

WINTERTHUR



Dr. Rosie Grayburn
Lead Scientist

Head, Scientific Research
& Analysis Lab
Assoc. Professor WUDPAC

The Poison Book Project

What You Need to Know About Heavy Metals in Historical Bookbindings

FAIC C2CC Webinar • September 20, 2023

UNIVERSITY OF
DELAWARE

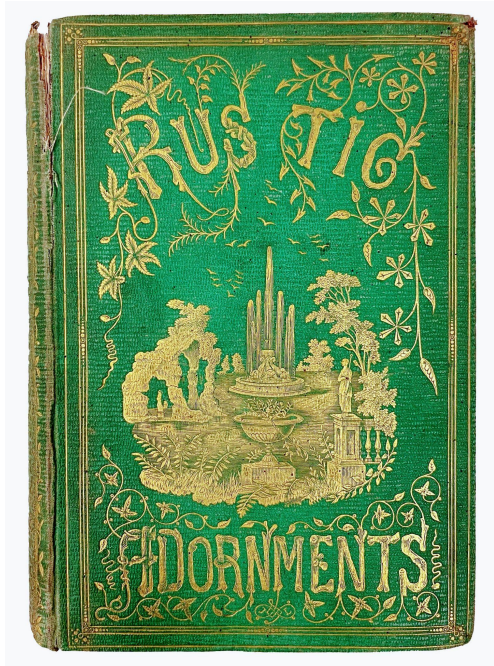


Dr. Melissa Tedone
Lead Conservator

Assoc. Director, WUDPAC
Asst. Professor for Library &
Archives Conservation

All images by project researchers unless credited otherwise.

A Brief History of the Project & Where We Are Now



Rustic Adornments for Homes of Taste, 2nd ed.
Shirley Hibberd. London: Groombridge & Sons, 1857.

- Discovery of mass-produced, emerald green cloth bookbinding



A Brief History of the Project & Where We Are Now



- Discovery of mass-produced, emerald green cloth bookbinding
- **Analytical survey of 19th-century cloth bookbindings**

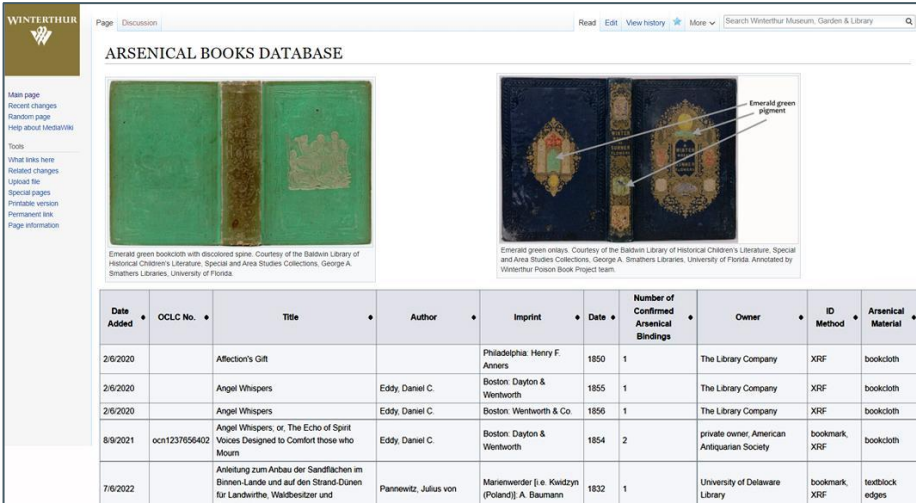
Collection Survey

English-language, cloth-case bindings
published 1837-1900 (Victorian era)

Portable XRF elemental ID

Raman spectroscopy molecular structure

A Brief History of the Project & Where We Are Now



The screenshot shows the 'ARSENICAL BOOKS DATABASE' on the Winterthur Museum website. It features two images of book covers: one with a green cloth binding and a worn spine, and another with a dark blue cover and gold-tooled spine. Below the images is a table listing book entries.

Date Added	OCLC No.	Title	Author	Imprint	Date	Number of Confirmed Arsenical Bindings	Owner	ID Method	Arsenical Material
2/6/2020		Affection's Gift		Philadelphia: Henry F. Anners	1850	1	The Library Company	XRF	bookcloth
2/6/2020		Angel Whispers	Eddy, Daniel C.	Boston: Dayton & Wentworth	1855	1	The Library Company	XRF	bookcloth
2/6/2020		Angel Whispers	Eddy, Daniel C.	Boston: Wentworth & Co.	1856	1	The Library Company	XRF	bookcloth
8/9/2021	ocn1237656402	Angel Whispers; or, The Echo of Spirit Voices Designed to Comfort those who Mourn	Eddy, Daniel C.	Boston: Dayton & Wentworth	1854	2	private owner: American Antiquarian Society	bookmark, XRF	bookcloth
7/6/2022		Anleitung zum Anbau der Sandflächen im Binnen-Lande und auf den Strand-Dünen für Landwirthe, Waidbesitzer und	Pannewitz, Julius von	Marionowder [i. e. Kołdzyn (Poland)]: A. Baumann.	1832	1	University of Delaware Library	bookmark, XRF	textblock edges

- Discovery of mass-produced, emerald green cloth bookbinding
- Analytical survey of 19th-century cloth bookbindings
- **Crowd-sourcing data**

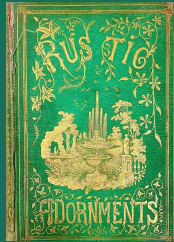
wiki.winterthur.org/wiki/Poison_Book_Project

A Brief History of the Project & Where We Are Now

Epidemiology

Toxicology

Conservation

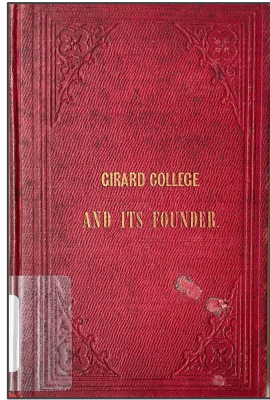


Industrial Hygiene

- Discovery of mass-produced, emerald green cloth bookbinding
- Analytical survey of 19th-century cloth bookbindings
- Crowd-sourcing data
- **Ongoing analytical research**
- **Ongoing collaborations with health & safety professionals**

What do 'poison books' look like?

Mercury



unconfirmed compound

Chromium,
Lead



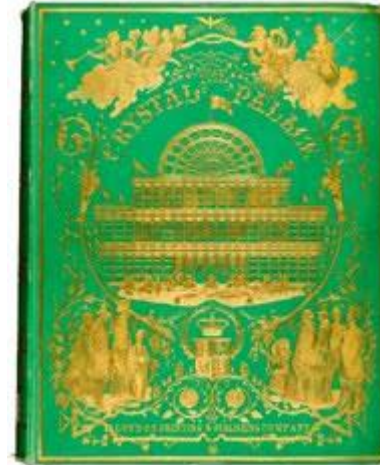
chrome orange

Chromium,
Lead



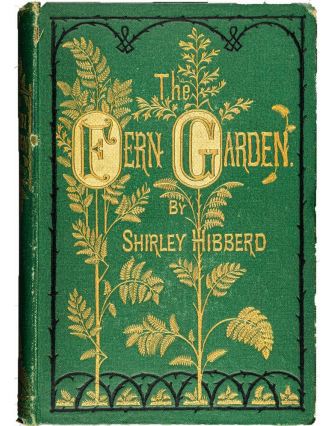
chrome yellow

Arsenic



emerald green

Chromium,
Lead

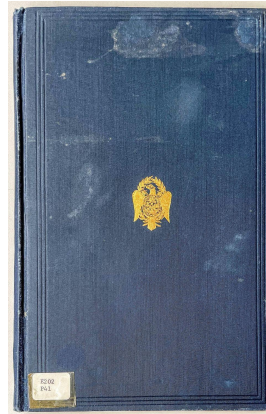


chrome green
(chrome yellow + Prussian blue)

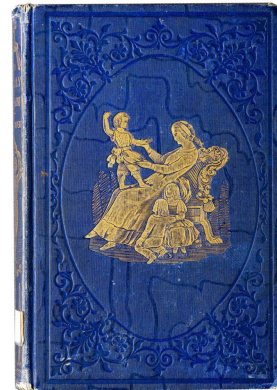
What do 'poison books' look like?

Benign Blues

often still contain lead



synthetic
ultramarine



Prussian
blue

What do 'poison books' look like?



Emerald Green



Emerald green pigment

Decorative onlays & paper labels



Bookcloth

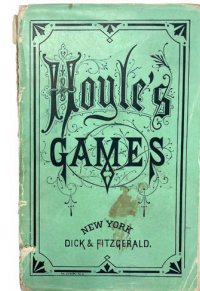


Textblock edges

Courtesy of the Baldwin Library of Historical Children's Literature, Special and Area Studies Collections, George A. Smathers Libraries, University of Florida. Annotated by Winterthur Poison Book Project team.

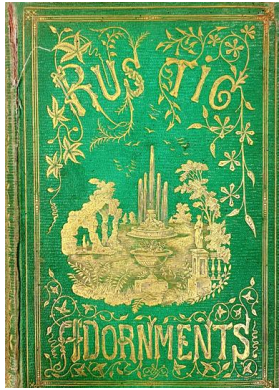


Paper
< hard cover
soft cover >



Heavy Metals & What We Know About Hazards

Emerald green pigment



Arsenic trioxide



Image credit: Wikimedia Commons
(Public Domain)

Vermillion

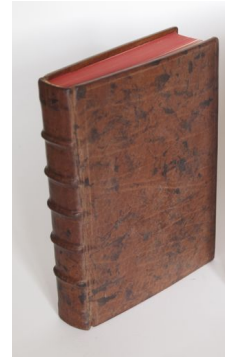
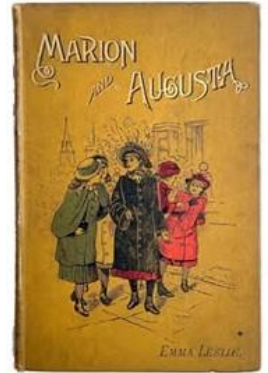


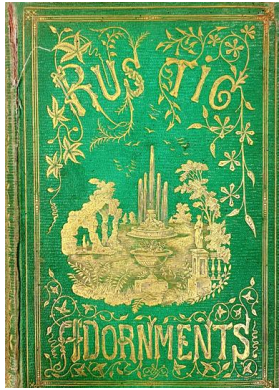
Image credit:
jeffpeachey.com/tag/1
8th-c-french-bookbindi
ng/

Chrome Yellow



Heavy Metals & What We Know About Risk

Emerald green pigment



Arsenic trioxide



Image credit: Wikimedia Commons (Public Domain)

Vermillion

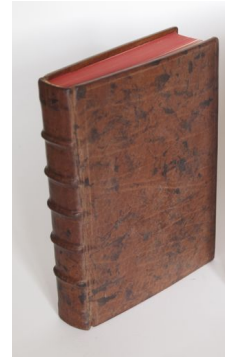


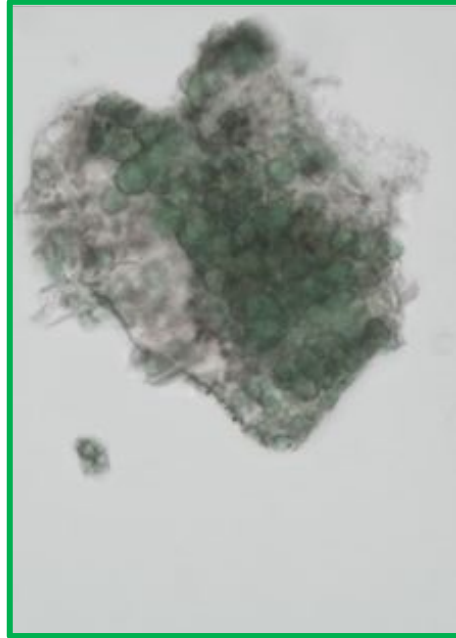
Image credit:
jeffpeachey.com/tag/18th-c-french-bookbinding/


Chrome Yellow



Tedone & Grayburn 2023

Identification Strategies




WINTERTHUR
MUSEUM, GARDEN & LIBRARY

**The Winterthur
Poison Book Project**

The 19th-century books on
your shelf might be toxic.
Find out how to identify
a poison book.

Why?
Toxic pigment* in some green
bookcloth, bookbinding papers,
and textbook edges may come off
when handled and can be harmful.

Where Do I Start?

Handling Basics:


- Wear nitrile gloves while handling
- Isolate books in zip-top, polyethylene plastic bags

What to Look for in Cloth Bindings:

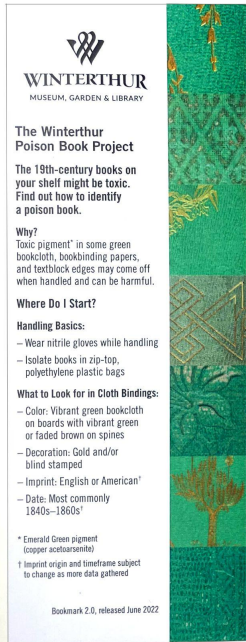
- Color: Vibrant green bookcloth on boards with vibrant green or faded brown on spines
- Decoration: Gold and/or blind stamped
- Imprint: English or American*
- Date: Most commonly 1840s–1860s

* Emerald Green pigment (organic cadmium salt)
† Report origin and timeframe subject to change as more data gathered

Bookmark 2.0, released June 2022



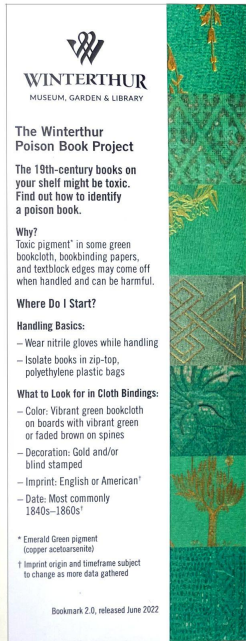
Identification Strategies - Visual analysis



reference@winterthur.org

Write “**Emerald Green Bookmark**” in the subject line and include your **name** and **postal address**.

Identification Strategies - Visual analysis



Cost: Free!

Time: How big is your collection?

Safety precautions: Wear gloves and wash your hands!

Important other considerations: No insect damage; pigment may not be visible or present on the spine :





Courtesy of the
George A. Smathers
Libraries, University
of Florida.

Identification Strategies - Arsenical Books Database

WINTERTHUR

Page Discussion Read View source View history Search Winterthur Museum, Garden & Library

ARSENICAL BOOKS DATABASE

This growing list of known arsenical green bookbindings was initially based on emerald green, cloth-bound books discovered by the Poison Book Project; however, as contributing institutions have discovered emerald green paper and leather bindings, as well, we have expanded the scope of the list to include any mass-produced, 19th-century bookbinding that contains arsenical emerald green pigment. Please note that, while the use of arsenically toxic azo pigments in book illustrations is well known, this database does not list illustrations within the textblock. This list tracks the use of heavy metal pigments in the binding specifically.

In the 19th century, not every book from the same edition would have been bound identically. Therefore, it is possible to have a book of the same edition listed below, but which does not contain an emerald green component. We provide this table of arsenical, mass-produced bookbindings as a starting point from which other institutions and private collectors may continue their own collection. This table includes information collected from bookmark requests about possible emerald green cloth bindings, as well as more correlative identification by Winterthur and other contributing institutions using instrumental analyses. To contribute data to the project, please read How To Submit Data to the Poison Book Project.

This table was last updated on February 28, 2022. Total number of emerald green bindings identified to date: 148.

- To receive this table as a .csv file, please contact mlm@winterthur.org
- This table can be searched using CTRL-F
- This table can be sorted in ascending or descending alphabetical or numerical order by column by clicking the black diamond next to each column heading.

Date Added	OCLC No.	Title	Author	Illustrator	Date	Number of Confirmed Arsenical Bindings	Owner	ID Method	Arsenical Material
2/8/2023		Albion's Or		Philochea Henry F. Asses	1855	1	The Library Company	XRF	bookcloth
2/8/2023		Angel Whiskers	Eddy, Daniel C.	Boston: Dayton & Witherborn	1855	1	The Library Company	XRF	bookcloth
2/8/2023		Angel Whiskers	Eddy, Daniel C.	Boston: Witherborn & Co.	1855	1	The Library Company	XRF	bookcloth
6/9/2021	ooc123795042	Angels Whiskers; or, The Echo of Saint Voices Designed to Comfort those who Sigh	Eddy, Daniel C.	Boston: Dayton & Witherborn	1854	2	private owner: American Antiquarian Society	bookmark, XRF	bookcloth
1/8/2022		Anleitung zum Aufbau der Sandfischer in Bremen-Land und auf den Strand-Graben für Landwirthe, Wollweber und Furdenskerne	Steinmetz, Julius van	Manuscripter (J. K. Wiedtgen (P. H. H. E. A.))	1822	1	University of Delaware Library	bookmark, XRF	wireback edges
3/24/2022		Aphorisms of the Wise & Good	Beumann		1822	1	Undisclosed	bookmark, XRF	bookcloth
4/20/2022		Ballets of Ireland	Hayes, Edward	London, Edinburgh, and Dublin: A. Fisher & Co.	1856	1	Wye Smith	bookmark	bookcloth
11/19/2021	1532195	The book of beauty, or Tales of Francelina		New York: Leavitt & Allen	1856	1	William & Mary Libraries	bookmark, XRF	bookcloth
3/24/2022		The Book of the Royal-Medical Society	Murray, Andrew		1803	1	Undisclosed	bookmark, XRF	bookcloth
11/19/2021	18371729	Carnie Pathology	Starna, O. P.; Bossey, Thomas	London: T. & T. Bossey	1822	1	William & Mary Libraries	bookmark, XRF	bookcloth
1/24/2022		The Christian's Steps in Order Time	Swelling, Henry		1822	1	Undisclosed	bookmark, XRF	bookcloth

[http://wiki.winterthur.org/wiki/ARSENICAL BOOKS DATABASE](http://wiki.winterthur.org/wiki/ARSENICAL_BOOKS_DATABASE)

Known emerald green containing books are listed with title, OCLC, publication date.



Also available as a .csv file upon request.

Identification Strategies - Arsenical Books Database

WINTERHURST

Page Discussion Read View source View history Search Winterthur Museum, Garden & Library

ARSENICAL BOOKS DATABASE


The growing list of known arsenical green bookbindings was initially based on emerald green, cloth-bound books discovered by the Poison Book Project; however, as contributing institutions have discovered emerald green paper and leather bindings, as well, we have expanded the scope of the list to include any mass-produced, 19th-century bookbinding that contains arsenical emerald green pigment. Please note that, while the use of arsenical book arts pigments in book illustrations is well known, this database does not list illustrations within the textblock. This list tracks the use of heavy metal pigments in the binding specifically.

In the 18th century, not every book from the same edition would have been bound identically. Therefore, it is possible to have a book of the same edition listed below, but which does not contain an emerald green component. We provide this table of arsenical, mass-produced bookbindings as a starting point from which other institutions and private collectors may continue their own collection. This table includes information collected from bookmark requests about possible emerald green book bindings, as well as more correlative identification by Winterthur and other contributing institutions using instrumental analyses. To contribute data to the project, please read How To Submit Data to the Poison Book Project.

This table was last updated on February 28, 2022. Total number of emerald green bindings identified to date: 188.

- To receive this table as a CSV file, please contact mlm@winterthur.org
- This table can be searched using CTRL+F
- This table can be sorted in ascending or descending alphabetical or numerical order by column by clicking the black diamond next to each column heading.

Date Added	OCLC No.	Title	Author	Illustrator	Color	Number of Confirmed Arsenical Bindings	Owner	ID Method	Arsenical Material
2/8/2023		Albion's Or		Philocheia Henry F. Asses	1855	1	The Library Company	XRF	bookcloth
2/8/2023		Angel Whiskers	Eddy, Daniel C.	Boston: Dayton & Wetherm	1855	1	The Library Company	XRF	bookcloth
2/8/2023		Angel Whiskers	Eddy, Daniel C.	Boston: Wetherm & Co.	1855	1	The Library Company	XRF	bookcloth
6/9/2021	oai:127950402	Angel Whiskers; or, The Echo of Saint Voices Designed to Confront those who Blush	Eddy, Daniel C.	Boston: Dayton & Wetherm	1854	2	private owner: American Antiquarian Society	bookmark, XRF	bookcloth
1/9/2022		Anleitung zum Aufbau der Sandfächer in Birnen-Lärche und auf den Strand-Stein für Landwirthe, Waldweidner und Forstbesitzer	Pathelet, Julius van	Manerweder (J. K. Kieditz) (P. B. H. E. J. A. Beumann	1822	1	University of Delaware Library	bookmark, XRF	webbook edges
3/24/2022		Aphorisms of the Wise & Good	Stanhope, Samuel		1802	1	Undisclosed	bookmark, XRF	bookcloth
4/20/2022		Ballads of Ireland	Hayes, Edward	London, Edinburgh, and Dublin: A. Fisher & Co.	1856	1	Wye Smith	bookmark	bookcloth
11/19/2021	1532195	The book of beauty or Tales of Franchise		New York: Leavitt & Allen	1856	1	William & Mary Libraries	bookmark, XRF	bookcloth
3/24/2022		The Book of the Royal Horticultural Society	Murray, Andrew		1863	1	Undisclosed	bookmark, XRF	bookcloth
11/19/2021	18371729	Carnie Pathology	Starna, O. P.; Bossey, Thomas	London: T. & T. Bossey	1822	1	William & Mary Libraries	bookmark, XRF	bookcloth
1/24/2022		The Christian States in Olden Time	Sweling, Henry		1822	1	Undisclosed	bookmark, XRF	bookcloth



Cost: Free!

Time: Very quick with CTRL + F

Safety precautions: Wear gloves and wash hands.

Important other considerations: Not comprehensive... yet!

Identification Strategies - XRF



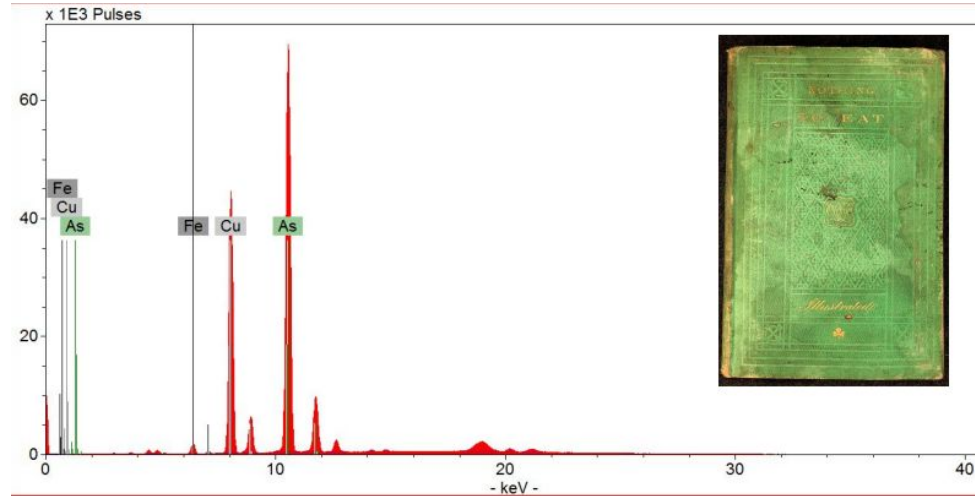
XRF:

- Requires x-ray fluorescence spectrometer, which gives elemental information
- In survey mode, a two-person job (analysis and documentation)

Identification Strategies - XRF



Nothing to Eat
1857



Identification Strategies - XRF

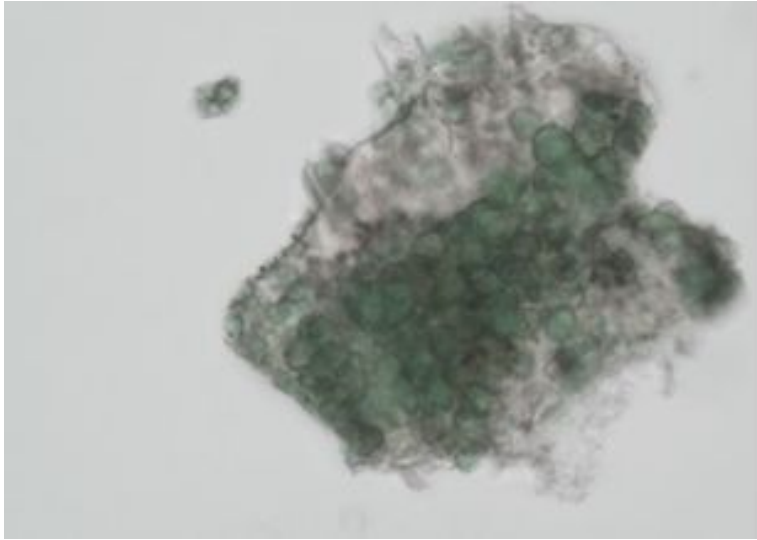


Cost: \$100-1000s for a contractor; \$50k+ for an XRF; consider safety costs of radiation program

Time: Quick measurement, but interpretation requires time and expertise.

Safety precautions: **X-ray safety** requirements (differ per state); **handling** precautions followed

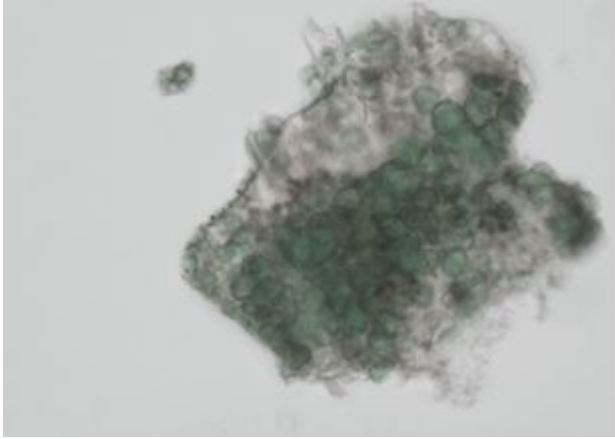
Identification Strategies - PLM



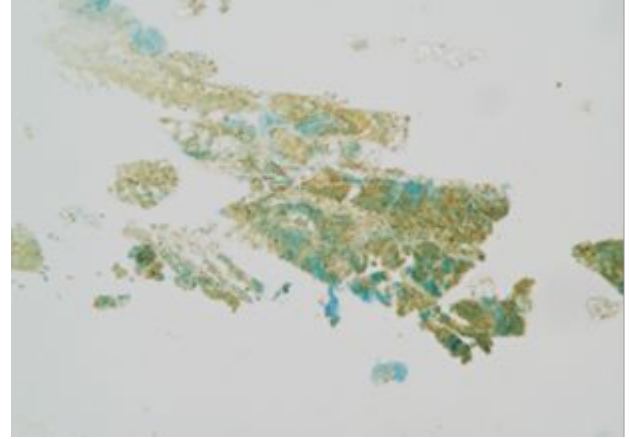
Polarized Light Microscopy

- Must remove a sample
- Mount between glass slip and mounting medium
- Observe under plane and cross polarized light.

Identification Strategies - PLM

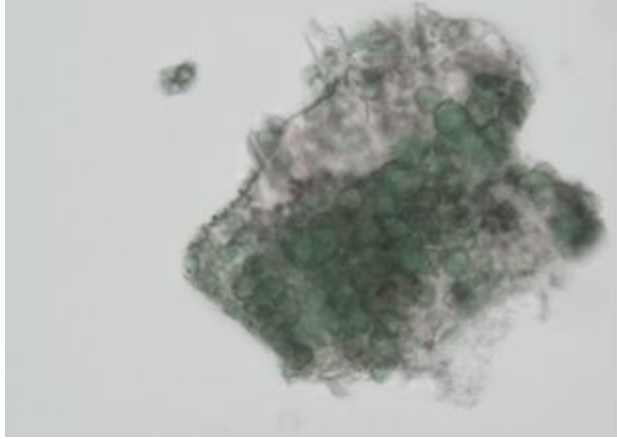


Emerald Green



Chrome Green

Identification Strategies - PLM



Emerald Green

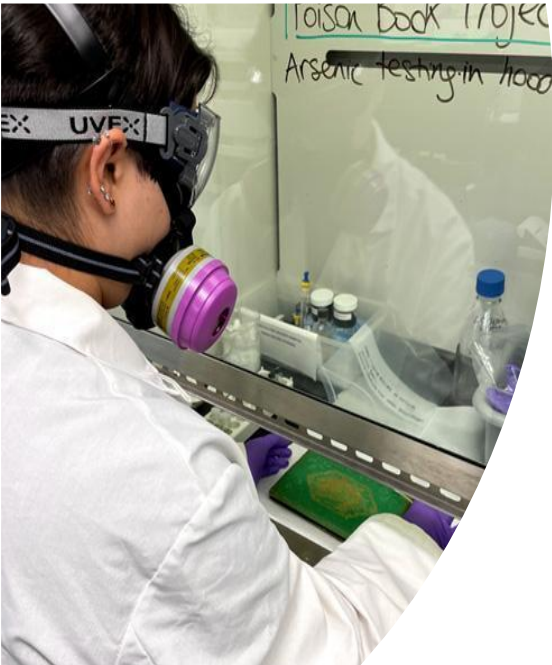
Cost: Contract a conservator (hourly rate for analysis + reporting); microscope and chemicals \$50k-60k+

Time: Sample removal and preparation time; interpretation requires time and expertise.

Safety precautions: **PPE** for possible arsenic exposure during analysis and sampling; **ventilation** while working with heated mounting medium

Important other considerations: Permission required for sample removal.

Identification Strategies - environmental testing



DELAWARE SOIL TESTING PROGRAM

- COOPERATIVE EXTENSION
 - NUTRITION, FOOD SAFETY & WELLNESS +
 - SUSTAINABLE PRODUCTION SYSTEMS +
 - 4-H PERSONAL & ECONOMIC DEVELOPMENT +
 - ENVIRONMENTAL STEWARDSHIP -
 - CLIMATE VARIABILITY AND CHANGE -
 - DELAWARE SOIL TESTING PROGRAM -
- General Information on what, how, why and where soil is tested
- Soil Testing Program Forms
- Nutrient Recommendations
- FORESTRY
- LAWN AND GARDEN +
- DELAWARE MASTER GARDENERS +



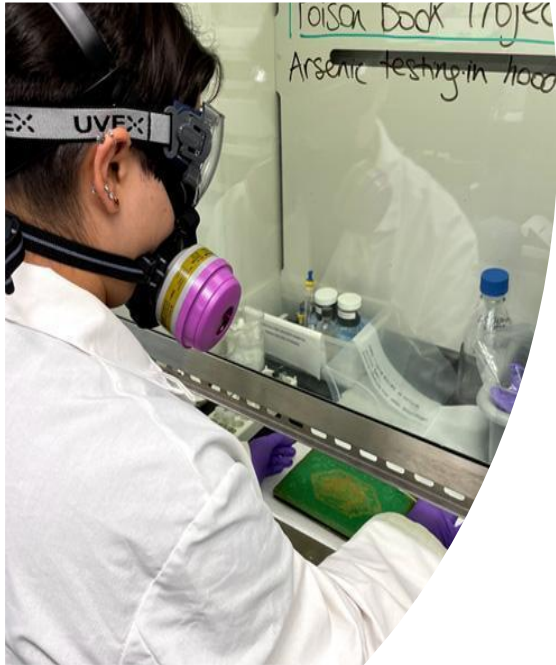
Providing accurate analyses and unbiased interpretations to clients since 1947.



Image credit clockwise from bottom R: SKT Ltd., Pacific Water Technologies, Millipore Sigma

Intern Jess Ortegon (WUDPAC '22) trials test kit efficacy at Winterthur Library.

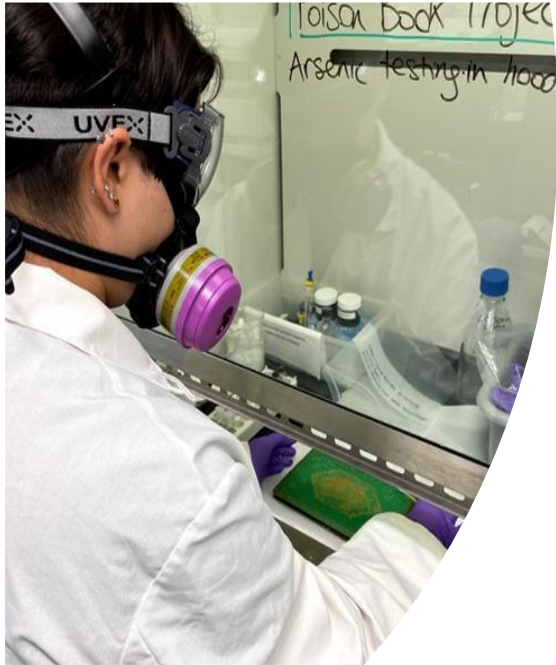
Identification Strategies - environmental testing



Environmental testing

- Water and soil testing standards for arsenic
- Destructive testing of samples
- Labs require swabs or wipes
 - **Ghost wipes are not suitable for use on objects due to their pH & moisture content**
- Off-the-shelf kits require significant PPE and ventilation.

Identification Strategies - environmental testing



Cost: \$25/sample analysis with a certified lab. Kits are affordable but have to consider cost of hazardous waste disposal.

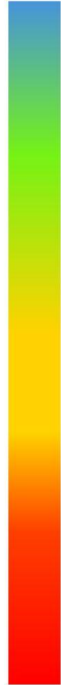
Time: 5-7 business days turnaround

Safety precautions: If using off-the-shelf test kits, **full PPE** and use of a **working fumehood** is required due to the production of arsine gas during testing. Used kits must be disposed of as **hazardous waste**.

Hierarchy of Controls

Safer
Handling
&
Storage
Practices

Most
effective



Least
effective

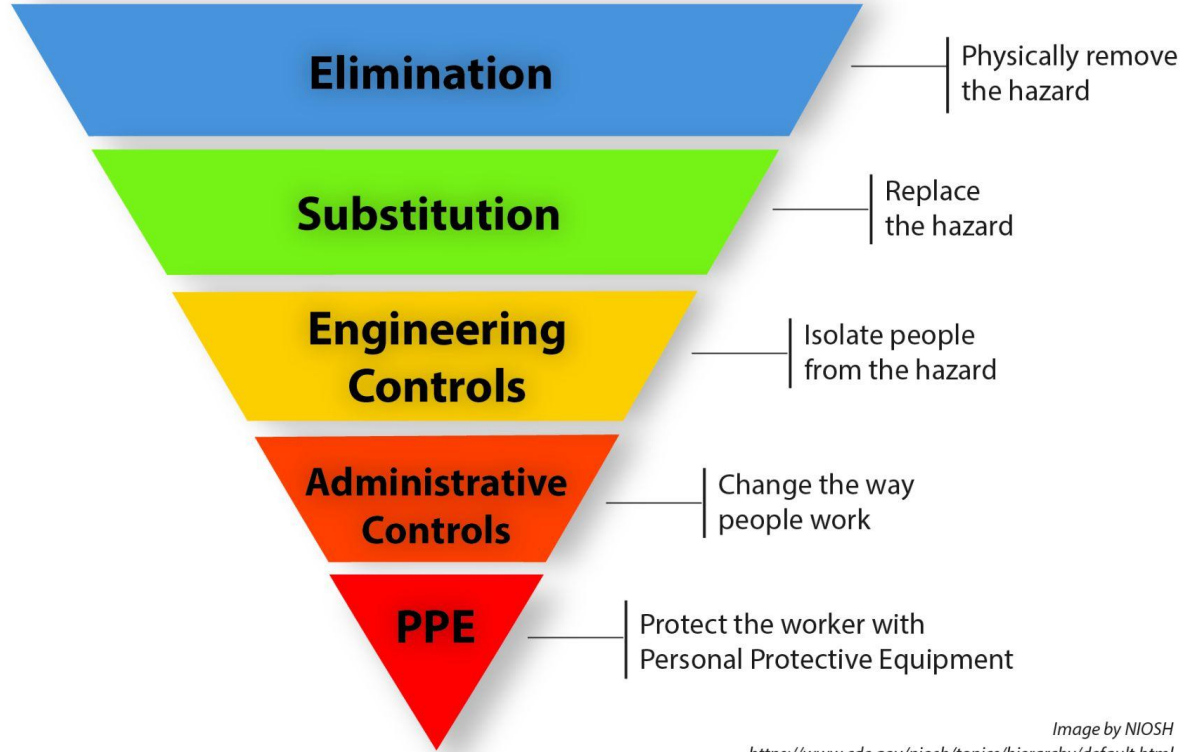
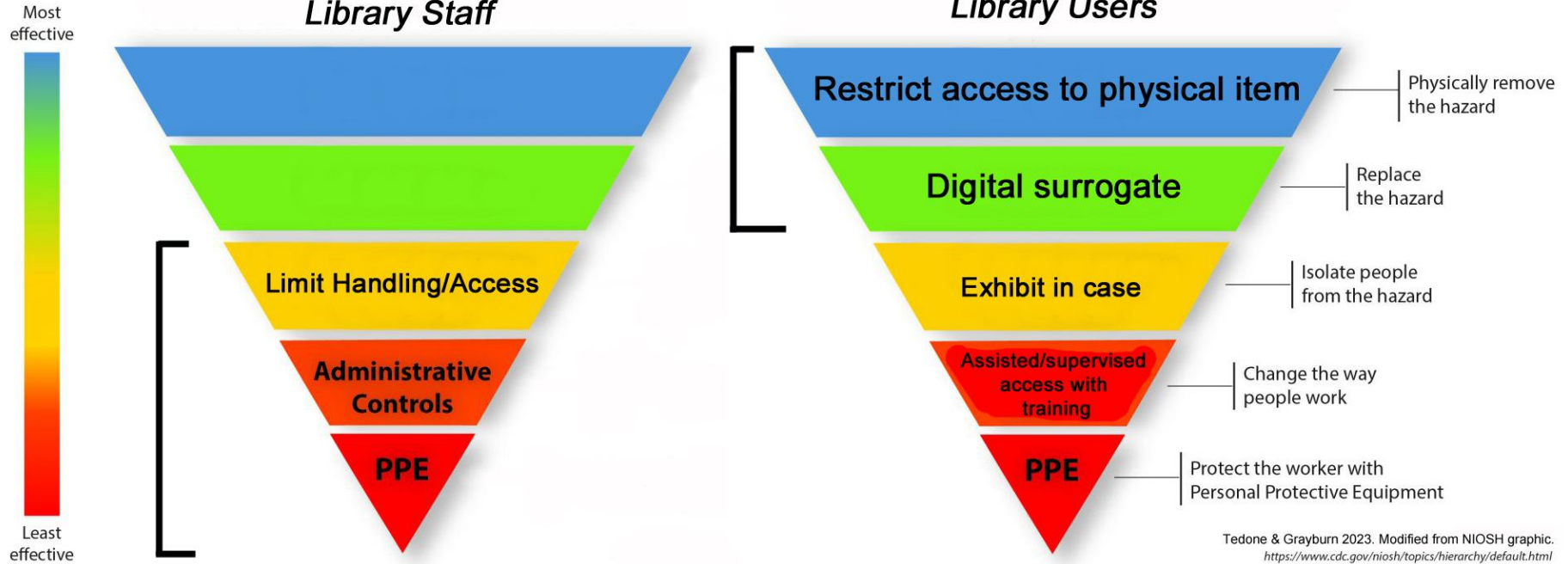


Image by NIOSH
<https://www.cdc.gov/niosh/topics/hierarchy/default.html>

Hierarchy of Controls for Toxic Library Collection Materials



Safer Handling Practices

Nitrile gloves



Nitrile gloves

N95 masks are not required*

Mindful interaction

Hand washing

D-lead soap & wipes

Cotton gloves



ESCA Tech, Inc.

D-Lead® Wipe or Rinse Skin Cleaner with Abrasive

Revision Date: 25-June-2015

4455ES

1. IDENTIFICATION

Product Name: D-Lead® Wipe or Rinse Skin Cleaner with Abrasive
Other means of identification: Product Code: 4455ES
Recommended Use: Skin cleaner with Abrasive

Company

ESCA Tech, Inc.
3747 North Booth Street
Milwaukee, WI 53212
e-mail: cservice@esca-tech.com

Emergency Telephone Number

Company Phone Number: Phone: (414) 962-5323
Fax: (414) 962-7003
Emergency Telephone (24 hr): INFOTRAC 1-352-323-3500 (International)
1-800-535-5053 (North America)

2. HAZARD IDENTIFICATION

GHS Classification

Eye Irritation: Category 2B

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Thick white liquid
Color: White
Odor: Apple-orange
Odor threshold: Not determined
pH: 7.0 – 8.0
Melting point/Freezing point: Not determined
Boiling point/Boiling range: ~100 °C/ 212 °F
Flash point: >100 °C/ >212 °F
Evaporation rate: 0.75
Flammability: Not applicable
Upper Flammability Limits: Not applicable
Lower Flammability Limits: Not applicable

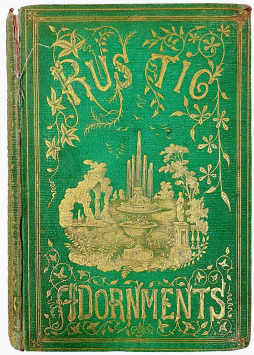
De-lead (heavy metal removing) wipes and soaps are not all equal.

pH 7.0-8.0 = safe
to use for arsenic

pH 6.0 or lower = UNSAFE
to use for arsenic



Image credit:
Grainger.com

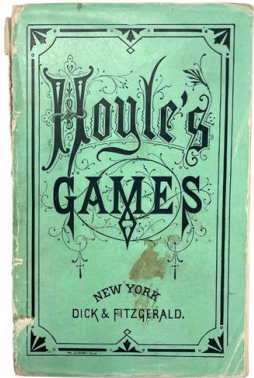


Cloth binding

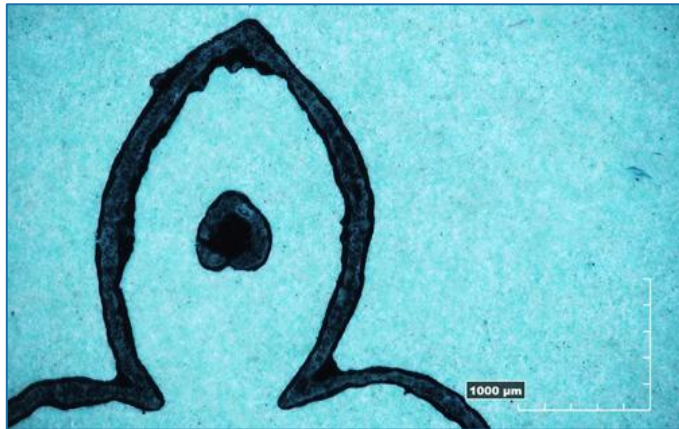


35x magnification with Hirox digital 3D microscope

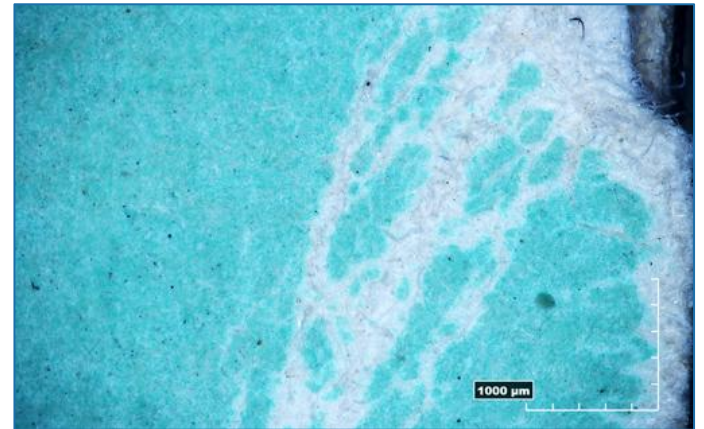
Emerald green bookcloth
vs. bookbinding paper



Paper binding



60x magnification with Hirox digital 3D microscope



Safer Handling Practices: Exposure Risk

Higher risk of arsenic exposure

Pigment is in **bookcloth** or on **textblock edges**, where it is inherently friable and must be touched directly to use the book.

Pigment is present in paper with larger surface area and/or on exterior binding: **endpapers**, **paper book covering**.

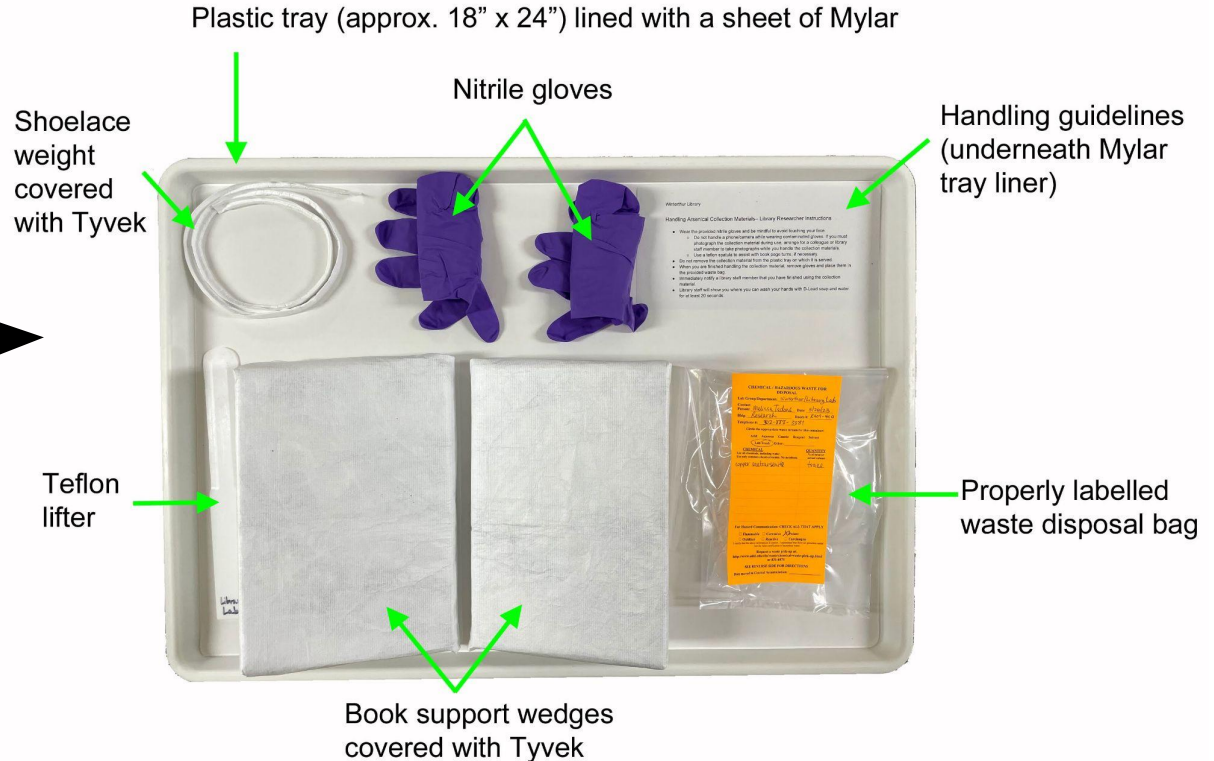
Pigment is present in smaller quantities & direct contact can be avoided: in **illustrations** within textblock or on maps; **spine labels**, decorative **onlays**.

Lower risk of arsenic exposure



Safer Handling Practices

- **Digital-first strategy**
- Serving *lower-risk* arsenical materials to users
- *Higher risk* materials (emerald green cloth bindings) are not served to users.



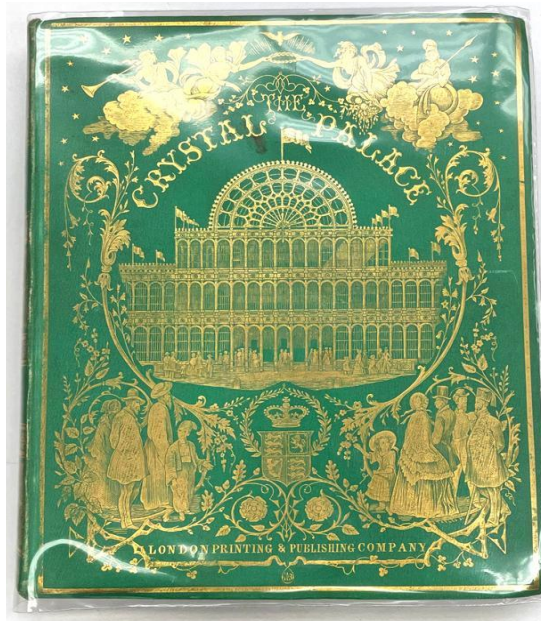
Safer Storage Practices: Rehousing



Recommended:
zip-top polyethylene
bags
(4 mil.)

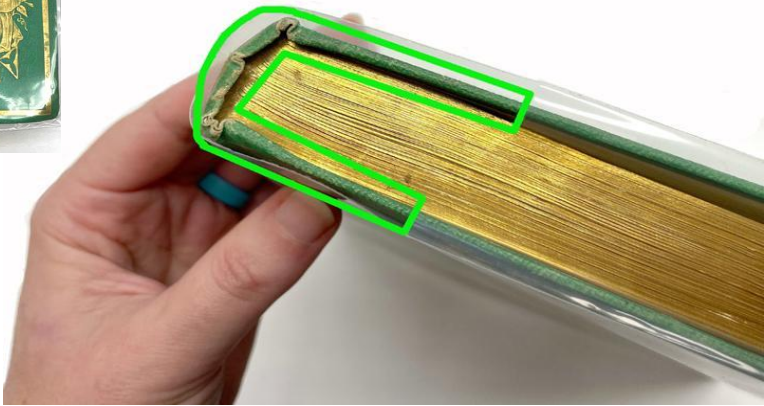


Intern Alison Chew tests storage options.



Gaps allow arsenic shedding

Dust Jackets
Not recommended for emerald green cloth bookbindings



Safer Storage Practices: Updating Disaster Plans

Update written disaster plan

Add warning to salvage-related shelf signage

Ensure appropriate PPE are included in disaster response kits



ARSENIC

This bookcloth contains friable **copper acetoarsenite** (emerald green) pigment.

- Wear nitrile gloves to handle.
- Wash hands afterwards with soap and water.
- Use only on hard, nonporous surfaces.
- Wipe down surfaces that have come in contact with bookcloth using a damp, disposable cloth.
- Dispose of gloves and wipe cloth as trace hazardous waste.

Safer Storage Practices: Labeling

Labelling objects

	Danger Contains Arsenic & Lead
	May cause cancer. May cause damage to the central nervous system. May damage fertility or the unborn child. May cause damage to organs through prolonged or repeated exposure.
	Identified using XRF on _____
	Wear gloves while handling
	Do NOT eat, drink or smoke while handling
	Wash hands after handling
	Follow standard operating procedures



Credit: Northwestern University Libraries

Labels from Winterthur Library

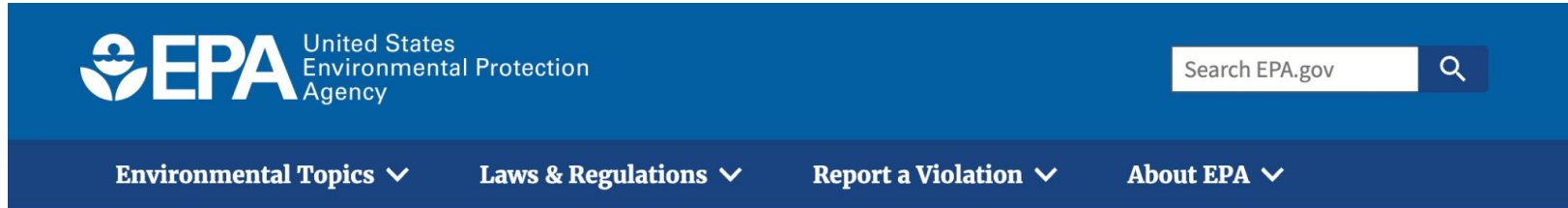
Recording information in your CMS

Collections Management System



Catalog handling notes; coded to alert users and staff to a poison book

Disposal of Hazardous Waste



Trace* hazardous waste: used gloves, polyethylene bags, wipes

U.S. Environmental Protection Agency (EPA)

www.epa.gov/hw

State Governance of Hazardous Waste Disposal

Delaware: dnrec.alpha.delaware.gov/waste-hazardous/management/hazardous/

Removal of Arsenical Books from Collections



Responsible Stewardship

- What does this mean for your organization?
- Whose problem are arsenical books?

Goals

Removal of arsenical books from circulation/access vs. removal from collection/institution: what is the goal and why?

Options

- Responsible storage
- Selling/donating (with full disclosure)
- Disposal as hazardous waste

Removal of Arsenical Books from Collections



Responsible Stewardship

- What does this mean for your organization?
- Whose problem are arsenical books?

Goals

Removal of arsenical books from circulation/access vs. removal from collection/institution: what is the goal and why?

Options

- Responsible storage
- Selling/donating (with full disclosure)
- **Disposal as hazardous waste = destruction of historically significant collection material**



Communicating with the Public

Why we call our research the **Poison Book Project**

Talking about 'poison books':

- Don't use evasive/euphemistic language
- Put potential risk *in context*
- Offer sensible, achievable, affordable solutions

We do *not* recommend 'upcycling' 19th-century cloth bookbindings!

Image credit: [instructables.com/How-to-make-a-purseclutch-from-a-Book/](https://www.instructables.com/How-to-make-a-purseclutch-from-a-Book/)

biblio = relating to books

toxicology = the study of poisons



Bibliotoxicology Working Group

- **ID toxic substances** in bookbindings and archives materials
- Define **safer management** strategies
- Make **reliable information** broadly and publicly accessible



With Gratitude for Our Research Community



Winterthur Museum, Garden & Library

- Joy Gardiner, Director of Conservation
- Conservation: Catherine Matsen, Dr. Patricia Elena Gonzalez Gil, Mina Porell, Matt Cushman, Jim Schneck, Natale Caccamo
- Library: Rebecca Parmer, Sarah Lewis, Carley Altenburger, Allie Alvis, Emily Guthrie, Linda Martin-Schaff
- IT: Phil Hall, Andrew Talecki, Alan Harbaugh
- Interns: Meghan Abercrombie, Alison Chew, Philip DePaola, Layla Huff, Amanei Johnson, Sara Leonowitz, Tempe Stewart, Esther Weyer
- Publicity & Bookmarks: Mark Nardone, Jason Brudereck, Teresa Vivolo, Gayle Bezerra, Stephanie Gaster

Bibliotoxicology Working Group

Special Thanks to Our Funders

- ICON Fred Bearman Research Grant
- UD Art Conservation Department
- United Way Do More 24 Delaware
- Private donations

Data-Contributing Institutions

- Appalachian State University, Colonial Williamsburg, Boston Athenaeum, British Library, Library Company of Philadelphia, Middlebury College Special Collections, Northwestern University, Philadelphia Athenaeum, Queens University Jordan Library, University of Arkansas, University of Florida, University of Washington, William & Mary

University of Delaware

- Debra Hess Norris, Art Conservation
- WUDPAC: Karissa Muratore, Veronica Ivette Mercado Oliveras, Jess Ortegon, Johanna Pinney, Katarina Stiller
- Environmental Health & Safety: Brandon Calitree, John Verdi, Michael Gladle
- Epidemiology: Dr. Jennifer Horney
- Conservation: Susan Maguire
- Special Collections: Tim Murray, Alexander Johnston, Petra Clark

Other Contributors & Consultants

- Dr. Justin Brower, NC Office of the Chief Medical Examiner
- Dr. David Goldsmith, Epidemiologist