# Advice sheet:
## Monitoring light and UV radiation in museums

SCOTTISH MUSEUMS COUNCIL

## Introduction

Monitoring of the museum environment is one of the basic tasks of all museums. The SMC factsheet *What is Environmental Monitoring?* explains the reasons for monitoring the environment and its purpose. This advice sheet aims to introduce the basics of monitoring the environmental factors of light and ultraviolet radiation. It will describe the equipment that is available to you, how to look after it and maintain it in good order and how to use it to best effect.

## Monitoring: How Often?

How regularly and frequently you need to monitor light depends on several things, including the light-sensitivity of the collections, how you light your museum and your exhibition programme. A basic rule of thumb to follow is to check light levels before every new exhibition and, if you have natural lighting in your museum, to carry out a lighting survey over a period of one year. Just as with other forms of monitoring, the purpose of light monitoring is to help inform improvements.

## Monitoring equipment: what should I use?

In museums, light is measured in terms of its concentration and expressed in Lux, which is one light unit (Lumen) per square metre. Ultraviolet radiation can be measured as an absolute, in microwatts, or expressed as a proportion of the light. In museums, it is normal to use the proportional measurement, which is expressed in microwatts per Lumen (µW/Lm). There is a range of light and UV monitoring equipment available and prices vary too, depending on accuracy and sophistication.

Using spot readings is still the most common way to monitor light in museums, but there are instruments that log total light exposure over time and increasingly museums are turning to dosimeters to monitor the effects of light. This is because the effects of light are cumulative and it is more important to consider the total light exposure that an object may be receiving, than to know the light level at any one time.

## Instruments for spot reading

**Light meter**
The light meter contains a photosensitive cell which is able to match the way the human

eye perceives light. The photocell converts light energy to electric energy which in turn is read off a scale or represented digitally.

**Ultraviolet meter**
This meter works in the same way as a light meter, again using a UV-sensitive cell to convert UV-radiation to electrical energy.

**Combined Lux and UV meter**
There are some instruments available that combine light and UV measurement in one instrument, but use the same technology as described above

## Instruments for continuous or cumulative measurement

**Dosimeters**
This method of monitoring the effects of light has been around for a long time. Dosimeters work on the principle that light will cause a perceptible amount of fading of organic material (usually dyes) over time. The blue wool scale is the most well known dosimeter system; it was developed for testing the light-fastness of dyes. Blue wool dosimeters fade in light conditions to a known degree. This means that, by comparing a faded dosimeter with the scale, it is possible to find out how much light the adjacent object has been subjected to.

**Data-loggers, telemetric sensors and hard-wired systems**
These instruments use photo and UV-sensitive cells to measure the light and UV levels and repeat the readings so frequently that it is possible to build up a picture of the cumulative light and UV. The data is relayed to a computer for easy presentation and manipulation.

**Accuracy**
All instruments are subject to some degree of error. This is usually discussed as accuracy. Manufacturers and suppliers of light and UV monitors will be able to tell you the accuracy of the instrument you are buying. Many instruments are more accurate within a restricted range and so it is worth checking that the instrument you want to buy is at its most accurate at the low light levels. This is because you are likely to want to measure most accurately within the 50-200 Lux range.

Because we cannot prevent the error that is present in all instruments, we must make sure that we keep it to this minimum by reading instruments accurately and making sure that they are maintained properly. This means making sure that the photo and UV-sensitive cells are kept clean and dust-free.

Check that your meters are reading correctly every time you use them. Cover the photo or UV-sensitive cell completely with your hand and check that the reading is zero. It is also important to send light and UV meters to a NAMAS registered laboratory for a calibration check every couple of years.

With some basic light meters, it is possible to adjust the meter to read zero. Many more meters cannot be adjusted easily. If you are finding that the meter is reading much too high, you should send it away for repair or replace it.

## Where and when to monitor?

How you choose to monitor light will depend on what you are trying to find out. You may be trying to map the pattern of light in a display space, to help with planning of exhibitions, or you may want to check that the cumulative light falling on a particular object remains within the safety limits that you have specified for it. In either case you will need to make sure that the meter you use is placed to give you the most representative reading. In other words, you need to make sure that the sensor is positioned in the right plane and location, and that it is not shadowed or blocked in any way.

If you are taking spot readings in order to build up a picture of the changing light in a space over time and season it is vital that you always take readings from the same positions.

## Keeping a record

Your recording system for light and UV will depend on how you take the readings and the purpose of the monitoring. Sometimes it is easier to mark light readings on a plan of the space, sometimes it makes sense to record daily changes on a table. Whichever recording system you use you should always include notes or relevant information to help anyone reading the record to understand what they are seeing. This will include noting the date and time of the reading, and might also include information such as the weather, whether windows were covered or not, and any changes to the lighting scheme that might have been made.

If you are measuring the cumulative light falling on an object using a data-logger then you will need to remember to make a separate note of relevant information, which you will be able to refer to when looking at the data.

## Using the information

It is relatively straightforward to manipulate light and lighting, far more than is possible with temperature and relative humidity. It is therefore much more common for light monitoring to result in immediate improvements for collections. Light can be filtered, removed, redirected and diffused using simple and effective technology. A quick survey of the light levels in your museum might immediately reveal where the problem areas are - and where light levels are safe for even the most sensitive object.

## Reporting – what and how?

By letting others know what you have discovered you make it easier to make long-lasting changes for the benefit of the collections. This is particularly true if you prepare your report for those who make decisions on forward plans and budgets. A well thought through report on the lighting in the museum will be persuasive. A report is particularly useful if you are able to include recommendations for improving the lighting in the museum. Giving a list of possible options, with the pros and cons of each and a preferred solution, helps those making the decisions on budgets and spending.

## The final analysis

Monitoring of light and ultraviolet radiation in a museum is an important part of environmental management.

Successful monitoring will:
• protect collections
• reduce the need for remedial conservation treatments
• train staff and volunteers in essential museum skills
• support funding applications
• inform improvement projects

**Further information and advice**
This is one of a series of factsheets, advice sheets and guidance notes produced by SMC on common collections care and preventive conservation issues. For more details, signposting to further sources of advice or information on how to contact a conservator, see our website at: www.scottishmuseums.org.uk

**Further reading**
Environmental Management – Guidelines for Museums and Galleries
(May Cassar, 1995, Museums & Galleries Commission / Routledge;
ISBN 0-415-10559-5)



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