DRY ROT
AND
ITS CONTROL

A Guide to the Biology, and
the Control of Dry Rot
using
Safeguard ProBor Boron
Preservatives

Published by Safeguard Chemicals Ltd

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DRY ROT AND ITS CONTROL

PREFACE.

The dry rot fungus, *Serpula lacrymans*, is often regarded as the 'cancer' of a building. Many myths have built up concerning what this fungal decay is capable of doing, occasionally leading to the belief that the fungus is indestructible and that the whole of the building will have to be pulled down.

However, dry rot is vulnerable to certain environmental effects and, like *all* wood destroying fungi, it has essential needs, and it is those needs that limit the extent of spread and damage that this organism can inflict. Unfortunately dry rot is a very secretive organism, favouring dark, damp stagnant conditions to develop. This is frequently why it is able to spread extensively before the damage is first noticed

'Dry Rot and its Control' sets out to describe the fungus its biology, what it can and can't do, the conditions it must have, and most importantly how it can be readily controlled with the proper combination of environmental and building considerations coupled with the *proper* use of timber and masonry preservatives.

Many people expect large volumes of chemicals to be used and that they will have to put up with the risk of any toxic effects and unpleasant odours and fumes which may be a part of the treatment.

'Dry Rot and its Control' describes the use of Safeguard ProBor 50, ProBor 20 and ProBor 10, a new series of fungicides based on boron, a naturally occurring mineral. These new products are virtually odourless and have a mammalian toxicity generally in the order as that of common household salt! Furthermore, 'ProBor' formulations are 'environmentally friendly' and have a very significant advantage over the traditional dry rot preservatives in that they are water diffusible and therefore diffuse into those areas that are particularly susceptible to dry rot and other decays, i.e., where the wood is wet; the traditional preservative will not diffuse into wet timber therefore leaving such wood at great risk of decaying.

The correct use of Safeguard 'ProBor' products as described in 'Dry Rot and its Control', coupled with good building practice, will ensure that a building will be at very little risk from further dry rot activity and yet not put the occupants or the environment at risk from the problems which can arise from the use of traditional timber and masonry preservatives.

DRY ROT AND ITS CONTROL

The wood destroying fungus, *Serpula lacrymans*, is commonly known as dry rot. However, the name ‘dry rot’ might be considered rather inappropriate since like all wood destroying fungi it requires water for germination, growth and survival. Indeed, water/dampness is the fundamental need of all wood destroying fungi plus, of course, a food source (wood); without either the fungus ceases to grow and dies.

WOOD AS A FOOD SOURCE:

FORMATION OF WOOD

Wood is a natural material being the end product of a complex chemical process, photosynthesis, which occurs in green plants (Fig. 1). Wood basically consists of boxes and tubes made of sugars which are linked together to form *cellulose*, the basic building material of plants. Chains of cellulose are laid down in different orientations and bonded by another material, *hemicellulose*. A further material, *lignin*, adds rigidity and strength. It is the arrangement of cellulose with the two other materials which give wood its characteristic properties and its ‘cellular’ structure.

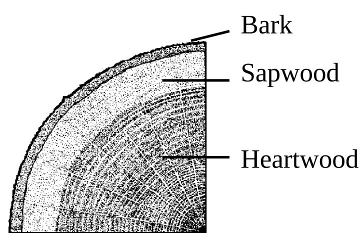
Figure 1: The formation of wood:

CARBON DIOXIDE + WATER —(photosynthesis)→ SUGARS

SUGARS → CELLULOSE, HEMICELLULOSES, LIGNIN

The wood forming the outer part of the tree is known as the *sapwood* and transports sap and stores food (Fig. 2). This is the most vulnerable part of wood to fungal decay and attack by wood-boring insects. The inner wood is the *heartwood* and forms the older wood in the centre of the tree; it does not conduct sap or store food but it does contain some excretory products and is more resistant to decay than the sapwood. It is also more resistant to the movement of water and preservatives in general. The heartwood of different timbers varies in its resistance to fungal decay and it is this heartwood resistance to decay by which timbers can be classified, i.e., non-durable, durable, etc.

Figure 2: Structure of wood



WOOD DECAY

Wood decay is basically the reverse of wood formation. Dry rot attacks the cellulose and hemicellulose of the wood to break it back down into its sugar components (Fig. 3). The sugars are respired with air to produce carbon dioxide, water and the energy for growth. However, the lignin is not metabolised and this gives rise to the darkening in colour of the wood

Figure 3: Wood decay:

CELLULOSE —(Enzymes from fungus)→ SUGARS + WATER

SUGARS + OXYGEN

↓

WATER + CARBON DIOXIDE + ENERGY

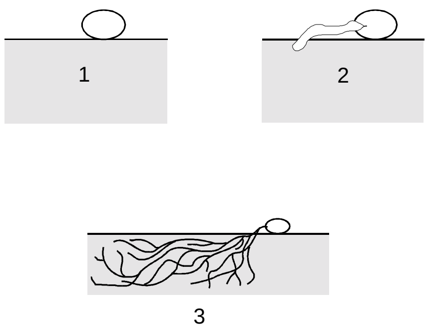
A number of wood destroying fungi other than dry rot also decay the wood in the same manner, leaving the lignin untouched. The characteristic darkening of the wood by these fungi give them the loose title of ‘brown rots’; dry rot is one of the brown rots.

When the wood is broken down and utilised for food, shrinkage, loss of weight, loss of strength and cracking occur. It is the shrinkage which causes the typical ‘cuboidal’ cracking (cracks to form small cubes) of dry rot and the other brown rots. Indeed, it is this shrinkage and cracking which is often the first signs of a problem.

THE INITIATION OF FUNGAL DECAY.

The essential requirements for any fungal decay to take place are both food and water, especially the latter at a sufficient level. Fungal decay is generally initiated in several stages.

Figure 4: Initial colonisation of wood.

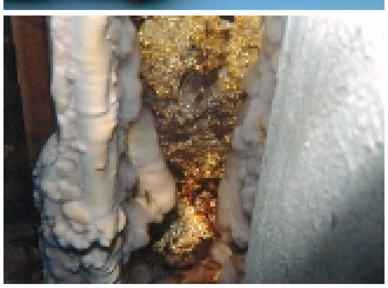


First the water penetrates the wood and this allows bacteria and micro fungi to colonise. These break down part of the cell structure but do not cause weakening of the wood. Instead, the wood becomes more porous which allows it to become even wetter. Provided that the wood is now sufficiently wet and remains wet and that other conditions are suitable the wood rotting fungi such as dry rot can colonise.

DRY ROT -- *SERPULA LACRYMANS*

COLONISATION

A minute spore of dry rot lands on wet wood and germinates (Fig. 4, 1 - 2). The first growth that emerges from the spore is known as the *germ tube*. This grows and divides to produce fine filaments, *hyphae*, which invade the timber and secrete enzymes to break down the wood (Fig. 4, 3).

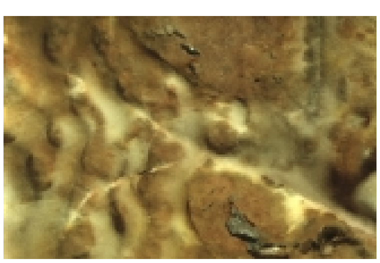


Mycelium

As the wood is broken down by the enzymes secreted by the growing fine filamentous *hyphae* the wood becomes even more porous so allowing further water to penetrate into the timber. Furthermore, the by-product of the decay process is water which can also contribute to the moisture within the wood (Fig. 2).

VEGETATIVE GROWTH

The fine filaments of fungal growth, the hyphae, develop into a larger mass, the *mycelium*, which grows into and across the damp wood. Under humid conditions the mycelium is white and cotton-wool like, and in a very humid and stagnant environment droplets of water will form on the mycelium rather like tear drops; hence the name ‘lacrymans’. These droplets are probably caused by the fungus removing excess water from the wood.

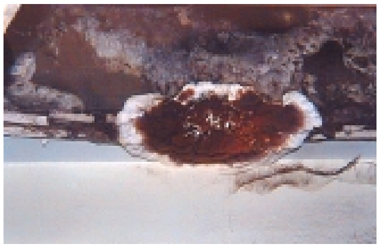


Developing strands

Under less humid conditions the mycelium forms a silky grey coloured skin which is often tinged with yellow and lilac patches. This form of the mycelium can be peeled rather like the skin on the cap of a mushroom.

Strands: Within the mycelium special thick walled hyphae develop — these are known as *strands*. They are resistant to desiccation and assume their real importance when the fungus spreads over and into ‘inert’ materials such as mortar and brick. In these situations they conduct water and nutrients to the growing hyphal tips so allowing the fungus to continue to spread over non-nutrient substrates. It is this ability to travel away from the food source, over and through inert materials allowing the fungus to reach more timber, which makes dry rot so potentially destructive.

FRUITING BODY (SPOROPHORE)



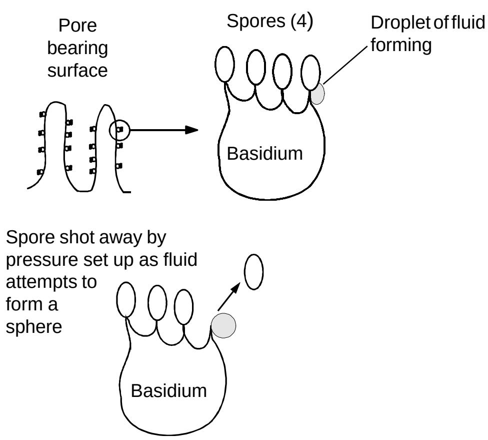
Fruiting body

When growth is usually advanced a *fruiting body* (*sporophore*) may develop. This can occur as the result of two different mycelia meeting, or the onset of 'stress' conditions such as drying out of the wood/environment. Light is also thought to be the cause of fruiting body formation in some situations.

The fruiting body takes the form of a 'fleshy pancake' or a bracket, the surface of which is covered with wide pores or corrugations. The surface is orange/ochre coloured. The corrugations form the spore bearing surface.

The spores themselves are very small (about 0.01mm), ovoid in shape and orange in colour. They develop on a structure known as the basidium, four spores to each basidium (Fig. 5). When fully developed a small droplet of fluid forms at the junction between the spore and the fine stalk on which it developed. The pressure exerted by the droplet of fluid trying to form a true sphere is sufficient to eject the spore some 20mm away from the fruiting body into the surrounding air currents for dispersal.

Figure 5: Spore formation and dispersal:



Large numbers of spores frequently collect around the fruiting body under still conditions and form the red 'dust' often visible where there is a significant attack of dry rot.

GROWTH AND SURVIVAL

It is essential to understand that water is absolutely fundamental to the growth and survival of not only dry rot but all wood destroying fungi; wood decay cannot occur, exist or survive without it!

Spore germination: To *initiate* growth from a spore the wood must be physically wet; in other words it must be subject to a source of water ingress, e.g., leaking gutters, wood in contact with damp masonry, etc. In practical terms the wood must have a moisture content in excess of 28-30%. Spores will not germinate on dry surfaces or surfaces which are not suitably wet. In other words, unless the wood is wet dry rot cannot become initiated.

Growth: Whilst timber needs to be wet for growth to be initiated, at moisture contents of around 22% existing mycelial growth ceases and the fungus will eventually die; decay just above 22% is likely to be *very* minimal. However, for practical purposes when dealing with fungal decay as a whole moisture contents of 20-22% should be taken as the threshold figure and assume moisture contents in excess of this level put the timber at risk.

The fungus flourishes under humid, stagnant conditions; hence growth tends to be secretive and hidden and is therefore often extensive before it becomes evident.

Identification of dry rot

- The wood shrinks, darkens and cracks in a 'cuboidal manner (typical 'brown' rot damage)
- A silky grey to mushroom coloured skin frequently tinged with patches of lilac and yellow colouration develops under less humid conditions. This 'skin' can be peeled like a mushroom.
- White fluffy cotton wool-like mycelium develops under humid conditions: 'teardrops' may develop on the growth.
- Strands develop in the mycelium; these are brittle when dry, and crack on bending.
- Fruiting bodies are a soft fleshy pancake or bracket with an orange.ochre surface: the surface has wide pores.
- Rust red coloured spore dust frequently seen around fruiting bodies.
- Active decay produces a musty, damp odour.

Dry rot:

Unlike other wood destroying fungi dry rot can grow significantly on and through damp masonry; under special conditions very limited growth might occur over and through dry materials. Distances in excess of 2 metres away from its food source have been recorded, and it is this ability to grow over and through inert material that can lead to significant problems of spread.

Like all wood destroying fungi dry rot flourishes in the slightly acidic conditions found in wood. But unlike the others it also flourishes under slightly alkaline conditions which explains the frequently encountered rapid growth behind and through old mortars and renders.

Growth rates of up to 4 metres per annum have been recorded; in other cases the organism may only have spread a few millimetres in the same period of time. However, Building Research Establishment give a figure of about 0.8 meters per year as a general purpose maximum growth rate (BRE Digest 299) and Coggins (1980) gives a general figure of about 1 metre per annum. Because there are large variations in growth rates, the age of an outbreak cannot be positively determined. The problem is further complicated since it is not always possible to tell if an outbreak is the result of a single outbreak or the coalescing of numerous outbreaks.

Without a source of food (wood) growth will quickly cease and the fungus eventually die. But research has shown that in the laboratory the food reserves in the mycelium may allow up to 20% growth before spread ceases. This might have important implications in control measures since it could theoretically allow the infection to pass to immediately adjacent non-infected wood even though the original food source had been removed but leaving the mycelium on, say, damp brickwork.

Survival: The spores are reported to remain viable for up to 3 years. They could therefore lay dormant until such times when conditions become suitable for their germination, that is, when any exposed wood surface on which they have landed becomes wet. The mycelium can remain viable in damp masonry at around 18-20ºC without a food source for up to 10-12 months. But under the damp, humid conditions such as found in a cellar with temperatures of 7-8ºC, the mycelium may remain viable for up to 9-10 years! If untreated wood is put in contact with damp infected masonry there is always the potential for the new wood to become infected.

THE PRINCIPLES FOR THE CONTROL OF DRY ROT

The *principals* for the control and eradication of dry rot are outlined as follows:

PRIMARY MEASURES

The most vulnerable feature of the fungus is its requirement for water, and it is the control and elimination of this essential requirement that forms the *fundamental* measure for the control and elimination of dry rot.

- Locate and rectify the source of water causing and maintaining the rot.
- Promote and maintain rapid drying conditions.

The removal of the source of water is the first point of attack. It is therefore absolutely essential to stop further water ingress. This action alone will eventually control and eliminate the activity. Indeed, it is the fundamental measure in eradicating the organism. Included in this action is the promotion and maintaining of rapid and good drying conditions.

SECONDARY AND SUPPORT MEASURES:

- Remove infected wood: the removal of the food source will relatively quickly stop the spread of growth.
- Reinstate using pre-treated timber (double vacuum/pressure impregnated as appropriate), or use inert materials such as concrete, steel, etc. Consideration should also be given to the use of preservatives for steeping joist ends prior to reinstatement.
- Spacial and physical isolation: for example reinstate timbers using joist hangers, joinery wrap. These deny the fungus a potential food source and they also prevent timbers from becoming wet.
- Contain the fungus within the masonry away from potential food sources as follows:

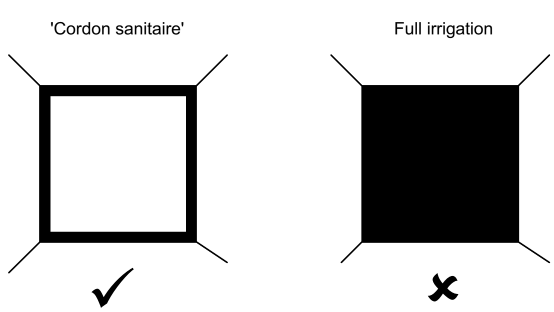
   a. Physical containment: joinery lining around adjacent timbers.

   b. Fungicidal renderings and paints: these effectively form chemical barriers. They are based on the use of zinc oxychloride (ZOC).

   c. Masonry sterilisation: This involves the application of a special water based fungicide to the masonry in the following manner:-

A surface spray with a masonry biocide is usually all that is required. However, in more severe situations a ‘cordon sanitaire’

Figure 6: Masonry treatment.



('toxic box') could be used (Fig. 6) This involves drilling perimeter of the infected area and injecting masonry sterilant into the masonry under pressure; the work is finished with a liberal surface spray or brush treatment with the sterilant

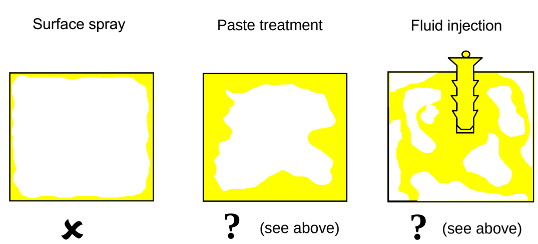
The traditional full wall irrigation using standard water based fungicides injected under pressure where the whole of the wall is drilled and injected usually introduces too many problems and is basically unnecessary. It introduces excess water into the masonry which frequently causes more damage than the dry rot. It is also unlikely that full saturation will be achieved, and it is also unnecessary use of a biocide.

- Insitu chemical treatment of timber:

a. Surface spray: These are likely to be relatively ineffective since they afford very little protection of the wood. Only the outer surface of the wood receives fungicide, the greater proportion of the timber remaining untreated (Fig. 7).

b. Conventional fungicidal pastes: Conventional pastes consist of an oil/water emulsion with the consistency of a thick 'mayonnaise'. Because of their high oil content which carries the fungicide there is the *potential* for deep penetration provided that sufficient is applied and that the wood is not too wet.

Figure 7: Insitu chemical treatments of timber:



In most situations, however, the wood is already damp and therefore at risk from decay. In such situations conventional paste preservatives are unlikely to penetrate to any great extent because of the resident moisture in the wood. Furthermore, any surface applied paste relies on diffusion to reach deep within the wood, and even with a paste preservative the levels of fungicide necessary to prevent rot are unlikely to be achieved since the highest loading remain towards the surface therefore affording little protection towards the interior (Fig. 7).

c. Fluid injection: This involves the injection of fungicides carried in organic solvents via special plastic valves driven into the wood (Fig. 7). The fluid is injected under pressure and can potentially give good distribution of the fungicide *provided* the wood isn't too wet.

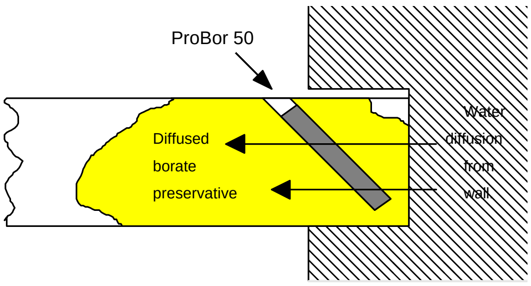
Unlike conventional paste preservatives the fluid is injected within the wood and doesn't depend on penetration from the surface. But it is likely that insitu timbers are damp/wet and when such a treatment is applied it can lead to very poor distribution of the preservative due to the presence of resident moisture.

d. Borate rods: This preservative is supplied as glass-like rods which consist of a special fusion of boron compounds; these are inserted into holes drilled into the wood. The rods are soluble in water and should timber become damp then the rod slowly dissolves and distributes the preservative by diffusion into the wet areas. Because the rod is embedded *in* the wood the preservative distributes precisely into those areas which become at risk to decay. Their use is ideal in those areas which are at risk to decay but not yet affected, e.g., embedded joist ends, window joinery, etc.

However, it must be appreciated that diffusion of the borate preservative from the rod does not take place at any significant speed at moisture contents below 26-27%. Thus, it is possible to have a situation which will propagate the spread of dry rot yet the preservative is not diffusing.

e. Safeguard 'ProBor' 20 and 50 boron preservatives: These consist of an inorganic boron preservative dissolved in a glycol. ProBor 20 Gel is a thickened liquid and is usually surface applied and ProBor 50 is a paste which can be either surface applied or preferably injected into holes in timber or into masonry by means of a caulking gun (Fig. 8)

Figure 8: The action of ProBor 50 boron paste



Like the borate rod Safeguard ProBor preservatives are water soluble and will readily diffuse into damp wood, even from the surface. But unlike the rods diffusion is significantly more rapid and efficient because the material is supplied as a water miscible liquid/paste. The glycol in which the borate is dissolved and suspended is hygroscopic thereby causing rapid mixing of the soluble borate with any resident moisture.

The nature of the Safeguard ProBor formulations also ensures that diffusion will occur in wood with a moisture content considerably lower than 20% because of the hygroscopic liquid base. This adds to the initial protective value of the treatment should the wood eventually become wetted because the preservative would have already diffused and distributed. In this respect ProBor 50 paste has the added advantage of leaving a reservoir of solid preservative after the initial rapid diffusion which will slowly dissolve and diffuse for a long period should the conditions remain damp. Indeed, a recent research paper by Holland and Orsler reporting the evaluation of *traditional paste* treatments was of the opinion that, " — treatment against wood destroying fungi — may be insufficiently effective for more severe risk situations in the longer term."

ProBor -v- Borate rod diffusion

The overall advantages of boron based preservatives, especially Safeguard ProBor formulations, are that they are designed to distribute effectively *within* timbers at risk thereby affording good protection, unlike the more conventional formulations which suffer from a distinct limitations where they are required to penetrate damp, susceptible wood.

Note: Whatever the strategy employed to control fungal decays it is essential that the primary measures are instigated immediately before deciding on the secondary and supportive chemical treatments.

All risks should be thoroughly evaluated where wood is like to remain embedded or in damp conditions, even where treated, and it is essential that in such cases the centre of the wood receives full treatment. The limitations of traditional preservatives and their application in conditions of sustained dampness must be fully understood.

CONCLUSIONS.

In considering the requirements for the growth and survival of dry rot and methods and practices for its control, *the emphasis is on attacking the essential requirements for growth and survival*.

Where chemical control is used as a support measure or to reduce the risk of decay to damp timbers it is essential that the *whole* of the area of wood at risk is treated, i.e., deep within the timber. This is unlikely to be achieved with 'conventional' preservatives. Indeed, Holland and Orsler (1992) reported in a paper to The International Research Group on Wood Preservation (Preservatives and methods of treatment) that, *"--- treatment against wood destroying fungi by this means [conventional preservative pastes] may be insufficiently effective for more severe risk situations in the longer term."*

Unlike conventional preservative pastes the boron based materials, especially Safeguard ProBor formulations, are designed to work under high risk situations, i.e., when the timbers are damp and at risk to decay. The ProBor formulations have the added advantage in that they will distribute more rapidly than the solid borate rods thereby ensuring greater potential protection and lowering more rapidly the risk of rot. This is especially important where the moisture contents for dry rot are marginal for survival -- the solid borate rods will not distribute so effectively under these marginal conditions. Furthermore, ProBor 50 also leaves a 'reservoir' of solid borate for long term diffusion and effectiveness.

The control of dry rot should be the *total* responsibility of specialist treatment companies; this includes all the attendant building works as well as any chemical treatment where deemed necessary. Fundamentally, the specialist contractor will fully understand the factors involved with the outbreak of dry rot and the significance of the control measures and associated risks. Furthermore, the use of the single specialist contractor will eliminate the problem of *'split responsibility'* where part of the required and essential work is undertaken by a third party and part by the specialist contractor. The elimination of this split responsibility certainly serves to eliminate the cause of many continued outbreaks following failure of third parties to comply fully with the instructions issued. It certainly can eliminate some potentially very expensive disputes!

A PRACTICAL GUIDE TO THE CONTROL AND ERADICATION OF DRY ROT

A guide to the eradication of dry rot using Safeguard ProBor soluble boron preservatives is outlined below. However, it must be remembered that the following details will need to be modified to suit site conditions and level of risk.

Before undertaking any work/treatment a full risk/hazard assessment must made as required under the Control of Substances Hazardous to Health (COSHH) Regulations 1988.

INSPECTION:

1) Carefully inspect all timbers, removing skirtings, floorboards, masonry, etc., to determine the extent of the infection. Test for fungal decay by prodding timbers with a screwdriver or similar instrument and carefully examine to assess depth of decay in any large dimension timbers.

2) Inspect plasterwork adjacent to decay for signs of fungal strands/mycelium. The extent of growth can be determined by removal of plaster samples. Strip off any plaster containing or suspected to contain the fungus; also examine the mortar courses for fungal growths. Flaking, bulging and damp patches an plaster should also be investigated.

3) Inspect cavity wall for spread of fungus by removal of random bricks to provide access.

4) Check ventilation to timber suspended floors and improve if necessary.

CONTROL MEASURES:

i Primary:

i) Locate and rectify the source of dampness causing the decay and identify other vulnerable areas within the property. Promote and maintain drying conditions.

The primary measures for control as described above are extremely important and form the basis for eradicating the fungal infection.

ii Secondary

Cut out and remove from site all decayed timbers together with a margin of up to 600mm beyond the last evidence of fungal decay; the actual amount removed will depend upon the extent of decay and the site conditions.

Remove all built in timbers e.g. lintels, bonding timbers etc., within the affected areas and replace with steel or concrete according to the local building regulations.

However, in many cases this might be unwarranted or too expensive. There fore the use of Safeguard ProBor 20 Gel and ProBor 50 preservatives should be used. Application details and rates are given below.

Ensure that all timber debris is removed from any damp subsite. Where dry rot is present in the subsite soil remove the top 75mm and dispose. Where this cannot be acheived, rake to a depth of 100mm after removing any debris and apply Safeguard ProBor

10 to sufficient quantity.

Replacement of timber suspended floors with solid floor should be considered if appropriate ensuring hardcore is NOT dry rot or wood contaminated.

Thoroughly clean down all exposed masonry using a wire brush to remove surface fungal growth. Thoroughly clean up and remove all dirt and debris which may contain fungal growth.

Full masonry treatment with conventional liquid sterilants is not recommended due to the attendant problems of injecting large quantities of water into masonry. It is also unnecessary and will also introduce excess biocide into the environment. Where masonry sterilisation is deemed necessary then:

(a) First rake out all mortar joints to a depth of 10-15mm; this will facilitate penetration of sterilant into the mortar and a key for subsequent replastering.

(b) Thoroughly sterilize the *surfaces* of walls using Safeguard ProBor 10 Masonry Biocide, using a coarse spray (not atomised); two to three liberal applications should be applied.

(c) Irrigation by injecting into masonry should only be undertaken to isolate an outbreak or dry rot by imposing a ‘cordon sanitaire’ (peripheral irrigation - Fig. 9); this may be undertaken in the following circumstances:

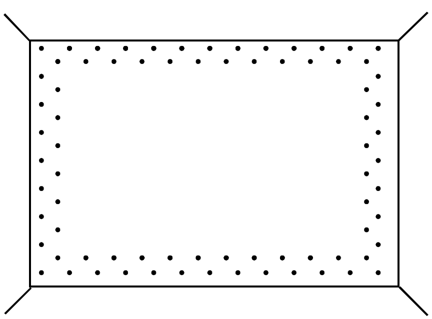
(i) between the outbreak and any timbers in close proximity not yet affected.

(ii) to isolate some built in timbers which have decayed and are not readily removable. Such timbers should also be thoroughly treated with a combination of Safeguard ProBor 20 Gel and 50 boron based preservatives.

(iii) to masonry where dry rot has become firmly established in timbers/masonry from an adjacent property.

(iv) to the base of a wall where dry rot is firmly established in infected wood beneath a solid floor.

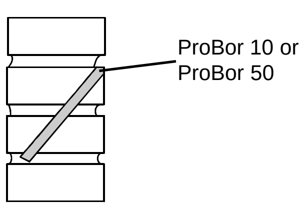
Figure 9: 'Cordon sanitaire' (peripheral irrigation)



Peripheral irrigation should only be carried out where deemed necessary to walls in excess of 130mm in thickness.

In most cases use Safeguard ProBor 10. Two to four rows of holes 10 - 14mm diameter should be drilled around the perimeter of the walls with a spacing between rows of 115 - 225mm (Fig. 9). Drill holes down through the brickwork at an angle to terminate in a mortar bed and with a spacing of approximately 230mm. Fill each hole with ProBor 10 (Fig. 10); top up holes if necessary after it has percolated into masonry. One litre of ProBor 10 should fill around 30-40 holes in a 225mm wall with a single application; double this figure for a 'top up' application. Finish with a liberal surface spray of ProBor 10 using low flooding technique using 2 - 3 passes to apply around 1 litre per 1 - 2 square metres.

Figure 10: Drilling masonry for Deepflow/ Deepwood



Alternatively, where masonry is likely to remain damp the perimeter may be drilled and Safeguard ProBor 50 injected into the holes; one cartridge should fill 10-12 holes in a 225mm wall. The surface must be treated with ProBor 10 as above.

Please note that the above figures are only a guide and may vary considerably according to the condition, nature and porosity of the substrate.

REINSTATEMENT

1) When considering reinstatement of timbers into previously infected damp walls careful consideration to the use of membranes, sleeper walls and joist hangers, in accordance with local Building Regulations, should be made. This will physically and spacially isolate the wood from damp infected masonry

2) Replaster exposed walls before replacement of woodwork. Consideration should be given to use of chemical barriers, including the use of zinc oxychloride based materials, in situations where a severe infection of dry rot has been identified; with particular reference to areas where access for treatment to both sides of masonry is not possible e.g. terrace property.

3) Replacement timbers should be pre-treated by industrially pressure impregnation, eg, tanalised timber, or similar approved method; following working any cut ends should be retreated with ProBor 20 Gel or ProBor 50 paste.

As an alternative new timbers may be first fully worked and the ends drilled using 8 - 190mm diameter holes. The ends are then steeped to a depth of at least 400mm in ProBor 20 Gel for 3 hours. ProBor 50 paste should then be applied into the holes. Joist ends should then be wrapped in suitable damp-proof membrane around their bearing ends or paint the cut ends where they are to be embedded with at least 3 liberal coats of a suitable bituminous compound and allow it to dry thoroughly. The remainder of the wood should be given liberal coats of ProBor 20 Gel.

4) All sound timber in the vicinity of the outbreak should be cleaned and thoroughly treated with ProBor 20 Gel and 50 preservatives. The extent of treatment should be assessed depending on site conditions. This treatment is especially important should the wood be sound but damp. Any embedded timbers will need to be drilled with holes of 8-10mm diameter and ProBor 50 applied in the holes and also around the periphery if possible.

In the case of embedded large dimensioned timbers or lintels it is recommended that masonry is removed to gain access to the embedded parts and these are treated with ProBor 50 paste before reinstatement of the disturbed masonry.

PLEASE NOTE:

Where timbers are to be left in situ in a damp environment they will be at risk from fungal decay. To treat these timbers it is essential that the whole of their area *and* volume receives treatment. Safeguard ProBor boron preservatives are designed to distribute well into the timbers under such conditions.

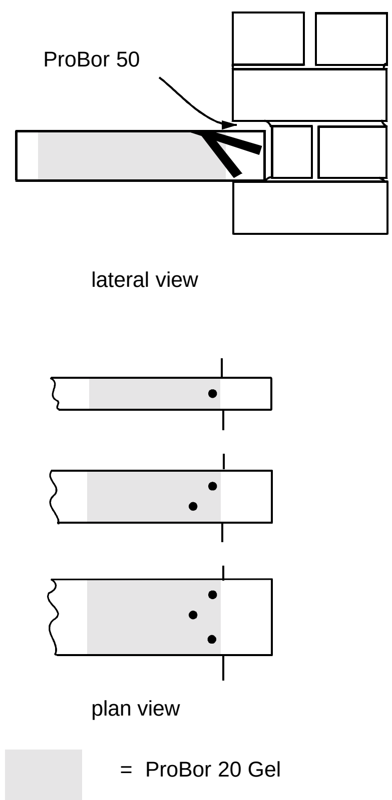
Any insitu damp timber will be at risk --whether treated or not! However, Safeguard ProBor preservatives, when applied as directed, will significantly minimise that risk.

Following works it is *essential* that the property is kept in good order and is maintained in a dry state.

APPLICATION OF PROBOR 20 AND 50 TO INSITU TIMBERS

In many cases it may be necessary, because of costs or other considerations, to leave wood in infected damp areas. Any timbers remaining in such a condition will be at risk from fungal decay. However, the correct use of Safeguard Deepwood boron preservatives will keep any risk to a minimum. It might also be considered prudent to treat those areas where dampness could appear, e.g., subfloor timbers.

Figure 11: Embedded joist ends



ProBor 20 Gel is supplied in 5 litre containers. It is a moderately viscous liquid which can be applied by brush and by dipping.

ProBor 50 is supplied as a viscous paste in plastic cartridges which fit readily in to caulking guns. An extension nozzle is also supplied to allow full application deep into holes drilled into timber and masonry.

SURFACE APPLICATION OF PROBOR 20:

Apply by brush or dipping.

Brush: Apply to wood surfaces at a rate of 1 - 2 litres per square metre; if necessary use more than one application to obtain this level of preservative application.

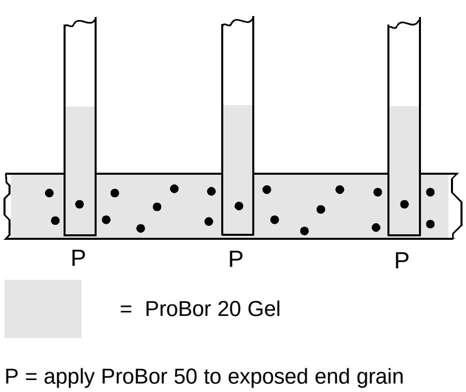
Dipping: Fully work timber before dipping. Bearing ends should be dipped at least to 400mm from their bearing ends for a minimum of 2 hours. 8 - 10mm holes may be drilled in the bearing ends to facilitate the uptake of ProBor 20 Gel within the wood during the dipping process (See ProBor 50 below). The holes may then be further filled with ProBor 20 Gel or preferably ProBor 50 before reinstatement. Dipping is considered to be more thorough than brushing, and should be used where possible.

APPLICATION OF PROBOR 50:

ProBor 50 boron paste has been cleared for use under the Control of Pesticide Regulations for both timber and masonry.

Timber:

Figure 12: Joists and wallplates



Joists and wallplates.

Warning! Always ensure that the structural integrity of the joist ends/wallplates is not compromised by drilling!

Ideally, if possible, lift the wallplate/joist and insert damp-proof membrane beneath to isolate wood from any dampness in the substrate.

If this is not possible and to give added protection then drill two holes each between 8 - 10mm diameter in the end of an embedded joist/wallplate (See Figs. 11 and 13). Where more than pair of holes is to be inserted the holes must be staggered as in Figure 11.

Figure 13: Joists on sleeper walls

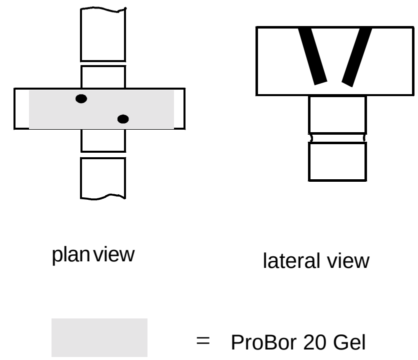


Figure 14: Lintels and embedded timbers

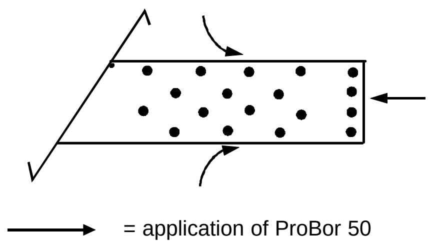


Figure 15: Window frames

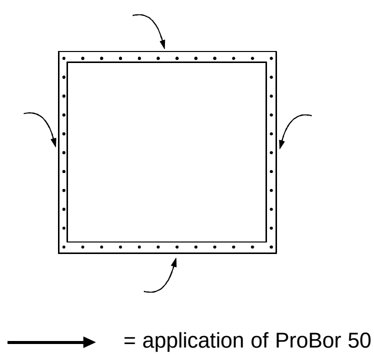
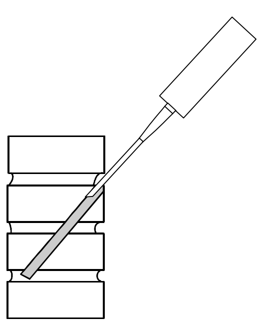


Figure 16: ProBor 50 applied to masonry



Where the whole length of a wallplate is embedded then drill a staggered pattern of 8 - 10mm diameter holes broadly as shown in Figure 12.

ProBor 50 is applied via a caulking gun into the holes by pushing down the extension nozzle to the bottom of the prepared holes and gradually withdrawing as the paste is extruded; this action ensures that the holes are fully filled.

ProBor 50 may also be applied to a surface by trowel or palette knife 3 -5mm in thickness and should cover all surfaces. This technique is especially useful following the above treatment of exposed insitu joist ends (Fig. 12) and in gaps and cracks around embedded timbers.

It is also possible to apply ProBor 50 in 'strips' of 8mm diameter from a caulking gun; these should be placed at 15 to 20mm intervals across the full width of the surface to be treated.

Lintels/embedded timbers

Drill holes 8 - 10mm diameter around the perimeter to within 10mm of the furthest face. The holes should be drilled within 25mm of the end of the lintel and follow a staggered pattern of 100mm intervals along the grain and 70mm intervals across the grain (Fig. 14). Ensure that 'end grain' is fully treated. Where possible remove masonry around the lintel/embedded wood and apply ProBor 50 paste to all exposed surfaces. The exposed face should be treated with ProBor 20 Gel.

Door frames/window frames

Warning! Always ensure that the structural integrity of timbers is not compromised by drilling.

Ideally these should be removed and the recess lined before reinstatement to prevent long term contact with damp/infected masonry. However, where this is not possible then drill holes 8 - 10mm diameter at 100mm intervals to within 15mm of far face and apply ProBor 50 by caulking gun. Plug holes following injection with short lengths of timber dowel. Where possible use ProBor 50 paste around the edges of the frames (Fig. 15)

Please Note: ProBor 50 may leave an 'icing sugar' like residue when applied to timber surfaces.

Masonry

ProBor 50 can be applied into pre-drilled holes in masonry for the control of dry rot (Fig. 16); this is recommended where walls are likely to remain damp for very long periods. The injection is undertaken by means of the caulking gun. The extension nozzle is placed down the drilled hole and the paste extruded whilst slowly withdrawing the nozzle.

GUIDE TO APPLICATION RATES OF PROBOR BORON PRESERVATIVES

The following figures should be taken as a guide only. They may vary with the condition and type of substrate.

Before use please read carefully the Health and Safety Data Sheets for ProBor preservatives.

ProBor 10

Masonry:-

Surface application:	1 litre per 1 - 2 m^2
Irrigation:	30 - 40 holes per litre in a 225mm wall

ProBor 20 Gel

Wood:-

Surface application (brush/spray):	1 litre per 1 - 2 m^2

ProBor 50

Wood:-

Surface application (trowel)	3 - 5 kilo per m^2
Holes in wood	around 25 holes of 150mm long by 8mm diameter per cartridge.

Masonry:-

Irrigation	10 - 12 holes per cartridge in a 225mm wall.