Guidance Note

Fungal Decay in Buildings

PCA
Property Care
ASSOCIATION

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Fungal Decay in Buildings

DRY ROT AND WET ROT

Dry rot and wet rots affect timber in buildings of all ages and when decay is discovered the fungus responsible should be identified and remedial action taken without delay. A variety of wood-destroying fungi attack timber due to the presence of excess moisture. The most well-known are True Dry Rot fungus - *Serpula lacrymans*, Cellar fungus - *Coniophora puteana* and Pore or Mine fungus - *Fibroporia vaillantii*. Many other species of fungi occur and affect exposed or internal timbers with some particularly linked with decay in joinery items, door and window frames.

Dry rot, *Serpula lacrymans,* is the most serious form of fungal decay of timber. It can spread into and destroy much of the timber. Wet rot occurs more frequently but is less serious. Decay is typically confined to the area where timber has become and remains wet.

Fungal decay always arises because the wood has become wet, in excess of 20% moisture content. Finding the source of dampness and eliminating the ingress of moisture, whilst promoting drying, is always necessary.

COMMON CAUSES OF DAMPNESS IN BUILDINGS

The first step after discovering fungal decay is to make a careful inspection of the building to find out how and where the water is entering. Any defect, such as a leak, must be repaired and any further water entry prevented. It is important the area is also dried out, by improved ventilation, until the wood is below 20% moisture content.

EXTERNAL INSPECTION

Roof

1. Missing, broken, displaced or loose tiles or slates.
2. Faulty flashings around chimneys.
3. Blocked gutters, especially in the hidden valleys of the roof.
4. Defects to valley gutters and flat roofs.
5. Defective gutters, downpipes and rainwater goods

External Walls

1. Deterioration of pointing/mortar in brickwork joints.
2. Cracked or defective render.
3. Cracked or broken water-pipes and waste pipes.
4. Faulty flashing around window frames and throats to sills.
5. Continuously running overflows from cisterns or water tanks.
6. Faulty or missing damp-proof course.
7. Bridging over the damp-proof course by soil in flower beds, plinths, etc.
8. Blocked air-bricks.

Ivy or other climbing plants may hide many of the above faults and roots may transfer moisture internally. Roots of nearby trees may cause damage to foundations, drainage and damp-courses.

INTERNAL INSPECTION

Look for evidence of moisture penetration where the outside inspection has identified faults and 'follow the trail'. Be aware that a number of potential causes of dampness will not be visible from the outside such as plumbing leakage.
Be particularly aware of:

1. Stone or concrete solid floors with timber skirting's and/or solid floors covered with timber where the impervious damp-proof membrane has been damaged or is of poor quality or where no membrane exists.
2. Condensation - this may be caused by: a) unlagged hot and cold water pipes, especially under floors; b) high atmospheric moisture from normal bathroom and kitchen usage. This is especially important in uninsulated and/or poorly ventilated buildings and is one cause of window joinery decay.
3. Flood-water trapped in under-floor void spaces and over concrete.
4. Toilet cisterns, either from fracture of the pan or, more commonly, defects in the plumbing unions.
5. Close-fitting linoleum, vinyl or laminate flooring laid over unventilated or poorly ventilated timber floors.

Adequate sub-floor ventilation, by means of suitable airbricks every 1.8m (approx. 6ft spacing), is important and careful attention must be given to clearing blocked air vents or improving through flow of air in sleeper walls. Pockets of dead air favour fungal growth and should be eliminated. Steps must be taken to dry out trapped residual dampness, dry down

existing moisture and prevent further entry of water in addition to the eradication of the fungus and repair of damage caused. When an extension is added to a property, especially with solid construction ground floors, it must be designed to maintain the subfloor ventilation from existing timber floors with extended (piped or alternative) forms of through flow ventilation.

WOOD-DESTROYING FUNGI

General

Outbreaks of dry rot and wet rot start in similar ways. The mature fruiting-bodies (sporophores) of wood-destroying fungi that develop during an attack produce millions of microscopic spores and these are widely dispersed by air currents. If they fall on untreated damp wood, they will germinate by pushing out a hollow tube called a hypha which grows and branches to form a mass of hyphal threads called mycelium. Mycelium develops on or within the wood and breaks down the wood for food. The timber may darken in colour and can develop into the characteristic cuboidal cracked appearance of dry rot and a number of wet rots. Some wet rots may result in bleaching of the wood; these are more common in doors and window frames. Eventually, the timber loses strength and in some situations may become structurally weakened.

The main differences between dry rot and wet rot are the degree of development of mycelium on the wood surface and the ability of the fungus to spread into other timbers via adjacent masonry. Fruiting-bodies are far more common with dry rot than with wet rots. It is important that the two types of decay are distinguished since they require different treatment. Wet rot treatment applied against dry rot is less certain of success. A dry rot treatment carried out against wet rot will be effective but will be unnecessary, costly and could be in breach of the Control of Substances Hazardous to Health (COSHH) Regulations 2002 (as amended).

Dry Rot

The mycelium of *Serpula lacrymans* develops extensively on the surface of infected timber and in still, humid conditions produces a mass of cotton wool-like growth with bright lemon-yellow patches. Water droplets produced on the surface of the mycelium has given the fungus its name *'lacrymans'* (latin for 'tears'). Lilac tinges are more common, especially in less humid situations where the surface mycelium is reduced to a thin silken grey skin.

Mycelium spreads over the timber surface by the continued growth and branching of the delicate hyphal threads with time. Thicker strands develop within the mycelium and these supply water and nutrients to the growing front as the fungus becomes established. The strands assume their real significance when the fungus spreads from infected timber onto the surface of adjacent masonry walls. The tiny hyphal threads penetrate the mortar joints and plaster layers. Therefore, large areas of damp wall can become infected. The fungus cannot derive any nourishment from the wall materials (although it is thought that calcium salts in such materials contribute to the success of the fungus in such situations). The strands, which have thick walls and are resistant to moisture loss, are able to continue to supply water and food to the growing front for considerable periods of time. The mycelium in which the strand originally developed often breaks down. In such cases, the strands alone link the food source (decaying wood) to the hyphae at the growing front and remain as the only evidence of fungal growth in the masonry wall.

In the past, it was believed that the fungus could 'wet' up previously dry areas to allow further spread, but this happens infrequently. In most instances, the fungus is restricted to areas where both timbers and walls are damp. It should be remembered, however, that the most careful examination of a building found to be suffering from dry rot must be made as the extent of dampness may not be clear and multiple sources of water may be present. The full extent of spread of the fungus *must* be determined before remedial treatment can be undertaken confidently.

The ability of dry rot to spread into fresh timber has led to damage in new buildings, for instance, when hardcore containing infected timber has been taken from old buildings and re-used as a base for new concrete floors. Mycelium can grow out from the infected timber in the hardcore and can cause damage to skirting boards and other timbers before the wet-work construction dampness has dried out. If hardcore from such buildings is used, current Building Regulations require all hardcore to be 'clean' and free from timber debris - in which case there is no risk.

Wet Rot

Many different fungi are responsible for wet rot but the most common are *Coniophora puteana and Fibroporia vaillantii.* Both of these produce decay symptoms similar in appearance to dry rot and so it is essential that they are identified correctly. Other wet rots produce decay known as white rot which is different in appearance. The most common of these is the fungus *Phellinus contiguus* which is a major cause of decay in external joinery. Each fungus has its own unique features (see table of differences) but all require similar treatment. Wet rot is typically confined to the area of dampness because the mycelium does not spread into walls but in some instances may grow over masonry. In rare instances mycelium can develop extensively and some wet rot fungi produce strands. Where there is *any* doubt, ask the advice of a reputable company (a list of PCA Remedial Treatment members can be obtained at www.property-care.org)

TREATMENT

General

When controlling dry rot and wet rots it is essential that the necessary steps to eliminate the source(s) of moisture causing the decay are carried out as part of the overall specification of repairs. This should ideally be carried out by a specialist contractor or made the responsibility of others (e.g. a general builder) and clearly stated in the specialist contractors report. In either case, this work should be carried out concurrently or within a specified period. Particular emphasis should be laid on efficient ventilation, particularly of subfloors and roof voids.

Dry Rot

Determine the extent of the outbreak.

Obtain indications of the possible extent of the outbreak by testing timbers in the vicinity of an outbreak by prodding, preferably with a bradawl or sharp pointed tool such as a screw-driver. Guidance as to the possible extent and direction of spread of fungus within walls can sometimes be obtained by observations aided by the use of an electronic moisture meter. Alternatively, moisture content measurement can be made by inserting timber dowels into holes set into damp masonry. These must be left in the wall for at least 48 hours to ensure that they reach equilibrium with the surrounding masonry.

The extent of growth of dry rot mycelium should be determined in order to ascertain the extent of risk of infection of adjacent timbers. This usually requires opening up the affected area by removal of joinery, stripping of plaster, removal of any timber fixings and lifting of floors.

In those buildings in which it is known from previous experience that no woodwork is embedded in walls, it may not be necessary to strip large areas of such plaster even though it may be thought to overlie fungus strands. It may then suffice to remove plaster for some 300mm adjacent to woodwork at risk, to confirm that no fungus has reached it. Alternatively, the spread of fungus can be determined by removal of plaster samples at intervals. Special consideration must be given to areas of solid flooring which are in contact with dry rot attack.

At the discretion of the surveyor cut out and remove decayed timber.

Whilst it is usually economic to cut away the full extent of even lightly affected building softwoods, there are special cases, for example durable timbers (both hard and soft woods) in which the removal of lightly affected members would be disproportionately costly or would destroy historically important features. In such cases clients should be advised of the possibilities of alternative in-situ treatments. Alternatives to complete removal may be particularly appropriate when the affected timbers are still structurally adequate and will readily dry out after being isolated from damp walls e.g. at first floor level and when effective ventilation can be arranged. The suggested safety margin may be inadequate in the case, for example, of a wall plate or alternatively it can be excessive in the case of a floorboard where it should normally be necessary only to cut away to the next joist.

The extent of the exposure work, strip out, chemical treatments and timber replacement will always be subject to variation and will be dictated by the prevailing site conditions and should ultimately be the responsibility of the surveyor.

Isolate existing sound timbers from dampness.

Timber in direct contact with damp and infected walls should be isolated by means of physical isolation. Timber beams and joist ends with bearing ends embedded in the walls should be removed and independently re-supported. A variety of support methods are available/suitable for a range of situations (e.g. sleeper walls at ground level, joist hangers, RSJ's, concrete lintels, cellar brackets, steel plates etc.). The choice will depend on the position of the timbers affected, space availability and, in some cases, providing continuity or lateral restraint to the wall in question.

All identified built-in timbers, lintels, plates, bonding timbers etc. within an affected wall area and in damp areas are at risk and should be removed and replaced with suitable alternative inert materials such as steel, concrete and/or brickwork in accordance with Building Regulations or pre-treated timber complying with BS8417:2011.

In order to reduce the risk of further decay, clean off all wall surfaces and oversites/solum to remove visible surface fungal growth and other fibrous materials that may be at risk of decay and may provide a food source. Additionally, removal of soil to lower the level of the oversite may be advisable. **Never apply fungicide/biocide to the oversite.**

The surveyor must be aware that the long term solution to the eradication of decay in buildings is the elimination of excessive water in the buildings fabric. Therefore, the use of masonry biocides must be seen as a control measure that will allow rapid or cost effective re-instatement.

Wood preservatives/biocides should not be relied upon to provide long term protection against dry rot in conditions where timbers are persistently wet.

Unless otherwise recommended in the survey report and agreed by the client, treat exposed wall surfaces identified as showing evidence of mycelium by one of, or a combination of, the following:-

- Surface application of a masonry biocide.
- Localised treatment of specific areas by insertion of approved fungicidal plugs, pastes or gels into holes drilled in the masonry.
- Localised irrigation by the formation of a 'toxic box' surrounding the outbreak.
- Irrigation with a fungicidal solution via holes drilled in the wall.

Use of wide-spread irrigation can rarely be justified. Although its use may result in a 'knock-down' effect on the dry rot fungus within the wall, it may also result in a flush of new growth and/or the production of fruiting-bodies. It will also extend the drying time for the wall, which is the primary control measure against dry rot. Therefore, this can be seen as counter-productive.

Irrigation should not be used where brickwork has open mortar joints or in masonry walls with loose infill cores. Contractors should be aware of the property owner's obligations under The Party Wall etc. Act 1996, when specifying irrigation treatments in party walls.

The use of controlled heat may be an alternative method of dry rot control. However, this form of treatment falls outside the scope of this document.

Replacement timbers should be pre-treated in accordance with BS8417: 2011 (Use Class 2 or 3) or, when this is not possible or practical, timbers should be treated on site with a wood preservative/biocide to meet the requirements of BS8417: 2011 when applied as a surface treatment. If cutting to size, notching etc. is required, any freshly-cut surfaces should be treated as detailed above. **Replacement timbers MUST be protected by isolation, particularly where they have contact with damp masonry walls.**

Where no alternative solution exists and timbers are required to be reinstated into a persistently damp wall area, only pre-treated timber should be used. **The timber MUST be protected by isolation, from the dampness source.** In these circumstances the client should be put on notice, preferably in writing, that the new timbers will continue to be **at risk** of future decay.

Retained sound timbers in the vicinity of the outbreak should be thoroughly cleaned and treated with a fungicidal wood preservative/biocide. The limited value of surface application of preservative in the face of sustained damp conditions must be understood by the surveyor (and the client).

Wet Rot

If the decay has been caused by *Coniophora* or other wet rot fungi it is not necessary to sterilise brickwork. Timber that is decayed should be cut out and replaced with pre-treated timber or restored with resin or other reinforcement systems. Sound timber remaining in the vicinity of an outbreak should be treated with an approved fungicide/biocide. Furthermore, where dampness is likely to persist, as in a cellar, all new replacement timber should be pre-treated. In any case, timbers should be replaced so as to prevent contact with damp walls by the use of, for example, steel joist hangers or damp-proof material.

The source of dampness must be sought and corrected. Where wet rot has been caused by direct leakage it can often be entirely checked by removing the source of dampness and by thorough and rapid drying. Extra heating and ventilation will do much towards preventing further outbreaks of wet rot.

Open up the affected area, cut out and discard structurally unsound timbers. Replace removed timbers preferably with timbers pre-treated in accordance with BS8417: 2011 ensuring that any cut ends are retreated with a suitable wood preservative/biocide and **that there is adequate isolation from the damp walls.**

PREVENTION

Although good design and construction offer the best protection against decay, these can be nullified by bad maintenance. There are, however, some parts - even in a modern house - in which any timber used should be pre-treated and isolated from damp surfaces with a damp-proof membrane. Wood boarding laid over concrete solid floors is often nailed to imbedded battens set in the concrete. It is essential that these battens are pre-treated.

Any timber boarding laid over a solid floor should be isolated with an appropriate membrane extending to protect the boards end-grain from contact with damp surfaces below damp-proof course level. The ends of joists and other timbers should be isolated from contact with the brickwork of the outside wall. The bearing ends of the joists should be supported on isolated hangers or protected with a membrane.

Where there is any possibility that dry conditions cannot be maintained, it is essential that all timber should be pre-treated. In exposed places where rain is likely to be driven by wind between brickwork and window - or door-frames then waterproof sealing is essential.

Timber-FD/0516

CHARACTERISTICS FEATURES OF THE MOST IMPORTANT SPECIES OF WOOD-DESTROYING FUNGI

Type of Decay	Fungus	Usual effect on the wood	Strands on the surface of the wood	Other growths on the surfaces of the wood	Fruiting-bodies (sporophores)
Dry Rot	*Serpula lacrymans*	**Rotted wood shrinks and splits into cubical pieces by deep cross cracking. Generally occurs in damp, not wet, situations. Spore dust light rust colour, later reddish brown, may be first indication of infection or decay.**	**Strands grey, sometimes as thick as lead pencil, becoming brittle when dried.**	**In damp dark places, soft white cushions or silky tassels; in drier places thick silver-grey sheets or skins usually showing patches of lemon yellow and tinges of lilac.**	**Fleshy, soft, but rather tough; shaped like pancakes or brackets. Spore-bearing surface ochre to red-brown with wide pore labyrinthine ridges and furrows. Margin white when young.**
Wet Rot	*Coniophora puteana*	**Causes darkening. Longitudinal cracking often predominates. Cross cracks that form are often covered by a thin surface skin of relatively sound wood. Usually found in very damp situations especially cellars, solid floors and roofs.**	**Strands slender, usually thread-like at first yellowish, soon becoming deep brown or nearly black.** **Often there are little or no visible growths of fungus on the surface of the wood. Sometimes there are fan-like growths over brickwork in damp cellars.**	**Occasionally very thin skin-like growths. Yellowish or dark brown (or greyish white under impervious floor coverings)**	**Rarely found in buildings. Sheet-like in shape. Spore-bearing surface olive brown, bearing spores on small rounded lumps or pimples.**
	Fibroporia vaillantii **(and other related species of** *'Poria')*	**Rot similar but less widespread than that produced by *Serpula lacrymans*.**	**Strands white or whitish seldom thicker than stout twine, remaining flexible when dried.**	**White or cream sheets of fern-like growths. Occasional local brown coloration from contact with iron.**	**Shaped like sheets or plates, white in colour. Spore-bearing surface, white, showing numerous minute pores.**
	Phellinus contiguus **(Found in exterior joinery)**	**Bleaches wood, which eventually develops a stringy fibrous appearance. There is no cubical cracking.**	**No strands**	**Sometimes tawny brown tufted growths in voids or at the surface.**	**Found occasionally. Tough brown growths often elongated. Surface covered with minute pores.**

The information contained in this document is given in good faith and believed to be correct. However, it must be stressed that of necessity it is of a general nature. The precise condition may alter in each individual case and the Association is therefore unable to accept responsibility for any loss howsoever arising from the use of the information contained therein.

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