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Technical Bulletin

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Canadian Conservation Institute

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Environmental Norms
for Canadian Museums,
Art Galleries and Archives

Raymond H. Lafontaine

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Art Galleries and Archives**

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Abstract

This Technical Bulletin presents a summary of the environmental norms applicable to Canadian museums, art galleries and archives to protect and preserve collections.

Author



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Photo by James Stark

Introduction

Environmental conditions within museums, art galleries and archives have a direct bearing on the preservation of their collection. The strict control of environmental parameters will effectively minimize the risk of damage, due to adverse conditions, to artifacts and works of art.

The Canadian Conservation Institute has published Technical Bulletins on specific environmental factors in order to help museum staff take the necessary steps to improve the conditions in their institution. The following environmental norms are extracted from these bulletins and other publications in the field of conservation. They are drafted essentially for directors and curators who must deal directly with architects and building engineers, and are meant for Canadian climatic conditions. They apply to newly constructed buildings, additions to existing facilities, renovation to old buildings, installation of new climate control systems and other relevant situations.

Institutions which are not contemplating changes to their existing facilities will also find this material useful as a summary of recommended environmental requirements for light, temperature and relative humidity.

1. Temperature Requirements

- 1.1 The *optimum* temperature for exhibition and storage areas is 21°C, maintained year round with a daily fluctuation not to exceed $\pm 1.5^\circ\text{C}$.
- 1.2 The minimum acceptable temperature condition is a set point varying from 20°C to 25°C with a change-over rate of 1°C per month. The maximum permissible daily fluctuation is $\pm 1.5^\circ\text{C}$ about the set point.
- 1.3 Temperature requirements are based upon the human comfort factor rather than preservation of the artifacts themselves. In many instances, deterioration rates of certain materials could be reduced at lower temperatures. It is, therefore, advisable to keep storage areas at slightly lower temperatures in winter, as this will help maintain the required humidity level.
Care should also be taken when transferring objects from a cool area to a warmer area. If the temperature differential between the two areas is excessive, condensation may occur on the object. To avoid this, place the artifact in a plastic bag or box (e.g., styrofoam cooler) and thus let it equilibrate slowly to the new conditions. Alternatively, keep a small room at an intermediate temperature to serve as a preconditioning area for artifacts being moved.
- 1.4 Consideration must be given to those materials having special temperature requirements. For example, fur garments, animal skins and similar artifacts

are best stored in a cold storage kept at $4^\circ\text{C} \pm 1^\circ\text{C}$, at the proper R.H. (see section 2.) and with sufficient air circulation.

2. Relative Humidity Requirements

- 2.1 The *optimum* relative humidity condition for exhibitions and storage is a constant condition year round with a set point between 47% and 53% RH, and with a daily fluctuation not to exceed $\pm 2\%$. Because of the severe climate in most areas of Canada, it is almost impossible and certainly impractical to try and maintain such strict humidity controls.
- 2.2 The minimum acceptable relative humidity set point for winter months is 38% and the maximum acceptable summer set point is 55%. Daily fluctuations should not exceed $\pm 3\%$. Occasional variations of as much as $\pm 5\%$ are tolerable if these are the exception and not the rule. The set point changeover rate from winter to summer should be no faster than 5% per month. These conditions apply to a mixed collection.
- 2.3 These relative humidity levels are suitable for the majority of artifacts encountered in a typical collection. Again, certain categories of materials will necessitate conditions other than those specified above. For example, many metallic artifacts are less prone to corrosion if kept at lower humidities.
It may be impractical to maintain different levels of humidity in an exhibition area, unless one uses display cases. Since metal artifacts are less susceptible to damage at lower humidities, a separate, dry storage room (15-30% RH) would be desirable.
- 2.4 In order to maintain the high relative humidity levels required during the winter months, we recommend that the building be maintained at a slightly negative pressure relative to the outdoors whenever pollution levels permit.

3. Structural Requirements

- 3.1 The exhibition area should ideally be free of windows and skylights unless these are U.V. filtered and, if necessary, coated or tinted to maintain the illumination levels suggested in paragraph 6.1. If the building is situated in an area where extremes in climate are common, then all its windows should be triple-glazed.
- 3.2 Wall construction should be of an appropriate design, considering relative humidity levels (see paragraphs 2.1 and 2.2) and the external winter conditions. Insulation should be of a quality to prevent condensation on the interior surfaces.

3.3 If the building structure is not designed to withstand the high relative humidity recommended for winter months (minimum 35%), structural damage will result to the envelope in a relatively short time. In older buildings and historic houses, the original wall construction would not have been designed to accept high winter RH. Unless new inside walls are added with proper insulation and vapour-barrier, relative humidity levels may have to be lowered during the winter. The choice between artifact preservation and structural integrity will eventually have to be made by the director of an institution. If wall construction modification is not made, it is always possible to control RH in those rooms that have no outside walls and leave the other rooms uncontrolled. Alternatively, artifacts can be kept in buffered or controlled display cases without the need to humidify the whole building.

4. Air Cleaning Requirements

4.1 The level of dust removal should be 95% of particles, 1 μm in diameter or larger and 50% of particles between 0.5 and 1 μm in diameter.

4.2 If unusually high levels of gaseous pollutants such as sulphur dioxide, nitrogen dioxide, ozone and hydrogen sulphide exist where the institution is located, some form of central air purification should be considered. Alternately, portable activated charcoal filters can be installed in problem areas. Electrostatic air purifiers and precipitators should not be used since they can produce ozone.

4.3 The frequency of air changes and the amount of fresh air make-up should comply with any existing codes or regulations for public buildings. They should be such that the requirements stated in sections 1. and 2. are achieved.

5. Recording Requirements

5.1 For central forced air systems, daily records should be kept of the return air temperature and relative humidity.

5.2 Portable thermohygrographs should be maintained in each exhibition and storage area of the building. Calibration should be checked every month using a motor-blown psychrometer or an electronic hygrometer. Sling psychrometers are not recommended.

5.3 In lieu of the above (5.2), a central electronic monitoring system can be utilized with RH and temperature sensors in each exhibition and storage area of the building. Periodic verification of this system is also necessary to ensure precise and reliable results.

6. Lighting Requirements

6.1 Light levels in exhibition areas should meet the following requirements:

High sensitivity to Light—50 lux. Some examples: dyed materials, plant and animal colours, water-colours, textiles, colour prints, felt-tip pen drawings, colour photographs, parchment—with coloured dyes and inks.

Medium Sensitivity to Light—150 lux. Some examples: black and white prints, photographs and archival materials; unpainted organic materials; painted and lacquered materials; oil and acrylic paintings; polychromes and ivory.

Low Sensitivity to Light—300 lux. Some examples: ceramics, porcelain, argillite, glass.

Negligible Sensitivity to Light—Some examples: stone, bare metal. These objects will not suffer any photo degradation, even at high light levels. However, intensive lighting will cause surface temperature increases with resulting desiccation and possible damage. Levels much higher than about 500 lux should therefore be avoided.

Brightly lit areas or surfaces are also not recommended, in order to avoid unpleasant contrasts of brightness and to facilitate the gradual visual adaptation from bright levels to subdued illumination.

6.2 Both incandescent and fluorescent lighting systems can be used. The ultraviolet radiation emitted by fluorescent lamps should not exceed 75 $\mu\text{watts/lumen}$; otherwise a U.V. filter sleeve or a U.V. absorbing diffuser will be required. In order to minimize colour distortion, fluorescent lamps should have a colour-rendering index of at least 85.

Areas other than the exhibition area can be illuminated at the discretion of the designer or curator; however, it should be remembered that the public requires a gradual decrease in lighting in order to adjust to lower levels. When in storage, keep light-sensitive materials in the dark at all times. Switch off lamps in storage areas when not in use.

6.3 High pressure mercury and sodium lamps should not be used in exhibition and storage areas of museums, art galleries and archives because of poor colour-rendering properties and/or high ultraviolet radiation emission.

7. Special Considerations

7.1 The actual move of artifacts to a new climate-controlled facility should be planned very carefully. If the environmental conditions of the old facilities are

much different than those recommended in sections 1. and 2., it may be necessary to adjust the control settings of the new facility to the levels at which the artifacts had previously been accustomed. They should then be changed gradually to the recommended values so that the artifacts can acclimatize slowly to the new conditions. The rate of change can be as much as $\pm 5\%$ R.H. and $\pm 2^\circ\text{C}$ per week depending on the sensitivity of the collection.

- 7.2 If possible, display cases should be lit from the outside to avoid heat build-up within. If lamps are located inside a case, they should be sealed off from the rest of the case and well-ventilated.
- 7.3 Museums closed during the winter season can avoid excessive damage to their collections, if the following recommendation is observed. If continuous heating is being considered, it is much better to maintain a relatively low temperature of $5\text{-}10^\circ\text{C}$. Normal temperatures of $20\text{-}25^\circ\text{C}$ will bring about low humidities—and subsequent desiccation if no humidification is provided. Even no heat at all is better than maintaining a temperature of 20°C without humidification.

Note: Water pipes near or inside exterior walls may freeze, even if the inside temperature is kept at 5°C . Therefore, all pipes should be drained or separately heated with thermostatically-controlled heating cables (found in many hardware stores).

- 7.4 The following materials have special humidity, temperature and/or other requirements:

Argillite—avoid shock and vibration

Bronze, brass and copper—ideally, store and exhibit at a humidity of 30% or less

Silver—avoid gases and vapours containing sulphur; e.g., SO_2 , H_2S , etc.

Skin, furs—store in a cold storage at 4°C and a humidity of between 35% and 58%

Iron, steel—ideally, store and exhibit at a humidity of 30% or less

Waterlogged wood—keep submerged in water

Nitrate- and acetate-based film—cold storage (see Rempel, Siegfried, "The Care of Black & White Photographic Collections: Cleaning & Stabilization", Technical Bulletin #9, Canadian Conservation Institute, Ottawa, Ontario.)

Colour photographs—store in a cold storage at 4°C and a humidity of between 25% and 35%.

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