



Contexts for Conservation

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Current Research into Mould Remediation from Historic Houses and Heritage Collections

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Abstract

Fungi play a considerable role in the deterioration of cultural material. Climate change predictions suggest that the future of the environment will exhibit a range of new conditions from increasing temperatures and relative humidity (RH) to rising sea levels. Resultant changes to indoor environments and an unstable thermo hygrometric environment can put organic collections at increased risk of biodeterioration by fungi.

This paper will research the potential of a biocide to remove and control fungal growth from a range of heritage artefacts. Working collaboratively with conservation scientists at the University of Leicester and University College London, and with students from the Courtauld Institute of Art, using a range of sites as case studies, chosen to reflect different indoor environments and a varying range of object types and media. The Historic House, Knole near Sevenoakes in Kent (The National Trust) was chosen as a representative of a typical unheated interior, with substantial mould issues on the wall interiors and highly significant Paintings on Canvas. The Secret War Tunnels at Dover, UK (English Heritage) are a network of chalk-cut tunnels deep beneath the castle, close to the south east coast of Britain, and contain a social history collection including costume, maps, books, furniture and The Underground Hospital. This site was chosen, as the extent of mould growth requires a current, exhaustive and unsustainable cleaning protocol.

Keywords: fungi, mould, mould remediation, environmental controls

Introduction

Throughout my conservation career, the issue of mould, its potential damage to collections, safety issues relating to health hazards and safe methods of control, eradication and prevention have been a regular

source of debate. In 2008, I was contacted by the NSW Office of Rail Heritage (ORH) to undertake a collection survey of their Small Movable Heritage Collection, then housed in the Carriage Works Building in Eveleigh, Sydney. The collection comprised of around 3,000 objects: rail artefacts and machinery, signs, furniture, framed artworks, textiles and rolling stock. On first inspection of the site it was apparent that the environmental conditions of the store were far from favourable. Apart from generating a greenhouse effect, the glass roof was badly deteriorated with missing and broken panes letting in not only rain and dirt from the adjacent railway but also several species of pest including rodents and birds had clearly made this their home and latrine! The evidence was everywhere with extensive mould growth, and droppings over much of the collection.



Carriage Works Eveleigh.

I was instantly concerned with not only the potential health hazards of handling the collection given the scale and type of contamination, with the possible presence of not only various species of fungus and mould but also the possibility of fungal diseases being carried in the bird and animal droppings, but also the vast range of objects and materials requiring treatment.

The standard method of dealing with fungal infected heritage collections seemed to be either to isolate, irradiate infected objects and to clean infected areas using vacuum extraction fitted with a HEPA filter or with 70% ethyl alcohol, all of which I considered to be either impractical or insufficient given the extent of the problem and the composition of many of the objects and so I began researching a suitable cleaning solution.

After much investigation, I became aware of a potentially suitable product that was in the process of being tested by independent - government approved MGS Laboratories and trialled by the National

Health Service in the UK as a surface-cleaning agent for the health industry. The British based product, called Steri 7

was a water-dispersed, High Level, Broad Spectrum Biocide, made for use as a surface sterilizer comprised of a mixture of Methylisothiazolinone, a high performance antimicrobial used as a preservative in personal care products, such as shampoos and conditioners, and Alkyl dimethyl benzyl ammonium chloride or ACBAC, which is a cationic surface-acting agent used in products such as skin antiseptics and throat lozenges and as an algaecide in the horticultural sector to remove algae, moss and lichen from outdoor surfaces.

From its technical information Steri 7 reported to be highly effective against Bacteria; Viruses; Spores; Fungi and Mould, and in fact to kill many (The Top 7) of the most dangerous microorganisms including superbugs and pathogens such as NOROVIRUS; SARS; E.COLI; SALMONELLA; LISTERIA; LEGIONELLA and other fungal, bacterial and viral diseases, whilst being harmless to other organisms and indeed advertised as being 'food safe'. It was also colourless, odourless, non-toxic, non-flammable had a pH of 5.5 and due to its patented 'Residual Barrier Technology®', provided further protection against subsequent contamination and re-colonisation.

This looked promising...

Initial Treatment

Steri 7 had already undergone extensive independent testing on a variety of surfaces and finishes in order to be passed as safe by the National Health Service and to gain DEFRA approval, however as there was some urgency to sanitize the ORH collection before the collection survey or any further work could be undertaken I sort advise and confirmation from conservation scientist Dr Jane Nicklin, head of microbiology at University College London, as to the composition of the product and its suitability for use on a variety of possible surfaces.

I proceeded to clean the collection, using a combination of Steri 7 in its ready to use surface spray form with the addition of microfiber cloths and impregnated cotton wipes.

The project was successful. The droppings and mould were easily removed in a single, clean, non-toxic

process. I was keen to take the research further however and so over the following two years I worked in collaboration with *Rail Corp, NSW* on two of their historic rail carriage interiors



Chair from Carriage interior. Rail Corp NSW.

Cleaning in progress.

The Historic Houses Trust of NSW in the Justice and Police Museum, The Australian Stockman's Hall of Fame, Queensland, collection in storage (damaged after a flash flood)



Cleaning in progress. Australian Stockmans's Hall of Fame.

and on a private textile collection, all of whom had experienced issues with mould.

The collections and objects were very varied and included various organic media from leather and textile to timber and paper, held in varying environmental conditions.

After undertaking several experiments on study collection pieces, I developed a series of techniques, using the biocide, to remediate mould from a range materials from simply swabbing or wiping to full immersion and misting using a humidifier. The technique and concentration adopted depended on the condition, and the materials of which the object is made.

These mould remediation trials appeared to be very successful. Objects that were treated with Steri 7 via a variety of methods throughout 2010 were in May 2012, still showing little or no signs of re-growth, when in some cases the existence of mould on the control pieces and the surrounding areas was extensive.

In July 2011 I began a two-year research sabbatical in UK with a view to undertaking further trials and experiments as part of my Masters in Museum Studies with Leicester University. It was evident that the product efficiently killed moulds prevalent in temperate and tropical climates but I wanted to investigate

whether it would kill other species present in differing climates, how long mould regrowth could be prevented and what if any was the long term affect on the surface of the treated objects.

Case 1 – Knole House



Knole House. National Trust.

Knole is a historic house close to Sevenoaks in England, owned and run by The National Trust, although the Sackville-West family still reside in various private apartments throughout the house. The house is surrounded by a large park, still owned by the Sackville-West family; they also own many of the collections of the house. Parts of Knole date back to the mid-15th-century, but it has seen many alterations since. In the early 17th century the building was an archbishops palace and was transformed into a renaissance mansion. By the end of the 17th century Knole had acquired a unique collection of Stuart furniture and textiles (Sackville-West, 1998). However, little has changed at Knole since the late 18th century, when it acquired a large collection of old masters and contemporary English paintings. My research focuses on one large room at Knole, the Leicester Gallery; named after the Earl of Leicester who was granted Knole by Queen Elizabeth 1st before its acquisition by Thomas Sackville (Sackville- West, 1998).



The Leicester Gallery

The Leicester Gallery is surrounded by rooms on most sides, one at the end of the gallery with a north-easterly aspect, another which is technically within the billiard room, however there is no physical barrier between these rooms; this has a south-easterly aspect. The final windows face into a courtyard, with a north-westerly aspect. The long gallery is decorated with oak panelling dating from 1605, and there is a stone chimneypiece dating from the 15th century. Furnishings include a remarkable collection of early 17th century furniture including a chair with original upholstery of crimson silk damask. Various other furnishings are also present including settees, chairs and stools, and candle stands, a number of paintings also adorn the walls. (Sackville-West, 1998).

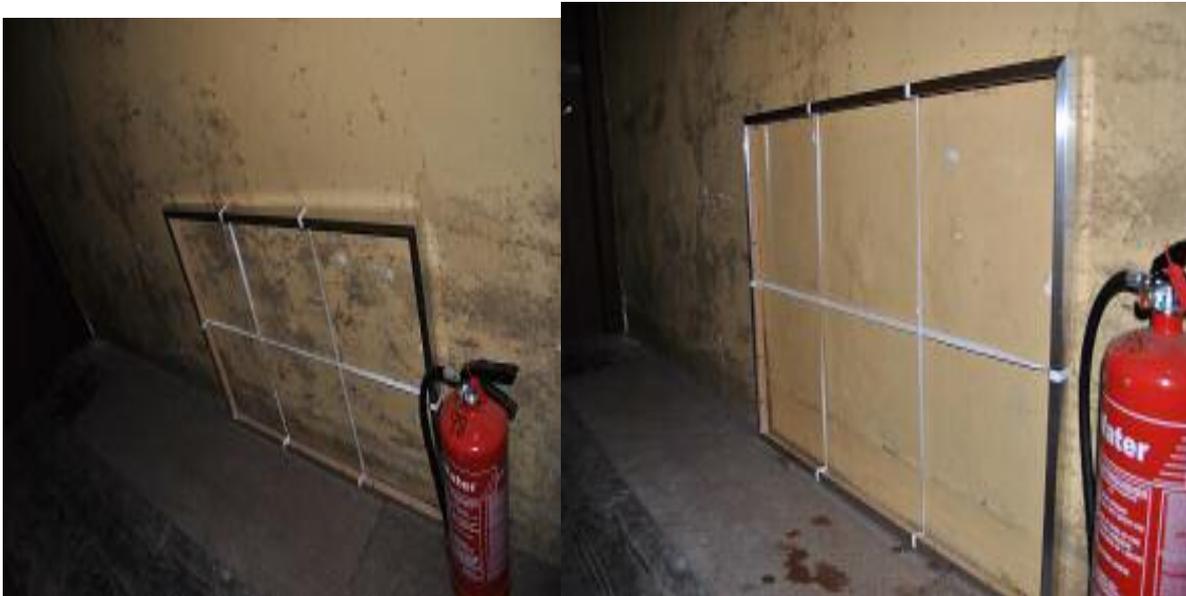
No heating is used in this room at Knole and so the indoor temperature and humidity are driven largely by the outdoor environment. At Knole both the indoor and outdoor climates are monitored. Indoor data is held for the gallery from March 2000, and is recorded on an hourly basis on Hanwell Monitors.

The property experiences quite dramatic seasonal fluctuations in temperature, from 22°C during summer months to as low as 0°C in the winter. For example the month of January 2012 saw a temperature range of 5.5°C - 10.7°C and a resultant Relative Humidity of between 85.2 and 99.5%. Mould growth has been found not only on the fabric of the gallery, but also on the billiard table and on the surface of several of the highly significant paintings.

In April 2013, a group of 2nd year students from the Courtauld Institute of Art began undertaking a detailed environmental survey of the National Trust operated rooms of Knole House in order to identify the living and growing conditions of the mould occurring on the paintings in the property.

Petrie dishes were placed in the gallery and the mould samples were collected and cultivated for use as identification of the fungal growth present and so I was able to test the biocides efficacy in a controlled environment.

I subsequently began a trial on a particularly badly affected area of wall in the servant's corridor off the Leicester Gallery. The project was to monitor the biocide's effectiveness and how quickly the mould returns, along with studying the affects on the painted surface. (details are posted on the Knole Conservation Team Blog).



Trial grid

before cleaning

after cleaning

A frame was placed against the wall, separated into 6 sections. Each square has been cleaned by a different method.

1 Cleaned with water and microfibre cloth	2 Cleaned with 50% ethanol solution and microfibre cloth	3 Cleaned with Steri 7 Surface Spray
4 Cleaned with Steri 7 Concentrate and cotton swab	5 Cleaned with Steri 7 Wipe	6 Cleaned with Steri 7 Surface Spray and microfibre cloth

Grid sections, Leicester Gallery, Knole.

After six months of monitoring, there has been no significant reoccurrence of the mould growth in any of the areas cleaned with the biocide. The Courtauld students are continuing with their survey and affects on the wall surface are being monitored by the National Trust Conservation Team.

Case 2 – Secret War Tunnels, Dover

Within the famous white cliffs of Dover, hidden from view, deep beneath the castle and safe from bombardment, lies a network of chalk-cut tunnels. They were first excavated over 200 years ago, when Britain faced the threat of French invasion. The tunnels were dug to provide barracks for some of the thousands of troops quartered here. By the end of the C19th the tunnels had been abandoned, but were brought back into service during the 2nd World War. From 1939 they housed the command centre controlling the operations of the Channel, and it was from here that the evacuation of the British Army from Dunkirk in 1940 was planned and coordinated. Over the next few years the tunnels were extended to serve as a hospital as well as an Army and Navy headquarters. Now cared for by English Heritage, the site is presented in its most significant history as the Secret Wartime Tunnels and contains a social history collection, the Military Hospital and Operations Centre.



Secret War Tunnels at Dover. English Heritage

Due to their material, construction and their proximity to the coast the environment within the tunnels is perfect for mould activity. They have an average annual temperature of between 15-19°C with Relative Humidity well above 70%. The conservation team at Dover are constantly dealing with outbreaks of mould, having to occasionally close them off to the public for health and safety and have a current cleaning protocol in some areas of once a week.

In June 2013 I began trials of Steri 7 on a small selection of objects that were continually being affected, namely the underside of the operations table, a set of bent wood office chairs and a pair of newspaper stands.



Underside of operations table. War Tunnels, Dover.



Bentwood chair. War tunnels, Dover.



Newspaper stand. War tunnels, Dover.

These trials are still on going. With the extreme environmental conditions of the tunnels it would appear that it could be impossible to permanently prevent mould from repatriating these objects, but the Steri 7 treatment has so far increased the time between outbreaks and hence the cleaning from weekly to monthly. The staff are very excited!

Conclusion

From the trials undertaken so far, it would appear that the biocide Steri 7 does indeed eradicate fungal growth from the surface of heritage objects. Further research is needed to discover whether it is the 'Residual Barrier Technology®' that is slowing down the regrowth of the fungi and what is the long-term effect of the product on the treated surfaces.

Both of the projects are still on going and I am continuing to work with the conservation scientists at the National Trust and English Heritage and am now looking at undertaking accelerated aging tests. It has been suggested that with climate change, mould risk is projected to increase due to increased winter relative humidity. I therefore believe it is important to research a safe, quick and effective solution to this growing problem.

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Biography

Tess Evans, Principal/Senior Conservator, Heights heritage Conservation

In 1984 Tess graduated from the Textile Conservation Centre, Hampton Court Palace, London, with a Post Graduate Diploma in Textile Conservation and a three-year apprenticeship in Tapestry Conservation. She was Deputy Head of the Textile Conservation Centre Tapestry Department for three years, before arriving in Australia in 1987. Since that time she has primarily worked in private practice both here in Australia and in the UK, setting up Heights Heritage Conservation in 2005 of which she is the principal and senior conservator. Tess has just returned from a two year sabbatical in London. During this time, she completed her Accreditation with the Institute of Conservation, worked in the exhibitions department of the Victoria and Albert Museum, and was a Lecturer for the BA course in conservation at the Camberwell College of Art, University of London. She is currently studying for a Masters in Museum Studies with the University of Leicester, for which she continues her research.