



### GETTING A HANDLE ON THE MUSEUM ENVIRONMENT

by

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Fabrics eaten by moths; photographs faded beyond recognition; ancient pottery turning to dust. These are disasters in museums, libraries and other cultural institutions, and preventing them is part of the daily routine for curators and directors. One of their tools is the ability to control environmental conditions, which can effectively slow the deterioration rate of historic artifacts and documents, and allow continued access and use for years to come. Regular monitoring of conditions is an essential component of environmental control.

Environmental monitoring generally includes three parts: temperature and relative humidity; light exposure; and biological activity. Equipment for environmental monitoring is available from the outreach program of the Minnesota Historical Society's conservation department: The Environmental Test Kit and the Electronic Data Logger can be borrowed by cultural institutions free of charge. (See pages 5 and 6 for details.) Like proper handling, storage and display techniques, these tools will help significantly prolong the life of collection material.

#### The importance of environmental control

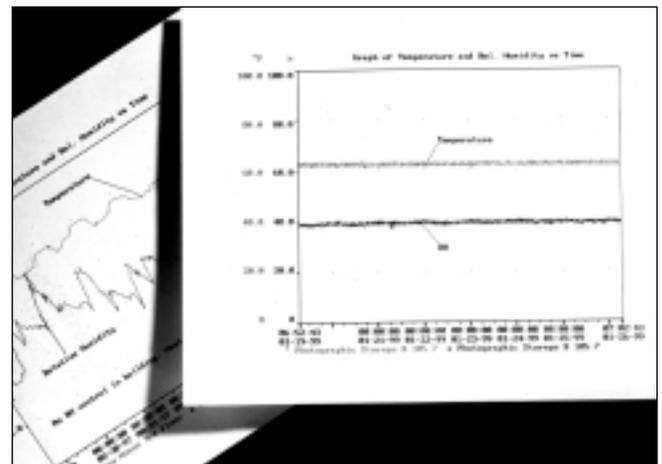
It is generally recommended that institutions maintain a temperature of 65-70 degrees Fahrenheit and 35-50 percent relative humidity (RH) to slow the deterioration of a wide variety of objects. The temperature in storage areas should be kept at the lower end of this recommended range while the upper range will be more practical for areas where people are using or working with collections. This strict environmental control can be difficult to maintain, so it is important to know why these guidelines exist.

Poor environmental conditions can lead to various kinds of damage to collections. High heat, humidity and airborne pollutants accelerate the chemical deterioration of materials. These reactions can cause paper to become brittle, photographs to fade, wooden objects to dry and crack, and textiles to deteriorate rapidly.

Because most museum and archival materials are hygroscopic, i.e., they absorb moisture from the atmosphere, they expand and contract as the humidity in the air fluctuates. This dimensional shifting causes stress to the object and can particularly affect already weakened areas such as cracks in furniture or deteriorated sewing in a book. Some studies suggest that the fluctuation between high and low temperatures and RH can do more damage to materials than an



Figure 1, right. Print-outs of data logger charts. One chart shows the desired, ideal steady lines for temperature and RH in a space with state of the art controls. The second chart shows how temperature and RH fluctuate wildly in a different space which lacks effective controls.



MHS photo by Eric Mortenson

environment that remains fairly stable at a "poor" humidity or temperature set-point. It is most beneficial to minimize the fluctuations of RH, especially if strict environmental control cannot be maintained. (See Figure 1, above.)

Exposure to light, too, can cause significant deterioration. We are all familiar with faded old photographs and quilts that have lost their color. Exposing collections to light, both in its ultraviolet (UV) and visible range, can cause major damage to collections, sometimes even if they are exposed for short periods of time. This damage can take the form of fading, yellowing or other shifts in colors, or becoming brittle. Sources of light exposure include windows, skylights, fluorescent lights and exhibit lighting that is too strong or improperly positioned.

In addition to UV and visible light, infrared (IR) light is a threat because IR is *heat*, and heat contributes to the deterioration of collections. Scientific theory holds that for every 18 degrees Fahrenheit (10 Celsius) increase in temperature, the rate of chemical reaction (such as fading or becoming

#### Editor's note:

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brittle) doubles. Awareness and control of heat from all sources including exhibit lighting is an important aspect of an environmental monitoring program.

Warm, moist environments are particularly conducive to promoting biological attack. Mold spores, which are present in all environments, begin to grow in humidity levels from 60-70 percent (some species have been found to begin growth at RH levels as low as 45 percent).

MHS photo by Eric Mortenson



*Figure 2, above. Environmental Test Kit. The kit includes instruments for measuring visible and UV light, a psychrometer for measuring RH, several inexpensive monitoring tools (see figure 3), and a manual.*

Insects also prefer warm, wet spaces. Common among museums and libraries are such species as the carpet beetle, silverfish, cockroach,

powderpost beetle and clothes moth. Mold, insects and pests such as rodents and birds are capable of inflicting a large amount of damage in a short time period. Without vigilance, whole collections may be seriously damaged or even lost to their attack.

### What can you do?

The first step a curator or director can take to control the environment is to set the parameters for the environmental control system at levels that can be consistently maintained. Economics, existing air handling equipment, the needs of the collection and the building itself are all factors in deciding the set points for environmental controls. The goal is to have the temperature and RH as low as possible, while eliminating fluctuations in the readings.

The second step is to take time to look around each area in the institution and determine what action can be taken immediately to eliminate trouble areas. Keep external windows and doors closed and seal any cracks in window sills, panes and door frames to prevent outdoor air from entering the building. Open windows bring unconditioned air into the building, causing stress and additional load on the environmental control equipment. Unnecessary openings can also allow airborne pollutants, insects and rodents to enter the building. Protect collections from heat sources such as radiators and vents, either by moving material away from these elements, or by deflecting the air-flow away from collection material.

Eliminate over-exposure to light by keeping blinds and curtains closed in collection areas. Turn off the overhead lights or keep them dimmed in low activity areas, especially storage areas. Light sources in display cases should be properly sized and arranged to reduce damage. Guidelines for proper light levels are readily available from a variety of sources, including the Society's Conservation Outreach Program.

Step three is to monitor for insects and other pests. A common and inexpensive technique is to use sticky traps or "blunder traps," which are available from many hardware stores or pest control businesses. These traps are usually tent-shaped and have one surface coated with a sticky glue. When pests "blunder" into them they get stuck and cannot escape. It is also helpful to collect samples of different insects and pests. This aids in the identification of the insects, which yields their life cycles, breeding habits, nesting habits, and food sources. With this information in hand, the pests can often be eliminated without resorting to extreme "chemical warfare."

### What's been done

A crucial step in controlling the environment is to monitor exhibit, storage and other collection areas. Monitoring the environment does not necessarily mean buying expensive equipment, but it does require diligence and commitment (qualities that curators and directors already have).

The Kanabec County Historical Society (KCHS) is a regular user of the Environmental Test Kit. Twice a year for approximately five years, KCHS Registrar Jan Franz has used the kit to monitor the environment of the building. Although KCHS has some monitoring equipment of its own, Ms. Franz uses the kit to keep track of general conditions in the facility, to check that the environmental controls are working properly, and to use equipment that they do not own.

"We have to be in the ball park with our RH and temperature," she said, "it's a good way to check that we are."

Franz also explained the benefits of using the light meters in the kit to determine light levels and re-direct lighting in the exhibit area. "It's been a real eye opener to me that the light can be that harmful." She stated that recent meter readings were specifically helpful in determining the lighting of an exhibit of large plat maps.



MHS photo by Eric Mortenson

*Figure 3, right. Monitoring tools that institutions keep each time they borrow the Environmental Test Kit: blue wool card, humidity indicator card, pH pen, "sticky" trap, and kit manual.*



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For the Clay County Historical Society (CCHS), a second-time borrower, timing of the test kit couldn't have been better. The test kit was ordered mainly for the use of the UV meter, according to CCHS Archivist Mark Peihl. New exhibit lighting was being considered, and Mr. Peihl wanted to test the lights. "We tested lamps that were possible candidates for exhibit areas. We wanted to find out if we could filter them and how effective the filters were," he said.

MHS photos by Eric Mortenson

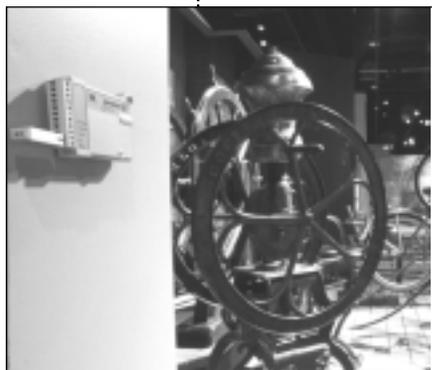


Figure 4, above. Data loggers in place in a museum exhibit. The data logger can be placed unobtrusively (lower photo) or more prominently (top photo) and labeled to educate the public about the monitoring that you are doing. Data loggers in public areas should be secured to prevent theft and the loss of the instrument and its data.

On July 19, 1998, a pipe burst, flooding parts of the archives. "We were in the process of changing exhibits and it [the test kit] was here when we had the water break," said Peihl. Using their own equipment and tools from the

environmental kit, he continually monitored the RH levels in the archives during the recovery effort. A professional cleaning company also monitored the environment to ensure the humidity levels were under control. (See also articles in the September and November 1998 issues of *The Interpreter*.)

The staff of the Scott County Historical Society (SCHS) used the electronic data logger that they borrowed to good advantage. They documented the temperature and humidity in their building and made the data available to the engineer and conservator who consulted with them about improving the environmental conditions in their building. This information, along with other information gathered by the consultant, was used to formulate recommendations that were incorporated into a successful IMLS grant application.

The grant provided funds to modify the heating system to improve humidity control, and also for the purchase of several data loggers so that they can monitor conditions precisely without having to borrow equipment. Corrine Wegener, SCHS curator of collections, said that it is "critical to have access to loan equipment for institutions lacking the budget to buy expensive instruments."

## Testing the environment

Inexpensive instruments can give the rough idea of the temperature and humidity that is needed to be aware of environmental trends. A variety of thermometers and hygrometers (for measuring RH) are available and can range in price from \$5 to \$150 or more. These can be found at local hardware or electronics stores, or can be ordered through suppliers of preservation materials. Precision instruments and instruments that keep records of the readings (either on paper or in electronic form) are more expensive.

Humidity indicator cards can be obtained readily through commercial library suppliers or photographic preservation supply companies. These inexpensive cards, with small patches of moisture sensitive material, change color from blue to pink when exposed to humid conditions. (A list of suppliers is available from the Society's Conservation Outreach Program; see p. 6 for contact information.)

Lighting can be easily monitored or measured using simple-to-use blue wool cards or light meters. Available at library or preservation supply companies, blue wool cards use specially dyed fabrics that are sensitive to light, and can indicate whether display lighting or the room lights are causing damage to your collections.

Light meters will give a more accurate reading of the amount of visible and UV light in a room or display case. However, these instruments can be expensive, and organizations may *not* need to own one. Fortunately, organizations in Minnesota can borrow light meters (see below) to help them with their environmental monitoring and control program.

These tools can give a curator an idea of what conditions in the institution are like at a specific point in time. If consistently recorded, a *general pattern* of the environmental conditions in the building can be established and used to make improvements.

## Equipment available for loan

For more accurate and recorded monitoring, the Society's conservation department has two kits available to Minnesota cultural institutions. Both the Environmental Test Kit and Electronic Data Logger are free upon request and contain precision monitoring equipment and detailed, easy-to-follow instructions. (See Figures 2 and 4.)

### *Environmental Test Kit*

The Environmental Test Kit is available, free, to cultural institutions in Minnesota. (See Figure 3.) These kits come complete with almost everything you need to test the environment in your institution. Each kit includes:



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- detailed instruction manual and sample forms for recording data;
- two light meters (for visible and UV testing);
- blue wool card for monitoring light levels;
- battery-operated psychrometer for testing humidity levels;
- RH indicator card for testing humidity levels;
- pH pen for testing acid content of housing materials;
- sticky trap for monitoring insects and other pests;
- copy of *The Museum Environment* (Second ed.), by Gary Thomson.

These instruments can help determine base-line temperature, humidity and light levels. **You keep the manual, pH pen, RH indicator card, the sticky trap, and the blue wool card**, so that even after the return of the instruments, you can continue to monitor your institution's environment. Loan period: one week.

### Electronic Data Logger

Electronic data loggers monitor and record temperature and relative humidity. (See Figure 4.) These data can be used to identify and trouble shoot environmental problems, or verify that your environmental controls are working properly. The data logger may be used in one or more locations depending on your needs and situation.

**Upon return of the data logger, an MHS conservator will download, analyze and print your data, and send you a copy of the printout and**

**a written report about your institution's environmental conditions.** Loan period: three weeks.

- **The Environmental Test Kit and Data Logger are free upon request.**
- **Easy-to-use manuals provide step-by-step instructions.**
- **Minnesota Historical Society conservation staff is available to answer any questions you may have.**
- **Your only expense is the return shipping at the end of the loan period.**
- **To request a kit or for more information, call or e-mail the Minnesota Historical Society Conservation Outreach Program. Phone: 651/297-1867 or 1-800-657-3773; e-mail: conservationhelp@mnhs.org**

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## Summary

A good environment can slow deterioration and prohibit biological attack; proper environmental control is a useful tool in the fight against time. The life of collection materials can be prolonged if temperature and RH can be maintained in safe ranges. In particular, fluctuations in temperature and RH should be avoided. Proper lighting is also important in protecting collection materials from irreversible damage; control of lighting can yield enormous benefits for the institution, with a very modest outlay of resources.

A program for monitoring the environment in exhibit, storage and other collection areas is an important tool for curators or directors in their efforts to prolong the life of their collections. Such a monitoring program should include consistent and diligent recordings, and using proper equipment that is available, for instance, in the test kits to help provided through the MHS conservation department. The kits come with detailed instructions and are easy to use. Contact the conservation department for further information at 651/297-1867 or email at [conservationhelp@mnhs.org](mailto:conservationhelp@mnhs.org).

## Further Readings

Appelbaum, Barbara, *A Guide to Environmental Protection of Collections*, Madison, Wis.: Sound View Press, 1991. (Available for loan from the MHS Conservation Outreach Program.)

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