

Sick home?

Remedy by design

Healthy building design appears to be a subsection of environmental design which remains low on the scale of importance for most architects and builders. **Chris Morgan** highlights the opportunities...

Whilst pollution is accepted as a major problem, at a design level, the response is conceived largely in terms of energy efficiency. Pollution happens 'out there' in the world, and we try to reduce this, but there is little grasp of the effect this pollution is having on us, personally.

Second, the awareness of health and of healthy lifestyles is quite advanced. Gyms, vitamin pills, organic food and alternative therapies all attest to a broad appreciation that our health is not all it might be, and yet the places where we spend the vast majority of our time, homes and workplaces, escape any critical analysis beyond the most immediately apparent.

Third, there have been scares. Most people now know that asbestos is dangerous, like lead in paints and pipes, and the media have picked up on concerns about electricity pylons, chemical treatments for rot and others. But like most things, these are considered isolated cases, and there is little sense of a generally, comprehensively harmful built environment. The rise in awareness of 'Sick Building Syndrome' has made some headway in this regard, but in most peoples' reality, it is still not an issue.

And yet for those who investigate, it is shocking to discover the extent to which we have exposed ourselves to a wide range of untested combinations of known carcinogens, mutagens

and other harmful elements, and in such close proximity to ourselves and our loved ones.

There is some resistance to such investigations, manufacturers are understandably reticent about any possible health risks associated with their products, and it is notoriously difficult to make clear links between symptoms and the plethora of possible causes. However, a great deal is now understood about what is likely to be both good and bad for health, and it is possible to design and build homes and workplaces which are broadly free from pollutants and actively beneficial in supporting the health and comfort of occupants.

1st Step: remove the pollutants

Non building related

Many pollutants have nothing to do with the building. Smoking is a significant pollutant, as are the many external fumes and particulates which can come in through open windows and air entry systems: agricultural spray drift, car and industrial process exhaust fumes, dust, pollen, then there is electromagnetic radiation from pylons, and even radon from the ground itself in some places. Clearly there is a limit to what can be done to avoid these pollutant sources, but in some cases, the addition of 'buffer' spaces filled with plants and water, acting as conditioners for

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the incoming air for the rest of the building, can help.

Services and maintenance

Water

Increasingly, the water that comes into our homes is likely to contain not only beneficial minerals and other 'impurities' but also a great number of potentially harmful pollutants such as nitrates, metals, synthetic (and some volatile) organic compounds, radon and controversial additives like chlorine and fluoride.

For those concerned, various types of water filtration system are available, each tending to deal better with some and not other pollutants.

Air conditioning

Some years ago, research in Denmark showed that the biggest source of pollutants in offices was not occupants, not smoking, not even the off-gassing of materials, but the air intake ducting and machinery itself. In other words, the equipment specifically installed to keep the air clean and healthy was the single biggest polluter. In most UK homes this should not be an issue, but it is relevant wherever there is a forced air supply.

Electropollution

The radiation effects of electrical equipment and cabling are much debated, but the links between electrical, and electro-magnetic fields and health are becoming harder to ignore, particularly at high voltage levels. Electric fields are produced whenever there is a voltage (for example, in an electrical appliance and the cable to it, even if it is switched off), while electro-magnetic fields are only produced when current is flowing – the appliance is switched on. Both fields reduce in strength with distance away from the source, so the most common advice is simply to keep a distance, for example, between the plug, cable and electric alarm clock from your head while sleeping.

Electric fields are quite easy to shield through the use of metal trunking or sheathing, but electro-magnetic fields are harder to avoid. The standard ring mains around a room is one source of the relatively high magnetic field in a room and one way of avoiding this is to produce a 'radial' or 'star-shaped' wiring arrangement, but this can lead to more costly wiring installations. The UK is a long way behind other countries in recognising the risks attributed to electro-pollution.

Fumes

Some of the most lethal pollutants are from >>>

incomplete combustion fumes from boilers and stoves, leaky flues, or flues where there can be backdraft in the wrong wind conditions. Needless to say that these should be checked as a priority.

Decoration, fixtures and fittings

Decorating your home can be bad for your health! Paint stripper, and most old paint is of real concern, and conventional paints and varnishes etc. are some of the worst offenders for environmental pollution in their manufacture, and in terms of their effect on the health of occupants. The main concern is from the solvent fumes (the bit that dries off) but even water soluble paints may need to be avoided. Natural, non-toxic paints are available and while some are more expensive, switching to these is one of the simplest ways of reducing pollution and safeguarding your health.

A great deal of furniture and fittings now available contain toxic chemicals not only internally, but in the coatings which are applied to make them stain-free, fire-proof, 'low maintenance' and so on. Chemicals, such as formaldehyde, benzene and phenols are found in plywood and particle boards (chipboard and 'mdf'), plastics, resins, glues, adhesives, synthetic textiles, flooring such as laminates, vinyl, insulation, carpets, curtains and furniture. Many of these chemicals 'off-gas' slowly over months and even years, and their effect can be traced in all areas of the body, particularly the nervous system.

Avoidance is the simple solution and it makes sense to keep to items which are as close to natural as you can find – linoleum not vinyl, timber not chipboard, screwed not glued, oiled or waxed not varnished and so on. Common sense – and a dash of scepticism – can take you a long way in this regard.

The building fabric

One of the most insidious pollutants is the chemical treatment of timber, for example in the roof rafters, or sometimes all over in the case of some timber frame buildings. Even in old properties, such treatment is rarely necessary, and in return for 'peace of mind' your property has been made thoroughly toxic to human, as well as insect or fungal life. It is possible to avoid all chemical treatment of timber if the building is

designed properly and still ensure durability.

2nd Step: create comfort

Once you have removed the pollutants from your home or workplace, the next step is to create the ideal conditions for comfort. Even without any pollutants, it is possible (and quite common) to design things so badly that the health of occupants will be at risk under certain conditions. The green building designer's job is to do the opposite.

The big three - heating, ventilation and humidity

Heating

The health effects of heating are the least appreciated aspect of health promoting design. A great deal is known about heating and thermal efficiency, particularly amongst the environmental design community, but, from the point of view of human health, the only sensible heating system is a radiant, or largely radiant one.

Human thermal comfort is far more than having a thermostat fitted at 20°C. The most comfortable thermal environment for humans will be created when the surfaces of the room are a little warmer than the air, when the air is relatively still (not too many draughts, or convective currents) and there is sufficient thermal and moisture mass in the building fabric to moderate both temperature and humidity swings.

The conditions described above are almost impossible to create with a convective (warm air) system, and these systems may have a number of other disadvantages which negatively affect the health of occupants such as dust scorching. A low level radiant system, ideally at wall level, not in the ceiling, and with perhaps some 'top-up', quick-response radiant system if needed is the ideal.

Ventilation

At its most basic level, fresh air is needed to replenish the oxygen we use up in breathing and exhaust the carbon dioxide we produce. However, required ventilation rates have developed in order to account for other aspects. Air extract is needed to cope with pollutants and odours produced by people, materials and services.

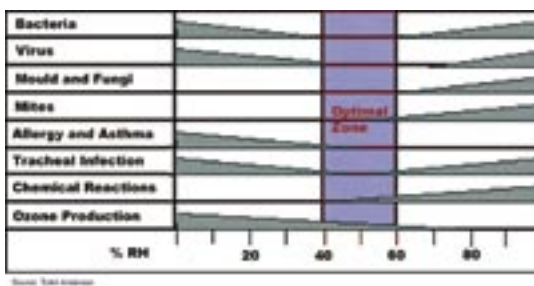
Extract is also needed to deal with (usually excessive) humidity and micro-organisms.

In a building with few pollutants and with humidity dealt with passively by the building fabric, the need for ventilation is much reduced. This is not recognised by the regulations yet, but the argument has been successfully submitted in Norway to reduce ventilation levels without health risk to occupants, and to save energy, both in servicing, and in heat loss.

This brings us to another consideration of ventilation, that in extracting air, we are usually extracting warmth, hence the rise in the use of heat exchange extract fans. Given the increase in fabric insulation levels, the percentage of heat loss through ventilation has increased and so these fans perform a valuable function. However, they are effectively covert convection heating systems and, again from a health point of view, might warrant further investigation.

Humidity

The need to moderate humidity in buildings goes far beyond the risks associated with damp and mould, to well understood aspects of human health. Put simply, humans need a fairly balanced relative humidity of roughly between 40% and 65%. Beyond these, there are very close correlations with increased health risks, as clearly pictured in the diagram, below.



Air conditioning helps to moderate humidity, but like chemical preservatives, this comes with a possible health risk attached. It is possible – and preferable – to moderate humidity passively through the use of the building fabric and materials which naturally absorb and desorb moisture. These materials are known as ‘hygroscopic’ materials and can perform a valuable role in the

design of internal air quality, helping to maintain a comfortable and healthy balance of humidity with no running costs or energy input. Clay is by far the most effective material for achieving this, but other natural materials like timber and lime also work, as long as they are not coated with impervious paints or varnishes. Another method, for those not building new, might be by the installation and use of passive vents that open automatically when there are high humidity levels.

Other aspects

Lighting

Natural light changes and in so doing links people back to the natural passing of time which is increasingly valuable as we now spend so much time indoors. Rooms with windows in more than one wall and orientation will help to enhance this changing pattern of light.



Natural light in buildings create the right conditions for health and contentment. South facing glazing can bring sunlight and combat SAD disorders etc.

Light surface finishes will reduce the need for supplementary lighting, and when designing artificial lighting, it is worth considering an emphasis on task lighting or mood lighting. This can be more energy efficient and likely to be more pleasant to use and control. Lighting with poor flicker should be avoided and daylight bulbs can be helpful to overcome the lack of daylight in

areas where this is unavoidable.

Noise

Excessive noise is obviously to be avoided, but low level background noise often associated with machinery, and noise from sources that cannot be controlled are considered to have the greatest potential to stress people. Many noises can be attenuated but not all, and in many cases, this can conflict with other requirements, such as the need for fresh air, so design strategies need to be considered early.

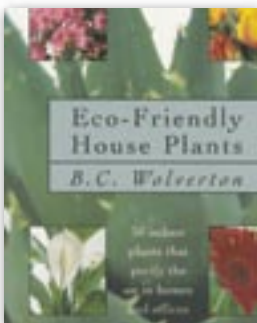
Plants

Plants use the carbon in the carbon dioxide we breathe out, and give off the oxygen we need, 'fresh' air is largely fresh because of the activities of plants, so it is not surprising that putting plants inside a house will have some beneficial effect on the quality of the air. Beyond that, it has been found that some plants have an extraordinary capacity to absorb some of the pollutant gases which we produce as part of our modern lifestyle, so their targeted use will have benefits. Plants (and the earth in which they tend to be planted) also help to moderate humidity so should have a more important place in our homes, beyond 'looking nice'.

Conclusion - priorities

Prioritising issues is important as it is easy to lose perspective. Everyone will have their own list,

Houseplants can play a role in helping rid toxins from the atmosphere. Eco-Friendly House Plants by D C Wolverton available from The Green Shop, www.green-shop.co.uk 01452 770629



but consider the following as a starter.

1. We spend a lot of time asleep, in one place. Sleep is the body's time for recuperation on a number of levels. If you can only make one place 'healthy' make it your bed and bedroom.
2. Children, whose cells are developing quite differently from adults are at much greater risk from the effects of toxins. They also spend more time closer to the floor than adults, so pay particular attention to floors and childrens' bedrooms, as above.
3. Arguably the worst offender for health in many peoples' homes can be the unassuming wall to wall carpet, not only because of the materials and treatments it contains, but its capacity to store dirt and harbour dust mites and their faeces. Beyond steam cleaning, if you are experiencing health problems and suspect carpet, replace with wooden floors, linoleum, tiling or similar. Smaller rugs which can be washed do not tend to pose the same threat.
4. The great majority of applications of chemicals for protection against infestation, rot, mould and so on are unnecessary. If you have a problem, consider contacting a specialist (not one trying to sell you a chemical treatment) who will probably be able to assess the situation independently and offer remedial solutions, such as better ventilation, better drainage and so on, without the need for chemicals - environmental controls.

Lastly, a word or two on perspective. Wendell Berry wrote that "No place can be considered healthy until all places are healthy" This serves to remind us of the interconnectedness of these things, and of the fallacy of describing a house as 'healthy', particularly when, as an architect, you cannot control what goes on inside.

Studying buildings and health can turn you into a sort of building-related-hypochondriac. One cough and you begin to eye the skirting boards suspiciously, whereas there may just be a virus going around at school. If you live an otherwise healthy life, it is likely that you will survive your home and workplace(!), but as with most things, why take the risk, when there is a much more comfortable and healthy way to live? ❖