chemicals can cause damage to people and property. Whilst poultice chemical cleaning is likely to be a more controlled process, the solid residue of the poultice needs to be disposed of safely so as not to contaminate the water course.

Dry and wet grit blasting have been used for many years to clean soiled sandstone. The main difficulty is in controlling the safe depth of the cleaning, as the grit can cause significant damage to the stone surface. To overcome this problem, a number of different systems have been developed using microparticles such as fine powder of aluminium oxide. These fine particles cause far less damage to the stone and have been used successfully on a number of Scottish conservation projects. However they do not always work effectively when attempting to remove paint, as the particles can be bounced off the surface, depending on the type of paint and its thickness.

Paint can also be removed using heat. Laser radiation has been used to clean artworks and with the development of laser technology larger area cleaning is possible, although expensive. The absorption of laser radiation on the paint film causes it to heat up rapidly and expand, forcing the paint film away from the surface of the stone. The patina of the stone is left intact, preserving fine arrises and details. Cleaning rates will depend on the type of material being removed - with paint this can be quite slow, although it would appear to be the best system for conserving the stone. The difference in costs reduces when all the aspects of the cleaning process are taken into account, such as waste collection and disposal, potential harm to operatives, disruption and the long term conservation of the stonework.

As a relatively new process, we would recommend that its adoption is encouraged, following more detailed inspection of the paint and sampling of the cleaning process. Paint removal by laser would cost in the region of £135 - £155 per metre squared inclusive of travel and subsistence, but exclusive of VAT.

4.3.4.1 Considerations for other projects

Extensive research has been carried out into the long-term effects of the cleaning of stone buildings. Initially this concentrated on analysing the extent of damage and/or chemical change which occurred to building stones when cleaned using differing techniques. More recently, there has been greater emphasis on identifying methods which are sympathetic to the environment as well as to the building being treated. The removal of dirt created by a polluted environment should not be carried out at the expense of further pollution of that same environment!

4.3.5 A Specific Issue - The safe treatment of dry and wet rot

As the building has been left unoccupied and unheated for some time, there is clear evidence of dry and wet rot outbreaks in the fabric. The full extent of any rot infestation has still to be determined, although one can expect the timber safe lintels and joist ends to be affected. The primary remedial measure will be to locate the source of any moisture, as removal of the moisture will kill the fungal growth once the fabric has dried out. Chemical treatments to walls and timberwork can help control infestation while the structure dries out, but it is wrong to assume that the chemicals themselves will prevent the recurrence of rot attacks.

Traditionally, treatment of dry rot (over the last 30 years at least) has necessitated the cutting back of all infected timber by about 1 metre (although BRE suggests a margin of approximately 400mm is in fact satisfactory). The affected walling is normally irrigated at closely spaced intervals and chemicals injected. Some phenolic solutions can migrate to the internal wall surface resulting in crystals of pentachlorophenol. These can dry in the air and cause a health hazard. Sometimes a ‘toxic box’ is formed around the infected area. However it is difficult to ensure that the fungal spores are contained only within this box.

In recent years, a range of alternative chemicals have been developed, mostly using boron. The boron is relatively benign and can be used in wall irrigation and in the form of rods, inserted into vulnerable timbers. The main problem occurs with embedded timbers which may not have the chance to dry out for some time because the surrounding wall is damp and can take several years to dry out properly. Original timbers are likely to be well seasoned and have an inbuilt resistance to wood decay. However new replacement timbers should be treated with a water based preservative, preferably boron, although CCA is often recommended. Isolating timber from the wall can be achieved by wrapping it in a suitable membrane, although care should be taken to prevent the creation of an environment which promotes condensation (sweating) on the timbers.

Wood preservatives and other biocidal products are now subject to the “Biocidal Products Directive-98/8/EC” (4) which provides guidance to practitioners and controls the use of biocides.

From a sustainable viewpoint, the unnecessary use of chemicals should be avoided. Treated timbers cannot be burnt, as the chemicals give off toxic vapours. There has been considerable evidence that excessive chemical treatments, particularly in domestic situations, can lead to health problems. However it would be wrong to imply that all chemicals are somehow unsafe, rather we should aim to control and limit their use.

There have been two main developments in the treatment of dry and wet rot, both resulting in a more sustainable approach.

The Danes have developed a heat treatment system to eradicate dry rot. It is not suitable for wet rot. The complete building is enclosed in a covered scaffolding and hot air blowers applied. This exposes any infested construction (masonry and timber) to a temperature of 50ºC for a period of 16 hours. This will kill off any dormant dry rot spores hidden within the structure. The advantage of this process is that the whole building is treated and not simply those areas identified under survey. Also no chemicals are used and since the building is dried out, the risk of providing damp conditions for new timbers is avoided, reducing the need for further preservation.

The project study team approached the Danish team regarding the system. They suggest that the first step is to create a demonstration project to create interest in the technique. Because the heat treatment method only addresses the dry rot problem, they advise that it is essential to conduct a thorough investigation of the building, identifying the dry rot and its extent by microscopic analysis of the timber samples and other building materials. The advantage of the hot air treatment compared to other systems is that it is possible to heat heavy brickwork thereby killing the fungus inside the masonry without resorting to chemicals or damage to the structure. Other fungal attacks, such as wet rot, can be eliminated by drying the construction and making constructional changes.

The system is now being developed in Norway. Although the concept is simple, the work has to be carried out by experienced personnel following adequate control procedures. A supervision and training system has been set up and all installations and design of heat treatments must be carried out by accredited members. Software is available as each project requires calculations to determine the optimal heat treatment for the building.

As far as the project study team are aware, the system has not been adopted in Britain, nor has it been tried here. The Danes recognise the need to demonstrate such new technology in order to overcome scepticism towards heat treatment technology. If promoted in Scotland, it could become adopted in standard tenement rehabilitation projects, reducing the need for chemical treatment.

Increasingly, specialist surveyors are adopting a far less disruptive approach referred to as ‘environmental control’. The emphasis is on carrying out a detailed moisture map of complete walls to ascertain the precise nature of the problem and provide a matched solution. This type of survey takes time and is not the sort of survey prepared by remedial rot contractors who are largely interested in identifying infected timbers, rather than the conditions which lead to the problem. The emphasis is on understanding the buildings ecology. Solutions may use a range of approaches, from improved ventilation, drying, to discreet chemical treatment. Environmental control aims to prevent the build up of moisture sources and reduces humidity levels by improving ventilation.

Sensors can be installed permanently in walls so that they can be monitored easily over their life. These sensors can be installed initially, as after about 4 weeks they reach an equilibrium with the surrounding material and react to the presence of the dry rot fungus. Keeping the monitors installed after remedial work can confirm that the treatment has been successful.

4.3.5.1 Considerations for other projects

In much the same way as methods of stone cleaning continue to become more sophisticated and environmentally acceptable, it has been increasingly recognised that treating timber with toxic agents in an attempt to reduce their susceptibility to decay is not a long-term solution. Likewise, there is a growing awareness that there are alternatives to the use of chemicals in the treatment of dry rot, indeed 'environmental control' has been promoted for over sixty years, and there are a number of examples of the assessment of buildings in a holistic manner having achieved the control of dry rot where more radical, toxic methods have failed. Ultimately, however, the principal message to building users must be that prevention is better than cure, and that a building maintenance regime which takes cognisance of the conditions which allow the development of decay is important to the long-term health of the property and its occupants.

4.3.6 Internal air quality, its relationship to finishes and the need for ventilation

"Sick Building Syndrome" results from a combination of the use of synthetic paints, formaldehydes and resins from furniture and carpets, and poor air quality due to defective ventilation and air conditioning. This will often result in a higher incidence of sickness resulting in allergies, headaches, lung disorders and the spreading of infection and viral conditions. Studies have shown that the indoor environment is now up to ten times more polluted than the external environment and yet we can spend up to 80% of our lives inside buildings.

Whilst lead in paint has not been used for decades, it is still present in our buildings and it's safe removal is a concern for decorators. Most of the paints used today are synthetic and derived from the petrochemical industry. Many synthetic solvents are classified as carcinogenic and can cause serious illness to the painters who apply them.

Volatile Organic Compounds (VOCs) are organic compounds used as solvents that evaporate rapidly. Certain VOCs are also pollutants which can add to external pollution levels. Lower VOC levels are achievable but care is also needed to avoid the long list of chemicals that are used in paint and product manufacturing, such as benzene, toluene, cadmium and formaldehyde.

The paint industry has been promoting water based paints as an alternative, but some of these paints can actually contain more chemicals than the oil based paints they are intended to replace. Vinyl