Arsenic & Old Lace: Controlling Hazardous Collection Materials (May 3, 2016)
Presentation Notes

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The following notes, organized by slide number, are meant to accompany the webinar slides from *Arsenic & Old Lace: Controlling Hazardous Collection Materials,* presented and archived through the Connecting to Collections Care (C2CC) website on May 3, 2016. Please note that they were used as a guide and may not be the exact content of the presentation.

See the handouts and bibliography provided with the original presentation for additional information on many of these topics.
http://www.connectingtocollections.org/arsenic-and-old-lace-controlling-hazardous-collection-materials/

SLIDE 1

- About the AIC Health & Safety Committee: AIC formed this committee to provide educational and technical information on safety hazards and general health issues related to the conservation profession. One of the committee's main objectives is outreach, like this webinar, to make sure the collection care community, not just conservators, are aware of health and safety issues in their work lives.
- Anne Kingery-Schwartz and Kerith Koss Schrager (co-chairs of the Health & Safety Committee) are objects conservators.
- Kathryn Makos is an industrial hygienist, a specialist in occupational health, and recently retired from the Smithsonian, so she has expert knowledge of both health and safety issues as well as the museum environment.
- One of the goals of this webinar is for attendees to understand the difference between what a conservator or collection specialist can do and what a safety professional does as it relates to health and safety, and why it's important for collecting institutions to have relationships with both professions.

SLIDE 2: Presentation Outline

- This presentation will help collection caretakers identify possible hazards within collections and make a plan for mitigating risks.
- Basic health and safety should be a part of the overall risk management program for the collection.
- When thinking about all the things that could happen to a collection, managers tend to focus on what negative things could happen to the ***objects***—what happens if this object falls off a shelf? For this presentation, the focus will shift to the human element—what happens if this object falls off a shelf and…on to me?
- Collection workers should consider their own health and safety and that of their visitors to be equally as important as the health and safety of the collections in their care.
- The presentation will cover:
    - Identification of hazards,
    - How to design a management plan,
    - What can be done on an administrative and collections care level,
    - What can be done on an object handling and conservation level, and
    - What may actually require professional health and safety assistance or very specialized training or licensing.
- Museums and historic sites may have limited resources, but there is a point that collaboration with specialists is required; case studies will be provided to demonstrate those situations.
- How to find a specialist and determine if they are the right kind of help? And what resources are available for organizations without institutional health and safety or conservation staff.
- **General recommendations will be provided throughout the presentation, since it's difficult to make claims about health and safety issues, without knowing the details of a specific situation.**

SLIDE 3/4: What are hazardous collection materials?

- A material is considered hazardous if it has the potential to:
    - Cause injury, illness, or death;
    - Cause damage to or loss of equipment, property or collections; or
    - Inhibit operations such as restricting access to storage cases.
- The examples provided are just a small sampling of the kinds of hazards found in collections and each one could have their own 90-minute webinar. The idea here is to raise awareness and provide resources to get specific help.

SLIDE 5: Inherent vs. Acquired Hazards (Inherent: Nature/Design)

- Hazards can be either inherent and/or acquired.
- Many objects are hazardous by nature or design. The hazard is often not apparent and may require specific knowledge about the collection. These include:
    - Toxic plants specimens
    - Mineral specimens that are heavy metals or radioactive, and
    - Chemical or medicinal sets

SLIDE 6: Inherent vs. Acquired Hazards (Inherent: Nature/Design)

- Some objects can also cause **physical** harm; These are objects that are heavy, sharp or breakable, spiny shells, and flammable materials such as alcohol-based preservatives.
- These hazards are often very apparent, but the hazard is so often assumed, they may be overlooked. Heavy objects stored high on shelves may seem stable, but could become dislodged during an earthquake

SLIDE 7: Inherent vs. Acquired Hazards (Inherent: Deliberate Incorporation)

- Certain materials were deliberately incorporated into an object during production,—in some cases to capitalize on properties related to their hazardous nature, such as with Weaponry, rifles, hand grenades, or gun powder.
- Hazardous material may have a particular property that is intrinsic to the function or value of the object: These include:
    - Luminous instrument dials painted with radium-based paint,
    - Silks with arsenic added to increase their weight for sale
    - Felt hats stiffened using mercury
    - Liquid mercury used for quick and accurate measurements in in thermometers and gauges, and
    - Cadmium, lead and chrome-based pigments, for their durability and color.
- These hazards will become apparent once collection care research into the production techniques has been conducted.

SLIDE 8: Inherent vs. Acquired Hazards (Inherent: Unintentional Incorporation)

- Sometimes, at the time of manufacture the hazardous nature of the material was not known and has only become apparent through recent study and health assessments.
- Asbestos was added to art plasters and stuccos used for decorative works, because it was cheap and plentiful. This kind of plaster was commonly used in exhibition dioramas or taxidermy mounts;
- Uranium was added to specialty glasses, cloisonné jewelry and certain glazes on Fiesta ware
- These are often hidden hazards. For example, materials containing asbestos were widely used, rarely documented and difficult to identify by sight.

SLIDE 9: Inherent vs. Acquired Hazards (Acquired: Deterioration)

- Deterioration or damage can result in materials becoming more toxic or unstable. These processes are often unpredictable, can occur without any warning signs, and require more in-depth knowledge of collection and production techniques in order to identify. They also offer the best examples of when to consult local hazardous materials specialists.
- The reflective surface on historic mirrors was created using tin and mercury. In good condition the mirroring is not hazardous, but once the deterioration process begins liquid mercury and vapor is released. County environmental protection agencies can assess this and contain and remove the mercury.
- Nitrocellulose film becomes extremely flammable upon decay. If it's unclear of how long this film has been stored, leave it and call the fire dept. They will always be happy to do this before, rather than after, a fire!
- Other materials, which we discussed already that were hazardous by nature, can become even more dangerous as they deteriorate.
- Any movement or dismantling of asbestos art plaster can release airborne fibers. An abatement specialist is needed.
- Medicinal and chemical collections can change with age creating highly reactive or explosive mixtures, or off-gassing toxic materials. If age or condition in unknown, call the fire department.
- Some pigmented paints can powder over time and pose inhalation and ingestion hazards.
- Ammunition can become unstable. For example, grenades form highly explosive peroxides as they degrade.
- Local police departments will safely remove old gunpowder horns and inspect old weaponry. They usually will safely remove the hazardous materials and return the collection object

SLIDE 10: Inherent vs. Acquired Hazards (Acquired: Treatment)

- Objects can acquire toxicity through treatment. These kinds of hazards ***may*** require specialized knowledge to identify, since even if collection histories and technologies are known, historical and modern treatment techniques that have been applied may be unusual or undocumented. Especially if proper documentation or institutional knowledge is not available.
- Some clues may indicate that pesticide treatments, for example, have been applied. Some pesticides will leave residues or have a characteristic odor; some highly toxic organics like naphthalene (which is what is found in moth balls), will recrystallize on surfaces of objects and cases, providing inhalation hazards.
- Mercuric salts used on botany mounting papers appear as gray-black-silver sheening, indicating that mercury vapor may linger in the storage cases.
- Many other pesticides such as arsenical compounds, are not obvious, yet leave harmful particulate residues which can be inhaled or ingested.
- Sometimes an organic object in perfect condition, when other objects have pest damage, is an indication of pesticide treatment.
- When acquiring an item for a collection or working on a project, try obtain archival records of treatments. If the item is more modern, ask for Safety Data Sheets (formerly MSDSs) on the materials that were used to create the object. Acquired collections may be orphaned with little data or have incomplete records. In any of these situations, identification of treatment hazards will probably require specialized analytical testing and possibly the help of a health safety specialist.

SLIDE 11: Inherent vs. Acquired Hazards (Acquired: Contamination)

- Objects can also acquire toxicity through environmental contamination. These hazards can sometimes be predicted such as mold following a flood or leak.
- This category also includes fiber and dust contamination from storage or building materials like asbestos-containing insulation or plaster **or** lead paint used on walls and exhibitions. Specialized training is required for this even for minor cleanup of lead or asbestos.
- Debris from pest infestation such as carcasses, casings, frass and bird droppings can cause severe allergic reactions as well as certain lung disorders and bacterial infections. A pest mitigation specialist may be needed.

SLIDE 12: Hazard vs. Risk

- Any given object may have one or more of these properties. A mirror may contain mercury, but it may also be heavy, awkward to carry, have broken glass or an insect infestation.
- Identification of hazards requires various levels of knowledge of the collection, environmental conditions, and production techniques.
- Having a hazard is not the same as knowing the health or safety risk--This is an important distinction!
- Just because there is a hazardous object in the collection doesn't mean it needs to be removed from the collection.
- A sharp shell is a hazard and a deteriorating mercury mirror is a hazard. Generally, more people feel comfortable handling the shell than the mirror, because it is a simple, common risk assessment.
- This presentation should help set up a management plan that will assist in navigating the hazards in a collection so that the comfort level dealing with the mercury mirror is the same as handling the shell—even if that means getting someone else to help.
- A ***hazard*** is a material's basic property. (The shell is sharp, the mercury is toxic). ***Risk*** is the degree to which that hazard affects the body's systems through illness or trauma.
- Understanding risk involves understanding **how** the hazardous condition is being worked with.
- A highly hazardous material may not pose a high risk IF proper safety controls are in place. Also, workers have to be trained on how to use the controls AND actually use them! ACTUALLY WEARING GLOVES!
- Inherent hazards may be difficult to change, but the risk from working with that hazard may be controlled.
- The risk can change for a specific material depending on several things:
    - The kind of safety protocols that are used,
    - How the material is used and the quantity of material that is present, and
    - The route of exposure
- Risk can be reduced by either reducing the contaminant or by reducing the possibility of exposure.

SLIDE 13: Hazard vs. Risk (Handling Techniques)

- Hazards can be controlled using *handling techniques*, thereby changing the risk.
- Formaldehyde, is a known human carcinogen and can be extremely hazardous if inhaled or absorbed through eyes, skin, or mucous membranes; however, with proper health and safety protocols (as seen here) any potential exposures to formaldehyde can be minimized.
- In the majority of cases, prudent health and safety measures can significantly reduce, if not eliminate risk.
- Personal Protective Equipment is a very effective mean of reducing the risk associated with formaldehyde.
- Personal Protective Equipment refers to things such as gloves, goggles, aprons, AND head protection and is referred to as PPE.
- Most collections won't have large vats of formaldehyde. There may only be one or two jars of preserved specimens. But the handling protocols don't change. Even if only topping off one specimen jar, the same same procedures of local ventilation, a respirator (if there is not local venti0lation), gloves, careful handling and spill control materials just in case should still be used.

SLIDE 14: Hazard vs. Risk (Usage)

- HOW the hazardous material is used also changes the risk.
- In the case of vermilion or cinnabar, it's a sulfide of mercury—so high hazard –it can be found as a mineral specimen, carved into decorative artifacts or ground up as a pigment or colorant. Mercury droplets actually form on the surface of the mineral specimen.
- In most paintings or as a colorant in Asian lacquers, it will be mixed with a binder. This reduces the risk—although it is still not entirely eliminated.
- Unless the surface is severely degraded or damaged, and with careful handling the likelihood of a painting containing vermillion affecting anyone's health and safety is very low. It is higher risk when it is under-bound, deteriorated or as a carved or raw mineral specimen.
- Proper safety controls become more critical to controlling risk in these cases. So even if wearing gloves, be aware that the loose pigment or mercury droplets can easily be transferred from gloves to other surfaces.

SLIDE 15: Hazard vs. Risk (Extreme Cases)

- Some items remain high risk no matter what precautions are taken when handling, because the high probability of the precautions failing.
- The rosary pea is made into jewelry in a variety of cultures, but contains a toxin which is similar to ricin and has the potential to cause total bodily system shut down—and is therefore extremely high hazard.
- Even with proper warning labels and safety protocols, rosary peas remain high risk--even the smallest exposure can cause severe illness or even death. In some cases, limiting access may be the only appropriate step in risk management.

SLIDE 16: Routes of Exposure

- The rosary pea also demonstrates how understanding routes of exposure effects risk. The effects of the toxin in the rosary pea depends on whether it is breathed in, swallowed, or injected. The major signs and symptoms of poisoning depend on how someone was exposed—referred to as the route of exposure--AND how **much** they were exposed to (or the dose).
- Understanding how a hazard can have a health effect is essential for taking the appropriate preventative measures.
- Elemental mercury is primarily a concern when it is inhaled as a vapor--less than 1% of the total amount of liquid mercury is absorbed if held it in the hand or swallowed it. But if vapor is created by agitating the liquid, or using a vacuum to clean it up, 80% of inhaled mercury vapor is absorbed. Similarly, asbestos poses an inhalation risk, while lead is primarily hazardous via ingestion.

SLIDE 17-19: Developing a Safety Plan

- The rosary pea is an extreme example of why collections should be safe, but often the question is raised "Why is it important?" or "Is it really worth the expense or time or resources when I have all these other things to do?"
- Managers are responsible to both their staff and public for providing a safe, healthy, and enjoyable experience.
- Ultimately it's the health and safety of staff that benefits from a safe collection.
- Collections with uncontrolled safety risks are inaccessible. Nobody can come read the collection's books if they are covered in mold.
- Once the commitment is made to create a safety program, it's not as difficult or overwhelming as it first appears. The technologies of hazard control are well-developed, often inexpensive, and easily accessible.
- How then can we reduce the health and safety risks associated with these materials? Institutions generally recognize that collections require a disaster plans. The same principles apply to these safety plans.
- The process involves identifying the hazards, protecting against negative events, keep evaluating and improving the process.

SLIDE 20: Safety Policy and Protocols

- A safe work environment should have a number of safety programs, to ensure health and safety but also to comply with the Occupational Safety & Health Administration (OSHA) standards.
- Federal OSHA regulations apply to all federal government agencies AND private employers including museums, cultural institutions and private business. OSHA regulations apply regardless of the size of the organization.
- States may administer their own programs, at least as stringent as federal requirements, but may have additional unique requirements. If in a state that administers its own program, follow the state laws.
- Every workplace should have an Occupational Health and Safety Plan, which outlines general safety policies throughout the institution. Within this plan there are numerous programs for dealing with specific hazards and tasks such as using chemicals, using machinery, or handling hazardous materials.
- A collection-based Risk Management Plan will identify the specific hazards in the collection. It will outline health and safety risks of working with these hazards and then establish procedures for controlling the risk.
- Development of the risk management plan can also rely on other safety procedures.
- A Job Hazard Analysis (JHA) is a technique that uses a step-by-step work-task chart to list the elements of a hazardous task.
- A blank OSHA Job Hazard Analysis form is included in the handout packet. This example is from an *AIC News* article so it was intended for general conservation tasks and gifts and JHA for using scaffolding to clean an object.

SLIDE 21: Benefits of a Risk Management Plan

- A written and clearly communicated Plan has the following benefits
  - **(1)** Hazards can be systematically identified
  - **(2)** By formalizing safety practices that may already be in place, it ensures that EVERYONE in the institution follows them.
  - **(3)** Worker efficiency is increased by not having to start from scratch every time that hazard arises or there is a change in staff.
  - **(4)** It allows for the systematic or planned budgeting of resources. A plan may not be implemented overnight, but a well-justified list of priorities can be presented during budget discussions for future projects.
  - **(5)** Injuries and illnesses are reduced, boosting productivity and saving on legal costs, worker compensation and fines.
- The goal of these policies is to protect workers from injuries and illnesses, to prevent assets from being destroyed by fire or structural failures, and to prevent polluting the environment.

SLIDE 22: Elements of a Risk Management Plan

- A plan must include these 5 elements:
  1) A clear definition of responsibilities,
  2) An Outline of practices to identify hazards,
  3) An exposure assessment for determining what the actual risk is and how to consult professionals,
  4) Identification of ways to minimize risk, and how to perform and re-evaluate them, and
  5) A system of training and hazard communication. Staff should be trained on how follow all the procedures outlined in the previous steps.
- This plan does not have to be extensive or elaborate to meet these criteria. It simply needs to serve as a plan of action for the safe handling and care of both the objects and the individuals

SLIDE 23: Assigning Responsibility

- A good plan starts with outlining roles and responsibilities.
- Managers and supervisors should demonstrate commitment to safety and health.
- Supervisors make sure that safety precautions are included in budgets and project deadlines. Safety is another cost of doing business—equally as important as all the other aspects of managing the collection.
- Staff needs to feel comfortable reporting and discussing their concerns as well as making suggestions on how to do a task more safely.
- If there isn't a professional safety consultant on staff or contract, then someone on staff should be assigned as a safety officer.
- Even contractors and temporary workers need to be included in all training and discussions. They must alert others to any risks their own work brings to the workplace.

SLIDE 24: Hazard Identification

- The presence of hazardous conditions can be identified through a variety of ways:
    - Begin by knowing materials and when to expect hazards. Research the materials before beginning a project or handling an object.
    - Review archival records and original collector's notes. Knowledge of past and current preservation methods within the institution can reveal hazards that might otherwise be unknown.
    - Understand the building's construction, how the collections are housed and handled, and environmental conditions. If the building was built prior to the 1970's, there's a good chance lead paint is on the walls (even if it's covered with latex-based paint), pipe fittings may have asbestos mud, or the attic ceiling is covered with asbestos-sprayed-on insulation. Be aware of the areas that are likely to leak, flood or attract pests.
    - Confirm suspicions with analytical testing, such as radiation surveys, and environmental analyses.

SLIDE 25: Hazard Identification, Testing

- There are various testing methods that can be applied to objects to identify hazards. These methods test for the presence of a substance and **not** for risk. The surface concentration of a hazardous substance does not translate to a quantifiable health hazard. For example, sampling pesticides that have been unevenly applied, that have migrated unevenly to the surface, or that were selectively applied in the first place.
- For objects to be repatriated, the risk is different, since these objects will potentially be used. For an excellent discussion on repatriation, please see the US Department of Interior fact sheet listed in our resource bibliography.
- The following tests that may not necessarily be appropriate for collection caretakers to conduct themselves, but are included in the discussion to bring awareness of what is available and can know what to expect from someone offering these services.
- While some of these can be used by conservators and collections staff, we recommend consulting safety professionals or a laboratory certified to perform these tests. It is important to understand the methods to be sure they do not require invasive techniques and that the object can withstand them.

SLIDE 26: Hazard Identification, Testing

- Particulate hazards, such as heavy metal or organic pesticides, can be collected from the surface of an object using a surface wipe or micro-vacuuming. This involves using filter paper, gauze or cotton swabs, typically moistened with water, alcohol or other solvent selected for the type of particulate being collected and the object surface. These samples are analyzed depending on the suspected contaminant.
- Spot tests and indicator papers can be purchased commercially, or simple chemical reactions can be conducted on-site for things like lead and arsenic.
- X-ray Fluorescence or XRF requires highly specialized analytical equipment, but provides the most specific results. XRF can be used directly on the object without taking samples to identify elements. Since it is now more readily available in a portable unit, it is more widely used by collections to identify materials.

SLIDE 27: Hazard Identification, Testing

- A mercury vapor analyzer can detect mercury vapor using a wand attachment to use within cabinets or bagged objects.
- Collection of gases from a whole air samples can be conducted using a sample bag or canister. These samples can then be sent out to commercial labs.
- There are also indicator papers and powders that will change colors in the presence of certain vapors.
- Radiation can be detected with a Geiger counter, which may be an expensive investment, but radioactive materials will also expose indicator papers and film. Certain materials such as uranium glass will have a characteristic fluorescence under UV light.
- Research and examination helps significantly with identification, these methods serve to confirm suspicions.

SLIDE 28: Exposure Assessment

- People are often tempted to skip over exposure assessment and go right to implementing controls. This can result in situations that are overly restrictive and cautious, or under controlled because of false assumptions of low risk.
- Investing time and money upfront on good exposure assessments may save lots of money by putting the risk of work methods into perspective.
- A qualified safety specialist or industrial hygienist can determine risks by monitoring exposure in relation to work practices. This may include physical, chemical, radiological or biological evaluations and will focus on the potential for injury, trauma or illness.
- Get to know a healthcare professional and tell them what you do and what kind of chemicals and materials you come in contact with. Explain the frequency in a week that you work with such chemicals as many biological tests (like urine samples) will have a limited window for testing post exposure.
- When discussing situations with these professionals, it is important to recognize that a collection-based work environment is not familiar to most safety experts or even physicians.
- Larger institutions will have safety specialists or industrial hygienists on staff, but smaller organizations can seek out professional help through numerous public health and safety resources that will be discussed in the next section.
- Understand that a safety specialist not familiar with an art collection may need assistance for determining the best method for the collection.

SLIDE 29: Exposure Assessment, The Dose Makes The Poison.

- Exposure is defined as the opportunity for the body to receive a dose substantial enough to result in an adverse health effect.
- Exposure can be measured in a variety of ways depending on the possible routes of entry into the body and an understanding of how a specific contaminant will be encountered. Possible routes of entry include inhalation, ingestion, or absorption through skin, eyes, or mucous membranes.
- Inhalation dose can be measured via an air sample in the person's "breathing zone", which is considered a radius of 1-2 feet around your head.
- Dermal wipes or patch tests can estimate exposure dose of absorption either through the skin or ingestion.
- An experienced industrial hygienist will then evaluate the results against regulatory standards.
- Significant exposure through routes of entry other than inhalation may require biological monitoring (typically blood, urine, or exhaled breath). These are markers of exposure, not health effect. Biological monitoring, however, can help the physician assess total body burden from all 3 routes of entry.
- The results of these surveys will help determine how to remediate or control exposures. This is the most critical element of an effective risk management plan.
- Keep in mind that not every project will require urine tests—but some might, such as for inorganic arsenic or mercury. A health and safety professional will be able to determine whether or not the amount of naphthalene in the air from that donation of old clothes containing moth balls requires that staff that processed the collection see their physicians for further medical consultation.
- Once the hazard and its associated risks have been assessed, a plan of action for reducing risks must be developed.

SLIDE 30: Hierarchy for Controls

1) Removal: the best line of defense. If the hazard can be removed from the collection, there is no longer a risk. Obviously as a collecting organization, this isn't always an option.
2) Isolate hazard
3) Proper work practices: teach people to work safety and provide the equipment and environment to do so.

SLIDE 31: Removal or Substitution

- Is the item vital to the collection? Could the same message be delivered with a replica? Can certain elements of the collection be removed and others retained?
- Try to efficiently remove anything that might have come in contact with the collection, like contaminated packing materials and beware of cross-contaminating work areas or other objects.
- Replace contaminated cabinets. After decades of containing off-gassing materials storage cabinets may have residual solids or volatile contaminates on the surfaces or within the wood that are very difficult or almost impossible to remove.
- Removal doesn't just mean just having to get rid of the object. Environmental hazards (such as mold or insect debris) can often be removed. Always use a vacuum that contains a HEPA filter. While Nilfisk brand is the gold standard for this—there are many other HEPA filter vacuums for a fraction of the cost. Remember, that cleaning removes the contaminant but can create additional hazardous waste.
- Consider using replacements or replicas such as: Digital copies of photographs, paper and books or modern replica mirrors in place of mercury containing glasses.
- Consider the new risks associated with replacements, for example in fluid preserved collections. The majority will be in ethanol or isopropanol. Many people think that ethanol is rather benign and safer than formaldehyde. But inhaling ethanol vapor hits the blood stream quickly, especially if topping off bottles or examining preserved specimens for hours without ventilation. The greatest risk then might be light-headedness and falling injuries.

SLIDE 32: Hazardous Waste

- Hazardous objects and any materials used for their storage, treatment or transport may require disposal as hazardous waste.
- It is difficult to make a blanket statement about hazardous waste disposal. It is determined at the local level. For example, many cities or counties will have drop off locations or a professional disposal contractor may be required.
- Local or state environmental regulation departments will know the specific tests and regulations for proper disposal, and any licensing that may needed. Do NOT be afraid to call them! Many people fear that a call for advice will lead to inspections and fines. But these professionals would rather have people ask for their help and on-site evaluations instead of creating environmental contamination.
- More information on hazardous waste disposal is available on the EPA website.

SLIDE 33: Isolating the Hazard

- In many cases, objects cannot be completely decontaminated and should be isolated to prevent contamination of surrounding areas and objects.
- Often well-sealed containers or sheeting, acrylic drawer tops, or in vitrines, or placing radioactive objects behind appropriate shielding is all that is needed for storage and display.
- When working on a contaminated collection, fume hoods, ventilation trunks or respirators should be used to protect from breathing in contaminants.

SLIDE 34: Safe Work Practices

- Safe work practices can prevent contamination through:
    - Diligent housekeeping and proper handling of materials,
    - The use of personal protective equipment, and
    - Thoughtful decisions regarding choosing and/or altering treatments and collection policies.

SLIDE 35: Housekeeping and Handling

- Prudent housekeeping reduces pests, dust, debris and hazardous residues as well as the possibility of contaminating the storage bins, cases or flooring.
- Storage containers and work surfaces should be cleaned before reuse or covered with removable or disposable materials.
- Try to segregate hazardous collections from non-hazardous, if possible.
- Use closed containers or coverings for short-distance transport of objects

SLIDE 36: Personal Protective Equipment

- Personal protective equipment must be selected to match the work task hazards identified.
- For respirators, use the right kind of mask, cartridge or filter for the hazard as indicated by the manufacturer. If a respirator, and this includes disposable dust masks, is required to complete a task, it should be fit tested by a safety professional. The handout packet includes a brochure about using disposable face masks.
- The materials for protective clothing and gloves are also specific to the hazard—particularly chemicals.
- A glove selection chart that is part of the handouts. Safety catalogues (or our chart) should indicate the glove material that will prevent breakthrough or degradation for at least 8 hours or a typical day's work.
- It may be surprising how restricted the options are for protective materials, for example, for acetone. Many people will be wearing nitrile gloves for accession numbering. The chart indicates that the container of acetone spilled, nitrile gloves would offer very little protection.
- When in doubt, call the glove manufacturer for help.
- A task may have more than one hazard that requires different types of protective equipment.
- Personal hygiene practices are habits that we are all familiar with. Things like:
    - Remove gloves inside out to prevent skin contamination.
    - Don't reuse contaminated materials.
    - Wash hands after completing tasks.
    - Don't eat, drink, smoke, or apply cosmetics while working with hazardous collections.
    - Don't store food in contaminated areas.
    - Avoid touching eyes, nose, or mouth while working.
    - Use a HEPA vacuum or disposable wipes to clean break areas, telephones, and other surfaces.
- **Personal Protective Equipment is the last line of defense.** That means other safety protocols should be put into effect first. PPE is exactly that--personal protection--it does not protect visitors or coworkers while working.

SLIDE 37: Treatment and Collection Management Protocols

- Once hazards have been identified, it may affect how the objects can or should be treated or exhibited. A pesticide contaminated object requested for loan may have to be reconsidered if it cannot be treated, shipped or displayed safely OR special shipping and exhibition mounts and protective wraps may have to be constructed.
- Try to select treatments that reduce hazards and risks. For example, use non-toxic pest treatment methods as part of an integrated pest management program to void chemicals
- Protocols for exhibition, loan and storage should also be adapted to address risks.
- For exhibitions, consider the case and building construction. Dioramas and old mounts should be tested for asbestos, and lead paint, prior to demolition. A hazardous materials testing consultant will be needed to do this.
- Clearly document any hazardous objects included in current exhibitions to protect workers during future de-installations.
- Hands-on displays or "living collections" especially those that contain "hand-me-downs" can be a real danger. There should be clearly outlined policies for how these objects are handled by the public. If education staff wants to use fascinating corals or donated costumes in hands-on learning centers, realize that some must only be handled by trained docents not by visitors, especially children.
- Storage protocols can range from simple to complex: Guns and explosives should never be assumed to be unloaded or inactivated. Facing guns toward an exterior wall of the storage area, so no one ever walks in front of them, is a simple and effective method of risk management. On the other hand, collections containing specimens preserved in flammable liquids require specially-designed storage areas with fire detection and prevention controls.

SLIDE 38: Hazard Communication

- Once all of the previous steps have been completed there should be a clear and concise protocol for communicating all of these conditions.
- All collection users should be given written fact sheets about the known or suspected hazards. We've given examples of how some institutions like the National Museum of Natural History have created these kinds of fact sheets in the resource list.
- Warning signs and labels should be posted on storage room doors or shelves; Include hazards in the collections records for new acquisitions as well as newly identified or suspected hazards on already accessioned objects.
- Access restrictions should be posted on each case or storage area that requires special ventilation or other pre-retrieval measures.
- The "Oh No! Ethnobotany" article which is in the resource list is a great example of creating a collection specific hazard communication system.

SLIDE 39: Hazard Communication, Shipping

- Any collection items leaving the collection must be accompanied by documentation disclosing hazardous materials; this is a requirement of the federal OSHA Hazard Communication Standard.
- Staff responsible for shipping and receiving are also required to take US department of transportation Hazardous Materials Transport courses and/or International Air Transport Association Dangerous Goods Training. These are provided through private training vendors.
- Hazard disclosures should be obtained *from* lenders as part of standard loan paperwork. Do not assume because there isn't a disclosure that the collections are safe—ask if they've tested their collections for pesticides.

SLIDE 40: Training

- All collection users (from employees to visiting researchers to docents to interns to contractors), must be trained on the organization's Occupational Health and Safety and Risk Management Plans.
- If you don't receive safety training at your new job, internship, or contract ask your supervisor about safety procedures. This includes periodic safety training updates.

SLIDE 41: Checklist for Sample Risk Management Plan

- This sample checklist for a risk management plan for residual pesticides can be easily adapted for any general or specific hazard.
- The next time someone suspects there is a pesticide contaminated object, they find the written plan, and can immediately follow the steps outlined in that plan.

SLIDE 42/43: Occupational Specialties

- Once something is confirmed or suspected to be hazardous in the collection—Don't panic. There are very simple precautions and procedures that can be taken by anyone to reduce risk.
- On an administration, registrar or basic collection management level:
    - There are a lot of available resources for researching materials online and in the handouts we provided. If researching online, make sure to check sources! Is the information coming from a reliable source like a museum or government agency?
    - Provide gloves, aprons, goggles and other PPE—all are available through lab safety suppliers or even Amazon or the local drug store.
    - Simple rehousing or bagging of materials, moving items to more well-ventilated areas or out of exhibition spaces, even as temporary measures, can help reduce the risk. If someone drops off an object to donate and there are suspicions about it, place it in a bag and clearly label it until more information is obtained.
    - Hazard communication, particularly in the early stages of dealing with a hazardous material is important. Announce the hazard and limit access to the collections. Clearly label anything that poses a health risk with what the risk is and who to contact for access.

- Perform basic sampling or housekeeping ONLY with the training and the correct equipment to do so. Removing mold does not require a conservator, but proper technique and equipment is important.
- Another issue might be leaking of hazardous materials, such as preservatives, refrigerants, mercury from mirrors and scientific equipment. Spills such as these, emphasize the importance of having a risk management plan in place and having a trained staff. Even though these materials are often regulated as hazardous waste, staff can identify the problem and take measures to evacuate and ventilate the area.
- In some cases, the severity of spill dictates whether specialized help is required. Purchase mercury spill kits to clean up small amounts of liquid mercury. For medium spills (more than a thermometer) ventilate the area and call the local health or fire department. Anything over two tablespoons requires contacting the National Response Center.
- There are simple tests for lead or arsenic that are commercially available, however, always have a professional confirm the results before continuing with the project.
- Dosimetry badges or a Geiger counter can monitor radiation exposure. Dosimetry badges measure the accumulated amount of radiation one is exposed to over a certain period of time. Quarterly monitoring can be as low as $65 per year.
- Make sure that collection policies are up-to–date and address these issues.

- When is a conservator or preservation specialist needed?
  - Any time there are more complex treatment issues or staff does not have the training on housekeeping techniques or if more complex sampling or testing is required, consult a conservator.
  - Many conservators will have the knowledge and analytical tools to identify materials or the resources to proceed with identification.
  - A conservator can also help with proper rehousing and isolation techniques as well as collection surveys to identify additional hazardous situations. Once staff have received the proper training they may be able to complete the rest of the project on their own.
  - Conservators can also assist with replicas or visual replacements or altering objects to remove hazardous materials.
- When to call in a health and safety specialist?
  - At the point in Collection and Safety Risk Management planning when there are more questions than answers, or that the control solutions (labeling, training, testing) are beyond time, equipment or budget resources.
  - Sit down with coworkers and managers and merge these Hazardous Materials Risk Management steps into existing collections assessment plan, IPM program, and facility inspection and maintenance plans.
  - Just as a building manager spends time before a problem happens getting to know the utility experts in the area, calling them in for free consults, highlight all the people that should be contact to inspect historic houses or small studios for fire code problems and get their free advice then act on it and ask them in again.
  - Hazardous waste regulators would rather come by and spend a morning helping with the right paperwork, assessing waste disposal levels, etc. before a spill happens.
  - Assign staff, interns or volunteers to research the type of gloves needed for various work; but for a fume hood or respirators, get an industrial hygienist or safety specialist.
  - There are certain high hazard materials (such as lead, asbestos and radiation) that require specialized training and state licensing.
  - Handling or simple cleaning of asbestos-containing or lead-based painted objects might only require OSHA Asbestos Awareness training but a safety specialist or industrial hygienist has to provide it, followed by a safe work protocol and periodic monitoring according to OSHA regulations.
  - Abatement or removal of delaminated asbestos insulation from a storage area requires licensed asbestos workers and firms.
  - If there is not a safety specialist on staff or contract, call the state environmental protection agency. A web search for asbestos should lead to the right office and to a list of state licensed firms.

SLIDE 44: Health & Safety for Museum Professionals

- *Health & Safety for Museum Professionals* is a gateway book covering the basics of every environmental, safety and health (ES&H) program components. One of the best parts includes the dozens of page long sidebars submitted by museum and collection staff, on real-world problems and solutions through the use of many stakeholders in a facility. For this discussion, focus on the process by which they approached the problem, solved it with safety professionals and then implemented and owned the solutions from then on.

SLIDE 45: Uranium Glass and Radiation

- Uranium Glass
  - Uranium was used into the 1940s as a colorant for glass, glaze and enamels.
  - In this case study, Strahan worked with a radiation safety specialist to be sure that the emitted radioactivity from their collection was controlled through distance and shielding, and in storage, by separating the pieces to diffuse the hotspots.
  - Strahan also notes that identifying and segregating them is critical because long term exposure to radiation emitted from uranium containing objects may alter the thermoluminescense of other objects stored next to them like ancient ceramics or bronzes with clay cores.
  - The main health hazard is usually not the radiation itself (which gets the most attention about especially with Fiesta ware) but it's the ingestion or inhalation of radioactive particles.
  - She cautions commercial conservators or restoration workers to wear a respirator and work under a hood when drilling, smoothing, polishing. Ingested or inhaled uranium particles are taken up by the kidneys, causing renal failure.
- Radium paint dust at the National Air and Space Museum.
  - A license from the Nuclear Regulatory Commission (NRC) is usually not required for naturally-occurring radioactive materials, but is for man-made sources such as promethium dials in spacecraft. The NRC also licenses anyone holding radium 226 sources, which is a constituent of radium paint on aircraft dials.
  - At the 2015 Annual AIC Meeting, Sharon Norquest and Amelia Kile of National Air and Space Museum (NASM) presented on Working with a Collection of Radioactive Aircraft Instruments, a survey project conducted with the help of a Smithsonian Industrial Hygienist and Radiation Safety Specialist Dave Peters. NASM has over a hundred radium painted instruments.
  - Even after they stop glowing in the dark, the radium's half-life is still 1600 years. Radium primarily emits alpha particles, which can be blocked by paper or clothing. But the paint is composed of radium salt, luminescent material and paint binder. When that flakes, or dust is formed by working on the instrument, the inhalation or ingestion hazard of radium may lead to bone cancer.
  - They conducted routine wipe samples on surfaces, analyzed on site by a liquid scintillation counter. The Industrial Hygienist formulated a control program for them to reduce the risk of paint flakes. Work surfaces were decontaminated; work was confined to dedicated fume hoods; tools used were labeled with radioactive stickers; instruments were individually bagged in polyethylene to prevent aersolization and to prevent cross-contamination. This resulted in a safe well-monitored working environment and a safe Plexiglass case for public display, which kept the dose well below regulations for the public.
  - While this required the assistance of someone knowledgeable of radiation safety, with the appropriate instruments, the actual control plans were easily done by staff and maintained by staff. This should be published soon in the Objects Specialty Group Postprints.

SLIDE 46: Leaks and Spills

- Damien Hirst (Museum of Fine Arts, Boston)
    - The study has lessons for exhibit display design and pre-planning, because the public frankly does not expect any risks from a museum or gallery.
    - These sculptures and work involving mammal specimens preserved in formaldehyde.
    - A report recently in *Analytical Methods* by a firm reporting relatively high formaldehyde measurements around Hirst displays at the Tate and also in the Summer Palace.
    - How could this problem be anticipated and prevented in exhibits?
    - Once a leak, for instance, is detected after the fact, it is difficult to back calculate possible exposures and by now the real issue is how to handle public perception and concern.

SLIDE 47: Exhibitions and Building Facilities

- Mike Frigon, Safety Manager at the Science Museum of Minnesota, who makes this point: "The moral of the story is that it's better to work with the authorities than to try and hide from them," when discovering that the exhibition design (not the objects themselves) caused health and safety concerns.

SLIDE 48: Finding A Conservator

- The best way to find a conservator is referrals from other individuals in the area or through conservation or museum-related organizations.
- Remember that conservators have different specialties and may not have experience with all hazardous materials. Make sure to clearly explain the situation.
- The American Institute for Conservation has a Find a Conservator feature on their website. This resource will only list conservators who are Professional Associates or Fellows which is an application process to demonstrate that they are actually a practicing conservator--- it is not an endorsement or statement of quality. There are very many well-qualified conservators who are associate members or not members of AIC, so don't panic if a particular conservator is not on this list. As with every service, references and examples of previous work are important for selecting a conservator.
- There are also various other resources that provide lists of conservators including local conservation guilds and other private websites.
- In general, a conservator will have better knowledge of *specific museum collection* hazards than non-collection trained health and safety specialists.

SLIDE 49: Finding Health & Safety Professionals

- Every specialist will have some kind of professional benchmarks that are required of their field. Look for evidence of that they are active within their profession such as continuing education and ongoing presentations and publishing.

Occupational safety managers or engineers (CSP, Certified Safety Professional) Hire an Occupational Safety Professional to manage an overall safety program. They focus on preventing injuries with emphasis on physical hazards (electrical, mechanical, hazardous and combustible materials, fall protection, working at heights, power tools, confined spaces). CSPs are also experienced in emergency management, fire protection, and training and will have cross-over experience in industrial hygiene monitoring.

Fire protection engineer (PE, Professional Engineer) who is skilled at designing and inspecting fire detection and prevention systems based upon complex life safety and building codes (National Fire Protection Association among others) regulating flammable or combustible liquid storage, egress and exits, etc. Hire a fire protection engineer for more comprehensive building design and asset protection plan needs.

Industrial hygienists (CIH, Certified Industrial Hygienist) also are a specialized group**,** usually with backgrounds in the biological, chemical and physical sciences, with experience in ventilation and acoustical engineering, and focus on prevention of diseases or other health hazards arising from the workplace. Seek the assistance from an IH to evaluate inhalation, or dermal exposures from chemicals, noise, biohazards, particulates and fibers. An IH can provide more detailed engineering system design recommendations and specialized training in PPE for health hazard control, like respirators and gloves. Radiation safety is a specialty for some IHs. But with lasers and ionizing radiation sources and analytical instruments, consider the experience of a **Health physicist (CHP, Certified Health Physicist)** who is skilled by education and experience to specialize in radiological hazard detection and protection.

Occupational medicine (Board Certified in Occupational Medicine) is a specialized field, usually obtained through a Master's program in public health after an MD is earned. Every facility needs to have some relationship with a medical clinic that has knowledge of industrial illness and injury prevention, surveillance and treatment. There are many regulatory required medical certification exams such as Department of Transportation driver's exams, respirator certifications, and fitness for duty exams (example: ability to lift certain amount of weight).

Environmental protection is a broad area, usually requiring a minimum B.S. in environmental science, environmental or public health. States may require licensure for certain activities, such as radon monitoring. A facility will want to contact these specialists in a county or state agency for reasons of hazardous waste disposal, or advice on proper spill and leak control measures, or permitting for underground storage tanks, for example. Hazardous waste disposal firms would not be the first contractor to pick. Talk with an environmental protection specialist first, either in a university or agency or in county offices.

SLIDE 50: Finding Health & Safety Professionals

- Some services may be of little or no cost: A facility's insurance company may have a risk management department that will send an IH or fire protection engineer. This may cost but it will definitely help insurance premiums if they were hired to help.
- OSHA's On-site Consultation Program offers free and confidential advice to small and medium-sized businesses in all states across the country for program development, exposure sampling, and training.
- On-site Consultation services are separate from enforcement. OSHA started this program in response to small business complaints that they want to provide a safe workplace if only they knew how to (like small conservation labs and museums it is hard to hire lawyers and safety professionals to explain how to comply with all regulations). No citations or penalties are issued and the only agreed obligation is to work with them on ways to correct serious hazards, a reasonable commitment for anyone.

SLIDE 51: Finding Health & Safety Professionals

- Consult facilities with environmental, health and safety staff.
    - Governmental units (such as National Park Service, Dept. of Energy, Defense branches, or Smithsonian Institution) with historical parks and displays, galleries, and museums).
    - Academic institutions (for example state universities) with archives, libraries, onsite museums and collecting units in their teaching departments. Consider calling their environmental health and safety office for some pro-bono help. As busy as they are, the promise of the "behind-the-scenes" tour is very likely to do the trick!

SLIDE 52: Finding Health & Safety Professionals

- Public health and safety regulatory agencies in countries around the world also offer complete program development and worker training resources. Listed are a few that have excellent websites with downloadable materials, podcasts, videos etc.

SLIDE 53: Finding Health & Safety Professionals

- Professional organizations world-wide, with technical information and listings for consultants, experts and clinicians, include these for Industrial/Occupational Hygiene:
  - American Industrial Hygiene Association
  - International Occupational Hygiene Association.
  - Canadian Registration Board of Occupational Hygienists
  - International Network of Safety and Health Practitioner Organizations
- The American Industrial Hygiene Association maintains a list for industrial hygiene safety and environmental consultants in every state. Proposal visits should be at no charge and the bid may be less expensive and more helpful than anticipated.

SLIDE 54: Finding Health & Safety Professionals

- Occupational Safety:
  - American Society of Safety Engineers
  - US National Safety Council
  - UK Institution of Occupational Safety and Health
  - Board of Canadian Registered Safety Professionals

SLIDE 55: Finding Health & Safety Professionals

- Radiation Safety:
  - Health Physics Society
- Occupational Medicine Clinics and Practitioners:
  - American College of Occupational and Environmental Medicine
  - Association of Occupational and Environmental Clinics

SLIDE 56-58: Finding Health & Safety Professionals: What to tell them.

- It's important to remember that Collection management involves workplace scenarios that are unique and may not be intuitive to many public health and safety folks.
- Most primary care physicians are not familiar with conservators' work and are not strongly trained to recognize the links between occupational factors and resulting health concerns. It will be up to workers to give them the information they need to understand and resolve health and safety risks.
- A Safety Specialist or Physician focuses on **the way you work**, considering the relationship between the worker, the task, and the methods used to determine possible injuries or illnesses that could result from any step of the process.
- Be prepared to explain to any consultant:
  - Specific work activities.
  - Detailed description of task duration and frequency. This places exposure monitoring results in the proper context as to the conditions it represents: a full-shift, time-weighted average or a short-term peak exposure.
  - Safety Data Sheets (SDS) or records of past treatment chemicals or inherent hazards.
  - Any symptoms or concerns.
  - Control & preventive measures in place and used.
  - Previous work, home (hobbies) and environmental exposures (this is particularly important to physicians when they are trying to determine how much exposure comes from work vs. environmental or home exposure).
  - Any available analytical data, such as x-ray fluorescence or radiation surveys or exposure sampling.
  - If testing of the object or specimen is necessary to identify the presence of chemical, radiological, or biological hazard in a collection, the IH must be asked to detail the methods and materials they plan to use so that any restrictions can be resolved.

SLIDE 59: Resources

- The resource list accompanying the presentation has good information separated out by topic.
- The Health & Safety Committee will also be working the C2CC to get more health and safety specific topics up on the website.

SLIDE 60: Health & Safety Committee Contact

- The Health and Safety Committee is here to help. It is our mission to provide resources on health and safety topics related to collection care. We have relationships with a network of health professionals that are familiar with dealing with our kind of occupational hazards.
- So please contact the Committee with any questions or concerns about work projects or conditions or help creating these kinds of safety documents. Lots of information can be found on the wiki and website

For more information about AIC Health & Safety Committee resources, please visit our website and wiki:

www.conservation-us.org/healthandsafety
http://www.conservation-wiki.com/wiki/Health_&_Safety

Contact the Health & Safety Committee via email:
HealthandSafety@conservation-us.org