Minnesota Historical Society

DANIELS OBJECTS CONSERVATION LABORATORY
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CHEMICAL, PHARMACEUTICAL, AND OTHER HAZARDOUS COLLECTIONS HANDLING AND DISPOSAL POLICY AND PROCEDURES

MINNESOTA HISTORICAL SOCIETY (MHS)

INTRODUCTION

This policy and procedures outline is intended for use by MHS Museum Collections Curators, Collections Managers, and Conservators. It can also serve as a reference guide for Site Managers and Site Technicians as a general source of information on what is involved in handling collections at their sites.

The policy and procedures outlined here are concerned with objects that contain substances that are considered hazardous and toxic due to their chemical nature. These substances can be of inorganic or organic origin. They include, but are not limited to, propriety medicines from the 19th and 20th centuries, cleaning chemicals, chemical reagents, preserved food items, and ammunition.

These substances can cause problems during long-term storage and display that will affect the containers, surrounding objects, and shelving. The substances, however, can be valuable for research purposes and should be curated properly to preserve them. The procedures outlined below propose safe methods to handle historic chemical substances in collections, while also preserving as much of the historical information inherent in the packaging as possible.

These procedures should be followed for objects, with the assistance of the objects conservators, as soon as they are accessioned and before they are put in storage or on display in order to avoid accidents and possible damage to other objects or collections.

SECTION 1. OVERVIEW

MHS museum collections may contain objects from

- pharmacies;
- hospitals;
- funeral homes;
- general stores;
- firehouses;
- military bases;
- chemical companies;
- taxidermists;
- mills.

These collections include containers filled with

- liquids;
- gels;
- crystals;
- powders;
- various combinations of the above.

Examples of handling, storage, and display problems include

- leakage due to failure of the closure;
- breakage of glass containers;
- crystalization of liquids as they evaporate;
- insect infestation in dried herb-based medicinals;
- exposure of staff to toxic compounds through handling.

SECTION 2. ASSESSMENT/SAMPLING

Curators and collections managers will submit a CMS Conservation Treatment Request for each object that contains historic chemical materials and work with the conservators in an advisory capacity.

Procedures:

1) Examine the object (i.e. container and contents) carefully when acquired.

2) Photograph the object, especially any packaging techniques and graphic information and write brief description of the object and its current condition in the proper CMS record.

3) Assess the identity of the contents as soon possible.

- Check the label, if present
- Compare visually by comparison with known material
- Sample the contents and follow with characterization analysis.
- Sample without damaging the container or its closure.
    - If this cannot be done, then open the container with the minimal amount of damage to the closure, the container, and the surrounding packaging, if present.
    - For example, if the container is closed with a cork and contains a liquid or a gel, then a hypodermic needle can be inserted into it.
        - Use caution if the cork is very brittle, since even slight pressure will cause it to fragment and fall into the contents.
        - Fill the syringe with 5 to 10 cc of the contents and remove the needle.
        - Place the contents in a glass sample vial with a Teflon or silicone/Mylar cap liner and label with the object name and accession number.
        - Submit the sample for chemical analysis and identification.

Removing Closures:

Crystals and other solids cannot be sampled as easily without opening the container, therefore the closure must be removed.

The following list gives suggestions for the removal of the various types of closures that may be encountered.

1) Corks:

- If the cork is not friable and broken:
    - Insert a chemical spatula between the cork and the rim of the container.
    - Work the blade of the spatula around the circumference of the cork to loosen it from the walls of the neck, while gently pulling upward to remove it from the bottle.
        - If this technique does not work, then paraffin oil (mineral oil) can be introduced around the outside of the cork, as long as there is no danger of it contaminating the contents.
- If the cork cannot be loosened:
    - Remove it by cutting it with an Exacto blade or scalpel, taking care not to allow pieces of the cork to fall down into the contents.

2) Glass stoppers:

- Crystals that have formed between the bottle neck and the glass stopper can seal the stopper very tightly.
- It might be possible to loosen it by running the neck of the bottle under running hot tap water, taking care not to expose paper or glass labels to the water. The heat may melt the crystals as well as expand the glass slightly.
- Apply mineral oil to the stopper if the hot water technique does not work.

3) Screw caps:

- If not corroded on, these closures can be removed by twisting off by hand.
- If this will not work, then use a cap removal device (i.e. a clamp, pipe wrench, or locking pliers).
    - Pad the jaws of the device with a cloth or ethafoam to prevent scraping paint off the lid and denting it.

4) Crown caps:

- Removed the cap with a conventional bottle opener.
- Pad the opener and move it around the circumference of the cap to loosen it gradually to avoid distorting the cap.

5) Paint can type lids:

- This type of lid is inset into the container and usually forms a tight seal.
- Insert the blade of a flat headed screw driver (padded) into the space between the lid and the container.
    - Gently pry up on the lid, moving the lever around the circumference to avoid distorting the lid in one area.
    - The underside of the lid may contain a portion of the contents that has become oxidized. Sample this material along with the less oxidized contents in the container below to serve as an "aged" comparison.

6) Sealed paper lids:

- These are folded paper or cardboard box lids usually used as the closure on an outer package. The edges of the lid are usually sealed with a printed paper label or tape.
- Open these flaps by slitting the closure with a sharp scalpel or Exacto blade.

- Make certain that the blade is perfectly horizontal, or the box will be cut.
- Reseal the box after the contents are removed with an unobtrusive adhesive or archival tape mend, to be determined by the objects conservator.\

7) Wax seals over corks, etc.:
- Carefully cut these off using a sharp blade, and then readhere to the container opening with an acrylic resin or other adhesive.
- Fill the mend margins in with pigmented microcrystalline wax that blends in with the original seal.

8) The emptied and cleaned/conserved containers will be returned to Museum Collections for further processing.

SECTION 3. CHARACTERIZATION OF THE CONTENTS

Prior to actual identification of specific compounds, which usually requires involved processes and analytical instrumentation facilities that are available outside the MHS, simple characterization of the compounds into general classes can be done in the conservation lab by the means of spot tests. This will supply curatorial information and aid in the packaging of the contents for legally proper waste disposal.

The materials and methods described herein require knowledge, skills and equipment for handling hazardous laboratory chemicals and should be performed by conservation staff in a properly equipped laboratory.

Procedures:

Sample the contents as outlined above.

1) Place a 1 gm sample in a clean 50 ml beaker.
- If the sample is a crystalline solid, add 10 ml of deionized water to dissolve and/or disperse the sample.
- If it is a dried plant material, shred the leaves or seeds and add the water.
- Allow the sample to stand at least 15 minutes in the water at room temperature to assure extraction. Test the pH of the sample using the pH meter following standard pH testing procedures.
- Record the pH reading. Follow the same step for any oxidized material that may have been collected from the inside of a lid.

2) Perform the following spot tests in order to characterize the substances into general organic compound categories:

a) 0.1% Aniline Blue (aqueous): indicates the presence of protein.
- Place a drop on the material to be observed or on a glass slide, observe under a microscope. - The blue color will penetrate first the edges of protein containing materials and may or may not completely stain it.
- Hair and feathers, skin, muscle, blood cells, fungi, green algae and lichen will stain.

b) Iodine/Potassium iodine: indicates starch.
- Dissolve 1 gm potassium iodine in 100 cc of water and add 1 gm of iodine flakes.
- Place a drop on the material to be analyzed.

- A visible purple black color indicates the presence of starch.
- Under the microscope, purple-black starch gains can be observed.
- A pink color may indicate micro-organism degradation of a starch.

c) Sudan III: indicates the presence of fats.
- Add 0.5 gm of Sudan III or IV in 100 ml of 70% ethanol or methanol.
- The surface films of plant or animal oil, oil in plant tissues, adipose tissue, and
- free animal fat stains red.

d) Phluoriglucinol: indicates the presence of lignin (wood products).
- 1 gm of phluoroglucinol is added to 50 ml ethanol or methanol.
- Add the solution to the material to be stained. Let stain soak in for 1 minute.
- Add one drop of 25% l/l HCl solution.
- A red-pink color indicates the presence of lignin.
- Under the microscope lignified plant tissue stains red.

e) Potassium permanganate: indicates the presence of unsaturated double and triple bonds in hydrocarbons (alkenes and alkynes, i.e. natural waxes, some natural resins, latex, plant and animal oils.
- 1% g/l aqueous potassium permanganate (Baer's reagent) is added by dropping onto the material to be tested.
- A visible brown color observed under the microscope indicates the presence of easily oxidized compounds that have reduced the permanganate ion to hydrated oxides of manganese.

f) Diphenylamine: indicates nitrocellulose as found in adhesives and early plastics.
- 5% g/l solution of diphenylamine in concentrated sulphuric acid is added to the sample.
- If the sample is a solid, dissolve it first with a few drops of acetone.
- A deep blue color indicates the presence of nitrocellulose.

There are other spot tests which may be used if more specific identification is required or if the above detailed tests fail to provide any information. The pH and spot test results will be provided to the person conducting further instrumental analyses.

SECTION 4. CONTENT DISPOSAL

Once the contents have been removed from the historic containers, placed in waste containers and stored in B 165, they become waste. According to the Minnesota Hazardous Waste Rules (Chapter 7045),"… anyone who produces or manages a waste, must evaluate that waste". The Minnesota Pollution Control Agency has assembled fact sheets on hazardous waste generation, management, and disposal, which are now posted on the MPCA website: http://www.pca.state.mn.us/waste/pubs/business.html. The information in those sheets has been adapted below for this manual. Consult the Minnesota Hazardous Waste Rules, part 7045.0135 for a complete listing of hazardous chemicals

The following characteristics will help to identify the waste as hazardous. If the waste can be identified from a label, then the specific technical data can be obtained from a chemical dictionary or an MSDS available from a chemical supplier such as Fisher Scientific, otherwise lab tests requiring specialized equipment will have to be performed.

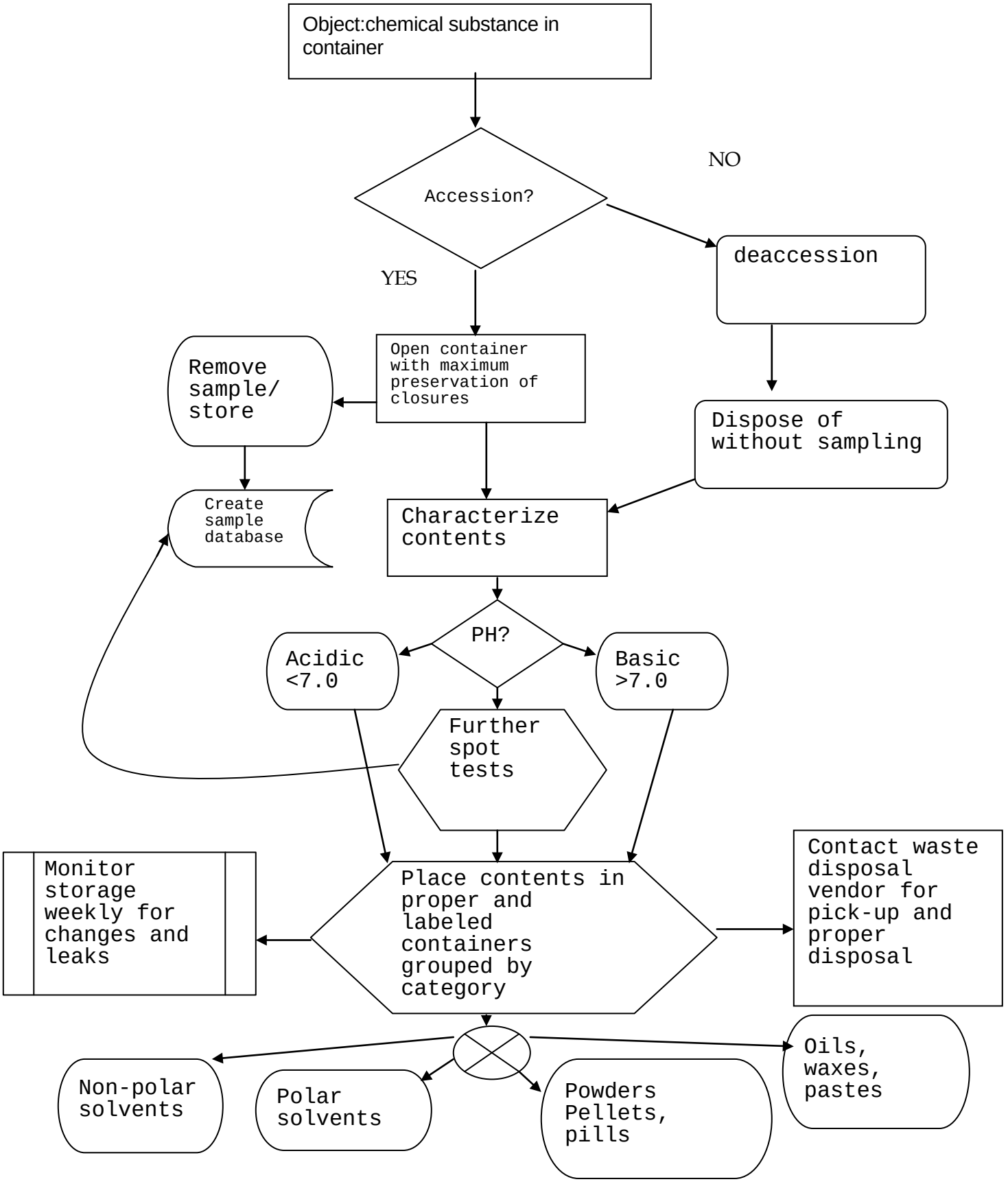
1) Ignitable waste: having a "flash point" of 140 degrees F or less. A solid waste is ignitable if it can spontaneously catch fire and burn so persistently that it represents a hazard.
2) Oxidizing waste: adds oxygen to a reaction/fire. Wastes having this characteristic often have major components whose chemical name contains the prefix "per-" or the suffixes "-oxide" or "-ate". Many wastes containing nitrogen or halogens (fluoride, chlorine, bromine, and iodine) are also oxidizers.
3) Corrosive waste (acids or bases): any water-based (aqueous) waste having a pH or less than or equal to 2.0 or greater than or equal to 12.5 is considered to be corrosive. A liquid that is able to corrode a 1/4 inch of steel per year is also considered corrosive and hazardous.
4) Reactive waste: unstable or explosive wastes, wastes which react violently when brought in contact with water and wastes which under certain conditions can liberate toxic vapors, such as hydrogen cyanide or hydrogen sulphide, are considered reactive and hazardous. The peroxides that form over time in old bottles of ether can explode upon impact to the container. These bottles must be removed by a fire department, police bomb disposal unit, or military ordnance- handling unit.

Unless the collection that is to be sampled and disposed of is very large, most museums and historical societies would qualify as “small quantity generators”, which is defined as:

1) "generates fewer than 100 kilograms (kg) or 220 lbs of waste per month”.
2) The weight usually includes the weight of the packaging.
3) It is possible to exceed this amount temporarily in the case of the processing of a large collection or backlog as mentioned above, then revert to a small quantity generator status.
4) Exceeding 1,000 kg (2,200 lbs) of waste influences the duration and type of storage .

Pack the waste in regulation glass or steel containers, depending on the nature of the waste, labeled with regulation labels and stored on shelves in B 165.

Record the stored waste annually during the conservation labs’ chemical waste reporting inventory. Dispose of through a contract vendor when enough has accumulated.


Object:chemical substance in container
Accession?
NO
YES
deaccession
Open container with maximum preservation of closures
Remove sample/ store
Dispose of without sampling
Create sample database
Characterize contents
PH?
Acidic <7.0
Basic >7.0
Further spot tests
Monitor storage weekly for changes and leaks
Place contents in proper and labeled containers grouped by category
Contact waste disposal vendor for pick-up and proper disposal
Non-polar solvents
Polar solvents
Powders Pellets, pills
Oils, waxes, pastes