INDIANA HISTORICAL SOCIETY
COLLECTIONSADVISOR
A RESOURCE FROM IHS LOCAL HISTORY SERVICES

Issue 174 | April 2026

The Science of Light, Ultraviolet, and Infrared

By Tamara Hemmerlein
Director, Local History Services

School No. 97, James E. Roberts School, Children at Window Seat (Indiana Historical Society)

When we talk about light in museums, we are often using the term in a very general way. When we say that light damage is cumulative and cannot be reversed, we are not separating the light source from what is being emitted by that light. We are using one term to talk about several causes of deterioration.

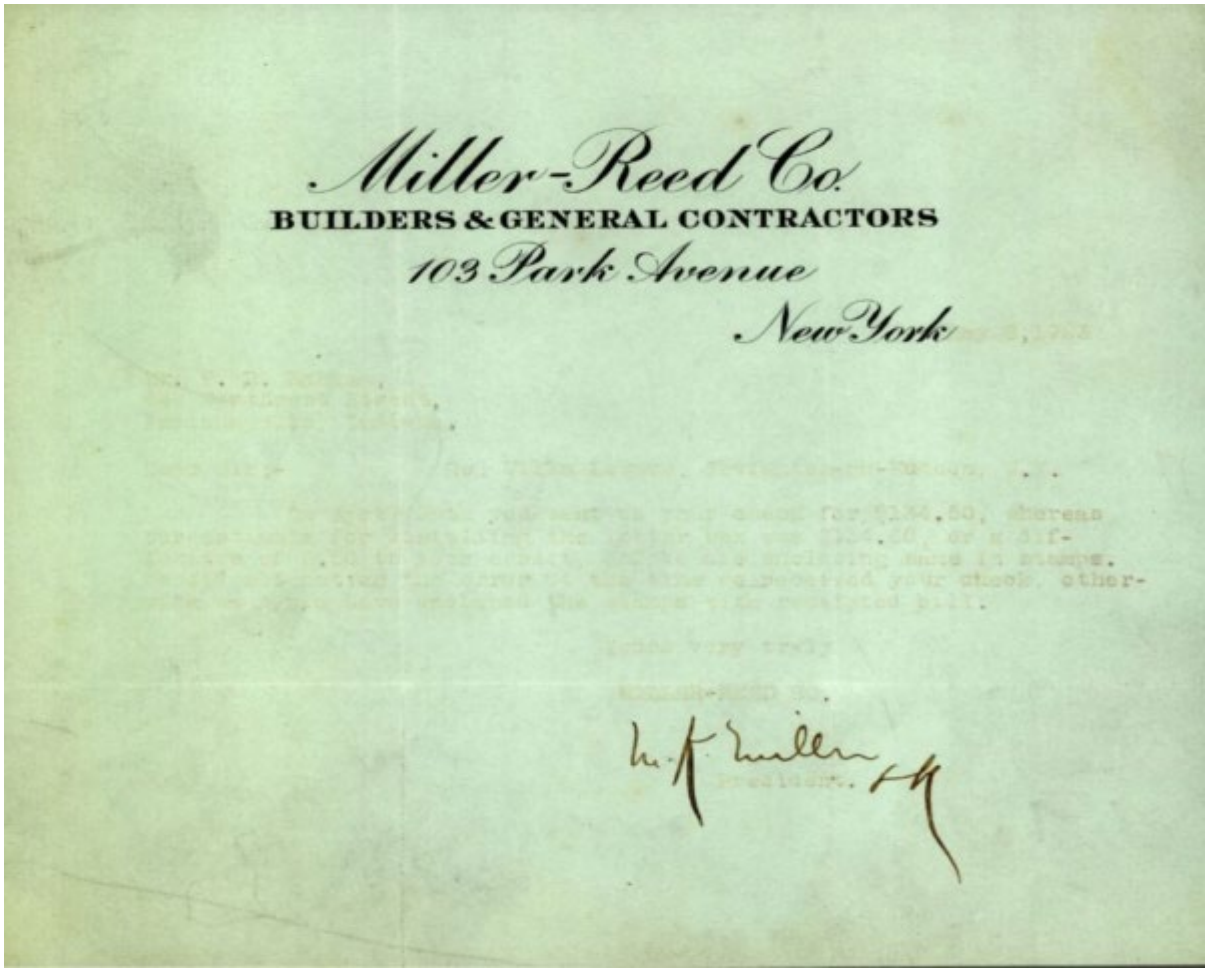
VISIBLE LIGHT

Light itself is defined as a VISIBLE band of radiation. The source of most visible light on Earth is the sun. It and other stars burn so hot that they produce light in a way called “incandescence.” It’s the same process that an incandescent light bulb uses to produce light. The filament inside is heated, begins to glow, and produces visible light.

INVISIBLE ULTRAVIOLET AND INFRARED

Alongside that visible band are ultraviolet (UV) and infrared (IR) bands of radiation that are INVISIBLE. They are not light sources themselves but are emitted from the light sources we use. A common source of UV in our museums is fluorescent lighting. Fluorescent lights luminesce; they generate light without heat by absorbing ultraviolet radiation and giving off light in the visible band of radiation. IR is an electromagnetic radiation that gives off heat and is not visible to the naked eye. Both UV and IR are damaging and cause deterioration in museum objects whenever they are exposed.

Exposure to light, UV, and IR, are all damaging. They can cause objects to discolor, fade, or darken, and degrade to the point of no longer having the physical ability to hold together. The rate of deterioration depends on the object itself. Varying materials and pigments are affected in different ways. For example, some fading may occur within days while, for other objects, the fading may take years of exposure to light, UV, and IR. Differing bands of radiation may combine to degrade one object in multiple ways. The intensity of light and UV added to the temperature changes caused by IR might result in various forms of damage. On one object, paper might yellow, and its fibers may weaken while ink on the paper may fade.


Miller-Reed Co.
BUILDERS & GENERAL CONTRACTORS
103 Park Avenue
New York

Letter from Mr. Miller n.d. (Madam C.J. Walker Collection, Indiana Historical Society)

Mitigating the deterioration caused by light, UV, and IR begins with measuring the amount

and intensity of light on a surface or “illuminance.” We frequently use the terms “lux level,” “light intensity,” or the older term “foot candles” instead of the more formal term “illuminance.” We use light meters to determine how much light there is in our exhibit areas, collections workspaces, and storage. Technological advancements have led to the development of specific meters that measure not only light, but also UV, relative humidity (RH), and temperature.

Measuring IR is a bit trickier because it involves determining heat from a light source rather than intensity of light. IR tends to be less damaging than UV and light, but the more exposure to light, and the UV, and IR emitted, the more our objects degrade.

The best ways to prevent damage by light, UV, and IR are to avoid exposure by setting parameters for indoor lighting, including shutting off lights when the room is not in use and switching out fluorescent and incandescent lighting with LEDs (Light Emitting Diodes). In contrast to incandescent lighting which uses a burning filament, LEDs produce light by the movement of electrodes through a semiconductor material, and because they only produce visible light, they don’t emit UV or IR. They don’t use a burning filament, so they don’t produce heat. In addition to lighting, LEDs are used in things like digital clocks, watches that light up, LCD tvs, and appliances. Continue to mitigate deterioration by monitoring objects for damage and determine what is causing the damage. Then, implementing measures to block light, UV, and IR by using filters, shades, and archival boxes for storage.

Knowing the science behind light, UV, and IR can help us identify, monitor, and take action to provide the best care we can for our museum objects.

Resources

FROM THE FIELD

Agents of Deterioration: Light, Ultraviolet, and Infrared (Canada Conservation Institute)
Light Exposure for Artifacts on Exhibition (CCAHA)
Light, Ultraviolet, and Infrared (American Museum of Natural History)
Predicting the Damages of Light (Art Institute of Chicago)
Conserve O Grams (National Park Service)

LOCAL HISTORY SERVICES

Collections Advisors (Indiana Historical Society)
Timely Tips (Indiana Historical Society)

Collection Trainings

UPCOMING COLLECTIONS TRAININGS

Indigenous Collections Care: Relationship Building and Consultation
April 7 (Gilcrease Museum)

Textile Preservation Tips and Tricks
April 14 (Conservation Center for Art and Historical Artifacts)

Creating an Integrated Pest Management System
April 14 (Northeast Document Conservation Center)

Water Management 101: Safeguarding Collections in Small and Mid-Sized Institutions
April 16 (Connecting to Collections Care)

Celebrating with Collections: Last Minute Preservation Reminders for the 250th
April 30 (Northeast Document Conservation Center)

RECORDED WEBINARS

Connecting to Collections Care (FAIC)

Local History Services Webinars (Indiana Historical Society)

Museum Services Webinars (Texas Historical Commission)

Local History Services
(317) 232-1882 | localhistoryservices@indianahistory.org