An annotated summary of PD 5454:2012

by Tim Padfield, June 2012

The internationally influential standard **BS5454:2000** for archival conservation has been revised and issued as a Published Document, rather than a standard. It is considerably different from the 2000 edition, in particular it relaxes the stringency of the temperature and relative humidity limits. The document's authors are not revealed, which is strange in modern times. The document makes extensive references to **PAS 198 - 2012 Specification for managing environmental conditions for cultural collections**, which examines the environmental sensitivity of artifacts, so the two publications should be read together.

Here is a summary of the environmental recommendations

The author's comments are in italics.

For general collections of robust ancient materials:

13°C - 20°C; 35% - 60% RH

The reason given for the rather high minimum temperature is the susceptibility to phase separation of beeswax seals. This is probably based on the article 'Surface Crystallisation on Beeswax Seals' by Novotná, P. & Dernovšková, J., Restaurator. Volume 23, Issue 4, Pages 256–269, ISSN (Print) 0034-5806, DOI: 10.1515/REST.2002.256, January 2008. This is available on line at: www.viks.sk/chk/res_4_02_256_269.doc This is good research, but a document which may morph into a CEN European standard, should not rely on a single article for advice which imposes wide side-effects on architecture and environmental control.

For paper records the recommendation is:

5°C to 25°C; 25% - 60% RH

There is no reason given for the lower temperature limit.

The category 'cool storage':

5 °C to 18 °C; 30% - 50% RH

Again, there is no reason given for the lower temperature limit.

Materials transferred from the cooler end of cool storage must be wrapped in an airtight enclosure and left for 24 hours at room temperature to avoid condensation.
The following materials can be cool stored, wrapped inside a microclimate package after conditioning to 25% RH: magnetic tape on polyester base. Gramophone discs of all kinds should be conditioned to 30% RH.

It seems perverse to specify a lower RH limit to cool storage which is at the limit, or above, for some categories of materials for which it is recommended. Is 50% RH really a risk to polyester based magnetic tape? It seems that a pronouncement from another standard has been yanked into this document without consideration whether this restriction of allowable climate is really necessary, given the generous general limits advocated.

Cellulose acetate based material should have a permeable wrapping around each document and a molecular sieve or other type of pollutant scavenger incorporated inside the outer packaging to absorb internally generated acetic acid vapour. This scavenger should also be monitored and might need to be replaced periodically. *One could argue that an object actively deteriorating in this way should be in cold storage to further reduce the reaction rate.*

Cold storage:

-15°C ±5°C.

No RH is specified

Suitable for film but optical discs (compact discs and digital video discs) should not be frozen (sic) because of the risk of layer separation. *Other published recommendations for minimum temperature for optical disks range from -20°C to +18°C. A problem with this document is that it has no apparent quality filter for its recommendations. There are very few references, one has to guess which item in the sparse bibliography has been mined for the advice.*

There is no RH specification, seemingly regarded as unnecessary because of the requirement that all objects be sealed in an airtight enclosure with buffer and RH indicator. *It would surely be easier and safer in the long term to specify a RH, say 50%, and leave the objects open to this environment.* The argument for adding the RH buffer is that it will absorb moisture when the object is moved, still sealed, from cold store to reading room. *However, the opposite is true: the buffer will warm up first, buffering the RH at its surface temperature, which will transiently be higher than the object temperature, which will therefore experience a raised RH at its surface: about +3% for every degree of temperature difference. Buffers which can transiently be at a different temperature from the object they are intended to protect will actually de-stabilise the RH around the object.*

The recommendation of cold storage without RH control of the room is controversial, because it requires reliable sealing of many individual packages rather than routine control of the room RH. A cold store requires mechanical cooling so adding dehumidification is a negligible extra complication and adds little to the running cost so long as the air exchange rate is low.

Advice about the building

Environmental control within the repository should be achieved by provision of a building or an enclosed space within a building that gives high thermal inertia, low air infiltration rates and that has an extensive hygroscopic buffer.

High thermal inertia, which means large amounts of dense materials, is not necessary in a building without internal sources of heat. The sad fate of the Cologne archive should be a warning. It buried its contents beneath thousands of tons of brick rubble from collapsed walls deliberately made massive for climatic effect. Exactly the same temperature stability can be achieved with thermal insulation, provided the air leakage rate is low.

The use of unfired brick as a humidity buffer is an innovation, seemingly based on a single scientific paper, which describes no full size working example of such an archive. As with the temperature limits for wax seals and for CDs, it is disturbing that a document claiming authority relies on evidence which may be of high quality but is not corroborated by independent researchers nor by a corpus of practical observations. A weakness of all museum environmental standards is that there is only a tiny scientific community feeding into their distillations of best practice. Furthermore there is no scientifically useful database of observations of damage in museums which can reliably be attributed to environmental insult. However, there is no excuse for the document being shaky in its grasp of atmospheric and building physics. The repeated use of 'freezing' as synonymous with storage below 0°C is misleadingly scary: freezing only applies to bulk pure water. An object pre-conditioned to 50% RH will never suffer ice crystal formation within it until cooled below -30°C. Passage through 0°C has no physical or chemical significance for objects equilibrated to a moderate RH.