EXPERIENCE AND QUALIFICATIONS:

TEAM OVERVIEW

The project team is composed of two companies with unique capabilities and experience in working with historic taxidermy. A.M. Art Principals Eugenie Milroy and Rachael Arenstein have worked on historic taxidermy and natural science collections requiring conservation treatment, exhibit preparation, and collections care consultation. George Dante is a master taxidermist, the founder and owner of two businesses, and a non-profit organization that provides taxidermy and natural history services. He has unparalleled expertise in historic taxidermy techniques and natural history exhibit projects. A.M. Art and George Dante Studios have worked together on several previous large-scale historic taxidermy projects. Independent conservator/taxidermist Fran Ritchie will evaluate the survey data and report recommendations to provide an additional layer of review. This team provides the experience and person-power required to survey the collection and detail the observations and recommendations in a way that can be publicly shared and evaluated by the many stakeholders looking to determine the fate of the taxidermy collection. A brief biography for each project team member is provided below and full CVs are presented in the Appendix.

Eugenie Milroy is a principal at A.M. Art Conservation, LLC and a Professional Associate member of the American Institute for Conservation (AIC) with over 25 years of museum and conservation experience. Eugenie has worked at the American Museum of Natural History, the Metropolitan Museum of Art, and the Brooklyn Museum of Art, among other institutions. Her objects conservation experience ranges from natural history to archaeological and ethnographic to modern collections. Eugenie is a founding board member and a *Heritage Response Team* member of the Alliance for Response NYC, which connects emergency responders with representatives of the cultural heritage community to strengthen disaster mitigation and response capabilities. Eugenie has conducted workshops and webinars in numerous preservation topics ranging from best practices for storage and rehousing, labeling objects, and integrated pest management. Eugenie majored in Art History at Barnard College, Columbia University and did her graduate work in Art History and Art Conservation at the Conservation Center, Institute of Fine Arts, New York University.

Rachael Arenstein is a principal at A.M. Art Conservation, LLC the private practice she co-founded in 2009. A.M. Art provides conservation treatment, preservation consulting and collection management services on a wide range of cultural heritage collection types. She has worked at the Bible Lands Museum in Jerusalem, Smithsonian Institution's National Museum of the American Indian, the Peabody Museum of Archaeology and Ethnology, the American Museum of Natural History (AMNH) and the Metropolitan Museum of Art (MMA), and completed internships at the British Museum and the Israel Museum as well as other international institutions. In addition, she is active in several professional organizations including positions as the e-Editor for the AIC and the Co-Chair of the MuseumPests Working Group, which focuses on integrated pest management issues for cultural heritage institutions. Rachael's degree in art conservation is from the University of London where she studied at the Institute of Archaeology, University College London. She is a Professional Associate member of the American Institute for Conservation.

George A. Dante, Jr., founder, George Dante Studios, Wildlife Preservations, & The Institute for Natural History Arts, has over 40 years of experience as a taxidermist, sculptor, model maker, illustrator, and fine artist. He has been an artist and naturalist his entire life and obtained a Bachelor of Arts from the School of Visual Arts in New York. Wildlife Preservations and George Dante Studios are world-class providers of natural history exhibit services, specializing in museum taxidermy, dioramas, and the restoration of historic specimens and exhibits. In addition to being the recipient of numerous awards, George is also an NTA certified judge, instructor, professional consultant, author, and was recently elected a Fellow of the Linnean Society of London. His clients include some of the most prestigious institutions and organizations in the world, such as the American Museum of Natural History, The Smithsonian National Museum of Natural History, Harvard University, National Geographic, Oxford University, The Field Museum, US Fish & Wildlife Service, and the USDA. George is also founder of the Institute for Natural History Arts, a non-profit organization whose mission is to preserve and improve upon the traditional methods of preparation for natural history exhibits and collections through research and education. The inception of INHA came from George's desire to help institutions and the public better understand historic collections and their continued care.

Divya Anantharaman works on independent taxidermy commissions in addition to working at George Dante Studios. She was awarded 2019 Best of Category Professional Division for both Birds and Mammals at the New England Taxidermy Championships, took second place in the Professional division at the 2017 World Taxidermy Championships, and is the coauthor of the book Stuffed Animals: A Modern Guide to Taxidermy. Divya is a board member of the New England Association of Taxidermists and Garden State Taxidermy Association and regularly works with various organizations like the Audubon Society.

Fran Ritchie is an objects conservator with 15 years of experience working with natural history materials. She is currently the organics conservator at the National Park Service's Harpers Ferry Center, but continually works in the private sector on taxidermy mounts and science collections as a consultant and conservator. Past clients include the California Academy of Sciences, Buffalo Bill Center of the West, and the Alaska State Museum. Prior to the NPS, she worked several years on the taxidermy and Native American collections at the American Museum of Natural History in New York City. She was a Mellon Fellow at the Smithsonian National Museum of the American Indian, a Save America's Treasures graduate fellow at the Harvard Peabody Museum, and a conservation technician at Biltmore Estate. Fran graduated from the Art Conservation graduate program at SUNY Buffalo State University and also holds an MA in Museum Anthropology from Columbia University. She earned her BA from the University of Delaware in Art Conservation and Anthropology, with a minor in American Material Culture Studies. She is a peer-reviewed member of the American Institute for Conservation, and the Chair of the Conservation Committee in the Society for the Preservation of Natural History Collections.

SELECTED EXAMPLES OF PRIOR TEAM PROJECTS

***Institution*: Academy of Natural Science Philadelphia, PA**
Date: March 2017 – June 2018
Project: Project Pilot restoration project of two mammal dioramas (Takin and Gorilla) conducted by George Dante Studios and AM Art. Our team documented condition, developed and conducted cleaning and conservation protocols for foreground elements and specimens and trained staff to assist in carrying out treatments. Followed all health and safety protocols for contaminated collections.

Institution: **The State Museum of Pennsylvania, Harrisburg, PA**
Date: March 2016 – August 2018
Project: Cleaning and restoration of 11 Dioramas in the Hall of Mammals. AM Art and George Dante were responsible for documentation and treatment of foreground materials which included fabricated plants, water, snow and other elements, cleaning and repair of historic taxidermy, and creation of new specimen mounts as needed. Trained and oversaw conservation technicians who carried out additional treatment protocols.

Institution: **Chicago Field Museum, Chicago, IL**
Date: December 2018
Project: Condition Survey of Carl Akeley's *Fighting Elephants.* AM art and George Dante worked with museum staff and taxidermists to carry out a 5-day on-site assessment of these iconic specimens and delivered a condition report and treatment proposal to the museum to be used for funding future work.

2024 Delbridge Taxidermy Survey Airtable Field List

Field Name	Field Description	Field Type	Field Options
ACQ Cost	Acquisition Cost (taken from City of Sioux Falls Fixed Asset List). Listed on GPZ Spreadsheet.	currency	
Additional Description/Source	Cleaned up description/Source information from GPZ spreadsheet. Combination of species attribution, source, and other information.	richText	
Appendage Issues	Survey field - Description of appendage condition issues. seen on legs, tail, etc.	multipleSelects	24 choice(s) - Split seams - Visible seams - Cracks (major) - Cracks (moderate) - Cracks (minor) - Distortion - Paint loss - Overpaint - No paint - Hair Loss - Loss - Missing toes - Missing hooves - Missing pieces - Splitting hooves - Tail (missing) - Tail (broken) - Tail (misshapen/bent) - Broken structure - Broken pieces - Support Rods (stable) - Support Rods (unstable) - Shrinkage - Grease leaching
Appendages Condition	Survey field - Overall assessment of appendage condition including legs, feet, tail, etc.	multipleSelects	4 choice(s) - Excellent - Good - Fair - Poor
Appendages Condition Notes	Survey field - Descriptive text of any appendage construction or condition issues.	multilineText	

Applicable Laws	As listed on GPZ spreadsheet: ESA – Endangered Species Act ESA (v) – Delbridge transaction violated ESA as animal was listed at the time of sale MMPA – Marine Mammal Protection Act MBTA – Migratory Bird Treaty Act	multipleSelects	4 choice(s) - ESA (v) - ESA - MMPA - MBTA
Appraised Value (2022)	Appraisal Value (July 2022) as communicated by B. Dewitz (personal communication 4/11/2024) listed on GPZ spreadsheet	currency	
Arsenic Positive?	Specimens measuring above the Midwest Laboratories detection limit of 0.50 mg/kg are positive for arsenic as determined by the GPZ 2023 wipe testing.	singleSelect	4 choice(s) - Yes - No - Unknown - No data in GPZ spreadsheet
Arsenic Test Results (mg/kg)	Midwest Laboratories 2023 testing results from GPZ Spreadsheet.	singleLineText	
Asset	City of Sioux Falls Asset Number from GPZ Spreadsheet.	singleLineText	
Base/Habitat/Case Description	Survey field - Description of the base or surround	richText	
CITES	From GPZ spreadsheet - Convention on International Trade in Endangered Species (CITES) of Wild Fauna and Flora. This is an international agreement between governments, and regulates how wildlife items can be sold, transferred, or moved between countries.	multipleSelects	5 choice(s) - Appendix I - Appendix II - Appendix III - NC - No Data in GPZ spreadsheet
Classification-Invertebrate	Field not used for Delbridge survey.	singleSelect	6 choice(s) - Poriferans (sponges) - Cnidarians (sea jellies and corals) - Echinoderms (sea urchins and sea stars) - Mollusks (octopuses, snails, and clams) - Annelids (worms and leeches) - Arthropods (insects, spiders, and lobsters)

Classification-Vertebrate	Survey field - Vertebrate Classification	singleSelect	6 choice(s) - Mammal - Bird - Fish - Amphibian - Reptile - N/A
Common Name (Linked Record)	Survey field - Common name based on GPZ, Wildlife Interiors or Survey team identification.	multipleRecordLinks	linked table: WIP_SPECIMEN backlink field: GPZ Taxidermy Specimens
Condition Overall	Survey field - Assessment of specimen condition overall.	singleSelect	6 choice(s) - Exceptional - Excellent - Good - Fair - Poor - Uknown
Condition-1993CAP	Information from September 1993 Conservation Assessment Program report by conservator Catherine Hawks. The report contained no specimen numbers, but information has been entered when reasonable certainty could be ascertained as to the identity of the mount.	singleLineText	
Data problem explanation	Survey field - this field explains any identified issue that requires further research to resolve e.g. problem with identification.	richText	
Data problem to resolve	Survey field - this field indicates an issue that requires further research to resolve. The issue will be identified in the Data problem explanation field.	checkbox	
DATE ACQ	Date Acquired by City of Sioux Falls from GPZ Spreadsheet	date	date format: local
Date of Hunt	Survey field - Hunt date when listed in the undated GPZ document HISTORICAL DOCUMENTATION of the HENRY BROCKHOUSE COLLECTION.	singleLineText	

2024 Delbridge Taxidermy Survey Airtable Field List

Department	Department from GPZ spreadsheet	singleSelect	4 choice(s) - PARKS - FIRE - LIGHT - No data in spreadsheet
Ear Condition	Survey field - Overall assessment of ear condition.	multipleSelects	5 choice(s) - Excellent - Good - Fair - Poor - Not surveyed
Ear Condition Notes	Survey field - Descriptive text of any ear construction or condition issues.	multilineText	
Ear Construction	Survey field - Description of ear materials and techniques.	singleSelect	12 choice(s) - Lead - Paper - Mache - Leather - Cellastic - Injection Molded Plastic - Urethane - Polyester Resin (Bondo) - Unknown - Other - N/A - Not surveyed

Ear Issues	Survey field - Description of ear condition issues.	multipleSelects	19 choice(s) - No ear issues of note - Split Seam - Cracks (major) - Cracks (moderate) - Cracks (minor) - Cracks - Missing - No liner - Distorted/Misshapen (major) - Distorted/Misshapen (moderate) - Distorted/Misshapen (minor) - Distorted/Misshapen - Delamination (major) - Delamination (moderate) - Delamination (minor) - Delamination - Discoloration - Old repairs - Hair loss
Endangered	From GPZ spreadsheet - The Endangered Species Act (ESA) provides a program for the conservation of threatened and endangered plants and animals and the habitats in which they are found. As part of this act, import, export, interstate, and foreign commerce of listed species are all generally prohibited. The mounts that were hunted prior to the ESA would be considered “Pre-Listed” parts. These are endangered or threatened species parts that are older than 1973 or the species' listing date (if listed after 1973). A Letter of Determination is required to import or export these parts. These parts may not be bought and sold.	singleSelect	3 choice(s) - No - Yes - Unkown

Eye Condition	Survey field - Overall eye condition.	multipleSelects	5 choice(s) - Excellent - Good - Fair - Poor - Not surveyed
Eye Condition Notes	Survey field - Descriptive text of any eye construction or condition issues.	multilineText	
Eye Issues	Survey field - Description of condition in and around the eyes.	multipleSelects	20 choice(s) - No issues noted around eyes - Crizzling/Crazing - Glass Disease - Cracks (major) - Cracks (moderate) - Cracks (minor) - Cracks around eyes (major) - Cracks around eyes (moderate) - Cracks around eyes (minor) - Losses - Abrasions - Paint loss/flaking/delamination - Yellowed/Discolored coating - Overpaint - Dust/Dirt - Eyelids, needed - Eyelids, shrunken - Asymmetric eye set - Feather loss around eyes - Not surveyed
Eyes	Survey field - Description of eye materials and techniques.	multipleSelects	7 choice(s) - Glass - Acrylic - Painted by Artist - Commercially Produced - Coated - Other - Not surveyed

Foreground or Diorama Elements	Survey field - Listing of foreground or diorama elements seen on the mount's base	multipleSelects	13 choice(s) - No foreground/diorama elements - Plants - Wood - Rocks - Soil - Moss - Other - Sand - Rocks (natural) - Rocks (fabricated) - Plants (natural) - Plants (plastic) - Gravel/Pebbles
Form Type	Survey field - Description of the type of taxidermy form used to create the mount. Firm identifications were made when the form was visible through split seams or cracks in the skin. At other times the feel or sound of the mount along with the surveyor's knowledge led to an educated guess. "Unknown" is added when there was not visual confirmation of the form type.	multipleSelects	15 choice(s) - Hollow fiberglass - Hollow paper - Hollow papier mache - Hollow form (material unknown) - Plaster - Direct sculpt - Handwrapped (excelsior and plaster) - Handwrapped (excelsior/sisal/cotton/mache) - Polyurethane foam - Unknown - No form - Possibly direct sculpt over paper form - Possibly direct sculpt over hollow form - Possibly hollow paper form
FR Comments	Survey field - Comments on specimens that received an external review by Fran Ritchie, National Park Service conservator.	multilineText	
GPZ EXCEL#	Survey number matching the Excel spreadsheet shared by GPZ.	autoNumber	
GPZ ID#	Great Plains Zoo identification number. From GPZ spreadsheet	singleLineText	
Habitat groupings	Survey field - Specimen placement.	multipleRecordLinks	linked table: Habitat groupings backlink field: GPZ Taxidermy Specimens

Historical Documentation	Information from HISTORICAL DOCUMENTATION of the HENRY BROCKHOUSE COLLECTION undated document shared by GPZ.	richText	
Horn/Antler Condition	Survey field - Condition of horns or antlers. N/A if not applicable for this species.	singleSelect	6 choice(s) - Excellent - Good - Fair - Poor - N/A - Not surveyed
Horn/Antler Condition Notes	Survey field - Descriptive text of any horn/antler attachment or condition issues.	richText	
Horn/Antler Issues	Survey field - Descriptive terms for issues noted with horns or antlers. N/A if this is not applicable for the species.	multipleSelects	24 choice(s) - Stable - Unstable - Cracks - minor - Cracks - moderate - Cracks - major - Cracks in modeling compound at base of horns - Gaps between horns and skin - Delamination - Losses - Detached - proper left - Detached - proper right - Loose - proper left - Loose - proper right - Discolored - Coated - Painted - Signs of infestation - Dust/Dirt - Fills - Prior Repairs - Oiled - Breaks - N/A

Horns/Antlers	Survey field - presence of horns, antlers or not applicable for this specimen.	multipleSelects	3 choice(s) - Horns - Antlers - N/A
Image filename for export - Back	Survey field - formula created to rename image file for export.	formula	value type: singleLineText 1 referenced field(s) - GPZ EXCEL#
Image filename for export - Detail	Survey field - formula created to rename image file for export.	formula	value type: singleLineText 1 referenced field(s) - GPZ EXCEL#
Image filename for export - Dorsal	Survey field - formula created to rename image file for export.	formula	value type: singleLineText 1 referenced field(s) - GPZ EXCEL#
Image filename for export - FRONT	Survey field - formula created to rename image file for export.	formula	value type: singleLineText 1 referenced field(s) - GPZ EXCEL#
Image filename for export - PL	Survey field - formula created to rename image file for export.	formula	value type: singleLineText 1 referenced field(s) - GPZ EXCEL#
Image filename for export - PR	Survey field - formula created to rename image file for export.	formula	value type: singleLineText 1 referenced field(s) - GPZ EXCEL#
Image filename for export - Ventral	Survey field - formula created to rename image file for export.	formula	value type: singleLineText 1 referenced field(s) - GPZ EXCEL#
Image-BACK OVERALL	Survey Image - back of specimen	multipleAttachments	
Image-Details	Survey Image - Details showing issues of note.	multipleAttachments	
Image-Dorsal	Survey Image - top of specimen	multipleAttachments	
Image-FRONT OVERALL	Survey Image - front of specimen	multipleAttachments	
Image-PL side	Survey Image - proper left side of specimen	multipleAttachments	
Image-PR side	Survey Image - proper right side of specimen	multipleAttachments	
Image-Ventral	Survey Image - underside of specimen	multipleAttachments	
INPUT_Description/Source	Original information from GPZ spreadsheet. Parsed and cleaned. For reference only.	richText	

IUCN	From GPZ spreadsheet - International Union for Conservation of Nature. The IUCN Red List of Threatened Species™ is an international standard for the current status of animal populations.	singleSelect	21 choice(s) - Critically Endangered - Critically Endangered, decreasing population - Critically endangered, increasing population - Endangered - Endangered, decreasing population - Least Concern - Least Concern, declining population - Least Concern, decreasing population - Least Concern, increasing population - Least Concern, stable population - Near Threatened - Near Threatened, decreasing population - Near Threatened, increasing population - Near Threatened/Critically Depleted - Threatened - Threatened, decreasing population - Vulnerable - Vulnerable, decreasing population - Vulnerable, increasing population - Vulnerable, stable population - No Data in GPZ spreadsheet
Life Stage	Survey field - life stage of specimen	singleSelect	6 choice(s) - Adult - Adolescent - Juvenile - Unknown - Other - Not surveyed
Location Description	Location description provided by GPZ	singleLineText	
Location Memo	Location as provided by GPZ	singleSelect	6 choice(s) - Secured Room - On Display - Not in Diorama - Storage - Other City Location - Unkown: assume other city location
LTD ACCUM DEPR	Accumulated Depreciation Amount (taken from City of Sioux Falls Fixed Asset List)	currency	

Mount Quality Notes	Survey field - Description on mount quality explaining the assessments assigned in the Overall Mount Quality field.	richText	
Mount Quality Overall	Survey field - On-site assessment on artistry, naturalism, taxidermy quality, Overall appearance of the mount. Is it a good representation of the species? Is this a piece that should be exhibited as a representation of the species? This field is taken into consideration in deciding Recommended Actions.	multipleSelects	11 choice(s) - Species accuracy - Exceptional - Species accuracy - Excellent - Species accuracy - Good - Species accuracy - Fair - Species accuracy - Poor - Artistic quality - Exceptional - Artistic quality - Excellent - Artistic quality - Good - Artistic quality - Fair - Artistic quality - Poor - Not surveyed
Mouth/Nose Condition	Survey field - Overall assessment of mouth, nose, beak condition.	multipleSelects	5 choice(s) - Excellent - Good - Fair - Poor - Not surveyed
Mouth/Nose Condition Notes	Survey field - Text description of condition issues noted on mouth, nose or beak and surrounding areas.	multilineText	

Mouth/Nose Issues	Survey field - List of condition issues noted on mouth, nose or beak.	multipleSelects	37 choice(s) - Mouth and nose in good condition - No issues of note around mouth/nose - Cracks around mouth - Cracks in mouth - Tongue (cracked) - Tongue (broken) - Tongue (missing) - Teeth (cracked) - Teeth (missing) - Cracks in gumline - Cracks in palate - Cracks in nose - Cracks around nose - No cracks in and around nose - Nose shrinkage - Loose elements - Missing elements - Flaking paint - Abrasion - Prior repair - Overpaint - Lacks finish work - Poor finish work - Loss - Insect activity - Real skull - Beak, cracks on/around - Beak, leaching grease - Beak, painted - Beak, unpainted - Beak, faded paint

Mouth/Nose Type	Survey field - Description of mouth/nose area.	multipleSelects	12 choice(s) - Mouth (open) - Mouth (closed) - Mouth (lips open, teeth exposed) - Teeth (natural) - Teeth (artificial) - Upper/Lower Pallet & Tongue - Sculpted by artist - Upper/Lower Pallet & Tongue - Commercially produced - Beak (natural) - Beak (artificial) - Skull present - Not surveyed - N/A
Notes (General)	Survey field - Notes that have no other place in the survey form.	richText	
Pests	Survey field - signs of pest activity	multipleSelects	14 choice(s) - No visible pest damage - Old damage but no sign of current activity - Active Infestation - Frass - Casings - Webbing - Grazing - Exit holes - Rodent droppings - Webbing Clothes Moth - Dermestid - Unknown - Dead - Alive
Photographer	Survey field - Name of project team member(s) who photographed the specimen.	multipleRecordLinks	linked table: Project Team backlink field: GPZ Taxidermy Specimens 2 view for record selection: Site team
Pose/Posture	Survey field - Simple description of the pose of the piece e.g. standing, level ground, ears forward, left turn, etc.	singleLineText	
Preparation Year	Survey field - Date of preparation if known.	singleLineText	

Preparation/Studio Notes	Survey field - Text field for additional information on the preparator, preparation studio or preparation techniques.	richText	
Preservation Type	Survey field - Type of preservation used to prepare specimen/mount.	singleSelect	12 choice(s) - Taxidermy (conventional) - Taxidermy (freeze-dry) - Taxidermy (erosion/maceration) - Study Skin - Hide/Skin - Rug - Wet Specimen - Skeleton (articulated) - Skeleton (partial) - Model - Other - Not surveyed
Preservation Type Notes	Survey field - Text field for additional information on the preservation type and preparation techniques.	richText	
Previous Intervention Report Available?	Survey field - Indicates whether any prior reports or documentation is available.	singleSelect	3 choice(s) - Yes - No - Unknown
Previous Repair/Intervention-Description	Survey field - Descriptive text of any prior repairs or interventions seen on the specimen.	multilineText	
Previous Repairs/Interventions	Survey field - Presence of noticeable prior repairs or restorations during or post preparation.	singleSelect	4 choice(s) - Yes - No - Repair during preparation - Unclear

Recommended Actions	This field recommends one or more actions for the museum to consider based on the overall condition, mount quality rarity of the specimen and cost of treatment. Items tagged with Study Specimen would be appropriate for teaching about the animal or about taxidermy techniques but generally is considered not exhibit worthy due to either condition or mount quality issues.	multipleSelects	5 choice(s) - Restore - Replace (cost of treatment likely more than cost of new specimen) - Unsuitable for exhibit without restoration - Deaccession - Study specimen
Reviewed by FR	Survey field - Survey data reviewed by Fran Ritchie, National Park Service conservator and taxidermist.	checkbox	
Reviewed by GD	Survey field - Site survey information reviewed by George Dante.	checkbox	
Scientific Name (Linked Record)	Survey field - Scientific name based on GPZ, Wildlife Interiors or Survey team identification.	multipleLookupValues	value type: singleLineText linked field: Common Name (Linked Record) linked table: WIP_SPECIMEN field in other table: Scientific Name
Sex	Survey team field - Specimen sex if known or determinable	singleSelect	4 choice(s) - Male - Female - Unknown - Not surveyed

Skin Issues	Survey field - Descriptive terms for issues noted with the skin/hide/hair/feathers.	multipleSelects	38 choice(s) - Inaccurate grooming - Signs of past insect activity - Acid degradation - Shrinkage - Crack (major) - Cracks (moderate) - Cracks (minor) - Seam splitting (major) - Seam splitting (moderate) - Seam splitting (minor) - Delamination (major) - Delamination (moderate) - Delamination (minor) - Drumming - Fading (major) - Fading (moderate) - Fading (minor) - Hair loss post-mounting (major) - Hair loss post-mounting (moderate) - Hair loss post-mounting (minor) - Hair loss pre-preparation (major) - Hair loss pre-preparation (moderate) - Hair loss pre-preparation (minor) - Hair slippage - Patches - Scars (pre-prep) - Visible seams - Flaking paint - Paint loss - Abrasions - Detached piece/fragment
Skin Preservation	Survey field - Method and techniques used in the tanning or preservation of the skin/hide.	singleSelect	8 choice(s) - Commercially Tanned - Dry Preservative/Borax - Freeze Dried - Pickled - Raw - Arsenic Powder - Tanned by Artist/Taxidermist - Unknown

Skin Preservation Condition	Survey field - Overall assessment of skin condition and state of preservation.	multipleSelects	4 choice(s) - Excellent - Good - Fair - Poor
Skin Preservation Condition Notes	Survey field - Descriptive text of any skin and hair issues across the specimen.	multilineText	
Source	Survey field - Information pulled from GPZ spreadsheet to facilitate sorting	singleSelect	4 choice(s) - Brockhouse Collection - Vernell & Louise Johnson - Great Plains Zoo - No data in GPZ spreadsheet
Specimen Name	Survey field - Specimen name pulled from a combination of GPZ spreadsheet, observations of the survey team and description by Wildlife Interiors.	singleLineText	
Specimen name and Asset#	Formula field - Combination of GPZ asset number and specimen name.	formula	value type: singleLineText 2 referenced field(s) - Asset - Specimen Name
Specimen name and GPZ#	Formula field - Combination of GPZ identification number and specimen name.	formula	value type: singleLineText 2 referenced field(s) - GPZ ID# - Specimen Name
Survey Date	Survey field - Date specimen was surveyed.	date	date format: local
Surveyed by	Survey field - Name of project team member(s) who surveyed the specimen/mount.	multipleRecordLinks	linked table: Project Team backlink field: GPZ Taxidermy Specimens view for record selection: Site team
Taxidermist/Artist/Preparator	Survey field - Preparator ID'd through plaque or other info on the mount or documentation.	singleSelect	7 choice(s) - Jonas Bros. - Joe Jonas Jr. (Tag) - Joe Jonas Jr. (Round Plaque) - Joe Jonas Jr. (Rectangular Plaque) - Joe Jonas Jr. (Brockhouse publication) - Not surveyed - Unknown
Toxicity-Test Performed	Survey field - Not used for Delbridge survey	richText	

Treatment Cost calculation	Formula field to calculate the estimated treatment cost.	formula	value type: number 1 referenced field(s) - Treatment Time Estimate (hours)
Treatment Cost Estimate	Survey field - Treatment cost estimate in dollars. Information provided by George Dante Studios.	currency	
Treatment Needed	Survey field - listing of treatment needs.	multipleSelects	22 choice(s) - Cleaning - Feather repair - Feather replacement - Fills (hair) - Fill (skin) - Fill (surface loss) - Pest Remediation - Re-preening - Reattach claw - Reattach ear - Reattach eye - Reattach hoof/foot - Recoloring - Repair cracks - Reset eye - Structural Repair - Treatment not recommended - Repointing - Inpainting - Grooming - Rehydrate - N/A
Treatment Notes	Survey field - Descriptive text on treatment needs of condition issues noted on mouth, nose or beak and surrounding areas.	multilineText	
Treatment Priority	TO DELETE	singleSelect	4 choice(s) - High - Medium - Low - N/A
Treatment Time Estimate (hours)	Survey field - Estimated treatment time does not include costs like shipping, storage, pest management, etc.	number	

UNFIT Team Assessment	Survey field - Checked specimens were deemed by the survey team as not worthy of restoration generally because the damage is too expensive to restore and/or the specimen can be replaced at lower cost than restoration.	checkbox	
WII_Condition	Wildlife Interiors Inc. field - 11/27/2023 report condition description	multilineText	
WII_Replacement Cost	Wildlife Interiors Inc. field - 11/27/2023 report replacement cost.	richText	
WII_Replacement Cost Appraised Value	Survey field - Replacement cost total extracted from Wildlife Interiors Inc. 11/27/2023 report	currency	
WII_Type of Mount	Wildlife Interiors Inc. field - 11/27/2023 report	singleLineText	
WII-Description Excerpt	Wildlife Interiors Inc. field - The 11/27/2023 report contains generic descriptions of the species. In some cases where there is information relevant to the condition or rarity of the specimen it has been excerpted and recorded here.	multilineText	
Wildlife Interiors Unfit for Restoration	Wildlife Interiors Inc. field - Checked specimens were deemed by Todd Lowe as unfit for restoration. This assessment was based on a images and video taken during a short site visit. No explanation is given in the 11/27/2023 report for this assessment.	checkbox	

A.M. ART CONSERVATION, LLC
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AGENTS OF DETERIORATION

The Canadian Conservation Institute (CCI) has long promoted a holistic approach to preventive conservation and has outlined ten agents of deterioration that provides a generally useful way of examining the threats to collections.

1. Light
2. Incorrect Temperature
3. Incorrect Relative Humidity
4. Pollutants
5. Pests
6. Physical Forces
7. Fire
8. Water
9. Security
10. Dissociation/Custodial Neglect

A brief description of the conditions at the Delbridge is given below.

Light

Light damage, which is cumulative and, once sustained, irreversible, is a function of light intensity (in lux or footcandles) times length of exposure. All of the mounts exhibited fading and other signs of light damage ranging from minor to substantial. This is not surprising for specimens that have been on continual exhibit for approximately 40 years at the Delbridge and for years, or decades before that at West Sioux Hardware, the Brockhouse family store.

The museum's original lighting plan called for eight 250 watt high pressure sodium luminaires with a "clear glass lens on bottom for filtering of UV". High pressure sodium lamps emit UV radiation and standard glass does not filter out ultraviolet light unless a UV film has been applied. So, it is likely there was long-term UV light exposure between 1984 and 2020.

Lincoln Rupp, GPZ Director of Facilities and Campus Projects did not have historical documentation on any past lighting changes but reported that in 2021 "eight new can lights (V Round LED) and over one hundred track lights (Theta4ET) replaced what was there at that time." (email communication 2/14/2024). LED lights do not emit UV radiation which reduces some of the most damaging forms of light exposure.

No light or ultraviolet (UV) readings were taken during the site visit. Ideally lights should not be on at the museum when it is closed and there are no visitors or staff working in the space. Recoloring of the faded mounts would be a part of treatment to restore lifelike color representative of the species.

Additional information on light and light damage for museum collections is available in the Canadian Conservation Institute (CCI) Note *Agent of Deterioration: Light, Ultraviolet and Infrared* available online at https://www.canada.ca/en/conservation-institute/services/agents-deterioration/light.html

Incorrect Temperature and Relative Humidity

General information on temperature and collections

The detrimental effects of incorrect temperatures (either too high or too low) are often observed after considerable time has passed, so the slow deterioration that results is often underestimated. Temperature is a measure of heat energy. High temperatures promote faster chemical reactions and so the overall degradation of organic materials occurs more quickly. Temperature is also important in that it directly affects relative humidity, given the same moisture in the air. If the temperature goes up, the relative humidity goes down and vice versa. A fluctuating temperature leads to a fluctuation in relative humidity.

- A stable temperature helps prevent relative humidity fluctuations and the damage they cause.
- High temperature can cause softening of meltable materials like waxes and resins, and general aging of organic materials, which leads to embrittlement and weakening.
- High temperatures can also promote faster desiccation of organics leading to loss of flexibility and cracking. Composite objects (those composed of two or more types of materials) have different rates of thermal expansion and contraction and this can cause physical damage resulting in cracks and splits along join lines.
- Generally, cooler temperatures are beneficial to most collections. Any temperature above that required for human comfort can be viewed as too high. However, while cold storage is a good preservation technique for some types of unstable collections, and most collections would benefit from cooler temperatures than normally used in museums, temperatures that are too cold can cause embrittlement, hazing, cracks in other types of artifacts, in particular those with resins and varnishes.
- Cultural institutions often have to compromise between the temperatures that are best for the preservation of the collection, what is economical in terms of equipment and energy policy, and what is best for the comfort of staff, and visitors.

Different types of collections have substantially different relative humidity requirements and so it is hard to give specific set points as they will be highly dependent on the type of collections, some general recommendations for museum environments are as follows:

- The optimum relative humidity range for general museum objects can vary, depending on materials, from 40-60% seasonal drifts that remain in this range are generally seen as acceptable.
- Many short-term fluctuations (i.e. those of less than a couple of hours) may not be damaging as moisture equilibration is slow. But regular fluctuations should be minimized to the extent possible.

- High relative humidity can accelerate chemical deterioration and promote mold growth (for example, above 65%).
- Low relative humidity may cause shrinking, warping, cracking, embrittlement, and desiccation (for example, below 30%).
- Organic artifacts require moderate RH levels to prevent desiccation or embrittlement.

Artifacts most at risk are composite objects (those made of two or more different materials), and thin organic objects. Different materials in composite artifacts will react to relative humidity changes at different rates and to different degrees. Since these different materials are attached to each other, they will either push or pull at each other, which may cause damage. Taxidermy is subject to these kinds of forces and fluctuating humidity will cause cracking and shrinking of hides over the inorganic forms. Lower temperatures in the museum will reduce pest activity and prevent premature chemical ageing of the hides.

It is a good practice to know what conditions your collection is being subjected to, so problems can be anticipated or appropriate climate solutions can be devised. Monitoring environmental conditions can be done using equipment such as Heating Ventilation and Air Conditioning (HVAC) and/or Building Management Systems (BMS) or using reasonably priced electronic dataloggers. Hobo Bluetooth Onset temp/RH loggers are recommended for the Delbridge to monitor the temperature and relative humidity in the museum. https://www.onsetcomp.com/products/data-loggers/mx1101

Additional information on pest damage to museum collections is available in the Canadian Conservation Institute (CCI) Note *Agent of Deterioration* is available online at
https://www.canada.ca/en/conservation-institute/services/agents-deterioration/temperature.html
https://www.canada.ca/en/conservation-institute/services/agents-deterioration/humidity.html

Pollutants

Pollutants include particulates such as soot, dirt and dust. Dust often has a large organic component, consisting of vegetable matter, skin and hair, which together are an excellent food source for pests. Furthermore, these can be abrasive and disfiguring, and absorb moisture from the surrounding atmosphere.

Prior to the closing of the museum the collection was “regularly dusted” (9-5-0223 Council Informational PowerPoint). Over five months had elapsed since the August 2023 closing of the Delbridge Museum and the site visit. Limited maintenance had been provided in the interim. The specimens and the carpeted habitats showed some accumulated build-up of dust and pest activity but generally appeared to have been well maintained.

Even with the museum closed to the public, for the care and safety of the mounts, a regular cleaning and maintenance schedule should be maintained. A HEPA filter vacuum is strongly recommended. The current backpack vacuum used in the museum does not have the higher

level of filtration recommended to deal with hazardous collections. Fibers from microfiber cloths of Swiffer dusters were seen caught in the horns of some specimens. Dust is not recommended for arsenic positive specimens. Cleaning using a HEPA vacuum and low suction would be preferable.

Additional information on pest damage to museum collections is available in the Canadian Conservation Institute (CCI) Note *Agent of Deterioration: Pollutants* is available online at https://www.canada.ca/en/conservation-institute/services/agents-deterioration/pollutants.html

Pest Damage

Pests as a risk factor encompass both rodents and insects. In recent years, health and safety concerns have led institutions away from the regular applications of toxic chemicals (pesticides or fungicides) toward greater emphasis on preventative and protective measures that are not chemical based. These include installing better housings; better control of temperature and humidity in collections areas (to prevent an environment hospitable to pests); removing food and other organic materials from collection areas that would be an additional source of food for pests; upgrades and repairs to building structure (to prevent pest entry); more effective monitoring; and treatment of outbreaks through freezing or anoxic environments. A combination of these different measures is known as "integrated pest management," often abbreviated to the acronym "IPM."

The first, and most fundamental step in pest management is prevention, followed up by monitoring and, if necessary, elimination. It may be necessary to use insecticides as part of managing pests in collections large in size or large in number. But treatment should be thoughtful and targeted and not used on collections.

Taxidermy is particularly vulnerable to damage from insect and rodents and extreme vigilance is necessary to prevent infestation that can rapidly damage mounted specimens. Attempts to preserve mounts and prevent infestations by using heavy metals and other insecticide and pesticide products date back centuries. While arsenical soaps commonly used in taxidermy preparation techniques until the 1970s - 1980's provided some protection, it is not uncommon to see insect damage on arsenic positive specimens. All historic taxidermy should be considered hazardous collections unless testing proves otherwise. For more information on arsenic see the Health and Safety section of this report.

During the survey there were signs of an active infestation of the Reticulated Giraffe (Asset#02085530) and additional 38 specimens showed signs of pest damage in the form of dead adult insects, larval casings, webbing, frass (excrement), exit holes, or rodent droppings. Thorough cleaning of these specimens is recommended. Any new signs of activity would then show that there is an active infestation.

A.M. Art Conservation can provide information on appropriate pest remediation methods for taxidermy upon request.

Additional information on pest damage to museum collections is available in the Canadian Conservation Institute (CCI) Note *Agent of Deterioration: Pests* available online at https://www.canada.ca/en/conservation-institute/services/agents-deterioration/pests.html The central resource for pest damage of cultural heritage collections is the https://museumpests.net/ website.

Physical Forces

Examples of damaging physical forces may include those that are fast and catastrophic including both natural disaster and human error (such as earthquakes, or bumping or dropping an object), or slower acting with minor but repeated opportunity for damage (such as improper handling during research and educational use, or vibrations from nearby construction). Physical force is also a risk for artifacts that do not have proper support on exhibit or in storage and may sag or become misshapen, or for objects that are not properly padded in boxes or drawers and may roll around when moved.

In the Delbridge collection, it seems that a number of the prior loan objects have suffered losses and damage from transport and storage. As noted in the report, numerous Brockhouse Collection specimens show signs of handling damage dating back to their days of exhibition at West Sioux Hardware. These include hair loss and loose or detached parts. Further damage is observed on the objects that went out on loan and have subsequently been in storage. Risk of damage from physical forces has been less of an issue since the exhibits were installed at the Delbridge but care should be taken to protect specimens during transport or when carrying out maintenance or cleaning work in the museum spaces.
Additional information on pest damage to museum collections is available in the Canadian Conservation Institute (CCI) Note *Agent of Deterioration: Pests* available online at

Additional information damage to museum collections is available in the Canadian Conservation Institute (CCI) Note *Agent of Deterioration: Physical Forces* is available online at https://www.canada.ca/en/conservation-institute/services/agents-deterioration/physical-forces.html

Fire

Fire can potentially lead to the quick and catastrophic loss of an entire collection. Reducing the risk of fire needs to be done at several levels: appropriate fire/smoke detection and alarms, fire suppression systems, isolating collections from other activities and good housekeeping. As the museum space is a shared building with the staff break room and offices, potential sources of fire risk should be considered.

The museum's emergency plan should consider the care and response efforts for the non-living collections in addition to human and zoo animal safety.

Additional information is available in the Canadian Conservation Institute (CCI) Note *Agent of Deterioration: Fire* is available online at

https://www.canada.ca/en/conservation-institute/services/agents-deterioration/fire.html

Water

Collections storage areas are frequently placed in attic or basement spaces which are most vulnerable to damage in the event of a roof or plumbing leak, sprinkler system malfunction or flooding. The City's website outlines the local weather hazards. Institutional emergency planning for exhibits and stored collections should account for these risks.

Additional information on is available on the following websites:
https://www.siouxfalls.gov/health-safety/emergency-management/local-hazards
https://www.canada.ca/en/conservation-institute/services/agents-deterioration/water.html

Security

Examples of security risks are planned theft by someone intent on violating the collection, opportunistic theft by visitors, embezzlement and vandalism. The museum is currently closed to the public, but security needs remain.

Some of the specimens and specimen parts are valuable. The ivory elephant tusks have been removed to secure storage and have been replaced by replicas. The rhino horn is real and considered highly valuable.

Should the museum reopen, more substantial barriers or enclosures would be recommended to both protect the specimens from the public and to prevent touching that would expose the public to arsenic positive mounts. Historical photos show children touching the mounts before the current barriers were erected. Most of the fur and hair loss seen on the specimens appears old and likely happened long ago.

Additional information is available in the Canadian Conservation Institute (CCI) Note *Agent of Deterioration* is available online at
https://www.canada.ca/en/conservation-institute/services/agents-deterioration/thieves-vandals.html

Custodial Neglect/Dissociation

In CCI's listing of the ten Agents of Deterioration only one, sometimes called Dissociation or Custodial Neglect, is non-physical in nature, although the effects of neglect manifest themselves physically. These two terms describe different actions:

1. Custodial Neglect - occurs when active care is not taken to preserve the collection or when information and practices on collections care are not current.

2. Disassociation refers to a loss of information about collection objects and their records. Ensuring that collections records are properly kept and maintained is of the highest priority.

The GPZ has done a good job collecting information on the specimens. The survey team found that several specimens were incorrectly tagged during the site visit and the tags were updated or switched to be accurate. The Airtable database should provide assistance with identification and record keeping.

Additional information is available in the Canadian Conservation Institute (CCI) Note *Agent of Deterioration* is available online at https://www.canada.ca/en/conservation-institute/services/agents-deterioration/dissociation.html

A.M. ART CONSERVATION, LLC
ART CONSERVATION, PRESERVATION AND COLLECTION MANAGEMENT
Email: info@amartconservation.com www.amartconservation.com

QUIET DANGERS IN COLLECTIONS: STAFF HEALTH & TOXIC COLLECTIONS

Connecting to Collections Care Resources:

Online Course

- **Health and Safety in Collection Care**, Six webinar series presented July-August 2021 https://learning.culturalheritage.org/products/c2c-care-course-health-and-safety-in-collections-care
  - Webinar 1: Understanding Hazards in Museums
  - Webinar 2: Understanding Roles Responsibilities
  - Webinar 3: Risk Assessment
  - Webinar 4 & 5: Risk Management
  - Webinar 6: Specific Examples

Webinars

- **Arsenic in Collections**
  Presenter: Fran Ritchie, Recording: September 6, 2023
  https://connectingtocollections.org/arsenic_in_collections/
- **Just how dangerous IS that object: Identifying and Managing Hazardous Materials In Museum Collections**
  Presenter: Hayley Monroe, Recording: June 23, 2021
  https://connectingtocollections.org/hazardous-materials/
- **Arsenic and Old Lace: Controlling Hazardous Collection Materials**
  Presenters: Kerith Koss Schrager, Anne Kingery-Schwartz and Kathryn Makos, Recorded: Tuesday, May 3, 2016
  https://connectingtocollections.org/arsenic-and-old-lace-controlling-hazardous-collection-materials/
- **Handling and Exhibition of Potentially Hazardous Artifacts in Museum Collections** Presenter: Neil Cockerline, Recorded: Wednesday, September 21, 2011 https://connectingtocollections.org/dangerous-collections/

Online Resources:

- **Beginner's Guide to Health & Safety (AIC Health & Safety Network)**
  https://www.conservation-wiki.com/w/images/1/1d/H%26S_BeginnerGuide.pdf
- **American Institute for Conservation's (AIC) wiki - Health and Safety Wiki**
  https://www.conservation-wiki.com/wiki/Category:Health_%26_Safety
- **AIC Health and Safety Forum**
  Free online community free registration required for access
  https://community.culturalheritage.org/communities/community-home?CommunityKey=8171fae7-e614-40ce-8028-0698813a7457
- **Hazards in Collections eTool**
  This resource from the Museum of London provides general information about commonly encountered health hazards found in some museum collections. *Note: Legal references in this tool are to laws and legal guidance in the United Kingdom and may not apply to your country or geographic region.*
  https://hazardsincollections.org.uk/
- **AASLH Technical Leaflet 248: The Handling and Exhibition of Potentially Hazardous Artifacts**, (AASLH membership required for access)
  https://learn.aaslh.org/products/technical-leaflet-248-the-handling-and-exhibition-of-potentially-hazardous-artifacts#tab-product_tab_overview
- **Collection-Based Hazards (Chapter 24: Smithsonian Institution Safety Manual)**
  https://www.sifacilities.si.edu/safety_health/docs/safety_manual/pdf%20PRISMout/ch_24_collections_based_hazards.pdf]

- **FAQ's about Contaminated Museum Collections**
  https://www.doi.gov/sites/doi.gov/files/migrated/museum/upload/Contaminated_Collections_FAQs.pdf

National Park Service (NPS) Conserv O Grams:

- Arsenic: September 2000, 2/3
  https://www.nps.gov/museum/publications/conserveogram/02-03.pdf
- How to Select Gloves: September 2010, 1/12
  https://www.nps.gov/museum/publications/conserveogram/01-12.pdf
- Guidelines for Handling of Pesticide Contaminated Collections, January 2002, 2/19
  https://www.nps.gov/museum/publications/conserveogram/02-19.pdf
- Disposal of Cellulose Nitrate Film: August 2004, 2/22
  https://www.nps.gov/museum/publications/conserveogram/02-22.pdf
- Health and Safety Issues with Geological Specimens, September 2006, 11/11
  https://www.nps.gov/museum/publications/conserveogram/11-11.pdf
- Chronology of Pesticide Use in NPS Collections 2001
  https://www.nps.gov/museum/publications/conserveogram/02-16.pdf
  https://www.nps.gov/museum/publications/conserveogram/02-16-3.gif

Canadian Conservation Institute (CCI) Notes/Resources

- Lead in Museum Collections and Heritage Buildings - Series 1/8
  https://www.canada.ca/en/conservation-institute/services/conservation-preservation-publications/canadian-conservation-institute-notes/lead-museum-collections.html
- Mercury in Museum Collections - Series 1/7
  https://www.canada.ca/en/conservation-institute/services/conservation-preservation-publications/canadian-conservation-institute-notes/mercury-museum-collections.html

Printed Resources

- The ABCs of Collection Care, 2023. Greater Hudson Heritage Network
  https://www.greaterhudson.org/abcs-of-collection-care.html
- Hawks, Catherine, Michael McCann, Kathryn Makos, Lisa Goldberg, David Hinkamp, Dennis Ertel and Patricia Silence, eds. 2010. 1st Edition. *Health and Safety for Museum Professionals*. Washington, DC: Society for the Preservation of Natural History Collections.

Further Reading and Listening

- New York Times article on Delbridge Collection South Dakota
  https://www.nytimes.com/2023/09/23/science/museums-taxidermy-arsenic.html
- David, Alison Matthews. Fashion Victims: the Dangers of Dress Past and Present. Bloomsbury Visual Arts, 2015.
- Hawksley, Lucinda. Bitten by Witch Fever: Wallpaper & Arsenic in the Nineteenth-Century Home. Thames & Hudson, 2016.
- Wharton, James C. The Arsenic Century: How Victorian Britain was Poisoned at Home, Work, and Play, Oxford University Press, 2011.
- Podcast - https://www.iheart.com/podcast/105-dressed-the-history-of-fas-29000690/episode/when-fashion-kills-an-interview-with-30075398/

Test Kits

- Lead test kits are available in hardware stores and online; the EPA recommends these brands
  https://www.epa.gov/lead/lead-test-kits

Why can’t you just tell me if it’s ‘safe’?

Industrial Hygiene Considerations for Handling Arsenic-Containing Collections

Kerith Koss Schrager
AIC Annual Meeting 2024

It depends….

Some considerations on how a hazard can affect your health

Kerith Koss Schrager
AIC Annual Meeting 2024

TYPE Chemical Composition

- **Inorganic**: arsenic trioxide, sodium arsenite, arsenic trichloride, arsenic pentoxide, arsenic acid, arsenates
- **Organic:** arsanilic acid, methylarsonic acid, dimethylarsinic acid (cacodylic acid), and arsenobetaine
- **Arsine gas**

DOSE How much is absorbed by the body NOT the concentration in the air or on surfaces

DURATION OF EXPOSURE How long were you exposed

- Chronic vs. acute

ROUTE OF EXPOSURE Different compounds can have different effects based on route of exposure

- Inhalation, Ingestion, Absorption, Injection

INDIVIDUAL VARIABILITY

- Age, sex, race, genetics, past exposures, etc.

AVAILABLE TOXICOLOGICAL INFORMATION

- Outdated resources, data sheets and exposure limits
- We don’t know what we don’t know

Precautionary Principle

In the absence of evidence that a material is safe, assume that it is hazardous and take appropriate steps to eliminate exposure

Exposure Scenarios: Hazard ≠ Risk

Kerith Koss Schrager
AIC Annual Meeting 2024

HAZARD

Intrinsic property of a substance to cause harm

RISK

Probability that the hazard will cause harm and the degree to which it affects your system

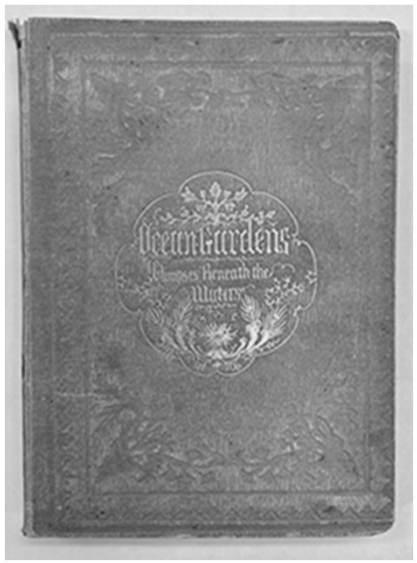
Type of Object

How arsenic is used in the object and its condition

Work Practices

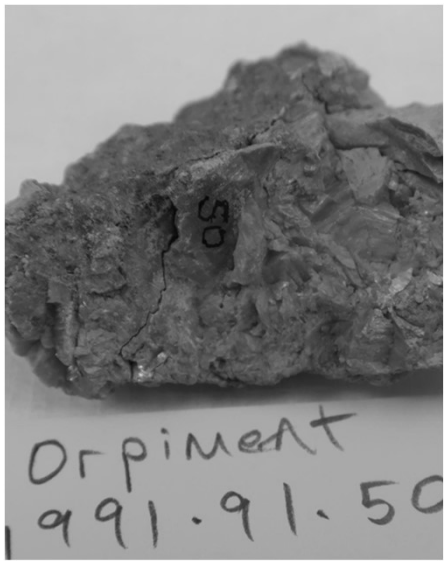
How we work with the object during exhibition, handling and treatment

Walter's Art Museum



University of Delaware

FIT



Tairawhiti Museum

Shelburne Museum

Exposure Scenarios: Hazard ≠ Risk

Kerith Koss Schrager
AIC Annual Meeting 2024

HAZARD

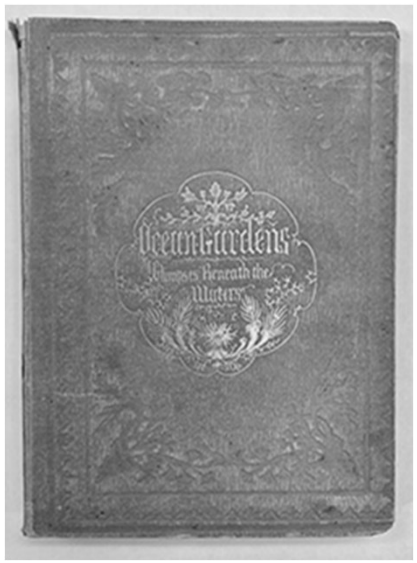
Intrinsic property of a substance to cause harm

RISK

Probability that the hazard will cause harm and the degree to which it affects your system

You may not be able to change the nature of the *HAZARD*,
but you can control *RISK* by limiting *EXPOSURE*

Walter's Art Museum



University of Delaware

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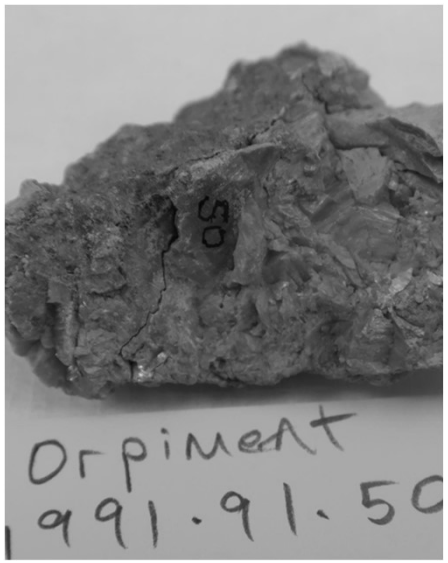


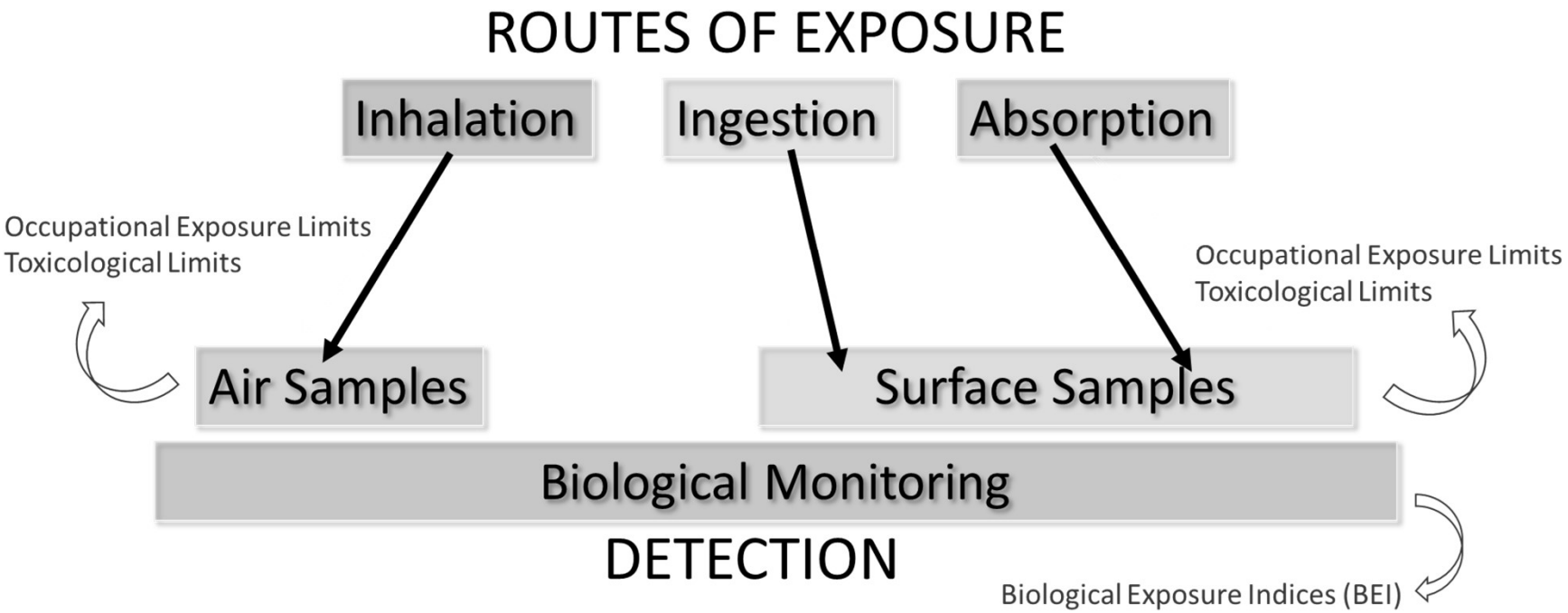
Tairawhiti Museum

Shelburne Museum

Evaluating Exposure

Kerith Koss Schrager
AIC Annual Meeting 2024

EXPOSURE the opportunity for the body to receive a dose substantial enough to result in an adverse health effect

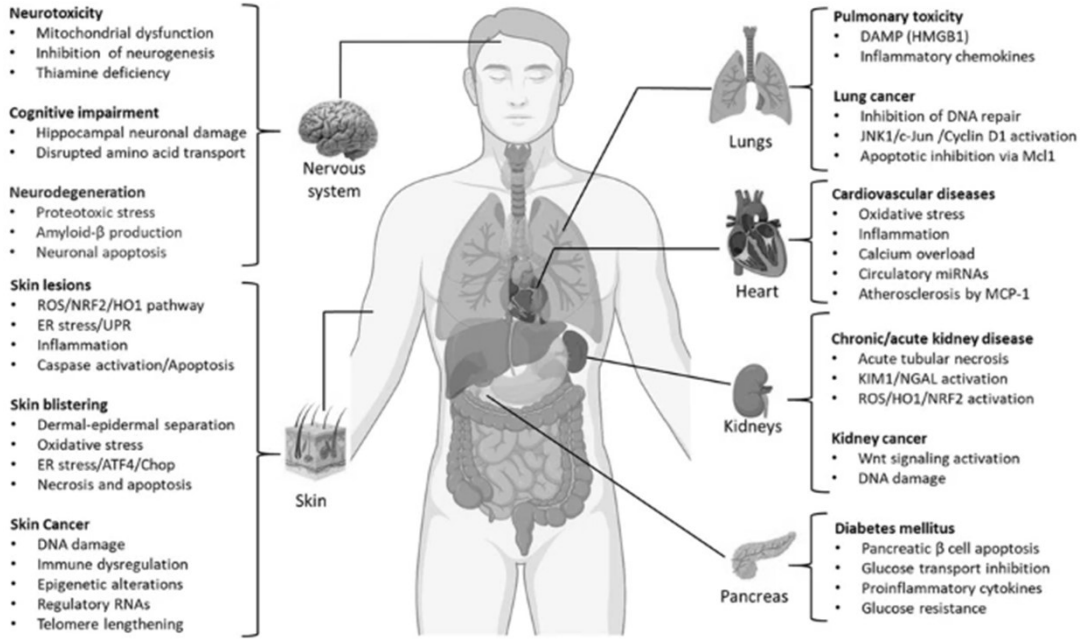


Exposure Limits (Arsenic)

The upper limit of the acceptable concentration of a hazardous substance for a particular material or class of materials, based on **available toxicological literature**

Exposure limits, if they exist, are based on <u>known</u> health effects, how particular target populations are most commonly exposed, and can vary by source/agency

- Carcinogen (lung, bladder, skin, liver, kidneys)
- Endocrine disruptor
- Eye and skin irritation and burns
- Irritation of nose, throat, and respiratory tract
- Weakness, nausea, vomiting, headache
- May damage nervous system and liver
- Birth defects and reproductive harm
- Death



Muzaffar, S., Khan, J., Srivastava, R. *et al.* Mechanistic understanding of the toxic effects of arsenic and warfare arsenicals on human health and environment. *Cell Biol Toxicol* **39**, 85–110 (2023)

Exposure Limits (Arsenic)

The upper limit of the acceptable concentration of a hazardous substance for a particular material or class of materials, based on **available toxicological literature**

INHALATION

OSHA PEL: **0.01 mg/m^3** (8-hour time weighted average)

NIOSH REL: **0.002 mg/m^3** (for no more than 15-minute period)

ACGIH TLV: **0.01 mg/m^3** (8-hour time weighted average)

Immediate Danger to Life and Health (IDLH): **5 mg/m^3**

EPA: **no ambient air standard**

Inhalation regulations focus largely on worker exposure in industrial settings such as non-ferrous metalworkers.

INGESTION

ATSDR/CDC Minimal Risk Level (MRL): **0.005 mg As/kg/day** acute (<14 days)
0.0003 mg As/kg/day chronic (>1 year)

EPA: **10 ppb** (drinking water)
WHO: **10 ppb** (drinking water)
FDA: **0.5 – 2 ppm** (food)

Ingestion regulations focus largely on the general population exposure to arsenic through environmental contamination of food and water

ABSORPTION

No US established surface contamination exposure limits

MAK: **Skin absorption (H):** Cannot rely on exposure limit alone, because if skin contact occurs you may be over exposed

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Risk Management Strategies

Health & Safety Priorities

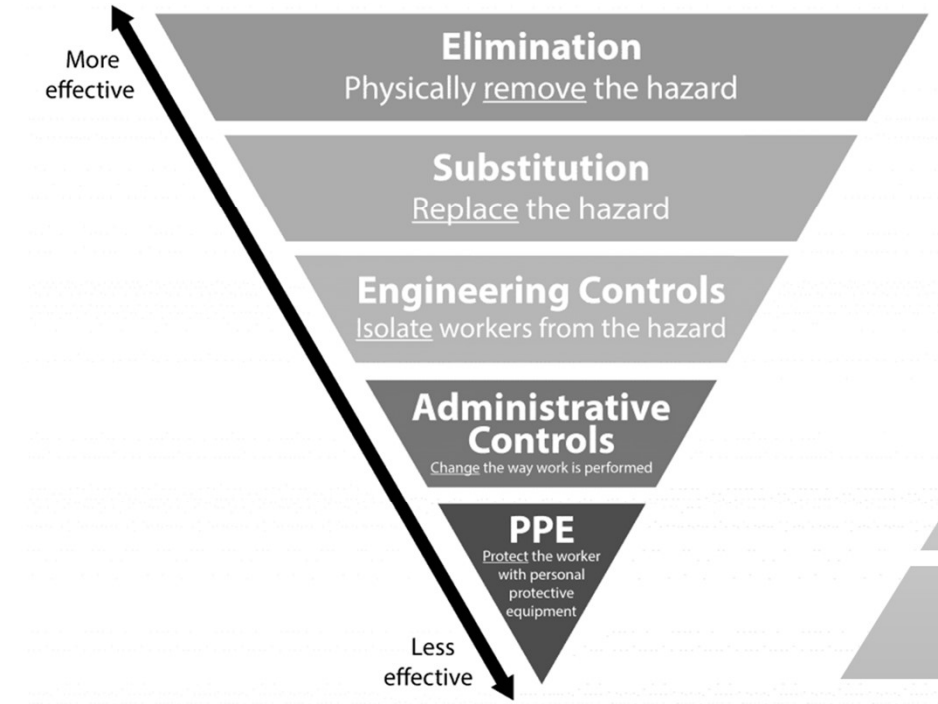

Image: CDC

Collections Priorities

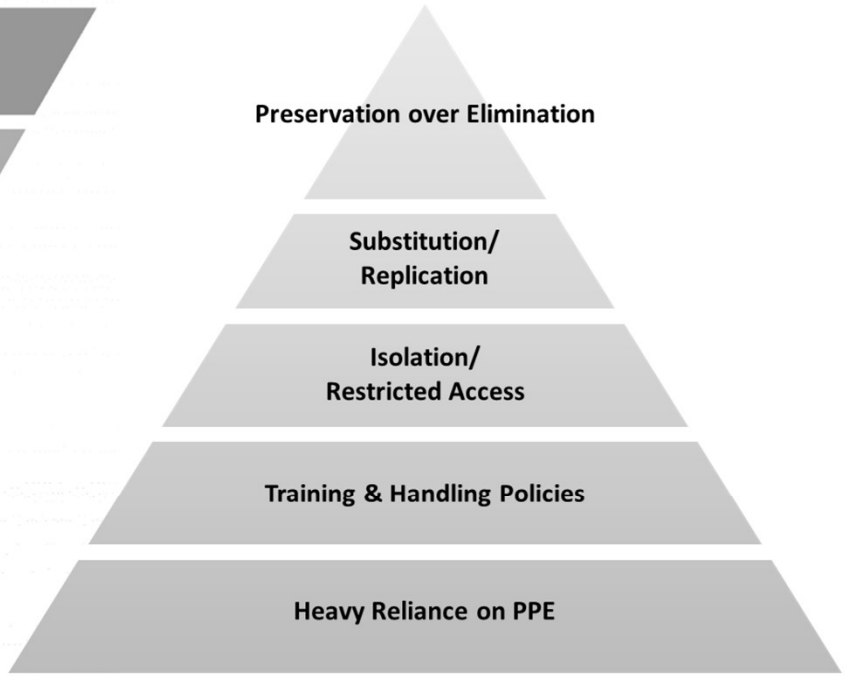

Image: Kerith Koss Schrager

Kerith Koss Schrager
AIC Annual Meeting 2024

Risk Management Strategies for Conservation

Hazardous collections can be safely handled and exhibited
with the appropriate investment of resources

▪ Time ▪ Funding ▪ Personnel ▪ Equipment ▪ Knowledge ▪ Training ▪ Purpose

Elimination, Substitution & Isolation

- Properly dispose of hazardous materials
- Rapidly process incoming collections/specimens
- Decontaminate objects, if possible
- Use scavenger products
- Replicate, digitize, or replace
- Enclose in well-sealed containers, bags, drawers, or vitrines

Engineering & Administration

- Ventilation controls (e.g., fume hoods)
- Proper hygiene (e.g., handwashing)
- Minimize dust and resuspension of hazardous particles
- Use only HEPA-filtered vacuums
- Clean storage containers and surfaces after use
- Cover surfaces with removable and/or disposable materials
- Segregate hazardous materials to prevent cross-contamination
- Transport in closed containers
- Minimize travel distances and agitation during handling
- Train users on proper handling

Personal Protective Equipment

- May be hazard specific
- Only protects the user

- HEPA particulate respirator
- OSHA Arsenic Standard (1910.1018) requires HEPA filters and acid gas canisters full face respirators when the inorganic arsenic concentration is at or below 0.5 mg/m^3; and half mask air-purifying respirators at or below 0.1 mg/m^3.
- Gloves
- Goggles
- Protective clothing (disposable or easily cleanable such as Tyvek)

Risk Management Strategies for Conservation

Kerith Koss Schrager
AIC Annual Meeting 2024

- Particulate hazard as a surface contaminant where is can be absorbed through the skin or accidentally ingested.
- Inhalation can occur if objects or surfaces are disturbed or manipulated to cause particles to become airborne.
- Exposure controls should focus on preventing contamination of surfaces, proper personal hygiene, and providing appropriate ventilation and respiratory protection.

Elimination, Substitution & Isolation

- Properly dispose of hazardous materials
- Rapidly process incoming collections/specimens
- Decontaminate objects, if possible
- Use scavenger products
- Replicate, digitize, or replace
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Engineering & Administration

- Ventilation controls (e.g., fume hoods)
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- Gloves
- Goggles
- Protective clothing (disposable or easily cleanable such as Tyvek)

HAZARD COMMUNICATION

Consider exposure for not only you, but everyone in your immediate workspace, within the entire organization as well as borrowing insitutions.

According to UN GHS Criteria

DANGER

Toxic if swallowed
May cause cancer
Suspected of damaging fertility or the unborn child
Causes damage to the gastrointestinal tract if swallowed
Causes damage to organs through prolonged or repeated exposure
Toxic to aquatic life with long lasting effects

Transportation
UN Classification
UN Hazard Class: 6.1; UN Pack Group: II

Hazard & Safe Practice Alerts to all staff and visiting researchers

Warning signs and labels on objects, storage rooms doors and/or shelves

Catalog entries and treatment records should be updated and clearly disclose hazards on new acquisitions or newly discovered hazards on existing collection items

Access restrictions for cases or storage areas that may require special ventilation or other pre-retrieval measures

Loan and accession documentation *must* disclose known or suspected hazardous materials.

Training for anyone who encounters hazardous materials to understand proper handing, disposal and treatment protocols

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As As As As

Arsenic in Collections

September 6, 2023
1:00-2:00 pm ET

Arsenic

Connecting to Collections Care

Fran Ritchie
Objects Conservator
Fran_Ritchie@nps.gov

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Objects Conservator
Fran_Ritchie@nps.gov

Webinars available on YouTube:

Identifying and Managing Hazardous Materials in Museum Collections, C2C Care Webinar presented by Hayley Monroe in 2021.

Arsenic and Old Lace: Controlling Hazardous Collection Materials, C2C Care Webinar presented by Kerith Koss Schrager, Anne Kingery-Schwartz, and Kathryn A. Makos in 2016


xrite
colorchecker
xrite

Mouflon shoulder mount, before and after conservation treatment.
Treated by Nicole Feldman

Arsenic (As)
Atomic number: 33
Color: Tin-white, tarnishing to dark grey

Geologyscience.com

Minerals.net

Mineralauctions.com

How does arsenic affect humans?

LONG-TERM EXPOSURE

- Arsenic exposure occurs through inhalation, ingestion, dermal or eye contact.

- *Chronic (long-term)* oral exposure to arsenic leads to skin diseases and increased risk of skin cancers.

- *Chronic (long-term)* arsenic exposure can also increase the rusk of lung, liver, kidney and bladder, and other cancers. **This has been seen mostly in workers exposed to arsenic at smelters, mines, and chemical factories, but also in residents living near smelters and arsenical chemical factories. People who live near waste sites with arsenic may have an increased risk of lung cancer as well.**

https://www.osha.gov/arsenic/hazards

"Effect of arsenic used in artificial flower-making **on worker's hands** (1859); Photo: Wellcome Library, London/Courtesy Bloomsbury" www.arsenicloss.com

How does arsenic affect humans?

SHORT-TERM EXPOSURE

"If you have direct skin contact with high concentrations of inorganic arsenic compounds, your skin may become irritated, with some redness and swelling.

However, it does not appear that skin contact is likely to lead to any serious internal effects."

Toxicological Profile for Arsenic, U.S. Department of Health and Human Services. Public Health Services. Agency for Toxic Substances and Disease Registry. August 2007. Page 8. atsdr.cdc.gov/ToxProfiles/tp2.pdf

Seated Buddha in "Maravijaya", leaded arsenical bronze sculpture from Thailand.
Currently at the Walters Art Museum

Container of sodium arsenite, a loose powdered compound of arsenic

Don’t lick it!

Arsenic in geological and historic pigment collections

Cluster of realgar crystals from Getchell Mine, Adam Peak, Potosi District, Humboldt County, Nevada, United States

As_4S_4

Orpiment crystal from Twin Creeks Mine, Potosi District, Humboldt County, Nevada, United States

As_2S_3

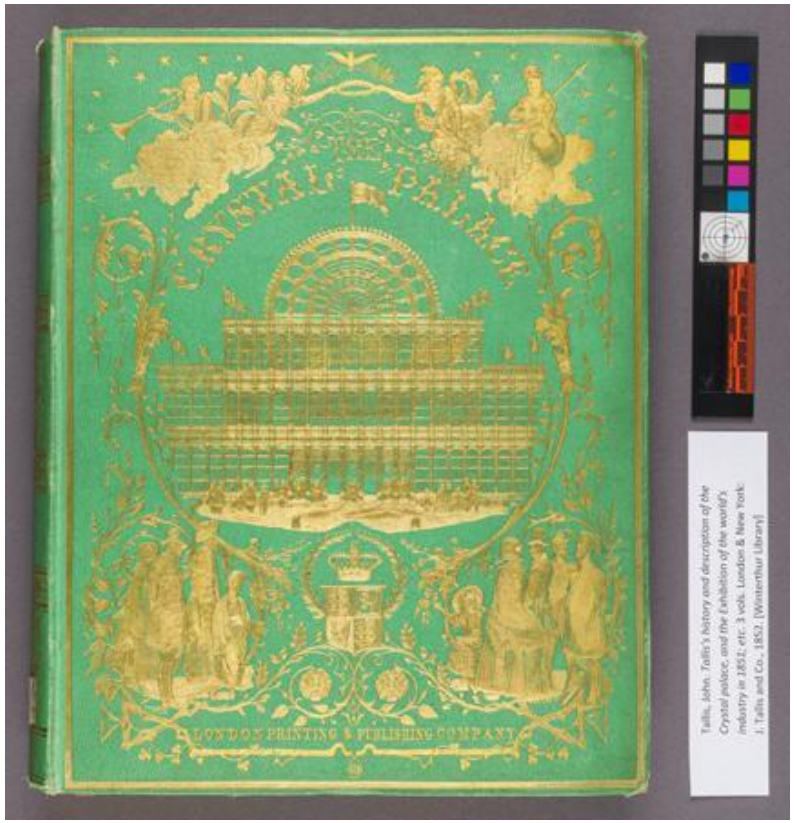
Orpiment pigment for mulling paint

Arsenic in social collections

Arsenical compounds used in the textile (clothing and book cloth), wallpaper, and artificial flower industry as dyes for vibrant green colors known as **Scheele's Green** and **Paris Green**

Artificial flowers, from the online article "Scheele's Green, the Color of Fake Foliage and Death". The Paris Review. May 2018.

Morris & Co.'s Daisy Wallpaper, from the online article "Scheele's Green, the Color of Fake Foliage and Death". The Paris Review. May 2018.



Tallis's History and Description of the Crystal Palace (1852), bound in emerald green book cloth. Winterthur "Poison Book Project"

Arsenic in social and medicinal collections

Ingested by women and men for youth and beauty in the Victorian Era, as well as medicines for tumor and other illnesses.
Empty (or full!) containers with residues may be present in some collections.

A Woman's Face Is Her Fortune.

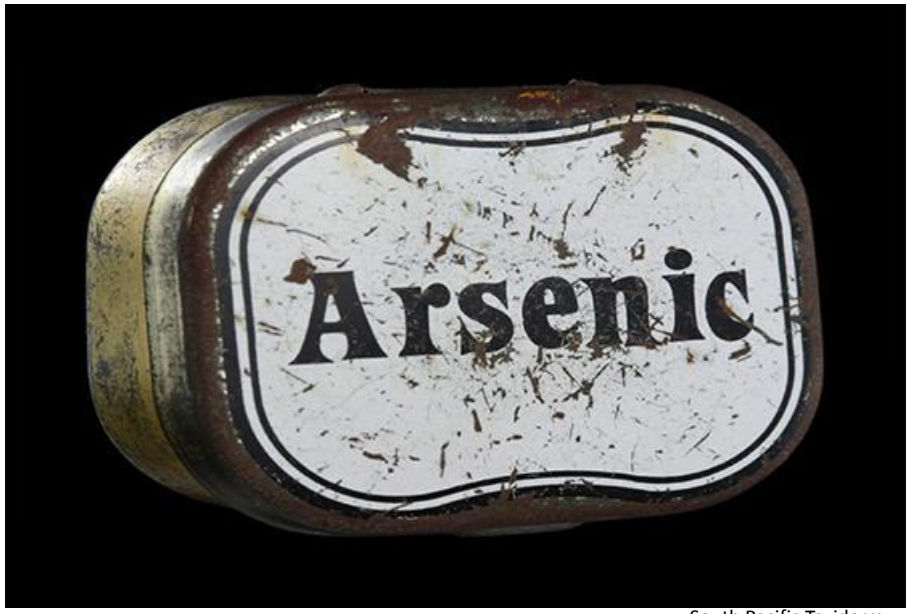
DR. SIMM'S ARSENIC COMPLEXION WAFERS

After a few days' use will permanently remove all Blotches, Moles, Pimples and Freckles, producing an Entrancingly Beautiful Complexion that shames the use of powders and creams. Warranted perfectly harmless. Sold by all leading druggists at $1 per box of 100 wafers.

Dr. Simms' Safe Periodical Wafers are sure and reliable for all female irregularities. Price $2 per box. Sent by mail (secure) on receipt of price. Warranted to contain no "Tansy" for "Pennyroyal."

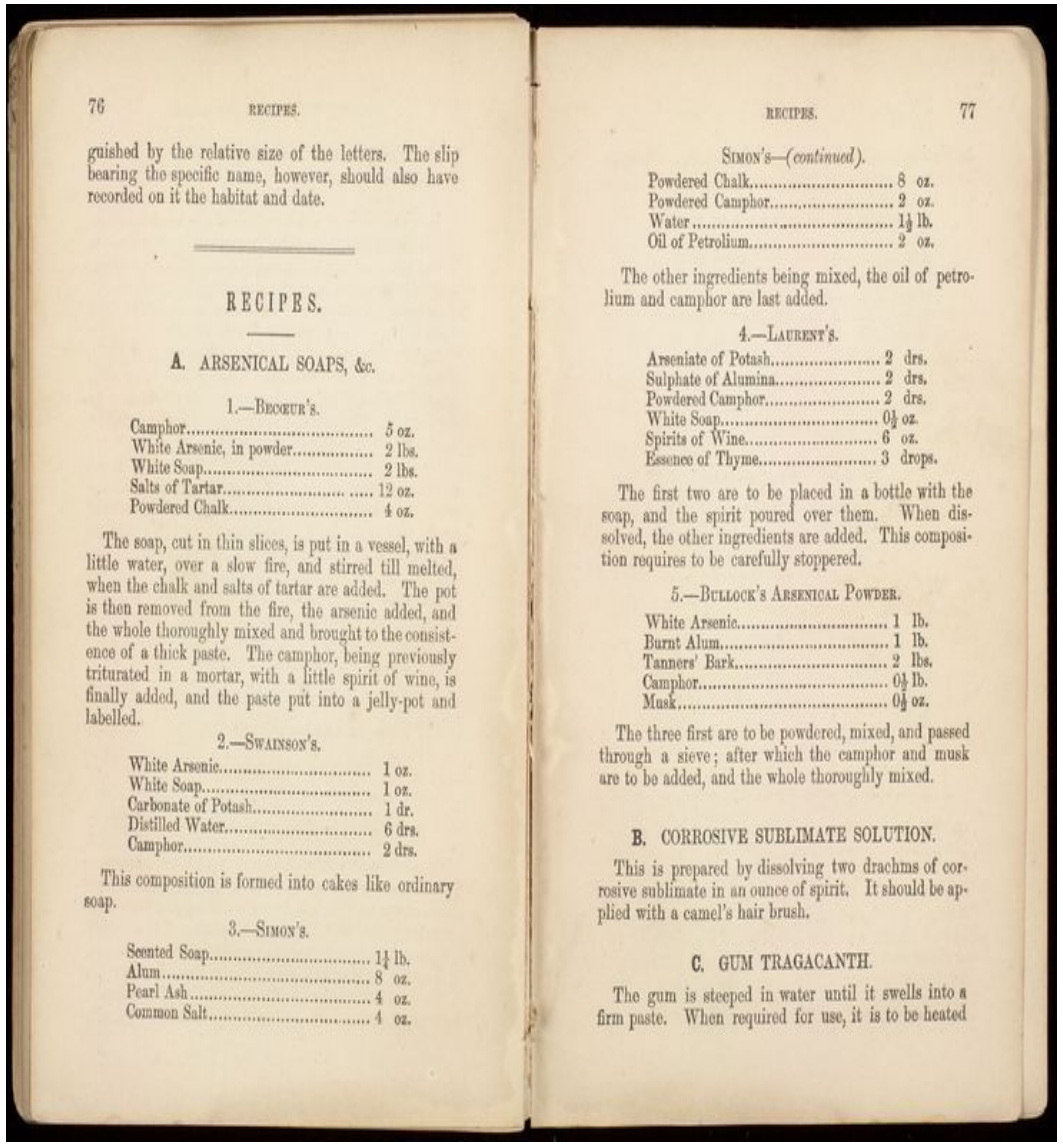
THUMLER & Co., 83 Chambers St., New York.
H. M. Parchen & Co., Sole Agents, Helena.

The Helena Independent (newspaper)
November 9, 1889



South Pacific Taxidermy

Arsenic in taxidermy and study skin collections



76 RECIPES.

guished by the relative size of the letters. The slip bearing the specific name, however, should also have recorded on it the habitat and date.

RECIPES.

A. ARSENICAL SOAPS, &c.

1.—Becœur's.

Camphor	5 oz.
White Arsenic, in powder	2 lbs.
White Soap	2 lbs.
Salts of Tartar	12 oz.
Powdered Chalk	4 oz.

The soap, cut in thin slices, is put in a vessel, with a little water, over a slow fire, and stirred till melted, when the chalk and salts of tartar are added. The pot is then removed from the fire, the arsenic added, and the whole thoroughly mixed and brought to the consistence of a thick paste. The camphor, being previously triturated in a mortar, with a little spirit of wine, is finally added, and the paste put into a jelly-pot and labelled.

2.—Swainson's.

White Arsenic	1 oz.
White Soap	1 oz.
Carbonate of Potash	1 dr.
Distilled Water	6 drs.
Camphor	2 drs.

This composition is formed into cakes like ordinary soap.

3.—Simon's.

Scented Soap	1¼ lb.
Alum	8 oz.
Pearl Ash	4 oz.
Common Salt	4 oz.

RECIPES. 77

Simon's—*(continued)*.

Powdered Chalk	8 oz.
Powdered Camphor	2 oz.
Water	1½ lb.
Oil of Petrolium	2 oz.

The other ingredients being mixed, the oil of petrolium and camphor are last added.

4.—Laurent's.

Arseniate of Potash	2 drs.
Sulphate of Alumina	2 drs.
Powdered Camphor	2 drs.
White Soap	0½ oz.
Spirits of Wine	6 oz.
Essence of Thyme	3 drops.

The first two are to be placed in a bottle with the soap, and the spirit poured over them. When dissolved, the other ingredients are added. This composition requires to be carefully stoppered.

5.—Bullock's Arsenical Powder.

White Arsenic	1 lb.
Burnt Alum	1 lb.
Tanners' Bark	2 lbs.
Camphor	0½ lb.
Musk	0½ oz.

The three first are to be powdered, mixed, and passed through a sieve; after which the camphor and musk are to be added, and the whole thoroughly mixed.

B. CORROSIVE SUBLIMATE SOLUTION.

This is prepared by dissolving two drachms of corrosive sublimate in an ounce of spirit. It should be applied with a camel's hair brush.

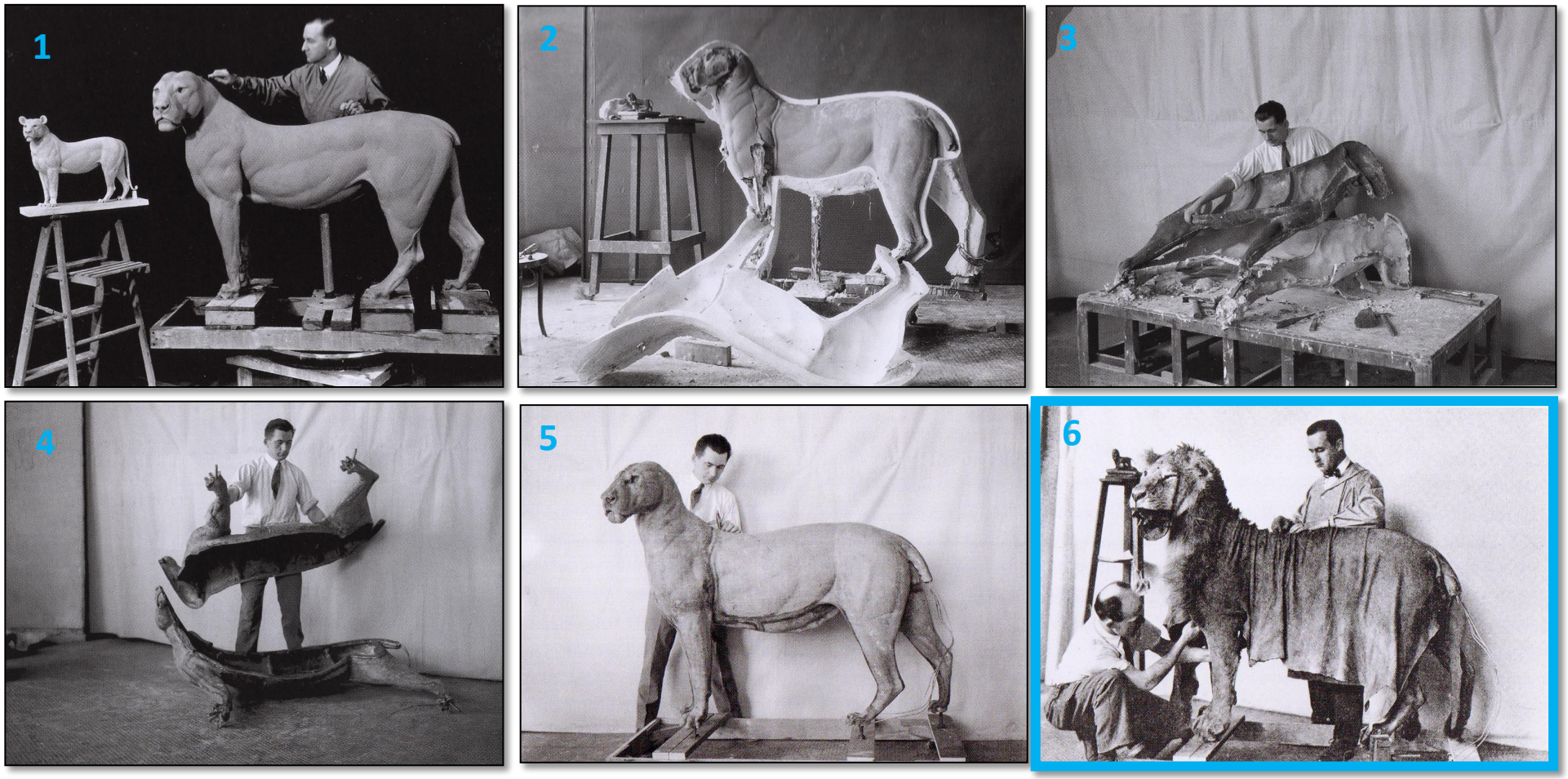
C. GUM TRAGACANTH.

The gum is steeped in water until it swells into a firm paste. When required for use, it is to be heated

Davies, James Boyd. 1858. The practical naturalist's guide : containing instructions for collecting, preparing and preserving specimens in all departments of zoology, intended for the use of students, amateurs and travellers, Edinburgh : MacLachlan & Stewart .. ; London : Simpkin.Marshall and Company.

Taxidermy containing arsenic above, taxidermy with no arsenic below

Arsenic in taxidermy and study skin collections



Arsenic was applied to the inside of the skin, before being mounted over a manikin.

Arsenic in taxidermy and study skin collections

Robin photos: Emily S. Durkin

Carl Akeley. African elephants.
The Field Museum of Natural History.

Paul Cézanne (1839–1906), View of the Bay of Marseille with the Village of Saint-Henri (c 1883), oil on canvas, 65.9 x 81.3 cm, Philadelphia Museum of Art, Philadelphia, PA. Wikimedia Commons.

Arsenic in Indigenous collections

From Smithsonian National Museum of the American Indian:

“Arsenic was commonly used as arsenic trioxide (As2O3) or arsenous acid.
Inorganic pesticides were often used in powder, paste, or dip form. The pesticide residue stays on the object and continues to be an effective insect killer for a long time.”

Physical Properties And Health Effects of Pesticides Used On National Park Service Collections

PESTICIDE	PHYSICAL PROPERTIES	HEALTH EFFECTS	ROUTE OF ENTRY	TYPE	HANDLING	SYNONYMS AND TRADE NAMES
Arsenic As	silver-gray or white metallic solid	carcinogen, skin, eye and respiratory irritation	inhalation, ingestion, skin	herbicide, insecticide, fungicide	Nitrile gloves, dust-proof goggles	arsenical soap, arsenic powder
Naphthalene $C_{10}H_8$	white crystals with moth ball odor; flammable; combustible	skin and eye irritant; affects liver and kidney	inhalation, ingestion, skin	fumigant	gloves, safety glasses, respirator	Napthalene, Coal Tar Camphor, Naphthalin, Naphthalinium, moth balls
Para-dichlorobenzene $C_6H_4Cl_2$	colorless or white, volatile crystals with strong odor; combustible	suspected carcinogen, affects respiratory, circulatory, central nervous, renal systems	inhalation, ingestion, skin	fumigant	gloves, full face respirator or dust or gas-proof goggles	PDB, Evola, Globol, Paracide, Parazene, Paradow, Paramoth, Paranuggets

Detecting Arsenic

1. Research the history of your collection
    i. Is there a history of residual pesticide use in your facility?
    ii. When was the object made?
    iii. How long has the object been in the museum collection?
    iv. Who made it?

Detecting Arsenic

Who made it?

After testing every material and several locations, only the back of the fur tested positive for arsenic, suggesting it was tanned by a non-Native entity and purchased or traded

Detecting Arsenic

1. Research the history of your collection
2. Perform a visual examination to look for white or grey particulates/haze

Personal Protective Equipment (PPE)

- Wear **Nitrile or latex gloves** (not cotton); one size larger than usual can be helpful in taking on/off
- Lab coat or smock, *if excessively handling*
- Particulate mask (N95), *if excessively handling*

Detecting Arsenic

2. Perform a visual examination to look for white or grey particulates/haze around feathers…

…but it could be dust

Detecting Arsenic

2. Perform a visual examination to look for white or grey particulates around the eyes, nose, ears, feet, etc.…

…but it could be Borax

…or plaster/manikin materials

Detecting Arsenic

2. Perform a visual examination to look for white or grey particulates….

…but it could be polyethylene glycol treatment, fatty bloom, or mold.

See conservation blog https://alaskawhitestuffid.wordpress.com/ for more information.

Detecting Arsenic

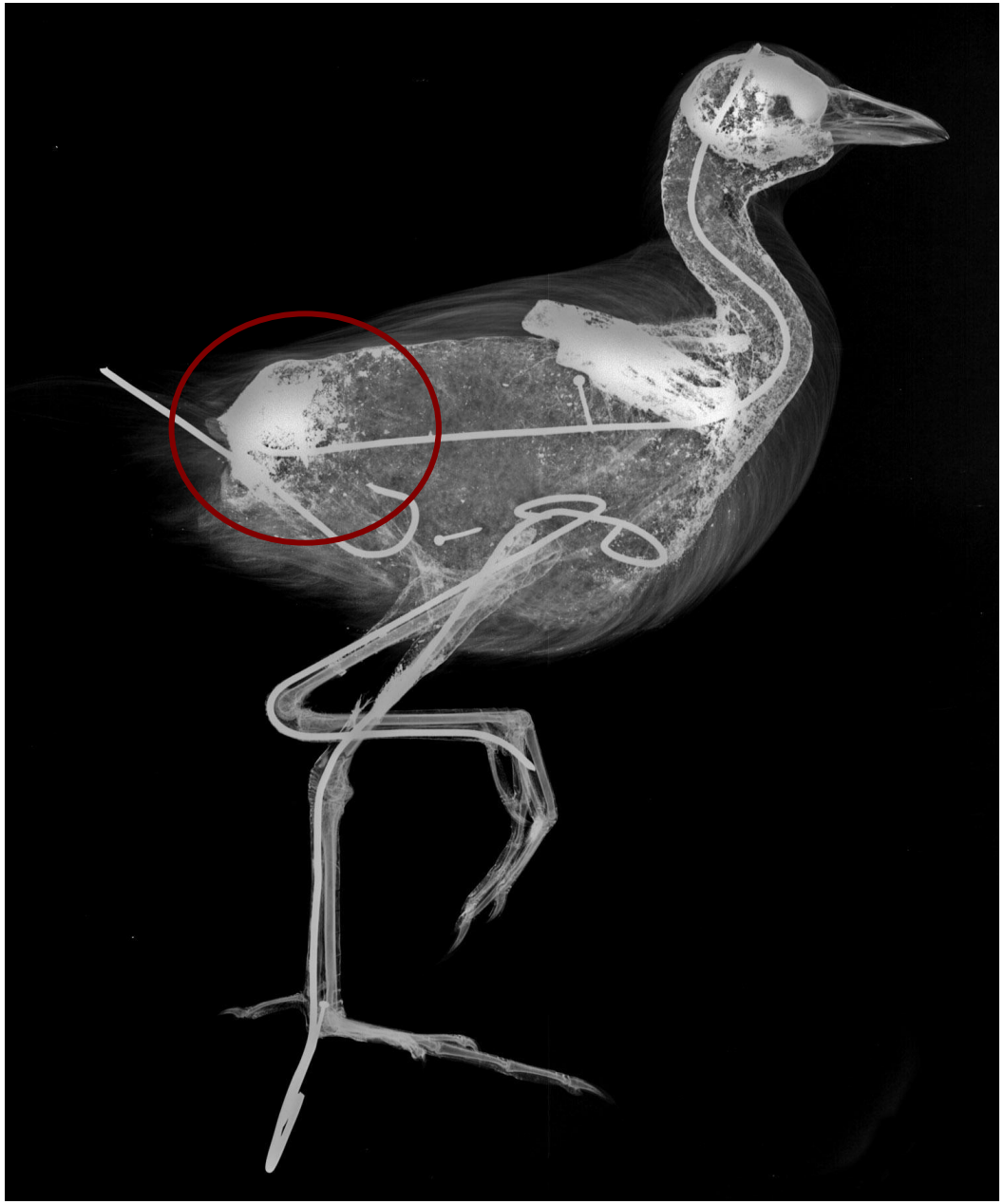
2. Perform a visual examination to look for white or grey particulates….

…but it could be undetectable.

Detecting Arsenic

3. Take an X-Radiograph

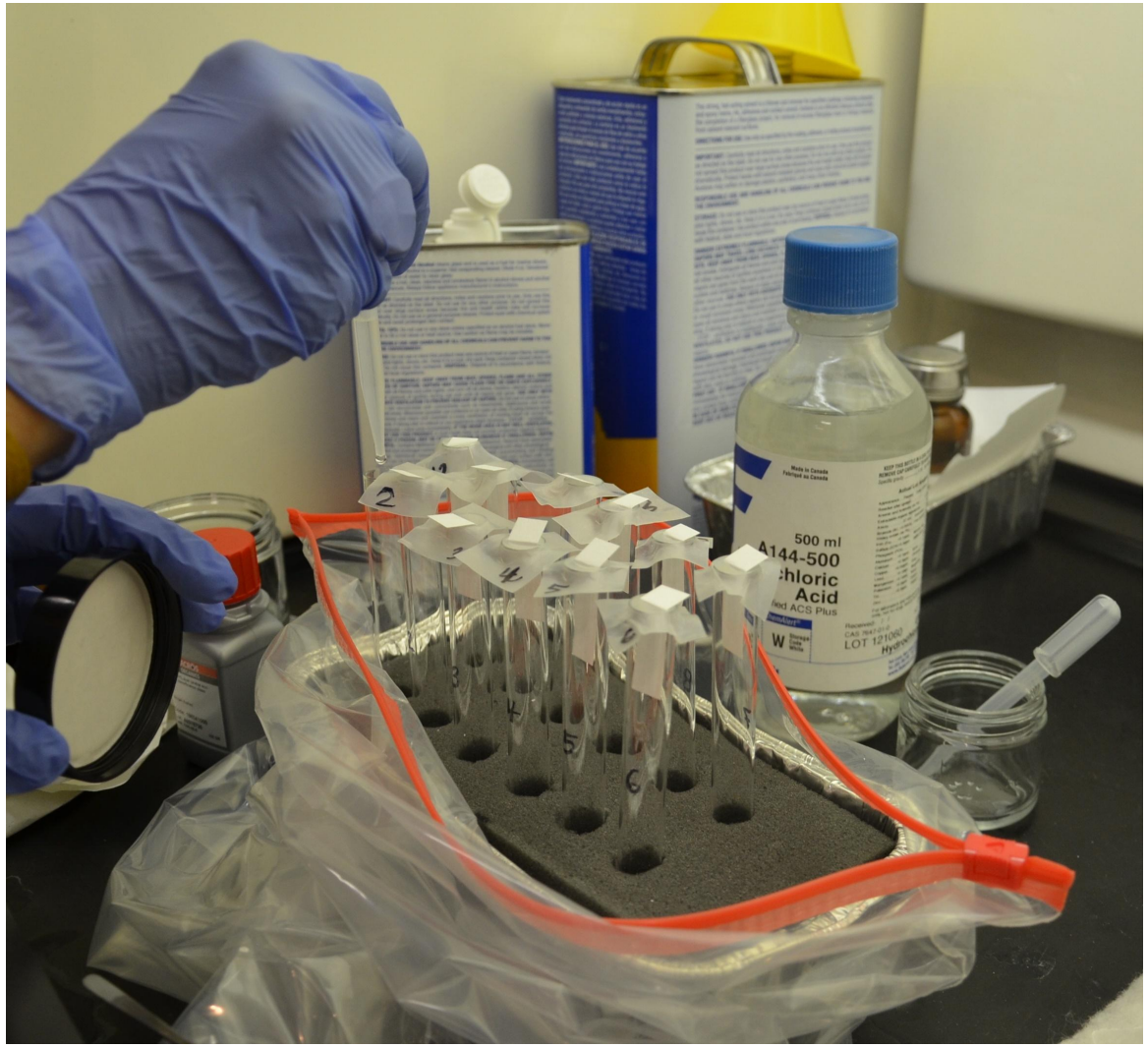
Residual pesticides can be difficult to detect because of uneven application. X-radiographs reveal thicker patches of arsenic (red circle) vs smears of arsenic.



Taxidermy bird with internal arsenic (white cloudy areas)

Detecting Arsenic

4. Perform a chemical spot test from samples of the object



Detecting Arsenic

5. Use adaptable at-home water test kits

(“Quick” brand Rapid Arsenic Test Kit for Water Analysis)

Quick Rapid Arsenic Test Kit, 100 tests
$170 on Amazon

Quick Rapid Arsenic Test Kit, 5 tests
$21.87 on Amazon

Relatively low cost, but have a limited shelf life of a few months, so you don’t buy stock to keep on hand.

Detecting Arsenic

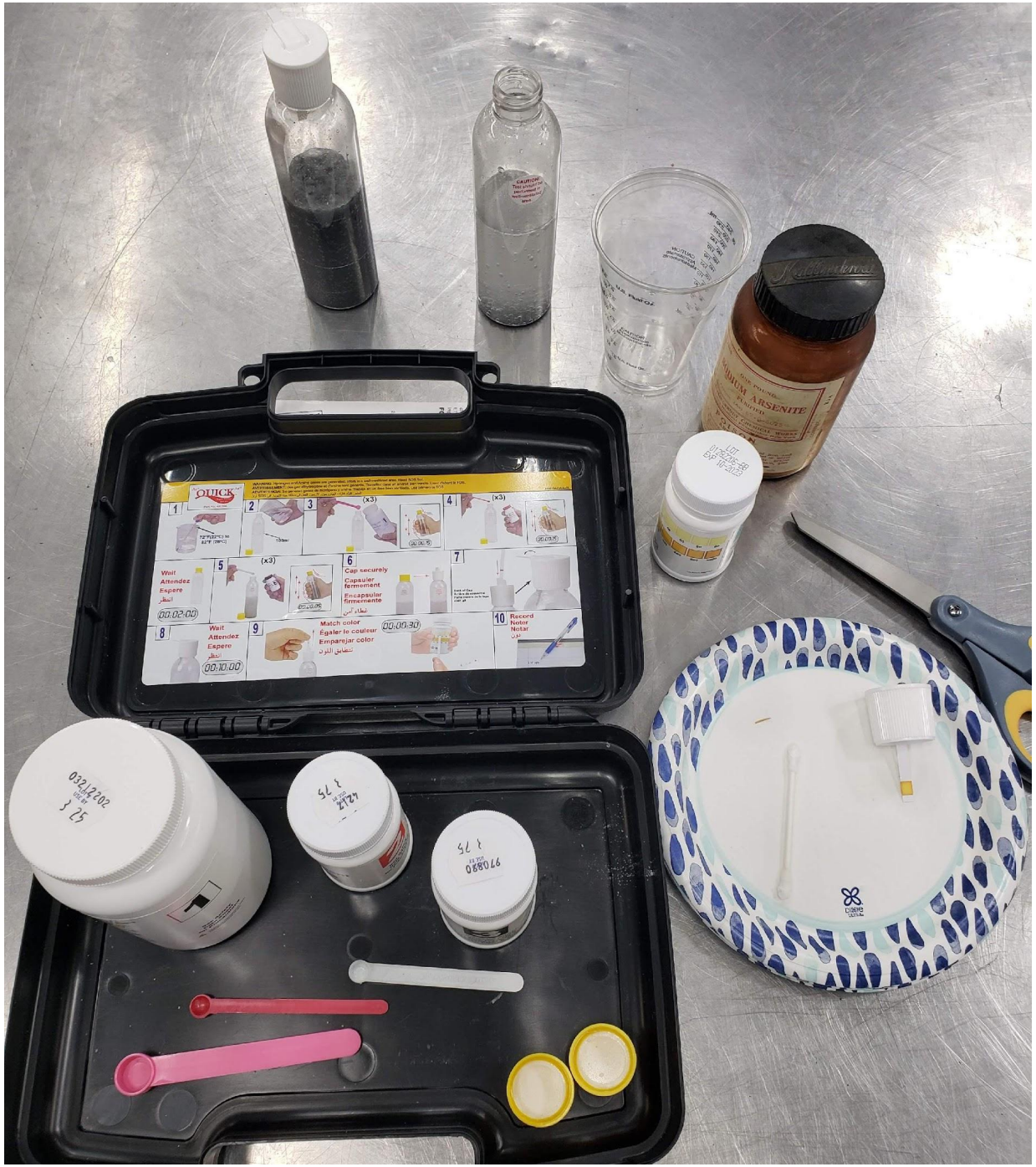
5. Use adaptable at-home water test kits

1. Determine a representative sample set to test, and test ONE object at a time.
2. Gather supplies and create a designated area for testing -
   - cover for table
   - cotton swabs or Q-tips
   - distilled water (NOT tap water)
   - nitrile gloves
   - scissors
   - stopwatch
3. Fill the designated test tube with distilled water.
4. Collect the sample:
   - For taxidermy, study skins: Dampen cotton swab in distilled water and roll over the object focusing on seams and openings or anything “loose” (don’t double-dip).
   - For everything else: Pre-loosen the cotton on a swab, then roll over object to collect anything “loose” (do not dampen swab with water).
   - If anything loose comes off (fibers, particulates) and if you have permission, add those to the test tube. Only use if CERTAIN it came from that exact object.

Detecting Arsenic

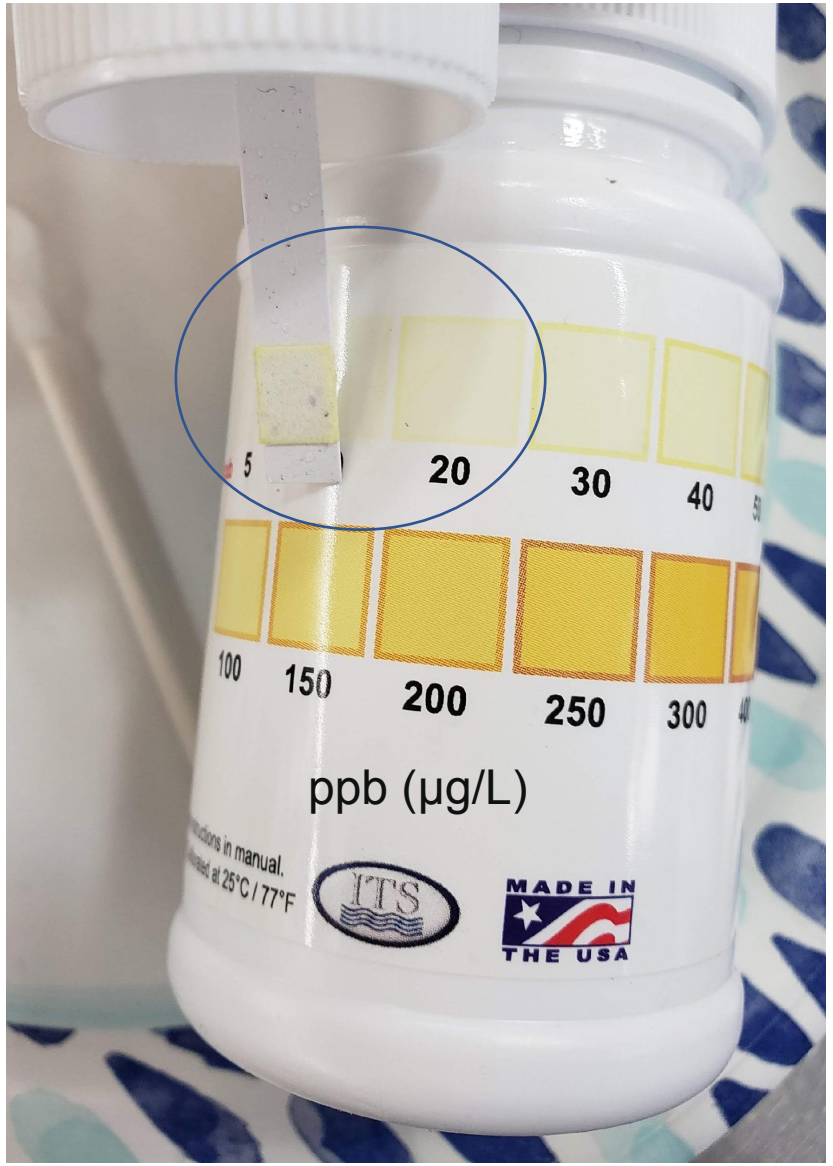
5. Use adaptable at-home water test kits

5. Cut the end of the swab into the tube with distilled water.
6. Run test **EXACTLY** as instructed. It will take 14 minutes total and there are specific steps to complete within a specific amount of time. Do not deviate from this.



Detecting Arsenic

5. Use adaptable at-home water test kits



7. Compare test strip to the reference to determine if arsenic is present. (If arsenic is present, arsine gas will be produced and react with the test strip to cause a color change.)
8. Record results as a YES/NO on a spreadsheet and in your database.
    - date of test, type of test, who performed it
    - where samples were taken
    - results as a YES/NO (this is not a quantitative test, since the kit is adapted from it's original purpose)
9. Vacuum table, after testing is complete.
10. Throw away testing materials, as test instructs.

Detecting Arsenic

5. Use adaptable at-home water test kits

Pros:

- Can perform the test on the area around objects, to test for transfer to a surface. Note that does not confirm conclusively that the arsenic came from a particular object.
- No false positives (unless you use tap water)
- Easy to run
- Relatively cheap

Cons:

- Ideally, you'd have a known positive to run to ensure the test is still accurate and you are running it properly
- There can be false negatives if the arsenic is not on the surface/is not loose, or if you sample from the "wrong" spot
- Difficult to test some materials
- Time consuming
- Short shelf life
- YES/NO, does not assess the actual risk to you

Detecting Arsenic

6. Use X-ray Fluorescence (XRF) Spectrometry

How it works:

X-ray fluorescence (XRF) spectra are collected using a Bruker Tracer 5i handheld energy dispersive X-ray spectrometer that is held in place on specific locations on the object. The excitation source is a Rhodium (Rh) target X-ray tube, operated on the "Metal Alloys 2" setting: 15 keV, 11.35 uA, 12 seconds, no filter. The X-ray beam interacts with the sample at approximately a 3mm circle. X-ray signals are detected using a proprietary 20mm^2 silicon drift detector (SDD) with a resolution of <140 eV @ 250,000 cps Mn Ka. Spectral interpretation is performed by the instrument in this standard setting.

Detecting Arsenic

6. Use X-ray Fluorescence (XRF) Spectrometry

Pros & Cons:

- Non-destructive technique, but must have complete steady contact with the surface, which sometimes is difficult
- Tests only take seconds to complete so you can test multiple locations around the object
- Still need to understand the history of the object (glass bead example)
- XRF analyzers are expensive, not every conservator has one. They can be rented, but that can be tricky
- YES/NO, does not assess the actual risk to you

Detecting Arsenic

6. Use X-ray Fluorescence (XRF) Spectrometry

Results are expressed as a percentage of what was detected in the 3mm detection circle. The results do not tell you exactly how much arsenic is present in an entire object.

Record results as a YES/NO on a spreadsheet and in your database.

- date of test, type of XRF analyzer, who performed it
- where readings were taken
- results as a YES/NO

Detecting Arsenic

6. Use X-ray Fluorescence (XRF) Spectrometry

XRF can be used to test storage area for transfer of arsenic from objects to other surfaces (although cannot definitively tell you which object it came from).

XRF can detect arsenic on cotton swabs and wipes collected from specimens and sent to a lab (although it still relies on being able to wipe up arsenic – consider it a first screening). Put all wipes and swabs from one object into a Ziplock bag that is clearly labeled.

Detecting Arsenic

6. Use X-ray Fluorescence (XRF) Spectrometry

- Add a label to the object tested that specifies it was positive for Arsenic and that gloves must be worn when handling.
- Avoid over-using the skull-and-crossbones symbol – consider saving that for a hazard that has *acute* risk.

How to work with objects positive for Arsenic:*

- Wear nitrile or latex gloves (one size larger helps to take on/off) and have multiple sizes readily available in collection storage to encourage use.
- Wear lab coat or smock, if excessively handling or if object is friable (can wash as normal)
- Wear particulate mask (N95), if excessively handling and/or vacuuming. If vacuuming in an enclosed space (vitrine) and if object is friable, wear particulate respirator.

- Cover surface with plastic sheeting (that you designate and re-use) or paper (that you throw away in regular trash)
- Clean object with a HEPA vacuum and soft brushes (vacuum brushes once done)
- Store cell phone in Ziplock bag while working on objects
- Vacuum all surfaces and tools afterwards with HEPA vacuum
- Wipe surfaces with wet wipe
- Throw away everything in regular trash (unless your health & safety officer instructs otherwise)

*And the other items that were represented by that sampled sub-set

IMPROPER GLOVE USE!!

https://extension.umaine.edu/food-health/cheesemakers/lesson-2/

Gloves DON’T protect you if you: touch your face, hair, phone, while wearing them.
Gloves DON’T protect you if you: wear them all day.

TAKE THEM ON AND OFF

Now What?

- Include an explanation of testing and results in the orientation for staff, interns, volunteers, and researchers. Have ample PPE available.

- Maintain records of pesticide testing and results for future staff in collections database.

- Purchase a HEPA vacuum. If objects are on open display, vacuum them 2-4 times a year (or vacuum beneath them, if they are fragile). Vacuum the exhibit space daily (carpet). Maintain stable environmental controls to prevent deterioration.

- Construct trays to house any smaller objects that currently do not have one, to minimize needing to touch the object itself.

- If cultural objects are ever asked to be worn, inform requestor of the arsenic testing. Vacuum objects prior to loaning.

- Enforce a perimeter around the object on display (glass cases, physical barriers, out of reach).

- Do not use objects that test positive for arsenic in educational programs where objects are touched.

Now What?

After researching the history of collection, consider a cost benefit analysis of performing arsenic testing.

What the use of the collection? Are objects on display, or researched daily? How often is it accessed? Who is accessing it?

It may be better to assume the hazard is present, wear PPE, and then spend staff time and resources performing housekeeping tasks that help maintain health of collections and staff, reviewing proper handling policies, and training staff.

For specific concerns, the BEST thing to do is consult an Industrial Hygienist *who has experience with museums* to help guide you through a risk assessment.

Thank you!

Webinars available on YouTube:

Identifying and Managing Hazardous Materials in Museum Collections, C2C Care Webinar presented by Hayley Monroe in 2021.

Arsenic and Old Lace: Controlling Hazardous Collection Materials, C2C Care Webinar presented by Kerith Koss Schrager, Anne Kingery-Schwartz, and Kathryn A. Makos in 2016

Book:

Old Poisons, New Problems: A museum resource for managing contaminated cultural materials. Nancy Odegaard, Alyce Sadongei, and associates. 2005. Alta Mira Press.