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tions) and ozone should be 2µg/m^3. Fine particulates (dusts) should not exceed 75µg/m^3. Pesticides that have been applied to collections will also be present, some such as naphthalene and mercuric chloride are extremely stable and will continue to form vapour around the specimens for an extremely long period of time. Air quality sampling is recommended for botanical and zoological collections, bearing in mind that the chemical species to be monitored must be known before analysis begins. The TWA (Time weighted average over a period of 8 hours) applies for the following three chemicals. Mercuric chloride should not exceed 0.025mg/m^3, naphthalene should not exceed 53 mg/m^3 or 10 PPM and dichlorvos (Vapona™) 0.92 mg/m^3. If the area in question is not air-conditioned then installing or increasing ventilation is essential to improve air flow and thus reduce toxic build ups.

Cassar, M. 1995. *Environmental Management; Guidelines for museums and galleries*. Museums and Galleries Commission. Routledge London and New York

Dust

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Dust, depending on its consistency can be a very harmful contaminant and cause specimen deterioration. Although we are aware of its damaging properties and try to exclude it from our work area, it still manages to seep in through the smallest of gaps.

In my experience, white-plumaged birds have been the most susceptible to the normal and everyday grey household dust. Once it gets into the feathers it is (so far) impossible to remove entirely, resulting in a pale grey bird. Specimens of coral, especially the larger colonial madrepores, once

bleached of their natural colour often fall victim to dust, thus appear drab. If the dust is at all acidic in nature, then feather proteins and coral aragonite may become corroded.

As always, we try to exclude dust from specimens and displays but we end up generating even more through our normal working procedures. Building and building fabric renovation generates masses of dust and despite precautions of moving specimens or covering with sheets, using dust traps and static electricity it still plagues us.

Reduction by prevention seems to be the only cure but how many of us have suddenly discovered that builders are in an adjacent room drilling through the wall (*didn't you get the memo*?) and it is back to square one.

Despite this rather depressing tone, I hope that contaminant analysis will continue and might produce some more detailed articles in the newsletter.

Dust Monitoring

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Introduction

Dusts deposited onto the surface of artefacts within museums can not only potentially cause harm by absorption of moisture or abrasion of fibres etc. but also may dull the visual appearance. Ambient dust levels are readily determined using a combination of gravimetric procedures and laser techniques such as the Grim Real Time Dust Monitor. Armed with this information it is possible to calculate the deposition time (see Ligocki *et al*., 1990 and Nazaroff *et al*., 1990). However, simpler techniques such as the glass deposition gauge (glass microscope slides) determine what is actually settling onto surfaces, and whilst glass may not exactly mirror the object surface because of different electrostatic characteristics, it does provide a good approximation. The dusts on the glass slide represent a weeks deposition and encompass changes in airflows, Brownian movement and access by staff and/or public alike.

Technique

Monitoring of dust deposition is determined by measuring the reduction in reflectance of a shiny surface, in this case a glass microscope slide. The original idea was developed by Brooks and Schwar (1987), and later Schwar (1994) produced a dust monitor for measuring the loss in gloss of a microscope slide. However, in both papers only one point on the slide was monitored. Adams (1997) designed a jig, which would allow measurement in same three places before and after exposure. This improved approach reduced errors. The results are expressed as "soiling units per week" (su wk^{-1}) where 1 su is equivalent to a one percent reduction in surface reflection (Schwar, 1994).

A meter was designed to measure the reflection from glass surfaces simultaneously in three places and the deployment of the technique won myself and David Ford (formerly of the V & A) the Research and Innovations Award from the Museums and Galleries Commission in 1998. This was sponsored by the Jerwood Foundation.

The external environment

The technique was originally applied to determine if dust deposition could be classed as a nuisance. The term nuisance here has legal implications and whilst no "legal" level as been set, the work of Moorcroft and Laxen (1990) suggested that levels greater than between 20 and 25 soiling units per week would constitute cause for complaint. It is important to determine the source of the particulate material and if, for instance, the origin is a building site then damping down at the works or providing wheel washes for lorries taking away debris can be encouraged, once the data is presented. The determination of background levels is equally important for without this there is no benchmark.

Sometimes when an external monitoring survey is being made birds may leave 'messages' on the glass slides! There have also been occasions when the slides have been returned broken mainly through accidental damage or vandalism but the technique often allows two readings to be made in these instances, thus retaining a weeks worth of data.

The internal environment

The application to the internal environment was first made by Laxen (1990/1) when, as part of a study about Sick Building Syndrome, the soiling rate was correlated with the percentage of unhappy staff. The use in the museum environment and historic houses has since been studied by the author and co-workers. A year long dust deposition survey (Ford & Adams, 1999) made at the Victoria and Albert Museum found that mean value at the entrance was 5 su wk^{-1} and within the body of the Museum 3 su wk^{-1}. This is relatively low compared with the mean of 16 su wk^{-1} recorded outside the Museum. The levels recorded internally tend to vary with location and consequently it is difficult to recommend a criterion. In many cases studied, remedial work or re-building is to take place and the method has been used to monitor the ingress of dusts from one area to another. In most cases the "background" levels were determined prior to works being carried out.

At Canons Ashby, a National Trust property, the effectiveness of down proofing during refurbishment was monitored using dust slides (Lithgow & Adams, 1998) and successfully showed how well the covering of artefacts worked.

Other considerations

Whenever these studies are undertaken, a number of other factors are recorded. The effect of temperature and relative humidity is currently being assessed and will be published in a forthcoming paper (Adams & Ford, *in prep.*). Also in this paper is the effect of the number of visitors entering a building and the associated dust deposition rates.

At the British Museum there are major building works in progress and dust slide monitoring has been maintained throughout the project. A number of locations had varying deposition rates and a study has been made on the accumulation rates under these varying conditions (Adams and Kibrya, *in prep.*).

Summary

The use of glass microscope slides and the measurement of the reduction of surface gloss to determine dust deposition is an inexpensive and unobtrusive technique, which can be applied to a wide range of environments. This method allows monitoring of dust sources and where contractors are involved discussing ways of reducing the ingress of dusts: assessing the influence of visitors, pinpointing "leaky" windows and assessing cleaning regimes.

References

Adams, S.J. 1996. Dust deposition and measurement: A modified approach. *Environmental Technology,* **18:** 345-350.
Brooks ,K. and Schwar, M.J.R. 1987. Dust deposition and the soiling of glossy surfaces. *Environmental Pollution,* **43:** 129-141.
Ford, D. & Adams, S.J. 1999. Deposition rates of particulate matter in the internal environment of two London museums. *Atmospheric Environment,* **33:** 4901-4907.
Laxen, D.N.H. 1990/91. Factors causing Sick Building Syndrome: A study of naturally ventilated offices. *London Environmental Bulletin,* **6**(2): 4-6.
Ligocki, M.P., Harvey, I.H.L. and Cass, G.R. 1990. Measurements of particulate deposition rates inside Southern California Museums. *Aerosol Science and Technology,* **13:** 85-101.
Lithgow, K. and Adams, S.J. 1998. Monitoring methods of dust control during building works. *Views,* **29:** 26-28. National Trust publication.
Moorcroft, J.S. and Laxen, D.P.H. 1989. Assessment of dust nuisance. *Environmental Health,* August, p. 215-217.
Nazaroff, W.W., Salmon, L.G. and Cass, G.R. 1990. Concentration and fate of airborne particles in museums. *Environmental Science and Technology,* **24:** 66-77.

Schwar, M.J.R. 1994. A dust meter for measuring dust deposition and soiling of glossy surfaces. *Clean Air,* **24:** 164-169.

Removing Mercuric Chloride Residues from Herbarium Labels

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Mercuric chloride or corrosive sublimate, as it is also known, has been applied to botanical specimens since the late 18th century. Over time, the chemical reacts with the paper medium and can produce a grey/black stain that can discolour the herbarium sheet and obscure data on labels. Catherine Hawks (Falls Church, Virginia) and Deborah Bell (Smithsonian Institute, Washington) have published a paper describing how to successfully remove these stains from labels.

The specimen itself does not become discoloured, so when re-mounting a specimen the previous discolouration (and therefore pesticide application) should be recorded onto the new sheet.

The authors found that the data was rendered illegible by the dark salt deposition. Analysis had shown that the stain contained mercuric sulphide and possibly a mercury oxide/sulphide compound. Un-reacted mercuric chloride could also be present on the paper.

The authors were familiar with the effectiveness of iodine in removing the colouration within mercury stained tissue (Natural History Museum, 1906) and so they experimented with varying concentrations of iodine solutions and found all to be successful. The following method was recommended.