

Relative Humidity

Relative humidity is a measurement of the amount of water in the air. It is important to collection managers because the objects in our collections respond to relative humidity. Organic collections (things like paper, cotton, ivory or silk) will absorb and desorb moisture from the air resulting in a matching change in their moisture content.

When organic materials have a higher moisture content they will swell and this may result in a physical strain especially if they are restricted: for example, a picture frame is restrained at each corner, or planks in a table are restricted by their alignment to the next one. High moisture content will make organic materials more tempting to many insect pests and whilst some moisture content is good to ensure flexibility too much may lead to the object being vulnerable to physical damage – think how delicate wet paper is.

Inorganic materials like glass or metal, have a different relationship with moisture in the air. Most inorganic have very specific conditions in which they are stable or unstable. High humidity often plays big part in their decay processes, for example think about how iron rusts faster in damp conditions. Other inorganics are surprisingly vulnerable to incorrect humidity, glass can weep, fossils decay or salts dissolve and recrystallize causing damaging splits.

Why does temperature matter?

Air can hold different amounts of water – think of damp or dry weather and you will be aware the air feels different. You can describe the amount of water in the air in terms of how much liquid there is in a specific volume. Imagine you squeezed all the moisture out of the air and collected it in a measuring beaker – that would tell you about the absolute humidity. Unfortunately, it is not absolute humidity it is relative humidity which is the indicator of moisture in the air that our collections respond to. The key to understanding this lies in the word 'relative'. When air is warm it can hold more moisture resulting in a drop in relative humidity and the air feels drier. Objects that are sensitive to humidity respond to the relative than the absolute humidity. So just like you can dry out a wet towel putting it on a hot radiator you can dry out the collection by increasing the temperature.

Temperature targets

Temperature targets are often set to be comfortable for people, such as in reading rooms and gallery's, or to create lower temperatures for chemical stability where objects are not being actively used. Safe low temperatures normally mean staying well clear of freezing unless you have a specific and well managed cold storage area. There it is also a technique known as conservation heating which uses the temperature to manage humidity. This may be the most energy efficient solution to manage humidity in a temperate climate with a non-purpose-built building. Allowing temperature targets to fluctuate seasonally is likely to be more sustainable and just needs to be managed for the impact on relative humidity.

Units for RH

Relative humidity is calculated as a percentage of the amount of water that the air could hold - so it is always shown as between 0 and 100 percent. For ambient conditions in cities like London, 50% RH will be a common mid-point and collections kept there will have acclimatised to those mid-point conditions. Many of our internationally recognised guidelines had their origins in the UK so this may be a factor to adapt for your climate guidelines.

Measuring Temperature and RH

Because temperature is so important to RH it makes sense to collect temperature and relative humidity data at the same time.

Relative humidity can be measured with a handheld device that tells you about the conditions at the time and location that you take the reading (be careful not to confuse the data by adding your own humidity). This information can be useful, but it is more useful to build up a picture of the relationship between RH and temperature over weeks and years and discover how your space performs in providing safe stable conditions.

Ideal RH?

There is no ideal RH for collections. Organic collections that have long been kept in humidity conditions around a set point of 50% will be best served by maintaining that and avoiding sharp extremes. If your collections have acclimatised to a different humidity be cautious and allow time before introducing any dramatic changes. As a general rule fluctuations around 50% RH will do less damage to organic materials than the same amount of fluctuation at a higher or lower set point. A lot of standards are therefore set for figures like 40 – 60% RH for mixed collections but allowing seasonal fluctuations to manage energy use may see you aim for 35- 55 in some months and 45-65% in others. Almost all collection organisations keep their humidity clearly below 70% RH to minimise the risk of mould, although dropping the temperature and getting air movement will also help manage this threat

Some objects will have very specific responses to RH, if you know enough about their composition it should be possible to specify safe conditions. For most inorganic materials there will be a cut off for stability - searching the latest guidelines is useful before investing in humidity management solutions such as providing microclimates or special conditions for collection such as photographic negatives, shells, or archaeological metals.

Sustainability

Lastly never set targets that you don't need or cannot check. In the past there was perhaps a temptation to appear to be caring by over specifying conditions, but this can result in unnecessary energy use and some exclusion in terms of loans.

<https://www.tandfonline.com/doi/full/10.1080/19455224.2017.1422777> Building a climate specification that is a good challenge, will protect most of your collection most of the time and is respectful of climate and organisational sustainability is the best way to integrate humidity and temperature management into the smooth running of your organisation.