CLIMATE MONITORING

Atkins, Richard. Environmental monitoring and energy conservation - a study of Norton Park. *Environmental Monitoring of our Cultural Heritage Sustainable Conservation Solutions. The Proceedings of the international conference on Environmental Monitoring of our Cultural Heritage - Sustainable Conservation Solutions 13-14 November 2003, Royal Museum Lecture Theatre, Edinburgh, UK.* Singh, Jagjit; Knight, Barry, Editors. Environmental Building Solutions Ltd, UK, (2003), pp. Chapter 16.

By the early 1990's Norton Park School had ceased after a century to be used for its original function, indeed the limited use to which it had been put was insufficient to justify the increasingly onerous maintenance and heating costs. At the same time a need was identified to provide the city centre accommodation for the voluntary and charitable sectors in Edinburgh. This new use justified the repair and conversion of the building. A new charity, the Albion Trust, was formed which successfully raised funding and has successfully converted the building incorporating the rigorous requirements of Historic Scotland and achieving the very highest environmental and accessibility standards. Post completion Norton Park was monitored for some 18 months as part of the Energy Efficiency Best Practice Programme (now Action Energy run by the Carbon Trust). The resulting Case Study 1271 demonstrated that the energy efficiency of refurbished building is now comparable to the current "new build" best practice.
The services installations at Norton Park included a full BMS and Lighting Control systems and during the process of monitoring the building initial results were fed back directly to the facility management team, enabling them to identify and carry out further refinement of the building systems. (Author's abstract)

Camuffo, D.; Van Grieken, R. E.; Busse, H. J.; Sturaro, G.; Valentino, A.; Bernardi, Adriana; Blades, N. and et al. Environmental monitoring in four European museums. *Atmospheric environment* 35, SUPPL 1 (2001), pp. S127-S140.
http://www.vu-wien.ac.at/i102/MitarbeiterArbeitsgruppen/Four-museums.pdf

Investigation of the microclimate, of the gaseous and particulate pollution, and of the biological contamination in the Correr Museum (Venice, Italy), Kunsthistorisches Museum (Vienna, Austria), Royal Museum of Fine Arts (Antwerp, Belgium), and Sainsbury Center for Visual Arts (Norwich, UK). Risk factors are: imbalance in temperature and humidity, heating and ventilating systems which enhance indoor gaseous pollution, building structures, and large visitor numbers. Plants and carpets represent potential niches for bacterial colonization. Conservation requires a constant climate by day and by night. Showcases are helpful, but incandescent lamps inside can worsen the situation. (Mi.B. - AATA)

Camuffo, Dario; Bernardi, Adriana. Controlling the microclimate and the particulate matter inside the historic Anatomy Theatre, Padova. *Museum management and curatorship* 15, 3 (1996), pp. 285-298.

Describes the main results of two field surveys carried out in the historic anatomy theatre of the University of Padua in order to monitor the microclimate, the daily thermohygrometric cycles, and the deposition of airborne pollutants. Daily and seasonal cycles in ambient temperature and relative humidity induce changes in the wood moisture content, resulting in configurational strain or fracture. Deposition of airborne pollutants causes disfiguring soiling and may damage wood, with acids producing hydrolysis, and alkalis dissolving lignin and hemicellulose, or forming iron salts near nails. The microclimate campaigns were made during two periods at the extremes of the seasonal cycle, i.e., in February and July. Of particular importance were the exchanges of heat and air through the windows, the convective motions induced by lamps, and the resuspension of large particles due to human traffic. In summer, the daily cycles of relative humidity are responsible for dangerous shrinking and swelling of the wooden structure. Problems and possible remedies are outlined in the conclusions. (A.B.)

Camuffo, Dario; Van Grieken, René; Busse, Hans-Jürgen; Sturaro, Giovanni; Valentino, Antonio; Bernardi, Adriana; Blades, Nigel; Shooter, David; Gysels, Kristin; Deutsch, Felix; Wieser, Monika; Kim, Oliver and Ulrych, Ursula. Environmental monitoring in four European museums. *Atmospheric environment* 35, 1 (2001), pp. S127-S140.

In a European multidisciplinary research project concerning environmental diagnostics, museums have been selected, having different climate and pollution conditions, i.e.: Correr Museum, Venice (Italy); Kunsthistorisches Museum, Vienna (Austria); Royal Museum of Fine Arts, Antwerp (Belgium); Sainsbury Centre for Visual Arts, Norwich (UK). Some field tests investigated the microclimate, the gaseous and particulate air pollution and the biological contamination to suggest mitigative techniques that may reduce the potential for damage in the long run. Potential risk factors are generated by imbalance in temperature and humidity, generated by heating, air conditioning or ventilating system (HVAC), or the building structures, exchange of outside air, or large visitor numbers. HVAC may also enhance indoor gaseous pollution. Plants and carpets represent potential niches for bacterial colonisation. Pollutants and particles have been recognised having external and partly internal origin. Tourism has a direct negative impact, i.e. transport of external particles, release of heat, vapour and CO_2, as well as generation of turbulence, which increases the deposition rate of particulate matter. However, the main problem is that the microclimate has been planned for the well being of visitors during only the visiting time, disregarding the needs of conservation that requires a constant climate by day and by night. In some of these cases, better environmental niches have been obtained with the help of showcases. In other cases, showcases worsened the situation, especially when incandescent lamps were put inside.

(BCIN)

Cassar, May; Hutchings, Jeremy *Relative humidity and temperature pattern book. A guide to understanding and using data on the museum environment.* Museums & Galleries Commission, London (2000), 40 p.

Daniel, Vinod; King, Steve; Pearson, Colin and Cole, Ivan. Stories from historic buildings. In *14th triennial meeting, The Hague, 12-16 September 2005: preprints (ICOM Committee for Conservation).* Verger, Isabelle, ed. James & James (Science Publishers) Ltd., London (2005), pp. 625-631.

Four historic buildings in Australia, i.e., Hyde Park Barracks (New South Wales), Norman Lindsay Gallery (NSW), Lanyon Historic Property (ACT), and Hill End Historic Site Museum (NSW) were extensively monitored for temperature and relative humidity. The colonial era buildings were all constructed to provide passive human comfort conditions, and some of them have been adapted with air-conditioning systems to provide appropriate object comfort. This report outlines results from the monitoring, and it strongly suggests the need for diagnostic monitoring as a tool for key decision-making as well as the ability of these building to provide appropriate collection comfort conditions without use of mechanical systems. (Author's Abstract)

Edwards, John. Environmental monitoring - a key element in research and analysis - case study: Cardiff Castle. *Environmental Monitoring of our Cultural Heritage Sustainable Conservation Solutions. The Proceedings of the international conference on Environmental Monitoring of our Cultural Heritage - Sustainable Conservation Solutions 13-14 November 2003, Royal Museum Lecture Theatre, Edinburgh, UK.* Singh, Jagjit; Knight, Barry, Editors. Environmental Building Solutions Ltd, UK, (2003), Chapter 15.

Lloyd, Huw; Singh, Jagjit. Environmental monitoring: inspection, investigative monitoring techniques for historic buildings and case studies - brief paper. *Environmental Monitoring of our Cultural Heritage Sustainable Conservation Solutions. The Proceedings of the international conference on Environmental Monitoring of our Cultural Heritage - Sustainable Conservation Solutions 13-14 November 2003, Royal Museum Lecture Theatre, Edinburgh, UK.* Singh, Jagjit; Knight, Barry, Editors. Environmental Building Solutions Ltd, UK, (2003), Chapter 12.
http://www.ebssurvey.co.uk/docs/Environmental%20Monitoring%20Investigatory%20Techniques.pdf

Environmental monitoring is the key for environmental risk assessment of historic buildings their structure, environments and contents. Environmental monitoring can include a range of parameters that can be monitored, but the most important in historic buildings are, for example, weather stations, Internal, external, fabric and material

monitoring, moisture profiling and mapping.
Measured parameters include UV, Lux levels, temperature, humidity, dew point, and vapour pressure. Data from both short term and long term monitoring is analysed and can be used where necessary to recommend a range of measures, which can be implemented to achieve optimum environmental conditions. This could include installation of a permanent monitoring system by an independent company, if necessary to link up with the BMS system, which could alter the environment within the building. This is particularly applicable in historic buildings, Museum and Galleries, Castles, Libraries and Archives. The presentation includes case studies on Cardiff Castle, Cardiff, Wales, Farmleigh House, Dublin, Ireland and Guys Hospital, London. (Author's introduction)

Singh, Jagjit. Environmental monitoring and the development of holistic sustainable conservation solutions - An
Over view. *Environmental Monitoring of our Cultural Heritage Sustainable Conservation Solutions. The Proceedings of the international conference on Environmental Monitoring of our Cultural Heritage - Sustainable Conservation Solutions 13-14 November 2003, Royal Museum Lecture Theatre, Edinburgh, UK.* Singh, Jagjit; Knight, Barry, Editors. Environmental Building Solutions Ltd, UK, (2003), Chapter 1 .

Staniforth, Sarah. Benefit versus costs in environmental control. In *Managing Conservation: Papers given at a conference held jointly by the United Kingdom Institute for Conservation and the Museum of London, October 1990.* Keene, Suzanne, ed. The United Kingdom Institute for Conservation, London, UK (1990), pp. 28-30.

Staniforth, Sarah. Environmental control in historic buildings. *Transactions (Association for Studies in the Conservation of Historic Buildings)* **20**, (1995), pp. 33-42.

Environmental control in historic buildings can be a challenge when the most important artifact may be the house itself. Solutions must be found that do not compromise the historic or artistic integrity of the architecture and do not damage the structure when installed. Environmental control should be part of any preventive conservation program. Risk management and cost-benefit analysis must be taken into consideration, and preparations for and measures against fire, thieves and vandals, water, physical forces, pests, air pollution, light and ultraviolet (UV) radiation, incorrect temperature, and incorrect relative humidity (RH) must be made. Modern preventive conservation has much in common with traditional housekeeping, and a brief historic overview of housekeeping and a few of the lessons offered by it are mentioned. The author concentrates on a discussion of light and UV radiation, incorrect temperature, and incorrect RH, as the damage they cause is irreversible and insidious and results in loss of cultural value. Light is very damaging to organic material. It causes photochemical changes in furniture, paints, and textiles and weakens threads. Methods for removing UV

radiation, reducing the time of exposure of a room's content to light, and of reducing light levels are detailed. Polyester films that absorb UV light should be installed on windows that are not fragile or leaded. Mechanical blinds and tinted and reflective solar control films may also be used to reduce light levels. Methods for controlling, surveying, and monitoring RH and condensation are set forth. Dehumidification, conservation heating (heating that is controlled to maintain constant RH year round), and the use of humidistats are described. As minimizing the disruption to the fabric of historic buildings is paramount, the author encourages the wider use of surface wiring and radiotelemetric systems in environmental control systems. (K.E.J.- AATA)

Staniforth, Sarah; Hayes, Bob. Temperature and relative humidity measurement and control in National Trust houses. In *ICOM Committee for Conservation 8th triennial meeting: Sydney, Australia, 6-11 September 1987: Preprints.* Grimstad, Kirsten, ed. The Getty Conservation Institute, Los Angeles, California (1987), pp. 915-926.

The three ways in which temperature and relative humidity are measured in National Trust houses are described. The most recent of these are battery-operated electronic data loggers. They have vastly increased the amount of information on conditions, and have facilitated improvements to the environment in many of the 200 houses. Three case studies illustrating methods of direct control of relative humidity using dehumidifiers are described. The first involves a storage area in a house undergoing restoration, in which a Polythene "tent" was constructed, and the relative humidity controlled within it, using a refrigerative dehumidifier. The second describes the controlling of the environment inside a Perspex display case containing a green baize and silk embroidery textile, by circulating dry air from a reservoir produced by a dehumidifier. The final case study shows the importance of draught-proofing for the successful use of dehumidification in a building. Finally, the possibilities for controlling relative humidity by temperature are discussed, and found to be particularly suitable for most rooms in historic houses. (Author's Abstract)