



Conserve O Gram

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Arsenic Health and Safety Update

Background

From the 18th century to the late 20th century, arsenic compounds were commonly applied as a preservative to biological specimens and ethnographic objects, not only as insecticides, but also as herbicides, rodenticides, and antibiotics. Arsenic in the form of soap mixtures and sprays (arsenic trioxide and sodium arsenite) was used to preserve bird and mammal skins and mounts. Arsenic was also used as a fixative in the preparation of wet specimens to control the growth of microorganisms.

Arsenic compounds retain their toxicity, and once treated, objects containing arsenic can probably never be fully decontaminated. Following its application, arsenic tends to adhere strongly to hair and feathers. Sometimes the compounds may be visible as white powder. In general, the older the specimen, the greater the likelihood that arsenic will be present. Accordingly, curatorial staff must exercise precautions when handling biological specimens collected and prepared before the 1980s. (The use of arsenic in the field preparation of specimens and in some museum applications post-1980 has been documented.)

National Park Service museum collections may contain arsenic-treated natural history specimens and ethnographic objects. These items pose a health risk to curatorial staff and to the public who come into physical contact with the objects, unless proper precautions are taken. Curatorial staff must take steps to identify arsenic compounds that may be on museum objects and to develop procedures for the proper handling of these items. This *Conserve O Gram* provides guidance on how to test collections for the

presence of arsenic and to implement proper handling, storage, and use precautions in the collections.

Health Related Effects

Route of Entry: Skin absorption, inhalation, and ingestion.

Organs Affected: Stomach, liver, intestines, heart, lungs, blood vessels, kidneys, nervous system, skin, and nails.

Acute (short-term) Effects: Weakness, headache, gastro-intestinal discomfort, changes in skin and nail texture and pigmentation, respiratory problems, coughing, irregular heart beat, breathing difficulty, and chest pain.

Chronic (long-term) Effects: General abnormalities to the pigmentation of the skin and abnormalities to nails and skin on the palms of the hands and soles of the feet. Linked to nonmalignant respiratory diseases, numerous diseases of the nervous system, emphysema, kidney diseases, and many heart diseases.

Carcinogenic Effects: A carcinogen, causes various cancers, including liver cancer, cancers of the reproductive organs, skin cancer, and lung cancer.

Reproductive Effects: May impair nail development in the fetus or lead to nail deformities in the newborn, and causes changes in gene expression.

harmful, as long as safety precautions and procedures are consistently practiced and adhered to at all times.

Handling, Storage, and Use Precautions

Any specimens or ethnographic objects known or suspected to contain arsenic should NEVER be used in hands-on interpretation. Generally, unless confirmed to be safe, treat all natural history specimens, prepared prior to 1980 as if they may contain arsenic or other toxic compounds. Any exhibited specimens from this period should be enclosed in an exhibit case.

Handle contaminated objects and specimens as little as possible. Never touch them with bare skin. Wear nitrile gloves and a protective smock or apron. Wear a fit-tested respirator equipped with high efficiency particulate air (HEPA) filters. (Note: Before wearing any respirator, you must have a medical evaluation.) If possible, handle specimens by their stands or mounts.

Always discard gloves and wash hands after working with the specimens. Keep lab smocks and aprons clean. Do not wash them with other fabrics.

Obtain a Material Safety Data Sheet on arsenic (available from the Regional Curator) and keep it in the park's curatorial workspace or office. (See *Conserve O Gram 2/1*).

Label museum storage cabinets housing specimens and objects suspected of, or known to be contaminated with arsenic, with a warning sign that indicates "**ARSENIC.**" Prepare and post a written set of instructions for handling contaminated specimens. Consult the Material Safety Data Sheet for further information.

Curatorial staff should always exercise caution whenever handling any museum object contaminated with arsenic. At the same time, staff should remember that arsenic encountered during the course of their work will not be

Procedures for Identification of Arsenic

1. *Inspect the collection.* Look for powdery or crystalline deposits at the base of feathers and hairs, around eyes, in or at the base of ears, around mouth or bill, along ventral incision, at base of tail, and on foot pads. On ethnographic objects, inspect crevices and seams where arsenic may have collected. Even if deposits are not evident, all natural history specimens collected and prepared before the 1980s should be tested for the presence of arsenic. In addition to examination, where possible, research the object's history. Try to determine when and by whom it was collected and if arsenic was used to protect objects from infestation.

2. *Test specimens for arsenic.* A test kit has been developed by EM Science to detect the presence of arsenic. At this time, the only vendor for the kit is VWR Scientific. Use of this kit requires no elaborate setup or special equipment, although depending upon the number of items to be tested, this project may involve a moderate to large investment of time. If testing a large quantity of specimens is necessary, it is recommended that staff prioritize these collections and develop a strategy for testing over a period of time, beginning with those items most suspected of arsenic contamination.

Each arsenic test kit contains the supplies and equipment necessary to conduct 100 individual tests. Additional supplies needed are 1 molar solution potassium hydroxide (KOH), a glass dropping bottle (with a polypropylene screw cap, rubber bulb, and glass pipet), a metal microspatula, and extra reaction vessels to facilitate multiple tests.

3. *Instructions for use of the kit.* The directions for use supplied with the kit were written by the manufacturer for testing a water sample for the presence of arsenic, and not specifically for museum specimens.

Instead of using the directions provided with the kit, follow these modified instructions:

- As outlined in *Conserve O Gram 2/1*, obtain, read, and keep on file a Material Safety Data Sheet (MSDS) for each chemical used in the test. At the time of purchase, request these sheets from the vendor. **Read the contact hazard label on the lid of the kit. Conduct the test in a well-ventilated workspace. Wear a respirator fitted with HEPA filters, an apron, protective nitrile gloves, and safety glasses.**
- For each test, obtain a sample from the specimen. If a residue is evident, use the tip of a metal microspatula to remove the crystalline or powdery material and place it in the reaction vessel. If there is no obvious residue, use a cotton swab dampened with distilled water to collect a sample from the base of hair or feathers or crevices of the skin. Cut off the swab fibers and use them as the test sample. Place the sample in the kit's reaction vessel. Use a glass dropping bottle to dispense the KOH. Add one to two drops of the KOH to dissolve the sample. If results of the first test do not indicate arsenic, collect and test samples from other areas of the specimen (see item #1), as the arsenic compound may not have been evenly applied.
- Affixed to one end of each plastic test strip is a white reagent impregnated blotter swatch. Holding the swatch area of the test strip downwards, insert the strip into the slit in the reaction vessel's cap. Ensure that the cap divides the test strip

into two approximately equal segments (one inside and one outside).

- Put 1 measuring spoonful (spoon provided in the kit) of zinc dust (container marked Reagent 1) into the reaction vessel.
- Using the syringe included with the kit, add 10 drops of hydrochloric acid (in the container marked Reagent 2) into the reaction vessel and immediately close the vessel with the cap.
- Allow the reaction vessel with contents to stand for 30 minutes. At the end of the test time, remove the test strip. Immerse it briefly in a small container of tap water.
- Compare any change of color on the swatch with the color scale provided on the vial containing the test strips.

4. *Tag specimens testing positive for arsenic.* Write "**Arsenic Contamination**" prominently on the specimen's label, and add this information to the item's museum catalog card. Retain complete records of each test, whether positive or negative, in the specimen's accession or catalog folder.

5. *Objects that tested negative may still contain arsenic.* Suspect items should be inspected and tested every two to three years, as arsenic may migrate from the interior of the specimen.

6. *Inform the Park Safety Officer and the Regional Curator about the project and the results.*

Proper Disposal of Waste Products Resulting from the Test

Following completion of the test, it is important to properly dispose of all resulting waste products:

1. The reaction vessel(s) containing the various chemicals utilized during the procedure, as well as the resulting precipitate materials.
2. The test strip(s) and the small container of tap water used to immerse the test strips.

All of these materials are considered hazardous waste and must be properly disposed of. The procedures for proper disposal are as follows:

1. Place the reaction vessel(s), test strip(s), and the small container of tap water within a larger, sealable, impervious container, such as a glass vial.
2. The sealable, impervious container must be labeled as containing hazardous waste. Information on the label must include the name of the active ingredient of the waste material.
3. Dispose of the container and contents in accordance with the park's Hazardous Waste Disposal Program. Contact the Park or Regional Hazardous Waste Coordinator for disposal guidance and/or instructions on proper interim storage of the container.

Sources

Arsenic test kit (catalog number EM-10026-1), one molar KOH in minimum quantities of one pint, glass dropping bottles, and metal microspatulas are available from VWR Scientific, 405 Heron Drive, Bridgeport, NJ 08014, (800) 932-5000. On the web at <<http://www.vwrsp.com>>.

For technical information concerning the arsenic test kit, contact the technical services department of the manufacturer, EM Science at (800) 222-0342.

Shell vials may be used as additional reaction vessels. They can be obtained from Southern Biological Supply Company, P.O. Box 368, McKenzie, TN 38201, (800) 748-8735. (Stock #8849; 12 dram capacity).

Protective equipment (e.g., respirator, gloves, apron, and safety glasses) is available from a variety of sources, including Lab Safety Supply Company, P.O. Box 1368, Jamesville, WI 53547, (800) 356-0783. On the web at <<http://www.labsafety.com>>.

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