

# A Collaborative Approach to Hazardous & Contaminated Collections Conundrums

Collections: A Journal for Museum  
and Archives Professionals  
1–9  
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DOI: 10.1177/15501906241234414  
journals.sagepub.com/home/cjx



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## Abstract

A wide range of inherent vices and acquired hazards can be found in museum collections worldwide. Inherent hazards include items decorated with lead paint, objects containing dyes and pigments, archaeological and geological collections containing silica dust, poisonous herbarium specimens, geological collections that naturally contain heavy metals or are radioactive, objects created from uranium glass and even historic medicinal collections containing old medications and other dangerous substances. Acquired hazards include historic chemical pesticide treatments including toxic metal-based poisons such as arsenic and mercuric salts and, later in time, organic compounds such as DDT were also employed. How can museums identify and manage these complex issues? This case study addresses these concerns and highlights a multi-year collaboration between the Indiana University Indianapolis Museum Studies Program, Purdue University's School of Health Sciences and the Indiana Medical History Museum (IMHM) that can serve as a replicable model for other museums grappling with these same conundrums.

## Keywords

hazardous collections, toxic heritage, museum health and safety, collaboration

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## Introduction

In the museum collections field, most professionals would agree on a few universal truths. There is never enough time, resources or space. While the authors can't solve the latter problem, we do offer new insights and solutions to the conundrum of identifying and managing hidden health hazards in museum collections. Some of these ongoing conundrums are inherent to the collections items, others were acquired or introduced in the form of past museum treatments. This case study addresses these concerns and highlights a multi-year, multi-disciplinary collaboration between the Indiana University Indianapolis Museum Studies Program, Purdue University's School of Health Sciences and the Indiana Medical History Museum (Figure 1).

A wide range of inherent vices can be found in museum collections around the world. This includes but is not limited to items decorated with lead paint, objects containing dyes and pigments, archaeological and geological collections containing silica dust, poisonous herbarium specimens, geological collections that naturally contain heavy metals or are radioactive, objects created from uranium glass and even historic medicinal collections containing old medications and other dangerous substances (Boyer et al. 2005; Hawks and Makos 2000; Hawks et al. 2010). Such inherent "hazards are often not apparent and may require specific knowledge about the collection" (Koss Schragger et al. 2024).

Likewise, acquired hazards are not always observable and include historic chemical pesticide treatments. In the 1800s, museums addressed pest infestations by treating items with toxic-metal based poisons such as arsenic and mercuric salts. By the 1940s, organic compounds (such as DDT) were developed and employed as pesticides and herbicides (Hawks 2001; Hawks and Makos 2000; Makos 2001; Odegaard and Sadongei 2005). Museums historically treated collections items to prevent insects from destroying valuable museum collections, but we now know that many of these historic treatments can pose health risks to the museum staff who regularly handle and care for these items without proper personal protective equipment (PPE).

The American Industrial Hygiene Association's (AIHA) Museum and Cultural Heritage Industry Working Group is composed of some of our nation's leading experts and scientists on this topic who are working collaboratively to address this complex problem in museum collections. Our "mission is to create a forum that brings together occupational & environmental health and safety (OEHS) professionals with conservation and collection care professionals to effectively address the risk management needs of cultural heritage worksites" (AIHA WG 2024). A primary goal is to provide cultural heritage and museum professionals with evidence-based best practice guidelines and occupational risk management tools for work tasks and public exhibit spaces. As active members of this AIHA Working Group, we offer this case study and suggest ways museums can extend the important work they are charged with through a collaborative, team-based approach to making museum collections safer for museum staff and visitors alike.



**Figure 1.** The Indiana Medical History Museum is located on the grounds of the former Central State Hospital in Indianapolis. The heart of the museum is the Old Pathology Building, the oldest surviving pathology facility in the nation and listed on the National Register of Historic Places (Courtesy of the Indiana Medical History Museum and Tom Mueller Photography).

Another primary aim of our collaboration was to better train the next generation of museum collection workers by supporting the active role of our graduate students in this unique, interdisciplinary project (Figure 2). We partnered with an external team of nationally known experts (including conservators, industrial hygienists, and environmental epidemiologists) to address the problem in museums and other collections spaces throughout the Indianapolis area. Now in our third year of this collaboration, our students continue to play an active role in addressing health and safety issues in collections worldwide.

## The Community Museum Partner

The Indiana Medical History Museum (IMHM) is housed in what is known as the Old Pathology Building. It is the 1896 pathology laboratory facility that was part of Indiana's first state mental hospital. It is remarkably intact with most of the original furnishings, equipment, specimens, books, records, and of course chemicals. IMHM operates very much like a house museum and offers guided tours of the building and



**Figure 2.** Graduate students from Indiana and Purdue Universities prepare to test for formaldehyde off-gassing in wet specimen collections at the Indiana Medical History Museum.

adjacent “Dead House” (building where the corpses of the hospital patients were kept) in addition to numerous public and school programs, lectures, and so on. There is also a medicinal plant garden, a native tree arboretum, and prairie patch on the grounds where the museum demonstrates and interprets plants that have historically been used for medicinal purposes. The tours are very immersive and authentic in ways that a lot of museums and even other house museums are not.

## **The Problem**

The building and the museum’s collections are unique for many reasons, including that so much of it is original and so many of the artifacts pose different health and safety hazards beyond the usual culprits found in most museum collections. There are many thousands of chemicals, pharmaceuticals, and patent medicines that contain heavy metals, poisons, and other hazardous substances. These collections are hazardous by their inherent nature

including belladonna, hemlock, mercury cyanide tablets, and picric acid (known to be very unstable and highly flammable/combustible) or have become hazardous over time as the pharmaceutical packaging ages and degrades. The collection was analyzed years ago, and a few things were removed from the collection and disposed of by partners at Indiana University Indianapolis. But this work was not well-documented, and there was no thorough inventory of the chemicals that remained in the collection. For many years the IMHM staff and Board had vague concerns about the collection, but no one felt empowered to address these concerns. There was little guidance and few resources available. In 2019 IMHM set out to assess and address these hazards and better prioritize and improve safety for the museum's staff, volunteers, visitors, and other collections.

Occupational and Environmental Health Science students receive training with a strong focus on manufacturing and other major industries, as this will be the career path of many graduates of the program. However, methods of evaluating and controlling hazards in an industrial environment may differ greatly from a museum in which contaminated and other hazardous collections items are often fragile and need to be handled and preserved very carefully. To address this, Occupational and Environmental Health Science students teamed up with Museum Studies students. The collaboration between different academic programs challenged the students to develop new methods of addressing issues which may be handled differently in another environment. Students developed new problem-solving skills and learned how to effectively communicate with individuals from different disciplines.

## **Testing Results**

We performed X-ray fluorescence to identify the concentrations of elements on the surface of objects on display or in storage, as well as various areas of the building which are open to the public. Heavy metal contaminants were detected across many of the tested inorganic and organic collections. Lead, arsenic, and mercury were the primary elements of interest, due to their toxicity. High concentrations of the contaminants were identified on individual objects and also in display areas. Mercury was not frequently identified but occurred in a display area as the only contaminant in high concentration. High levels of both lead and arsenic were often found together in objects. These findings resulted in recommendations for increased safety measures such as wearing disposable nitrile gloves and fit-tested respirators when handling these contaminated collections items. Recommendations were also made for better securing items on exhibit in public spaces.

## **Outreach and Education**

Outreach and education are key to resolving these complex collections conundrums. In May of 2022, our interdisciplinary team presented this research at the AIHA's





**Figure 3.** In 2022, the student team from Indiana University Indianapolis and Purdue University won multiple awards for their team-based, collaborative research with the IMHM.

National Annual Meeting in Nashville, Tennessee. The graduate students co-presented their research poster “Dust, Mold, and Heavy Metals: Health Hazards in Museums” that won multiple national awards including Bronze Best in Show from the American Industrial Hygiene Association, Best Student Research Poster from the AIHA’s Museum and Cultural Heritage Industry Working Group, Best Student Poster from the Exposure Assessment Strategies Committee, and Best Student Poster from the National Aerosol Technology Committee (Figure 3). Our research project was also featured in the November Issue of Synergist Magazine. “Preserving History, Protecting Safety: An Interprofessional Approach to Controlling Hazards in Museums,” further highlighting these serious human health and safety issues (Roberts 2022).

To expand our educational outreach, we again presented our project findings at the American Industrial Hygiene Association’s National Meetings in Phoenix, Arizona in May 2023. We shared this information with members of the American Industrial Hygiene Association’s Social Concerns Working Group and Workplace Health Without Borders (WHWB) International. We believe it is important to promote a team-based, interdisciplinary approach to this complex problem, but we also aim to



**Figure 4.** With permission from tribal authorities, the student team uses XRF technology to test collections for heavy metal contaminants before the items are repatriated to tribal communities.

reach new audiences in addressing these health and safety concerns in museums around the world. Collaboration is key. We must further this dialogue and continue to seek new solutions to this problem.

## **Beyond the Walls of the Museum**

Unfortunately, the threat of toxic and hazardous cultural heritage extends well beyond the walls of the museum. Toxic heritage poses real and ongoing dangers to Indigenous communities who are actively repatriating their cultural heritage worldwide. To address this, our collaborative team reached out and began dialogue with tribal communities (Figure 4). Like many of our tribal community partners, we believe it is important to conduct testing before items are returned to Indigenous communities when such communities deem testing and analysis culturally appropriate (HCPO 2009). We also hope to continue working with tribal communities to test cultural heritage items that were previously repatriated under the Native American Graves Protection and Repatriation Act (NAGPRA).

## **Conclusion: A Way Forward for Museums**

There are plenty of resources available for handling chemicals in laboratory settings, and there is a lot published from an industrial hygiene perspective, but the advice these resources offer don't always translate well to a museum environment, particularly when the hazard is the artifact itself. Many museum professionals have only basic knowledge of or experience in identifying and mitigating chemical hazards in their collections. The problem can be overwhelming. Our interdisciplinary, team-based approach to the identification, mitigation and/or management of hazardous toxins in museum collections is a replicable model for addressing these ongoing threats to human health and safety. Museums large and small can address their own unique collections conundrums by adopting this team-based approach.

We encourage museum collections professionals to engage with their local universities and Occupational Environmental Health and Safety (OEHS) programs to address these threats. The members of the American Industrial Hygiene Association's Museum and Cultural Heritage Industry Working Group encourage you to reach out and learn more. Our members range from students to career-long professionals, with a varied mix of OEHS practitioners, conservators, and collection managers. We are a welcoming and active group, with engaging monthly Zoom meetings. Our diverse members can assist you in locating local project partners who can collaborate with you to help identify and better manage your museum's hazardous collections conundrums. For more information about our working group visit <https://www.aiha.org/get-involved/volunteer-groups/museum-and-cultural-heritage-industry-working-group> or contact our Chair, Ralph Froehlich CIH, CSP, QEP, by e-mailing: [rfroehlich@helixenv.com](mailto:rfroehlich@helixenv.com).

## **Declaration of Conflicting Interests**

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

## **Funding**

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This collaborative research project was partially funded by the IUPUI Office of the Vice Chancellor for Research under a Research Support Funds Grant (RSFG) and support from the United States National Institute of Occupational Safety and Health Grant (T03OH008615).

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