MuseumPests.net
A Product of the Integrated Pest Management Working Group

The Accidental IPM Program:
A Case Study of Contemporary Art and Archives at The Andy Warhol Museum

AUTHORS
Amber E. Morgan *Author for correspondence. Collection Manager
The Andy Warhol Museum
117 Sandusky Street
Pittsburgh, PA 15212
T 412.237.8306
E morgana@warhol.org

John Samuel Jacobs
Assistant Registrar for Collections
The Andy Warhol Museum
117 Sandusky Street
Pittsburgh, PA 15212
T 412.237.8312
E jacobsj@warhol.org

ABSTRACT
The Andy Warhol Museum (AWM) recently battled an infestation in their archives collection. Due to the unique composition of this collection, flexibility and innovation were required to address the infestation. The collection manager and assistant registrar for collections will describe how the infestation was discovered, what the immediate response was, and how a complete Integrated Pest Management (IPM) program evolved out of their experiences. The use of preservation survey methods and statistical analysis will be described, highlighting the importance of data collection in relation to IPM. The benefits of developing policies and procedures that define and prioritize an institution's IPM needs will be discussed.

KEYWORDS: pest mitigation, archives, preservation survey, inferential statistics, integrated pest management, data collection, non-traditional materials.

THE ARCHIVES COLLECTION AT THE ANDY WARHOL MUSEUM

Since 1994, The Andy Warhol Museum in Pittsburgh, Pennsylvania, has been home to an extensive archive of over 8,000 cubic feet of historic materials, estimated to contain over 500,000 individual items.The archives collection documents Andy Warhol's life and work from the 1950s through the 1980s and includes source material, business records, correspondence, manuscripts, filmmaking equipment, household items, clothing, photographs, audio recordings, ephemera, and many other types of materials, including non-traditional art and archival objects. The material compositions of the collection are diverse and range from paper, animal fibers such as wool and fur, wood, metals, glass, and a wide

variety of plastics. Most of the archives are stored on high-density mobile shelving in a 1,510 square foot, climate controlled store room. For preservation purposes, the collection is considered to be divided into three categories: legacy boxes, series, and the *Time Capsules*.

The legacy boxes make up the largest portion of the collection. These boxes were hurriedly packed in Warhol's home or studio after his shocking and unexpected death; contents are generally arranged according to where they were found rather than by archival series or material type. Contents in each box can vary significantly and often contain troublesome objects such as textiles, electronics, cosmetics and other commercial products, alongside traditional archival materials such as correspondence and photographs. A basic register for these legacy boxes consists of brief, often incomplete descriptions for the contents. Accession numbers have been assigned to this list but have not been transcribed onto the items themselves. Cataloging for these items typically occurs in conjunction with their inclusion into exhibitions or for research purposes.

Some of the objects from the legacy boxes have been arranged into traditional archival series, such as photographs and correspondence. These items generally benefit from superior housing and organization, but are largely uncatalogued.

The *Time Capsules* are the most unusual collection within the archives. While archival in nature, the 610 *Time Capsules* are actually Warhol's largest work of art. The *Time Capsules* are housed in their original labeled containers, and while they have been widely exhibited for 20 years, the contents of hundreds remained unseen from Warhol's death in 1987 until a massive cataloging project, funded by The Andy Warhol Foundation for the Visual Arts and the Institute of Museum and Library Services, began in 2007. Warhol selected the items contained in the boxes, and he did not consider preservation or longevity in doing so – contents have included raw pizza dough, slices of cake, cans of soup, soiled clothing, prescription medications, and large quantities of cookies and candies. Each *Time Capsule* holds an average 210 complete objects; counting the components of these individual objects yields an average bulk count of over 800 pieces per box. Curatorial directives are to preserve the *Time Capsules* in their original state as much as possible by retaining the original groupings and the non-traditional items regardless of their preservation concerns.

AWM lacked an integrated pest management plan, and an infestation was discovered in the *Time Capsules* cataloging workspace. Further investigation revealed pest evidence throughout the workspace and in many of the *Time Capsules* themselves. A rapid cleaning and processing project focused on the *Time Capsules* and their related processing area was developed to address the situation. We will first discuss the *Time Capsules* pest mitigation project, and then explain how the experience of that work translated into a sustainable IPM program for the entire museum.

INFESTATION DISCOVERY AND RESPONSE

In the summer of 2011, staff noticed small insects in the *Time Capsules* cataloging workspace. Museum staff began a thorough inspection of the room and determined that it was infested with *Anthrenus verbasci* (varied carpet beetles), *Stegobium paniceum* (drugstore beetles), *and Oryzaephilus surinamensis* (saw- toothed grain beetles). Exact data on the quantities of each species was not documented.

We consulted with the museum's pest control vendor and entomologists at our sister institution, the Carnegie Museum of Natural History. Inspections were made by museum facilities staff, collections staff, and conservators to identify possible sources of the infestation. The species discovered, their

distribution in the space, the lack of a regular housekeeping plan, and the types of materials frequently contained in *Time Capsules* led to the conclusion that the infestation was brought about by the collection itself.

We considered mass treatments such as freezing or anoxia. However, because the *Time Capsules* had not been fully cataloged, we did not have an easy way of identifying and removing materials that would be damaged by freezing, such as adhesives, plastics, magnetic media, or cans of soda; and anoxic treatments were cost-prohibitive. Moreover, mass treating would not prevent future infestations because the insects' sources of food, namely the packaged food and products, would remain in the boxes. We devised a phased approach to clean the processing room and to open and methodically treat the contents of each *Time Capsule*.

Mitigating pest activity in the *Time Capsules*

We were able to divert our current *Time Capsule* cataloging efforts into a very thorough and rapid pest mitigation project. Cataloging was suspended for nearly six months while cataloging staff assisted with the treatment. In order to create a work space, the museum closed the floor which includes the processing area and a public gallery space.

Our first step was to completely empty the processing area. Infested packing and storage materials were discarded. The room was thoroughly cleaned, including long-neglected corners and areas behind furniture. All furniture and equipment was cleaned before being returned to the space.

We then turned our attention to the *Time Capsules* themselves. The pest mitigation process involved opening each *Time Capsule*, removing and isolating food or other products that are highly attractive to pests, removing frass and carcasses, individually freezing items that could be safely frozen, hand cleaning and vacuuming items, and lastly repacking the contents into their original boxes. This process posed a logistical problem as only a portion of the *Time Capsules* had been cataloged and numbered at this point. We relied on the expertise of the cataloging staff to devise a system for tracking the uncatalogued items as they moved through the treatment process. The catalogers created a database for documenting objects that were being isolated, enabling these objects to be tracked even though the *Time Capsules* had not been fully indexed.

Materials that could not be safely frozen or effectively hand-cleaned, and materials that would remain highly vulnerable regardless of treatment, such as packaged foods, liquids, or cosmetics, were double-bagged in polyester zip-top bags and stored in air-tight plastic bins with gasket locking lids. The Lock & Lock brand bins were the most suitable product for our needs; the rectangular shape allows for efficient stacking and storing. After treatment, each *Time Capsule* was sealed in a polyester bag to enable boxes to be returned to storage without risk of re-infestation.

PEST MITIGATION STRATEGY IN ARCHIVES STORAGE

Once we established processes and procedures for mitigating the live infestations in the *Time Capsules* and in the processing area, staff needed to assess the degree of risk posed to archives storage. There was a potentially high level of risk for infestation in that room because about seventy percent of the *Time Capsules* are stored there.

The immediate challenges were to determine the degree of active infestations within the storage area and to identify the infested boxes. These challenges were further complicated by a number of obstacles. We did not possess the necessary resources to perform a full-scale, rapid intervention as

had been performed on the *Time Capsules*, nor was it clear if such action was required. As stated previously, many items in the archives collection are neither cataloged nor physically numbered. Similar to the *Time Capsules*, the diverse range of materials housed within each box had the compound effect not only of making almost every box a suspect but also of limiting our options for box-level treatments. We lacked the space necessary for inspecting suspect boxes without running the risk of re-infesting the processing area that had just been cleaned. Finally, we lacked baseline metrics, such as counts of boxes, and documentation describing the physical arrangement of the archives collection within the storage area. To address these challenges, staff developed a low-cost and high-impact strategy consisting of multiple phases for identifying the locations of infestations in archives storage and for focusing our limited resources on mitigating the likelihood of pests in high-risk collection items.

Preservation survey with inferential statistics

In order to overcome these formidable challenges and to determine the risks posed by the insect infestation, we designed and conducted a comprehensive assessment of all boxes in the storage area by using a combination of physical inspections and inferential statistics. The inspections took the form of a three-step preservation survey, the results of which could be used for drawing statistical inferences about the likelihood of infestations within the storage area. Each subsequent step of the three-step survey enabled increasingly accurate predictions of which boxes and locations were most likely to be infested.

The first step of the preservation survey was conducting a random sampling of ten percent of the entire archives collection, inspecting 215 sample boxes for evidence of insect infestations. We also looked for the presence of materials and other conditions that might provide a potential habitat or food sources for the species of insects that we had identified while performing pest mitigation treatments on the *Time Capsules*.

Preparations for conducting the random sampling were extensive. Drawing valid, statistical inferences from large populations requires accurate counts of said populations; therefore, we were compelled to undertake a rather rigorous “census” counting all of the boxes in the storage area. We adopted the legacy system of box categories detailed in the register as a means of organizing the box counts into manageable subsets of boxes. We developed and tested a survey form. We also created diagrams showing the locations of the different box categories within the archives storage area. Future iterations of these diagrams would be used for locating infested boxes and for tracking pest traps.

Figure 1. Containment tent and tools

In order to inspect boxes during the preservation survey, we needed a quarantine area to prevent re-infesting the processing room we had just cleaned. For this purpose, we purchased a Wenzel® brand screen tent with a durable polyethylene floor, which functions as our portable containment and processing unit (Figure 1).

Results of the random sampling

The results of the random sampling showed that boxes with infestations were distributed throughout the storage room without any discernible pattern. Until this point, we had hoped that the infestations might be limited to a confined area within the room. Our statistical calculations also predicted that 850 of the 2,135 boxes housing collection items in the archives storage area were *at-risk* for insect infestations (Table 1). We also detected a strong correlation between the presence of insect infestations in conjunction with the presence of old, often acidic, packaging and storage boxes. Approximately ninety percent (or 751) of the at-risk boxes have storage materials that do not conform to preservation standards. Consequently, a major component of our on-going preventive IPM strategy involves replacing non-conforming packaging with preservation grade materials.

Table 1. At-risk boxes; results of the random sampling

Legacy box categories	Predicted maximum number of at-risk boxes	Percentage of boxes NOT meeting preservation standards
B-Boxes	196	92.5%
M-Boxes	126	100.0%
Misc-Boxes	81	68.4%
Idea-Boxes	41	100.0%
C-Boxes	52	47.6%
Clothing/Textiles-Boxes	118	38.5%
Other-Boxes	42	66.7%
AME-Boxes	90	90.9%
G-Boxes	6	100.0%
ACE-Boxes	50	80.0%
OSE-Boxes	23	83.3%
Realia (unboxed items)	25	100.0%
Predicted totals	**850**	**751**

The random sampling also confirmed our expectation that many series of the archives collections, including photography, commercial works, and source materials, were not infested. Overall, the

random sampling served to winnow the population of suspect boxes allowing us to focus our limited resources on the boxes with higher probabilities of containing infestations.

Results of the targeted sampling

During the second step of the three-step preservation survey, we performed a targeted sampling of the 850 at-risk boxes that we had identified in the random sampling. The results of the targeted sampling showed a statistical probability of 199 boxes at **high-risk** of infestation (Table 2). A pattern for the infestation rates began to emerge as it became clear that five legacy box categories had the highest probabilities of infestations.

Table 2. High-risk boxes; results of the targeted sampling

Legacy box categories	Actual infestation rates for the targeted sample	Predicted maximum number of infested boxes
B-Boxes	20.8%	64
M-Boxes	18.2%	47
Misc-Boxes	21.1%	52
Idea-Boxes	14.3%	20
Realia (unboxed items)	36.4%	16
Predicted total		**199**

The third step of the three-step preservation survey is ongoing. As each high-risk box is inspected and processed, data is continuously collected and added to our statistical calculations. Using this cumulative data, a prioritization sequence is updated continuously and helps us direct our pest mitigation efforts mathematically towards those subsets of the archives collection that have the highest probability of infestation.

While the prioritization sequence guided the inspections mathematically, we also decided to expand the scope of pest mitigation efforts based on the physical characteristics of the storage room and furniture. As we identified and located the infested boxes, we realized that hungry larvae in search of food sources could have infested any of the adjacent boxes that share a shelf with an infested box. Consequently, the scope of our work expanded to include not only “high-risk” and infested boxes but also every box sharing the same shelf. We called this tactic the “Plus One” plan, meaning that we inspected each box adjacent to an infested box.

PEST MONITORING PROGRAM WITH DOCUMENTATION AND DATA ANALYSIS

Another major component of AWM’s IPM program is the deployment and routine inspection of insect traps in all storage and processing areas, based on the guidelines published by the National Park Services. Our current pest monitoring program encompasses the entire facility, including the storage areas for the art and film and video collections, and has recently expanded to incorporate exhibition spaces on a case-by-case basis. In such instances, we collaborate with curators and visitor services staff in order to camouflage the traps by disguising their function without impeding their operation.

Pest monitoring is a critical diagnostic tool and information intensive activity, providing insight not only into the species and populations of insects inhabiting an area but also the effectiveness of housekeeping. We document the results of inspecting pest traps in a number of ways. We use Microsoft Excel® to make diagrams of the trap locations and to analyze the data we collect from the traps (Figure 2). This technique helps to simultaneously visualize the location and quantity of pest activity. The maps are color-coded showing, for example, the locations that have "hits" alongside numerical data including, for example, the frequency of hits that each location experiences. We use the Comments box in Excel® in order to maintain a historical record of the inspections at each trap location. Data is exported into sortable Excel tables that we use for analysis. The results of an inspection also are handwritten on every trap, forming inspection logs. This adds a degree of accountability and transparency because anyone, should they want to, may pick-up a trap and read the last time it was checked and the results of the previous inspections.

Taken together these documentation methods provide a comprehensive and robust strategy for making data-driven decisions, which is the crux of every IPM challenge. Collecting and interpreting data about pest populations allows us to direct efforts where they are most needed. A fundamental key to our success has been the ability to capture data and metrics that not only quantify the extent of the infestations but also provide a considerable amount of information about the size, arrangement and condition of our archives collections. Thinking in terms of measurable outcomes is a key to capturing meaningful data.

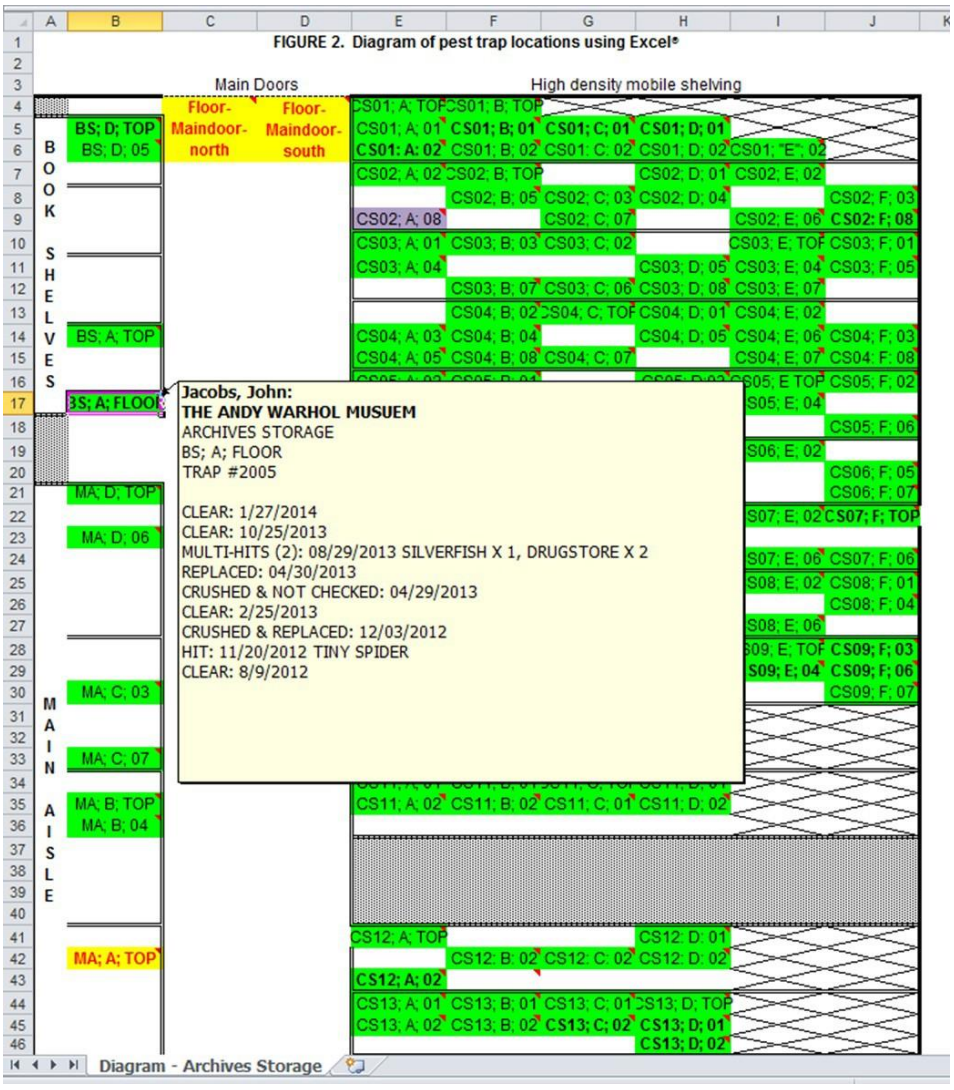

Figure 2. Diagram of pest trap locations

THE ACCIDENTAL IPM PROGRAM

AWM quickly acknowledged that the infestation of the processing area might have been prevented had a museum-wide IPM program been in place. We also realized that the intensive processing performed on the *Time Capsules*, although thorough, was not sustainable long-term; rather than a project, we needed an ongoing program. Building on the momentum of the initial pest mitigation work, staff authored a full IPM policy and plan, using the templates provided on the Integrated Pest Management Working Group's website.

Successful IPM requires the cooperation of all museum staff. Battling a large infestation certainly helps rally staff members to the cause, but after the initial shock fades and regular museum functions resume, IPM functions can easily be forgotten. AWM staff received periodic updates of the *Time Capsules* treatment project (complete with very graphic images) and of the ongoing pest mitigation work. The IPM policy was presented at an all-staff meeting; regular updates are planned. IPM is also regularly discussed in smaller meetings and incorporated into conversations about exhibition planning. Perpetuating an IPM program requires substantial advocacy from collections staff. In our case, it is easy to point to past mistakes and successes to encourage cooperation.

Long-term IPM will require devoted resources and staff. AWM has recently added IPM to the job description of the collection manager and assistant registrar for collections, which creates accountability for the program. Extensive documentation of the pest mitigation process will help current staff to maintain consistent practices and enable new staff to take over the IPM program in the case of staff turnover.

Conclusion

Although a large-scale infestation is generally a bad thing, AWM was able to turn it into a positive experience by using it as a catalyst for developing a full IPM program. The initial infestation and the resulting pest mitigation work performed on the *Time Capsules* provided a high profile and focused project that was then customized and expanded into a full IPM program for the rest of AWM's collections. The challenges posed by the large volume of non-traditional art and archival media were addressed by identifying, tracking and isolating these objects. The use of preservation survey techniques enabled staff to target activities effectively, reducing time and costs associated with mitigation.

Acknowledgements

The authors would like to thank AWM staff, especially Christine Daulton, conservator; Matt Wrbican, chief archivist; and the *Time Capsule* project catalogers, Erin Byrne, Marie Elia, and Elaina Vitale for their hard work on the unpleasant task of cleaning up infested materials. We would also like to thank Gretchen Anderson, conservator, Carnegie Museum of Natural History; John E. Rawlins, Ph.D., Curator, Section of Invertebrate Zoology, Carnegie Museum of Natural History; and Joe Zaijdel, branch manager, Terminix; trusted and generous consultants throughout the project.

References

Pest monitoring

Child, R. 2011. The wider use and interpretation of insect monitoring traps. In Integrated pest management for collections: proceedings of 2011: a pest odyssey, 20 years later, ed. et. al. P. Windsor, 66-70. Swindon, UK: English Heritage.

National Park Service. 1998. Biological Infestations; Monitoring. In NPS museum handbook, Ch. 5, Sect. E. http://www.nps.gov/museum/publications/MHI/CHAP5.pdf.

National Park Service. 1998. Monitoring pests with sticky traps. In Conserve O Gram no 3/7, http://www.nps.gov/museum/publications/conserveogram/03-07.pdf.

National Park Service. 1998. Museum housekeeping; pest monitoring task sheet. In NPS museum handbook, Ch. 13, Sect. D. http://www.nps.gov/museum/publications/MHI/CHAP13.pdf.

Preservation surveys & sampling

Keene, S. 2001. Audits of care: a framework for collections condition surveys. In Care of collections, ed. S. Knell, 60-82. New York: Routledge.

NEDCC Preservation Leaflets. 1999. Planning and Prioritization, nos. 1-6. http://nedcc.org/resources/leaflets.list.php

Patkus, B. 2003. Assessing preservation needs: a self-survey guide. Andover, MA: Northeast Document Conservation Center. http://www.nedcc.org/resources/downloads/apnssg.pdf.

Reed-Scott, J. 2000. Planning for preservation in libraries. In Preservation: issues and planning, eds. P. Banks and R. Pilette, 82-96. Chicago: American Library Association.

Ritzenthaler, M.L. 2010. Preserving archives & manuscripts. Second ed. Chicago: Society of American Archivists.

Materials list

Lock & Lock® storage containers, polypropylene with silicone seal, http://www.locknlock-usa.com/.

Wenzel Zephyr screen gazebo, model #36452, polyethylene and steel, http://www.wenzelco.com/; http://www.amazon.com/Wenzel-Zephyr-Screen-Gazebo-Area/dp/B004K6B5MW/ref=cm_cr_pr_product_top

Figure captions and table titles

Figure 1. Containment tent in AWM archives
Table 1. At-risk boxes, the results of the random sampling
Table 2. High-risk boxes, the results of the targeted sampling
Figure 2. Diagram of pest trap location using Excel®