drill a series of vertical holes about 0.5 inch (1.2 cm) in diameter through the slab, particularly at the base of partition walls and other points where the termites may be entering (fig. 25). The distance between holes is determined by the type of soil or fill material and its moisture content. However, in most cases 18 inches (46 cm) is recommended. Because a complete barrier is necessary for the treatment to be effective, the chemical injected into each hole must meet with that injected in adjacent holes. The advantage of vertical drilling and injecting is that the chemical will flood and cover the surface of the soil.

Another way to treat under slabs is to drill horizontally through exterior foundation walls to the soil just beneath the slab and inject the chemical in the holes. This method is complicated, requires special equipment, and should only be performed by a professional pest control operator. Extreme caution should be taken to prevent drilling into plumbing, electric conduits, or heating ducts that may be imbedded in concrete. **Injection of termiticides into these areas must be avoided.** Always treat along the outside of the foundation (see page 26).

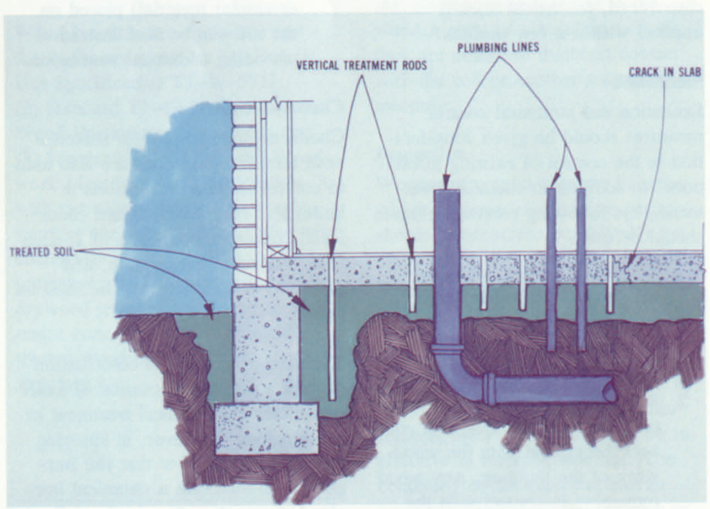


Figure 25. — Treatment under concrete slab with vertical rodding at joints, cracks, and openings around plumbing.

2. ***Crawl-space construction.*** — Buildings with crawl spaces usually can be treated easily and effectively. The procedures recommended for pretreatment can also be used for termite control in existing buildings (see page 26).
3. ***Basement construction.*** — Treat the soil along the outside walls of basements (see page 28).
4. ***Raised porches, terraces, and entrance slabs.*** — Termite infestations frequently occur at porches, terraces, and entrance platforms. The most satisfactory way to control infestations at these locations is to excavate the soil adjacent to the foundation wall, remove all wood debris, and apply a chemical to the soil as recommended. Place an access panel over the opening to permit inspection. Alternatively, holes may be drilled either through the adjacent foundation wall from within the crawl space or basement, or through the entrance slab. Chemicals should be injected to form a continuous barrier.
5. ***Buildings with wells.*** — Where wells are located close to or within foundation walls, the same principles of termite control apply as are recommended for their prevention. However, greater care must be exercised when using chemicals to form a barrier. Although the presently recommended termiticides are not very water soluble once they have dried on the soil, treated soil can be physically moved so as to carry the chemical into the well.

Other insects that damage wood in buildings

Other insects attack wood in buildings, and their damage may be mistaken for that caused by subterranean termites. The insects most commonly involved are drywood termites, wood-destroying beetles, carpenter ants, and carpenter bees. The work of these insects differs from that of subterranean termites in that the wood they attack is converted to either compressed pellets, powder, or shredded fibers. In contrast, subterranean termites leave small, grayish-brown specks of excrement in excavated areas. Subterranean termite galleries follow the grain of the wood, whereas the tunnels of most of the other insects mentioned usually cut across the grain.

Precautions for use of pesticides

Pesticides used improperly can be injurious to humans, animals, and plants. Follow the directions and heed all precautions on the labels.

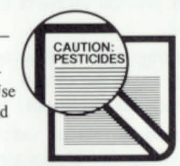
Store pesticides in original containers — out of reach of children and pets — and away from foodstuffs.

Apply pesticides selectively and carefully. Do not apply a pesticide when there is danger of drift to other areas. Avoid prolonged inhalation of a pesticide spray or dust. When applying a pesticide it is advisable that you be fully clothed.

After handling a pesticide, do not eat, drink, or smoke until you have washed. In case a pesticide is swallowed or gets in the eyes, follow the first-aid treatment given on the label, and get prompt medical attention. If the pesticide is spilled on your skin or clothing, remove clothing immediately and wash skin thoroughly.

Dispose of empty pesticide containers by wrapping them in several layers of newspaper and placing them in your trash can.

NOTE: Registrations of pesticides are under constant review by the Federal Environmental Protection Agency. Use only pesticides that bear the EPA registration number and carry directions for home and garden use.



Checklist for termite problems

1. Cracks in concrete foundation. These give termites hidden access to your house.
2. Posts in concrete. If they go all the way through the concrete to the soil underneath, they invite termite attack.
3. Earthfilled porches. Soil should be at least 6 inches (15 cm) below the level of any wooden members.
4. Formboards. If left in place after construction is completed, they provide excellent termite food.
5. Leaking pipes or faucets. They keep the wood or soil underneath continually moist.
6. Shrubbery near air vents. Anything that blocks air flow causes air underneath house to remain warm and moist — an ideal climate for termites.
7. Debris under and around house. Pieces of wood support a termite colony and permit termites to increase in number to the point that the home is eventually attacked.
8. Low foundation walls or footings. These permit wooden members to contact the soil.
9. Brick veneer covering foundation. If bond fails, termites have hidden entrance between exterior and foundation.
10. Flower planters. If built against the house, they allow direct access to unprotected veneer, siding, or cracked stucco.
11. Wooden forms around drains. Forms left in a hole in the slab where a drain enters the building provide a direct route to inner walls.
12. Porch steps on ground. Steps in contact with soil literally offer termites a stairway to your home.
13. Area around heating unit. Soil here is kept warm year-round, which accelerates termite development.
14. Paper collars around pipes. Paper is made of wood, which is the termite's food source.
15. Trellises. If a trellis touches the soil and is connected to the house it provides a direct link for termites from soil to wood.

Appendix B

Termite Pre-Treatment Notification Form

Nevada Department of Agriculture

Termite Pretreatment Notification

NOTIFICATION OF INTENT TO CONDUCT PRECONSTRUCTION TREATMENTS

PEST CONTROL COMPANY INFORMATION			
*Company Name:		*Date form submitted:	
Contact:		Company Number:	
E-Mail Address:		*Phone/Extension:	

APPLICATION DETAILS

Per NAC 555.427 A complete “Termite Pretreatment Notification Form” must be submitted to the Nevada Department of Agriculture before performing a preconstruction treatment.

Indicate Application details below:

Site (subdivision) Name:			
*Location or address (including zip code)			
Major Cross Streets:		*Builder / Contractor Name:	
*Expected Starting Date:		*Expected Completion Date:	
*Number of sites that will be treated:		*Treatment Type:	☐ SOIL ☐ WOOD
*Location of NDOA Pre-treatment Tag” (green) will be placed:	☐ PLUMBING STUB-OUT ☐ INSIDE ELECTRICAL PANEL ☐ FOUNDATION WALL ☐ OTHER: ______		

NDOA USE ONLY

Date Received:	
Reviewer:	
Comments:	

Form Submission:

Nevada Department of Agriculture -- 2300 McLeod ST., Las Vegas, NV 89104
Fax 1-702-668-4567
e-mail: pretreat@agri.nv.gov

*** = Required Information per NAC 555.427**