Lesson 2

BUILDING MATERIALS

Aim
To select building materials which are safe to human health.

INTRODUCTION

Some construction materials have no known impact on a person's health, but others can have a very serious impact. One of the best examples of undesirable building material would be Asbestos. Though used widely in the mid 20th century, it is now widely recognised that asbestos can cause cancer. In 1979, James Hardie Industries made a conscious decision to cease the company's heavy reliance on asbestos based products. The wide use of asbestos by other companies in the USA actually led to the downfall of those companies.

Research was undertaken around this time to develop asbestos free fibro cement, and new improved fibro cement was released onto the market by James Hardie in 1981. Despite the actions of Hardie such a long time ago, the legacy of asbestos has still plagued them with legal compensation challenges well into the 21st century.

Apart from this legal and commercial side to the asbestos story, there is also a tragic personal side. People exposed to asbestos decades ago continue to develop asbestos related illnesses, and all too often, not only the quality of life diminishes, but lives are lost.

DANGEROUS BUILDING MATERIALS

Choose building materials that enhance the health of people. Avoid building materials that damage health.

Preferred building materials will have the following characteristics:

- Regulate temperature as desired (eg. trap sun, insulate, etc);
- Chemically safe - usually being chemically inert (ie. do not produce damaging fumes;
- Physically safe - no sharp or hard surfaces in places where a person might hurt themself;
- Do not attract/harbour pests;
- Have a desirable affect on humidity -some materials absorb moisture, some don't.

CHEMICAL EFFECTS ON THE BODY

Some people are more affected by certain materials than others. Sensitivity may be no more than a mild allergy, or as much as life threatening allergic responses. In other instances, a body may be poisoned by toxins found in building materials. Exposure over a long period of time can result in a cumulative affect which eventually builds to levels with serious consequences.

Different chemicals affect the body in different ways. Many are specific (ie. affecting a specific physiological process in the body). Others may have a broader, more general affect, perhaps causing cell growth to become abnormal, leading to cancers.

Considerations

There are many different types of materials used in buildings. These can include wood, masonary, ceramic tiles, plaster, concrete, metal, plastics, fibreglass, glass, glues/adhesives, paints/sealants, etc. Each of these has distinctive characteristics, some of which may be detrimental to health. Any material chosen for a building should be considered in terms of the following characteristics:

Rate of deterioration

- Some materials will deteriorate fast, others virtually never deteriorate.
- Deterioration can lead to the need to dispose of, and replace parts of a building. Waste is not only costly but can cause negative environmental impacts.
- Deterioration may also lead to greater use of chemical treatments such as pesticides or preservatives.

Thermal qualities

- Some materials will absorb heat, others do not.
- By selection of materials for thermal qualities, you can reduce heating and cooling requirements for a building.

Chemical properties

- Many building materials have some toxins in their make up.
- Sometimes these toxins are fully stable and pose no threat. Other materials contain unstable toxins which may be released into the building environment slowly (i.e. some paints). These can find their way into the human body and have a cumulative affect over time.

Acoustic qualities

- Insulating against unwanted noise (eg. neighbours or a road), may be desirable.
- Avoiding echoes may be important.
- Some materials are more suitable for absorbing, or insulating sound, than others.
- Some materials (eg. impermeable hard surfaces such as tiles) will bounce sound around a room.

Dust collection/repellence

- Some materials will collect dust, which can be a problem for allergy sufferers

Light reflection.

- Some materials may absorb light energy, helping heat a building (providing a heat store)
- Some materials (eg. glass) are translucent allowing light to penetrate indoors.
- Some materials reflect light. This can create glare and heat where it is unwanted; or it may help improve lighting where it is wanted.

Waste Created during Construction

- Particles created by cutting plaster, timber, metal etc. during construction is unlikely to find its way off your property. Even if floors are supposedly cleaned first, dust and other particles will often remain under carpets, inside walls and roofing, under cupboards or buried in the garden.

TIMBER

Some timbers are preferable to use for various reasons. Other are selected against due to the negative impact they may have upon human health.

Some Considerations

- Veneer timbers are usually made using glues that are preferably avoided.
- Treated pine contains chemicals which when burnt will release a poisonous gas.
- Smooth surfaces are easier to keep clean and dust free.
- Shrinkage in timber which has not properly been dried will open gaps that can attract pests, dust, etc.
- Timber with high natural durability may negate the need for using preservatives or pest control measures.

Formaldehyde Adhesives

Formaldehyde may be used in processing products such as plywood or chipboard. It is used as an adhesive. It can produce a vapour which is toxic. The health risk is determined by factors such as ventilation (both in walls and rooms), and environmental conditions. The emission of toxic gas can also vary according to the type of product: some boards producing emissions for a very long time. Sealing the boards with varnish or melamine is one way of reducing (or stopping) the emissions.

Timber Terminology

The following are terms commonly used to describe timber in the building industry:

Air Dry Density	12% moisture content
Equilibrium Moisture Content (E.M.C.)	This is the moisture content the wood has when it is at equilibrium with humidity and temperature of the local environment (at this point there is no expansion or shrinkage).
High Shrinkage	Timber which has average tangential shrinkage of 10% or greater in drying from green condition to 12% moisture.
Seasoned Structural Framing Timber	Moisture content of 15% or less. Seasoned Timber for purposes other than Structural – moisture content between 10 and 15% or moisture content in a range nominated for a specific location or use in accordance with appropriate legislation.
Stress Grade (Stress Rating)	The classification given to a piece of timber for structural purposes in accordance with an Australian Standard (set by the Standards Association). This indicates stresses in bending, allowing engineering calculations to be made to determine what forces the timber can withstand.
Durability	Means natural resistance to decay and weathering
Exposed	Means timber is not fully protected from wind, rain or sun
Fully Protected	Timber is not exposed to the affects of any weather including wind, rain, sun or dampness (eg. rising damp through the floor or foundations).
Approved Preservative	Means timber preservative approved under appropriate legislation. (NB: This is no guarantee of complete safety though).
Platform Flooring	Floor laid over joists supported by stumps (ie. as a platform above the ground).

PLASTICS

Rate of deterioration

- Many plastics can deteriorate when exposed to UV radiation in sunlight.

Thermal qualities

- Plastics melt then burn at high temperatures. They can produce poisonous gases during combustion. Plastic materials do not readily conduct heat, and may be useful for insulation.

Chemical properties

- As plastics deteriorate, they can produce gasses which are toxic.
- Plastics which are UV stabilised can become a waste disposal problem. They are not normally recycled and do not readily break down in the environment

Acoustic qualities

- This is totally dependant upon shaping/moulding.

Dust collection/repellence

- Plastics are relatively easy to clean, but may build static electricity which can attract dust particles.

Light reflection

- Clear plastics can be used in skylights, windows etc. to allow light to enter a building.
- Plastics do not have the same inert qualities as glass, but they are less expensive and may be less likely to break.

MASONARY/ BRICKS & CONCRETE

These hard surfaces are generally inert, and long lasting once established, however they can pose some problems:

- Concrete releases lime for a period when it is fresh. This can be permanently detrimental to soil.
- Normal grouting contains toxins & gives of dangerous gases over time.
- Hard surfaces (e.g. tile floors) can be tiring on the legs and cause damage over long periods.
- Mud brick/Earth constructed buildings are cheap and environmentally friendly, but they can be associated with various health problems such as dust (even with sealing), allergies, shrinkage/cracks in walls, etc.

INSULATION MATERIALS

Various materials have been used including fibreglass, rockwool, paper based products, asbestos, wood shavings, polystyrene, etc.

- Asbestos has been shown to cause cancer and should never be used.
- Polystyrene will release dangerous gases in a fire.
- Paper and wood based products may attract vermin.
- Fibreglass and rockwool are inert and effective, but protection must be worm when handling it.
- Breathing in dust (which is minimal), or touching fibres can be a health risk.
- Formaldehyde (ie. Urea formaldehyde) foam may be used as insulation in walls or roofs. Vapours released from the foam may cause irritation to eyes, nose and throat; and in extreme cases, toxins may persist for years. Fumes may be controlled by either sealing and/or ventilation.

SOFT FURNISHINGS

- Carpets, curtains, upholstery and other materials can harbour mites, fleas, etc.
- Some materials may be a fire risk.
- Some materials may cause an allergic reaction in some people.

GLUES/ADHESIVES

Many glues and adhesives will give off toxic fumes for a long time (undetectable, but still undesirable a long time after use).

PAINTS/FINISHES & OTHER SURFACE TREATMENTS

Paints

Most paints are complex containing many different additives, which often include a range of toxins. The nature of modern paints may pose only a mild health hazard to the occasional painter; but for anyone coming in contact with them regularly, they can be a much more significant risk.

Components of paint may include:

- Pigments (giving the colour)
- Preservatives
- Drying agents
- Solvents
- Other components to improve durability, gloss, mould resistance etc.

The main concerns are some pigments and certain solvents. Lead based pigments have purity in the colour, but have been recognised as a health risk for a long time. Regulations were introduced to control the use of such paints, in Britain, in the 1920's. Solvents such as white spirit which are used in paints are often claimed to cause respiratory or neurological disorders. These solvents are of particular concern when paints are used for interiors. Solvent based paints are however more hardy to heat or weathering, hence may often be chosen, particularly for external surfaces. Water based paints are being improved however, and new water based products may eventually be as durable as solvent based paints.

More modern paints are synthetic acrylics. These use less solvents, and are water based, (ie. dissolve in water rather than turpentine oil) but still contain toxins. Even after paint has dried and the nose can no longer detect a smell, many paints will still continue to release small quantities of toxins into the air (even years later). Some people are particularly sensitive to this affect, while for others who are in good health, the toxins may seemingly be tolerated. There is no way to predict the long term affect on health however.

The above considerations make it important to choose paint carefully. Consider how free the paint may be of toxins, particularly for paints used on internal surfaces. Water based (solvent free) paints are preferable if you need to use a paint on internal surfaces.

Timber Treatments

Timber treatments may be designed to protect wood against insect attack, wood rots or even to simply improve the appearance of timber. Many timber treatments can be toxic to plants, animals or the environment. Proper application of treatments can greatly reduce the risks involved, but will not eliminate risk with more poisonous products. It is preferable to avoid such toxic chemicals; however there are few proven alternatives. The need for preservative treatments may be minimised or eliminated by appropriate design, such as creating barriers to insects or moisture (eg. damp proofing foundations). Protecting walls (in particular windows and doors) with extended eves can also reduce the need for preservatives.

Further Considerations

- Avoid paints with heavy metal pigments (eg. containing lead & cadmium).
- If applying dangerous paints, wear a mask/breathing apparatus.
- Organic Solvents are damaging to human health - avoid them (some solvents are worse than others).
- Linseed oil and beeswax is a safe treatment for timber, substituting for paint.
- Chalk is the only white pigment free of toxins. Titanium oxide is a white pigment usually considered free of toxins; however, its production results in toxic by products, and for this reason its use should not be encouraged.

For preserving timber and preventing insect attack, two chemicals have been used frequently: pentachlorophenol or creosote. Both can cause birth defects and cancer. The best solution if these chemicals are already present is to apply a sealant such as urethane, epoxy, or shellac to creosote-treated wood, or urethane, shellac, latex epoxy enamel, or varnish to pentachlorophenol-treated wood. As many wallpaper pastes contain anti-insect and anti-mould chemicals, it is wise to replace wallpaper with paint instead.

SET READING
Spend 2 hours investigating the safety of building materials. Your research may include textbooks, library books, journal articles and websites. If you have a textbook read any material that relates to the safety of building materials.

SELF ASSESSMENT
Perform the self assessment test titled Self Assessment Test 2.
If you answer incorrectly, review the notes and try the test again.

SET TASK
Research the composition of a range of different building materials, including the following (as far as is possible in the time allowed):

- 3 different brands/makes of paints
- 2 different sealants, glues or varnishes
- 3 different types of timber
- 2 different types of synthetic cladding (e.g. cement-based sheeting, plastic-based "weatherboards")
- 6 other building materials (ie. fittings, plastics, adhesives or structural materials)
- Find out the composition of each of the materials you research.
- Determine any possible health concerns with the materials you researched, including problems with initial installation (e.g. drilling, sanding, fumes), and with subsequent maintenance or removal.

This research may be conducted using the internet, literature or any other resources you have access to. You may need to contact a health or medical department for some technical information. (spend no more than 4 hours doing this set task)

ASSIGNMENT
Download and do the assignment called Assignment 2.