G Model
CULHER-3120; No. of Pages 8
ARTICLE IN PRESS

Journal of Cultural Heritage xxx (2017) xxx–xxx

Available online at
ScienceDirect
www.sciencedirect.com

Elsevier Masson France
EM|consulte
www.em-consulte.com/en

Original article

The effectiveness of dust mitigation and cleaning strategies at The National Archives, UK

Helen Wilson, Sarah VanSnick*

The National Archives, Ruskin Avenue, Kew, Richmond, Surrey TW9 4DU, UK

ARTICLE INFO

Article history:
Received 26 April 2016
Accepted 13 September 2016
Available online xxx

Keywords:
Preventive conservation
Archive storage
Vacuuming
Microfiber cloths
UV-fluorescent

ABSTRACT

Cultural heritage institutions allocate considerable resource to mitigating the risks of dust in their collections. In archives and libraries boxing collections and cleaning regimes go some way to address the problem. However, evidence of the efficacy of these methods is difficult to validate experimentally as dust is very difficult to see. To evaluate the efficacy of our boxing and cleaning programmes, The National Archives' Collection Care Department developed a method that used UV-fluorescing powder to mimic the movement and dispersal of dust during experimental cleaning and handling scenarios. Visual evaluation of dust dispersal enabled a qualitative assessment of the efficacy of existing collection cleaning techniques. Photographs and videos confirmed the value of vacuuming as the most efficient method of removing dust in comparison to other methods, and validated the usefulness of folders and boxes in limiting dust deposition and transfer onto archival documents.

1. Introduction and research aim

The National Archives (TNA) is the UK government's national archive for England, Wales, and the United Kingdom. Situated in Kew, west London, TNA houses almost 180 km of archival documents that span 1000 years of history. The collection is comprised of mainly paper and parchment documents in many formats including volumes, bundles, folders, rolls, and flat sheets, but also photographic, plastic, and textile material.

Dust presents a risk to cultural heritage collections as it can discolour or disfigure heritage materials. Surface cleaning to remove dust can cause mechanical damage to the surface. Extensive research into dust within museum and historic house contexts has addressed the risks it poses to collection items during open static display [1–4]. However, in an archive or library context, collection material is frequently retrieved and handled, which introduces the possibility of dust transfer from storage areas to collection items via people's hands.

The majority of collection items in The National Archives are housed in boxes or bags on open shelves in restricted access areas with controlled environmental conditions. Typically collection materials are transported in boxes to and from the public reading rooms where the boxes are then opened, closed, and the documents are handled. Approximately 5% of the collection is requested for viewing each year, with the most popular documents being requested 10 times a year.

Currently, the busiest areas of the storage areas are cleaned twice and the quieter areas once, every four years. To prevent damaging the collection neither water nor chemicals are used during cleaning. Cotton cloths, microfiber cloths, and lamb's wool dusters are used for collection material while metal shelving is cleaned using a fine mist of distilled water sprayed onto a cloth. Floors are cleaned using static mops and vacuum cleaners.

In-between these cleaning cycles a layer of dust accumulates on the boxes and shelves, so we needed to understand the risk that this presents to the collection. How much dust is too much? The study of dust in heritage institutions to date has concentrated primarily on source identification through monitoring and characterisation [5–7] and there is a lack of qualitative and quantitative assessment of recommended mitigation strategies such as cleaning tools and archival enclosures.

This investigation therefore aims to address this knowledge gap by assessing the effectiveness of boxes as part of a wider dust mitigation strategy and by identifying the most effective cleaning method for TNA's archival storage areas with the view to informing practice in other collections. Two specific scenarios were identified for investigation: one, the probability of dust transfer when delivering documents to a reader (Dust Transfer Testing) and two, the effectiveness of different cleaning tools and techniques to remove dust in archival storage areas (Cleaning Technique Testing).

The evidence emerging from this research informed cleaning programmes at TNA, and has potential for other collections as well. To ensure that the results were clear, the evidence of transfer and removal of accumulated dust needed to be visually recorded.

* Corresponding author. Tel.: +44 20 8876 3444.
E-mail addresses: helen.wilson@nationalarchives.gsi.gov.uk (H. Wilson), sarah.vansnick@nationalarchives.gsi.gov.uk (S. VanSnick).

http://dx.doi.org/10.1016/j.culher.2016.09.004
1296-2074/

Please cite this article in press as: H. Wilson, S. VanSnick, The effectiveness of dust mitigation and cleaning strategies at The National Archives, UK, Journal of Cultural Heritage (2017), http://dx.doi.org/10.1016/j.culher.2016.09.004

SEM-EDX analysis showed the dust in TNA's storage areas to be composed of small sized particles and fibres of similar colour to the boxes, suggesting that the boxes were the source of the fibres. Given this information we considered the small particles to be of most concern in dust transfer given the possibility of it being abrasive and ingraining into archive material. We chose to replicate this aspect of TNA's repository dust using a UV-fluorescing Glitterbug® powder. Fluorescent substances such as this are used as tracers in theft detection, pest tracking, and leak detection. The Glitterbug® (Brevis) product line is designed for use in hand hygiene training [8]. The powder has a similar particle size to the smallest dust particles present in TNA's storage areas, 4–5 μm wide. Consequently, its behaviour is expected to reliably mimic that of dust in some aspects. A more accurate replication of TNA's repository dust and consequently its behaviour could have been achieved through the inclusion of UV-fluorescing fibres and powders of larger particle size, and assessing the powder for changes in adhesion due to RH fluctuations, however this was not deemed necessary for the scope of this research.

Fig. 1. Cleaning tools that were evaluated. (A) 100% pure lamb's wool duster. (B) Dusting brush. (C) Dust Bunny Reusable Nylon dusting cloth. (D) Microfiber cloth. (E) Chintz Duster, 100% cotton dusting cloth. (F) Nilfisk vacuum cleaner with HEPA filtration and brush head attachment.

2. Materials and methods

2.1. Materials

Both experiments used UV-fluorescing Glitterbug® powder evenly distributed onto a surface using a fine woven metal wire mesh (A5 size, 0.239 mm aperture, 0.063 mm wire diameter SS304 Grade) that was overlaid onto a fine mesh sieve.

Lighting for photographing the results of the experiments consisted of two 3-tube Kaiser 5569 UV-lamps in which each tube was 18 watt UV-A Wave length: 366 nm with a light emitting area of 64 × 21 cm. Office lighting was also used. Following risk and COSHH assessments, appropriate protective clothing was worn.

2.1.1. Additional materials for the Dust Transfer Tests

The Dust Transfer Testing used three archival boxes, each containing non-accessioned folders filled with papers to mimic standard storage protocols. A trolley was used to transport the boxes to a table covered with 350 μm grey archival cover paper.

2.1.2. Additional materials for the Cleaning Technique Tests

The Cleaning Technique Testing used a highlighter, Staedtler® Mars plastic eraser, grater, smoke sponge, and sheets of 350 μm grey archival cover paper and 100 μm Melinex® to mimic the surface of boxes and shelves, respectively.

Cleaning tools were selected for testing based on one of three criteria: their current use for cleaning TNA's archival storage areas, being commercially promoted or professionally cited within conservation literature as appropriate for cleaning archival storage areas. The following cleaning tools were tested (Fig. 1):

- 100% pure lamb's wool duster, in use by TNA cleaning contractors.
- Dusting brush, in use by TNA Collection Care Department (CCD) staff for cleaning.
- Dust Bunny Reusable Nylon dusting cloth, sourced from a conservation supplier.
- Microfiber cloth, in use by TNA cleaning contractors.
- Chintz Duster, 100% cotton dusting cloth, used in conservation practice.
- Nilfisk vacuum cleaner with HEPA filtration and brush head attachment, recommended in professional guidance for cleaning library storage and in use by TNA CCD conservation staff for general cleaning.

2.2. Method

Experiments were designed to address five questions: 1. What happens to accumulated dust when an archival box is handled, opened and the documents removed? 2. When a dusty box has deposited dust onto a surface, what degree of transfer occurs between the surface and a clean file? 3. How effective are the cleaning tools and techniques tested at removing dust from boxes and shelves? 4. Which cleaning tool and technique is most effective? 5. Can conservation cleaning methods fully remove ingrained dust?

2.2.1. Dust Transfer Testing – dust transfer from dusty box during handling

Three document boxes each containing replica files were positioned side-by-side on a trolley to replicate the storage of boxes on shelving. UV-fluorescent powder (approximately 0.25 g) was scattered as finely and evenly as possible over the tops of the boxes using a fine mesh laid over a fine sieve, to replicate the dust levels on boxes in storage prior to cleaning. The first box was carried from the trolley to a table and opened. Each of the files within the box were removed and placed on the table next to the box. The first five and last pages in the last file in the box were handled and viewed. All files were then returned to the box, the lid replaced and the box returned to the trolley. This handling sequence was repeated with the second and third boxes. The handling of the three boxes was repeated 15 times with a re-application of approximately 0.12 g of UV-fluorescing powder in-between.

One person completed handling of all of the boxes. Hands were cleaned before but not during testing. The experiment was initially completed under office lighting to minimise the risk of changes in handling of the boxes due to seeing where dust had transferred to. Subsequently, handling was completed under UV lighting to view the movement of UV powder during handling.

After the first and sixteenth handling sequence, surfaces, boxes, and box contents were inspected under UV and office light to determine the extent of dust transfer.

2.2.2. Dust Transfer Testing – transfer from dusty surface to clean folder

A clean four-flap folder was placed and lightly pressed onto a piece of archival card covered in the loose and ingrained UV-fluorescing powder remaining from one box handling sequence outlined above. This action mimics the ideal handling of a full file during use. After inspection under office and UV lighting the folder was pressed firmly onto and slid across the surface to mimic