# CHAPTER 7: MUSEUM COLLECTION STORAGE

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# CHAPTER 7: MUSEUM COLLECTION STORAGE

## A. Overview

1. *What is museum collection storage?*

Museum collection storage is both a physical space and an ongoing process.

- It is a dedicated space used for storing museum objects, natural history specimens and archival materials. This space is designed or upgraded to meet standards and requirements for the preservation, protection, and accessibility of the collection.
- It is the ongoing process of containing, organizing and caring for the collection while it is in storage. This involves evaluating and implementing strategies and techniques to improve the condition and long-term preservation of the collection.

Each decision you make about storage should take into account how the consequences of the decision will improve the protection and preservation of collections.

2. *Where does collection storage fit in my park's preventive conservation program?*

Good collection storage is a major component of your park's preventive conservation and collections care program. It is essential to the long-term preservation of your park's museum collection. A well-planned and organized storage space reduces risks to the collection and provides accessibility. Deterioration, damage, or loss will be minimized if you implement:

- proper storage space, strategies and techniques
- good handling practices (see Chapter 6: Handling, Packing, and Shipping)
- effective security and fire protection (see Chapter 9: Security and Fire Protection)
- good housekeeping practices (see Chapter 13: Museum Housekeeping)
- appropriate environmental conditions (see Chapter 4: Museum Collections Environment)
- an effective Integrated Pest Management program (see Chapter 5: Biological Infestations)

3. *What is a multi-layered collection storage system and how does it protect my collection?*

A well-designed collection storage space that readily accommodates your collections combined with a rational, systematic approach to collections management and good housekeeping will minimize or block risks to the collection. It will provide the collection the best possible protection from all agents of deterioration. See Chapter 3: Preservation: Getting Started for more information about the agents of deterioration.

A multi-layered collection storage system is composed of successive layers of protective envelopes or enclosures, from the building itself to the equipment and containers that surround an object. The greater the number of layers, the more protection. Figure 7.1 illustrates the multi-layered approach to protecting an object with successive levels of containment. Although museum collection storage situations vary, the variables that need to be considered to properly house a collection are the same. Evaluate each layer of the system and adapt it

to meet your collection's preservation and protection needs.

In the multi-layered approach, each level adds another layer of protection to the collection by shielding it from the agents of deterioration. The more layers, the greater the level of protection or "buffering" from the agents of deterioration. The layers of protection are:

- *Building/facility envelope:* exterior (outside/external) walls of the structure housing the collection.
- *Room/space envelope:* walls of the room or space immediately enclosing the collection.
- *Equipment/storage furniture:* storage furniture such as a cabinet with gaskets, map unit, or shelving unit housing the object.
- *Container/housing:* container housing the object such as a box, tray, or other fully enclosed container.
- *Packaging/wrapping materials:* museum quality materials that cover and/or support the object inside of its container/housing, such as tissue, muslin, or polyethylene foam.

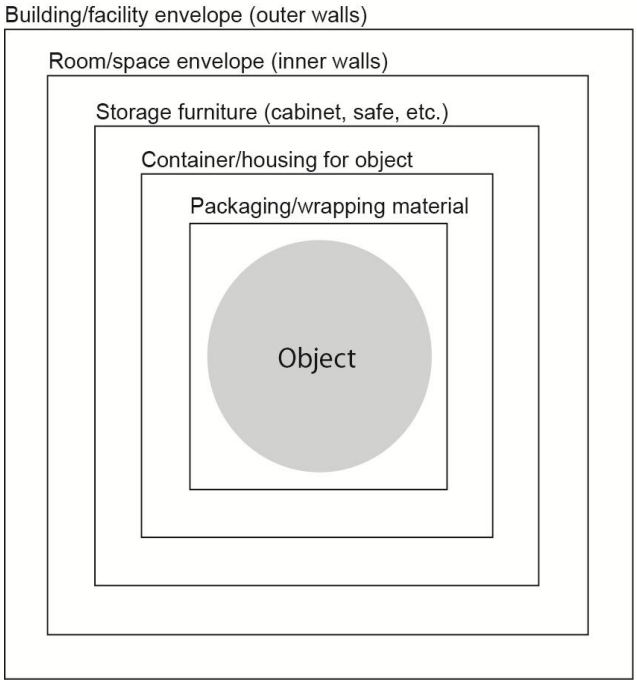


Figure 7.1. Multi-layered protection of an object

4. *How do I determine my collection storage needs?*

Become familiar with your collections and storage space. Evaluate each layer of protection. Become familiar with this chapter and complete the "NPS Checklist for Preservation and Protection of Museum Collections," in Appendix F: NPS Museum Collections Management Checklists. This checklist will help you evaluate your collection storage needs in the following areas:

- facility and space requirements
- protection requirements (physical security and fire protection)
- environmental requirements
- museum equipment and container requirements
- housekeeping requirements
- Integrated Pest Management (IPM) requirements

5. *Who should I consult with when developing or upgrading my storage space?*

Complete the Checklist by using the Automated Checklist Program of the Management Reports module of Interior Collections Management System (ICMS). See Appendix J in the *ICMS User Manual* for more information. Use this checklist when making changes or additions to collection storage space.

Consult with your regional curator, park facility manager, and a structural engineer and architect with experience in this area when building or updating your storage space. They will provide specialized knowledge and guidance on new buildings that are designed to hold collections (purpose built structures), structures that are adapted to store collections (adaptive use) and historic structures that house collections.

## B. Standards and Requirements for Storage Space

Standards and requirements for collection storage space are based on National Park Service (NPS) policies and standards, Department of the Interior (DOI) and professional museum best practices.

The NPS *Management Policies*, Section 5.3.1, states:

> *"The National Park Service will employ the most effective concepts, techniques, and equipment to protect cultural resources against theft, fire, vandalism, overuse, deterioration, environmental impacts, and other threats without compromising their integrity or unduly limiting their appreciation by the public."*

The Interior *Departmental Manual* Part 411 Policies and Standards for Managing Museum Collections, Chapter 3, provide departmental standards for museum property storage.

1. *What are the standards and requirements for collection storage space?*

The essential elements of NPS collection storage space standards and requirements are summarized below.

- Safe and secure storage of museum collections requires dedicated space. Museum storage areas must only house museum collections. **Separate museum storage from all other uses**, including office space and research and work areas.
- House collections in a dedicated space that has minimal penetrations and optimum thermal performance.
- Museum storage space must be adequate to accommodate the particular characteristics and quantity of objects, specimens, and archival items in your collection. It must also provide adequate space to accommodate reasonable

growth of the collection over the next ten years.

- Organize the space to allow for the efficient use of curatorial equipment and techniques, and to provide for effective access and optimum preservation of the museum collection.

- House objects in appropriate containers and package objects with appropriate materials.

- Containerize collections to the extent possible to minimize the negative effects of relative humidity and temperature fluctuations.

Ensure the collection storage space is both *suitable* and *sufficient* for proper storage. *Suitable* space is planned space that has been determined to be adequate for storing museum objects. *Sufficient* space is expandable space that provides room for safe, non-crowded storage of the collection and allows room for future growth.

Outbuildings, closets, and unimproved basements and attics are not suitable space. These inadequate spaces do not contribute to the preservation and effective use of a collection. See Chapter 4: Museum Collections Environment for further information.

**Note:** Recommendations provided in this chapter generally apply to structures that are purpose built and or adapted to house museum collections, followed by recommendations that apply specifically to historic structures.

The "NPS Checklist for Preservation and Protection of Museum Collections" provides a detailed checklist of standards and requirements for collection preservation and protection, including collection storage space.

2. *Why should my collection storage space be used exclusively for storing collections?*

By separating curatorial office, work, and research spaces from the space housing the collection, you minimize environmental impacts on the collections and lessen security risks. Do not combine storage space with other functions for reasons noted below.

- Collection security generally decreases; theft, mishandling, and vandalism increase with storage room visitation and use.

- People working in the storage area increase the number of air exchanges the area must undergo. Air exchanges cause temperature and relative humidity levels to fluctuate, resulting in accelerated deterioration of objects. More air exchanges increase the load on climate control systems, leading to higher energy costs and stress on passive control systems.

- Work areas often require lighting levels that may cause damage to unprotected light-sensitive objects due to the specific wavelength of the radiation, intensity or duration of the lighting. Lights are generally "off" in storage only spaces.

- Office equipment (copiers, computers) generate ozone, a pollutant damaging to collections.

- Movement of people into and within the area tracks in soil and disperses dust into the air, which in turn is deposited on surfaces of objects and equipment .

- Potential for pest infestation increases.
- Accumulation of non-collections items increases the risk of fire and pest infestation, and creates clutter that can lead to dirt/dust accumulation.

***Store flammable liquids and materials, curatorial supplies, audiovisual equipment, and other interpretive materials outside the museum storage space to lessen clutter and thereby reduce the risk of fire.***

3. *Where should I locate research, work and office spaces?*

Locate all research, work, and office spaces convenient to but *not* within the collection storage space. Research is a fundamental use of a museum collection and collections research space has its own specific requirements. Refer to the *Museum Handbook* Part III, Appendix D: Guidance on Planning for a Research Space, for guidance on a planning research space.

4. *How do I ensure that I have adequate space to store the collection?*

The storage space must be large enough to accommodate the existing collection as well as the projected growth of the collection over the next 10 years. When designing or upgrading your storage space, be sure that your space:

- houses individual objects appropriately and safely
- allows for the use of proper storage equipment and techniques
- incorporates aisles at least 48" wide between rows of equipment; this width allows safe handling and movement of drawers, cabinet doors, and larger objects
- ceiling height is sufficient to accommodate raised and stacked cabinets without interfering with lighting and protection systems
- provides adequate access to the collections that is safe for staff and the collections

Make sure the space allows movement of personnel, equipment and objects in and out without hindrances such as inadequately sized doors; narrow, winding, or steep stairs; or passageways with low ceilings. Plan and organize your storage space to facilitate access to the collection.

5. *What do I need to know about the type of structure that houses the collections?*

Different types of structures have different construction requirements. Therefore, installation of equipment such as fire and security systems, and storage furniture needs will also vary. A *purpose built structure* has different requirements than a structure that is adapted to house collections (*adaptive use*) or an *historic structure* that houses collections. Consult with your facility manager, regional curator, historical architect and structural engineer during planning and implementation of a storage or construction project.

In a historic structure, the best approach to providing suitable collection storage space is to create a "room within a room." This creates another layer of protection for the collections and protects the historic fabric of the structure. Particularly when strict environmental control is required, this strategy

improves the prospect of success because the equipment that controls the storage facility environment has only the benign interior environment of the historic structure to temper rather than the harsher exterior environment.

In pursuing such a strategy, configure the interior room in such a manner as to be as reversible as possible. Also, set it sufficiently away from the historic structure's exterior envelope to provide a maintenance access passageway around its entire perimeter. This avoids inadvertent damage to the historic envelope attributable to altered temperature or moisture gradients. It also allows for easy inspection and repair of any other moisture or structure-related issues developing in the exterior envelope. Moreover, by providing an access passageway avoids the need to block or alter the appearance of windows in the exterior envelope.

6. *What structural load capacity should my storage space or facility have?*

Collection storage space requires a greater structural load (weight) capacity than office or living space. Storage equipment filled with museum objects can become extremely heavy. When housing collections in historic structures, remember these structures may not be able to bear large loads. Consult with your regional curator, park facilities manager, and a structural engineer and architect.

Design or modify your storage facility or space to meet the following guidelines:

- Always consult a structural engineer to determine the suitability of a floor and the placement of supports and equipment. Follow the *International Building Code*® all new purpose-built structures, and the *International Existing Building Code*® for existing buildings. Various chapters within the *International Existing Building Code*® deal with historic structures. For facilities not under direct ownership of the National Park Service, codes adopted by other jurisdictions may apply.

- Determine whether the load capacity of the existing structure is adequate to accommodate your collection. The load will depend on th*e types and quantity of materials* you plan to store. Use space capable *of sustaining a live floor load of at least* 150 pounds per square foot.

  Note that in historic structures it is often not possible to achieve the prescribed uniform live load capacity without unacceptable alterations. Floors constructed to a lesser load capacity may be considered if you install spot load supports (usually post supports from below) and arrange equipment to take advantage of existing structural supports (usually equipment arranged around the perimeter of a room close to load bearing walls). To use this strategy, it is essential to engage in a continuous dialog with an historical architect and structural engineer to attain an acceptable arrangement of storage furniture through an iterative process. Once such an arrangement is established, it should not be altered without re-engineering.

- A live floor load of 350 pounds per square foot is desirable, especially for particularly heavy collections such as paper-based materials such as archives and herbaria, some fossil collections, metals, heavy equipment, and if you plan to install a moveable aisle (compactor) storage system.

  Note that such a load capacity is rarely achievable in an historic structure. Consult a structural engineer and the equipment manufacturer when determining the required load rating for a floor supporting a moveable storage system or have objects of exceptional weight

- Design, construct and/or retrofit storage facilities to accommodate local or regional considerations, such as seismic activity or snow loads to minimize damage to the collections and structure.

- Consider reinforced concrete or masonry construction with a wind load rating of 110 miles-per-hour or higher for new construction of stand-alone purpose-built storage facilities in areas susceptible to severe wind conditions. Fasten roofs to the wall and/or foundation structural components so the roof can withstand hurricane force winds.

7. *What are the requirements for the location, layout, and structural features of storage space?*

To adequately preserve and protect the collection, locate and construct collection storage facilities and spaces to meet the following requirements:

- Locate the storage space outside the 100-year floodplain. This is in accordance with Executive Order 11988, "Floodplain Management," May 24, 1977 (42 USC 4321) and Procedural Manual 77-2: Floodplain Management.

- Store only collections in the space. Local and national building codes usually rate collection storage space as "storage occupancy." Locate work, office, research ("human occupancy"), and supply storage areas close to, but not within, the storage space.

- Space is sufficient for the movement of staff, equipment, and objects in and out without hindrances (e.g., low ceilings; inadequately sized doors; or narrow, winding, or steep stairways). Space is large enough to accommodate the current museum collection and anticipated growth for at least the next ten years.

- Use space that is constructed of fire-resistant or fireproof materials. Cover interior wood framed walls and ceilings with gypsum wallboard or other material to achieve a minimum one-hour fire rating (some codes may require a two-hour fire rating). In historic structures, consider creating a "room within a room," using fire-resistive materials for the newly-inserted construction.

- In a purpose built structure, do not include windows on an external envelope wall. Use as few doors as practical to enhance security and environmental control, but not so few as to be in violation of health, safety and fire codes. See National Fire Protection Association *NFPA 101,* "Life Safety Code," 2009 Edition, and *OSHA Standard 1910.36,* "Design and construction requirements for exit routes." Create a "room within a room" to house collections away from the exterior envelope to minimize environmental fluctuationsand condensation and place offices adjacent to exterior walls.

- If the space has windows, make sure they are physically blocked and insulated in a reversible manner to eliminate natural light, reduce environmental fluctuations, and enhance security. In an historic structure, this must be accomplished in such a manner as to be undetectable from the exterior, and to allow ready access to the window for maintenance purposes.

- Insulate the space so it will maintain a stable environment that protects the objects from adverse temperature and relative humidity conditions and damage from biological infestations. Insulate walls to a minimum R-19 rating and the ceiling to a minimum R-30 rating.

- Install an adequate vapor barrier in walls, ceilings, and floors in a purpose built museum structure.

  **Note:** Consult with a specialist in this area before installing a vapor barrier in

an extant facility as vapor barriers can inadvertently create moisture and mold problems. .

- Use space with as few exterior walls as practical. This will minimize the chance of condensation on walls and windows during seasonal and diurnal temperature changes, enhance security, and increase energy efficiency.

- Keep areas adjacent to the structure's exterior free of trees, shrubs, or other plants. Plantings close to or touching exterior walls provide a habitat for pests that may then migrate into the structure. Install a sanitary barrier of small pebbles over a geotextile and have surrounding dirt slope away from the structure to minimize moisture seepage into the structure.

  Consult with a specialist before installing a vapor barrier in buildings, in particular, ones that have crawl spaces with exposed dirt to avoid introducing moisture problems. The specialist will need to determine whether a vapor barrier in this location will have the unintended effect of encouraging additional capillary uptake of ground moisture into adjacent masonry elements. Also, the specialist will need to recommend a means for removal of moisture that accumulates on top of the vapor barrier due to infiltration or condensation. If possible, install a slab on grade as described below. However, in a historic structure, use a more reversible approach.

- Install rigid foam insulation and a vapor barrier in concrete floors on grade for purpose built structures. Make sure the level of the top of the concrete slab is at least 6" above the grade level of the soil. Consult a specialist before installing a vapor barrier to avoid inadvertently creating a moisture problem.

- Require frame walls to be a minimum of 6" thick, constructed with 6" metal or wood studs. This thickness of wood-frame wall construction provides structural strength and is capable of accommodating the required insulation.

- Use metal hollow-core or wooden solid-core doors with a good fire rating. Equip entry doors with a mortise lockset or a key-in-knob lock combined with a separate deadbolt lock. Place door hinges on the interior side of the door. If hinges are located on the exterior of the door, use non-removable hinge pins.

- If the historic or adapted structure requires wood underlayment beneath new resilient flooring, use only softwood plywood as it produces minimal off gassing or use products that have minimal or no noxious gases. Other types of underlayment material may contain adhesives that off-gas significant amounts of formaldehyde, which can damage objects. Note that wood subflooring is inappropriate for use with compact/mobile storage systems which require carefully leveled flooring with the rails installed in concrete.

8. *What are the requirements for building systems and utilities in storage space?*

Use the following structural features, layout, and building materials to provide safe and secure conditions for storing objects:

- Alarm and/or monitor space 24/7 to detect fire and unauthorized entry.

- Locate HVAC (heating, ventilating and air conditioning) and other climate control equipment outside the storage space. This reduces the possibility of damage to the collection from system leaks. It also avoids the need for non-curatorial staff to enter the space for maintenance or repair. Install monitors and sensors for system control in the space itself to ensure that the storage

environment and not the air in the ductwork controls the environment.

- Make sure all electrical systems and equipment are UL listed and installed in full compliance with local and national electrical codes. Include sufficient electrical outlets to power supplemental environmental conditioning equipment, vacuum cleaners, and task lighting.

- Verify that space is free of water and sewer pipes and valves that can burst or leak and cause damage. **Note**: Water lines associated with fire suppression systems are allowed.

- Spaces equipped with fire sprinkler systems should have adequate floor drain(s) with backflow check valve(s). Consult with a structural engineer on how to handle potential water damage that might result from the fire suppression system. Take precautions to avoid creating a pest habitat by keeping drains dry and adding fine mesh screening over drain opening(s). Include routine maintenance checks in your housekeeping plan.

- Space is not susceptible to flooding if pipes or drains in adjacent spaces (e.g., a bathroom on the floor above) leak or backup.

- Space is free of water, gas, or electric meters, electrical panels, and utility valves that require monitoring and servicing by non-curatorial personnel. This will limit the need for access by non-curatorial staff and minimize security concerns.

9. *What features and materials are required for the walls, ceilings, and floors in storage spaces?*

Use the guidelines below to ensure that walls, floors and ceilings have the appropriate features and are made of safe materials that do not damage collections.

- Do not install dropped ceilings in storage areas, and avoid using them elsewhere in the structure. They obscure leaks, provide a habitat for pests, and the acoustic tile material can generate dust and debris.

- Paint walls and ceilings using acrylic emulsion latex, vinyl acrylic, or acrylic urethane coatings. Other coatings may off-gas at unacceptable levels. Do **not** use any oil-based paints.

- Paint walls and ceilings white or a light color. Paints with titanium dioxide (most white paints) absorb ultraviolet light emitted by ambient or artificial lighting.

- Treat concrete floors with a sodium silicate sealing/curing agent. This hardens and increases the density of the surface of the concrete, helping protect it from cracking, dusting, and other damage. The floor should be easy to clean without the use of chemical cleaners or water.

- Seal concrete floors with a water-borne sealer. Select a product that does not off-gas during or after cure. Make sure that the product can be reapplied when it becomes worn without the need to remove collections from the space.

- Use deck grey colored sealer so that you can determine when the finish is dirty or scuffed. Avoid other types of floor coverings, as they require wet cleaning and/or are a source of off gassing.

- Cover plywood subfloors with a highly durable, chemically inert, and stable floor covering such as true wood plank flooring (not particleboard or OSB) covered with a moisture-cure epoxy sealer, or impervious ceramic tiles with 100% epoxy resin grout. Ceramic tiles can also be used over concrete. Consult with your park facility manager, a flooring specialist and a conservator before making a selection.

10. *What type of lighting is required in storage spaces?*

Damage from visible light and ultraviolet (UV) radiation is cumulative and irreversible. Select the appropriate type of lighting and always minimize the intensity and duration of lighting in collection storage spaces. Use the guidelines below to provide appropriate lighting for your collection storage space.

- Eliminate ambient light sources that can damage objects (i.e. unblocked windows and skylights) that can damage collections.
- Use LED or UV-filtered fluorescent lighting. Remove or replace incandescent lighting to reduce energy costs over time. Do **not** use quartz or halogen lights; they emit unacceptable levels of UV and infrared radiation. Lighting levels should not exceed 200 lux or 20 footcandles.
- Install lights in multiple zones controlled by individual light switches. This allows lights to be activated only in areas where there is activity. When storage space is unoccupied, turn **all** lights off.
- Provide indirect (diffuse) lighting by aiming fixtures at walls or ceilings. This reduces light intensity, and light reflected off the surface of white or light-colored walls reduces UV radiation levels.
- Avoid using mercury vapor or tungsten lighting on or near the exterior of structures containing collection storage space. These types of lighting attract insects.
- Mount exterior lighting at a distance from the building itself. Focus lights towards walls but avoid windows and doors. Light focused on these features will attract pests.
- Place a central lighting control panel at a convenient location at the entrance of the storage area.
- Use emergency lighting that is triggered by occupancy to save energy where codes permit.

11. *How do I establish proper physical security for the collection storage space?*

Conduct an assessment of the security risks to the stored collection to determine what is needed. Refer to Chapter 9, Security and Fire Protection, of this handbook for details on conducting a risk assessment and for specific security guidance.

12. *How important is fire protection in the storage space?*

Collection storage houses the majority of the park's museum collection. This space must have an early fire detection and suppression system installed to guarantee the safety of the collection and the personnel who use and care for it. Refer to Chapter 9 of this handbook for information on conducting a fire risk assessment and for specific fire protection guidance.

13. *What role does housekeeping play in the collection storage space?*

Housekeeping is a vital part of museum collection storage. Establish and follow a museum housekeeping plan to ensure that collection storage space is properly maintained. Refer to Chapter 13: Museum Housekeeping and the *ICMS User Manual* for guidance on establishing a housekeeping plan.

- Routinely and thoroughly dust and vacuum the entire storage area using a High Efficiency Particulate Air (HEPA) vacuum. Be sure to include areas in, underneath, and on top of cabinets and shelving.
- Do not wet clean floors, equipment, or any other areas in the collection storage space. This interferes with relative humidity control and can cause metal storage furniture to rust.
- Do not use any kind of chemical cleaner or spray, as they may introduce pollutants to the storage space.
- Prohibit smoking, eating, and drinking in the storage space.
- Implement and follow an IPM program

Make sure that all areas within the storage space are identified and addressed in the housekeeping plan. This includes storage equipment and supports create areas where dust and debris gather, such as underneath or on top of cabinets.

14. *Where do I find additional guidance on collection storage spaces?*

For additional information in this handbook, see Appendix T, Curatorial Care of Biological Specimens, Section D, Storage of Biological Collections and Appendix U, Curatorial Care of Paleontological and Geological Collection, Section F, Handling and Storage of Paleontological Specimens.

Refer to the NPS *Conserve O Gram* series for additional information and specific guidance for planning collection storage space and to the bibliography of this chapter,

## C. Standards and Requirements for Storage Equipment and Containers

Standards and requirements for storage equipment and containers are based on Department of the Interior (DOI) and National Park Service (NPS) policies, and professional museum practices. The Interior *Departmental Manual* Part 411 Policies and Standards for Managing Museum Collections, Chapter 3, provide departmental standards for museum property storage. The NPS *Management Policies*, Section 5.3.1, states:

*"The National Park Service will employ the most effective concepts, techniques, and equipment to protect cultural resources against theft, fire, vandalism, overuse, deterioration, environmental impacts, and other threats without compromising their integrity or unduly limiting their appreciation by the public."*

1. *What are the requirements for collection storage equipment and containers?*

The use of appropriate specialized, museum quality storage equipment and containers promotes preservation, access to, and effective management of your museum collection. These storage containers are constructed of chemically stable, neutral materials. They protect objects by providing physical and environmental protection (buffering).

NPS collection storage equipment and container standards and requirements follow below.

- Sufficient quantities, number and appropriateness of equipment and containers

are used to house museum objects without crowding.

- Museum storage cabinets, shelving units, racks, and equipment are in working order and good overall condition.

- Museum cabinets are not stacked more than two high and cabinet drawers are not loaded beyond the manufacturer's recommended weight capacity.

- Museum cabinets, shelving units, and other equipment are raised off the floor at least 4" preferably 6"on metal risers as a precaution against potential flooding and to facilitate cleaning of floors and inspection for pest problems.

- Museum cabinets, shelving units, and other storage equipment are made of metal. Wood is not used even when painted, as it can off gas harmful acids.

- Museum cabinets, shelving units, and other storage equipment are arranged so that access to objects and interior spaces is not impeded, allowing for safe access and inspection and cleaning.

- Museum objects that are not enclosed within cabinetry are protected and covered and/or cushioned by appropriate materials and mounts.

- Open shelving is stabilized (e.g. bolted to the floor, wall, or adjacent equipment) to prevent it from tipping over. Install restraining bars or cords to edges of shelves to prevent objects from falling, in particular, for collections in earthquake zones.

- Objects in museum cabinets, shelving, or other storage furniture are properly cushioned, mounted, or stored in trays using museum quality materials.

- Natural history specimens stored in fluids are housed separately from dry specimens and are housed in a space that provides appropriate ventilation and fire protection.

- Spaces and/or cabinets housing specimens stored in fluids, objects containing fluids, specimens and objects treated with pesticides, rocks/minerals/fossils that are radioactive, or nitrate film are identified by appropriate health and safety signs.

- Nitrate film is housed in buffered sleeves or envelopes, placed in sealed polyethylene bags, and stored in appropriate frost-free freezers in separate space from all other collections. See *COG 14/10*: Cold Storage for Photograph Collections – An Overview, 12/11: Cold Storage for Photograph Collections – Using Individual Freezer Unit, 14/12: Cold Storage for Photograph Collections –Vapor-Proof Packaging.

- The "NPS Checklist for Preservation and Protection of Museum Collections" provides a detailed checklist of standards and requirements for collection storage equipment and containers. See Appendix F: NPS Museum Collections Management Checklists.

2. *What is considered "museum quality" for storage equipment, containers and materials?*

Museum quality, equipment and containers are made using inert, non-reactive materials that do not off gas (emit) substances that accelerate or cause deterioration of objects. Terms such as "pH neutral" or alkaline-buffered are used to describe museum quality materials. The term "archival" was widely used in the past but is no longer used to describe storage materials.

Using materials that are not museum quality can damage objects and shorten their lifespan. The NPS *Tools of the Trade* provides a list of materials and equipment suitable for managing museum collections. It also provides a vendor address list. Refer to the bibliography of this chapter for additional information on collection storage equipment, containers and materials.

***Storage equipment:*** Museum quality storage equipment is usually constructed out of steel that is powder-coated with an epoxy, acrylic or polyester finish. Testing suggests that only the epoxy powder coating is durable. Anodized or powder-coated aluminum, although less common, is also an acceptable material for storage equipment. Older steel equipment was finished using a baked enamel coating. Because of the solvents used in the curing process, all coatings off-gas harmful substances until they are cured. Consult a conservator if you believe your older steel equipment with baked enamel is off gassing.

Storage cabinets, shelving units, and other equipment built of wood, especially unsealed wood, pose a high risk to sensitive collections. Even after many years, wood off-gasses harmful organic acids and peroxides. Replace wood equipment with newer steel equipment.

For guidance on selecting storage equipment, see *COG* 4/1: Museum Storage Cabinets and 4/10: Determining Museum Equipment Storage Needs.

***Containers:*** Storage containers are often made of corrugated paper-based boards or plastics. They come pre-made, ready-to-assemble, or can be custom material made. Museum quality corrugated boards are made of acid-free paper and are available in neutral pH (unbuffered) or alkaline pH (buffered) varieties. Museum quality corrugated plastic is usually made polyethylene or polypropylene plastics, which are stable and non off gassing.

***Other storage materials****:* Other paper and paper-based materials include tissue paper, folders, and many forms of paper-based board. To be museum quality, they must be acid-free and of neutral or alkaline-buffered pH.

Certain plastics are considered museum quality storage material, such as polyethylene and polyester. These are available in a variety of bags and folders. See *COG* 8/4*:* Care and Identification of Objects Made from Plastic. Note: These plastics can generate static electricity at low RH and should not be used with objects that have friable surfaces.

3. *Where do I find additional guidance on storage equipment and containers?*

For guidance on selecting storage containers and other materials, see the following *COG*;4/9: Buffered and Unbuffered Storage Materials, 13/3: Polyester Encapsulation, 14/2: Storage Enclosures for Photographic Prints and Negatives, and 18/2: Safe Plastics for Exhibit and Storage.

Refer to the NPS *Tools of the Trade* listing of materials, equipment and suppliers for managing museum collections, the bibliography at the end of this chapter and the NPS *Conserve O Gram* series.

## D. Assessing the Collection and its Storage Needs

1. *How do I assess the collection?*

To assess the collection:

- Examine the entire collection, focusing on objects in, or designated for storage. Include all objects that may be returned to storage, including those currently on exhibit, awaiting processing or outgoing loan.

- Note the types of objects by discipline and material, quantities of each object type, relative sizes, and required volumes for safe and accessible storage. For example, consider a hammer and a wagon. Both are history objects and made of more than one material, however, each has different storage requirements and containment needs.

- Note object types by discipline and material makeup and their ranges of sensitivity to agents of deterioration such as temperature and relative humidity, light, and air pollution.

- Identify the types and approximate quantities of objects that the park plans to acquire in the future. Consult the park's approved Scope of Collection Statement for this information.

Consider future archeological and natural history projects that are likely to generate collections that will need to be accommodated in storage.

2. How do I assess collection storage equipment needs?

Use the following guidance to assess current storage equipment and what is needed:

- List the types of existing storage equipment (museum storage and specimen cabinets, map cabinets, file cabinets, shelving, painting racks, specialty racks, high-density storage systems). See NPS *Tools of the Trade* for equipment types and descriptions.

- Note the manufacturer and model number of each type of equipment. If the equipment is non-standard, note its size (width, depth, and height).

- Note the condition of the equipment (operation of locks, condition of gaskets, evidence of rust, dents, holes, scratches).

- List any equipment that will need replacement due to poor condition or functionality.

- Note if additional museum equipment is needed.

- Determine if you will need specialized equipment or adaptations to equipment to house specific types of objects or make more effective use of the space. For example, installing a high-density (compactor) storage system or racks to make optimum use of vertical storage or wall space.

- Determine if a rearrangement of the equipment could better use the existing space.

- Note the types, numbers and location of devices used to monitor temperature and relative humidity and types of environmental equipment used to assist or

take the place of a central HVAC system.

- Note the types of supplies or equipment used in the housekeeping program for the space (vacuum cleaners, brooms, dust mops, etc.).

3. *How do I assess storage techniques and methods?*

Use the following guidance for assessing object storage techniques and methods:

- Note the condition and appropriateness of equipment used.
- Note how types of objects are organized in cabinets, racks and shelves. Indicate if objects are crowded or stacked; these are conditions that must be fixed.
- Note how individual objects are contained. Indicate whether containers are appropriate and provide adequate physical protection.
  - Are objects stable and set securely in their containers?
  - Are objects adequately secured and cushioned to prevent them from moving or sliding when being accessed?
- Make recommendations for improving storage techniques and methods.

The assessment worksheet and observation/recommendation codes in Figure 7.2a and 7.2b can help simplify the assessment process. Figure 7.2a contains the sample worksheet. Figure 7.2b contains the assessment codes to be used in the worksheet.

## E. Assessing the Current Storage Facility or Space

1. *How do I assess the existing storage facility or space overall?*

Examine the existing structure(s) and space(s) that are used for museum collection storage to identify how well they meet storage space standards and requirements covered in this chapter. Work closely with facilities management staff to assess your storage facility or space. In particular:

- Note the structure's construction and fabric (wood, masonry, single-story).
- Record the overall dimensions of the space, including the ceiling height and type (for example, 8' drywall ceiling).
- Note the number and size of access doors (measure all doors that objects will pass through).
- Determine, with the assistance of an architect or engineer, if the structure has the strength to safely withstand the loads associated with the collections to be stored. This is especially important for second floors in a structure.
  Note: Paper, ceramic, metal, glass, and wood objects in great volumes are very heavy.
- Note any characteristics of the structure that would hinder the movement of objects or equipment. Stairs and structural posts impede the movement of objects, especially large and heavy ones. Such access routes also increase the risk of accidental breakage.

- Note sizes and directional orientation of windows, overall condition, and type of glazing such as glass, acrylic or polycarbonate).

- Note any electrical service and plumbing fixtures and determine if existing electric service has capacity for add-on functions such as air-conditioners, humidifiers, dehumidifiers, or additional lighting.

- Note wall coverings (dry wall, plaster, brick, paneling). Some wall coverings and construction are more fire-resistant and secure than others.

- Note type and location of light fixtures (incandescent, fluorescent, etc.).

2. *How do I assess physical security?*

Your collection must have appropriate security. You will need to conduct an assessment of the security risks to the collection. Use the following guidance in assessing physical security:

- Conduct a physical security risk assessment as described in Chapter 9, Security and Fire Protection.

- Note any extant intrusion alarm system (type, location of sensors, nature of monitoring, who responds, and response time) serving the space.

- Note the construction and locking mechanisms of doorframes and doors (e.g. metal, solid-core wooden, wooden hollow core, mortise or dead bolt locks).

- Note how windows are secured (latches, plywood-covered, bars).

- Identify the park staff who have keys to storage areas and park staff who require access but are not issued keys. Note whether staff members from other divisions need to enter or pass through the area to access major junction boxes or cleaning supplies.

- Note any other functions that occur in the storage space.

- Note any areas in the storage space where security is compromised. For example, easy access from an adjoining space through the area above a dropped ceiling.

- Note if a visitor/researcher log is used and maintained.

Refer to Chapter 9 of this handbook for details on conducting a risk assessment and for specific security guidance.

3. *How do I assess fire protection?*

Use the following guidance in assessing the fire protection system:

- Conduct a fire protection risk assessment as described in Chapter 9.

- Note any extant fire protection system. Include type of system (wet pipe sprinkler, water mist, ionization, smoke, heat activated) serving the space.

- Determine how the detection alarm is monitored, the responsible party for responding to an alarm, and the response time.

- Check to ensure that the park's Structural Fire Plan is current and consistent with *Director's Order #58: Structural Fire Guidelines.* The plan should

clearly identify the pre-suppression actions for the responding authorities (for example, how to enter the storage space or the priority list for evacuating objects).

- Identify the number, types, and locations of hand-held fire extinguishers. Check extinguisher inspection tags and labels to be sure extinguishers are regularly maintained.

- Identify the closest water supply (fire hose or hydrant) available for large-scale suppression of a fire.

Refer to Chapter 9 of this handbook for further information on conducting a fire risk assessment and for specific fire protection guidance.

4. *How do I assess environmental monitoring, evaluation and control?*

To assess collection storage environment:

- Become familiar with the information on environmental monitoring and control in Chapter 4, Museum Collections Environment.

- Monitor and analyze readings on duration, time and location of readings within the facility or space for temperature and relative humidity.

- Note the type of existing environmental monitoring equipment (data logger, hygrothermograph, etc).

- Check to ensure that environmental monitoring equipment is properly calibrated and maintained.

- Answer the following questions:

  – Do the records indicate a proper environment is being maintained?

  – Do building features such as the climate control system (heating, ventilating, air-conditioning (HVAC) or superior insulation and vapor barrier contribute to maintaining the environment?

  – Do the records indicate diurnal or seasonal changes?

- Obtain and reconcile readings for the local climate (outside temperature and relative humidity readings) with your interior readings. The local climate impacts your ability to maintain a the storage space environment. For more information, see Chapter 4: Museum Collection Environment.

- Note the type of HVAC (air-handling) system in use (oil-fired furnace, heat pump, central air). Indicate whether the system is dedicated to controlling the environment within the storage space or the entire structure. In particular, note the following information:

  – location of the thermostat (or humidistat)

  – location of air supply and return registers

  – how the air is filtered

- Obtain manufacturer's equipment operating manual. Work closely with facilities management staff to determine maintenance history of equipment.

- Examine the data on visible light and ultraviolet radiation levels in the storage space. If fluorescent lighting and ultraviolet filters are installed, use a light monitor to take readings to ensure that filters are blocking ultraviolet light.

- Note levels of dust and possible sources of dust. Note the types of dust covers used to protect objects stored on open shelving (for example, plastic or cotton muslin).

- Note any current evidence and/or history of biological infestation. Determine if the park has an Integrated Pest Management (IPM) program in operation. Note any data that staff has recorded on types of pests found in storage.

If available, obtain measurements for sulfur dioxide, hydrogen sulfide, and oxides of nitrogen from the Environmental Protection Agency or a local agency. Attempt to identify industry in the area that could produce pollutants that affect the collection. If appropriate, examine data available on pollutant readings from a number of years. Note any trends and describe the existing and potential threats to the collections.

5. *How do I record and represent information about the storage space and structure?*

Prepare a floor plan that indicates the following information:

- dimensions and arrangement of storage areas, including structural features that may restrict arrangements of equipment and must be worked around (structural posts, beams, conduit, drains)

- location of doors, stairs, and windows

- location of electrical service (conduit, outlets, switches, fixtures, and panel boxes) and plumbing (pipes, valves, and drains)

- dimensions and existing location of museum specimen cabinets and shelving, including aisle widths

- location of fire detectors/suppression system detectors and sprinkler heads, fire extinguishers, stand pipes, and any other fire protection equipment

- location of environmental monitoring and control equipment

Security systems and devices are generally not indicated on the floor plan because dissemination of the plan could jeopardize security.

Refer to Figures 7.3, 7.4, and 7.5 for sample floor plans.

## F. Planning for New or Upgraded Storage Space

Use the information you gathered in your assessment of storage needs (Section X) and your assessment of the current storage space (Section X) to plan your new or improved storage space. Only after you determine how much equipment you need, and the space you need to house that equipment, will you be able to adequately assess storage locations and spaces.

1. *How do I determine the storage equipment needed?*

Refer to *COG* 4/10, "Determining Museum Storage Equipment Needs," for guidance on determining equipment needs.

2. *How do I determine how much space is needed to store my collection?*

Refer to *COG* 4/11, "Determining Collection Storage Space Requirements," to determine your space requirements

3. *What process do I use to evaluate potential storage locations?*

If you find that your current storage space is too small to house the collection or if the current space is unsuitable for other reasons, conduct a value analysis of the collection storage function. A value analysis is a process of defining the problem, exploring solutions to the problem, and deciding on the best solution in terms of overall value. See NPS Director's Order #90, Value Engineering Guideline, for information on conducting a value analysis.

Policy requires that you complete a formal value analysis for renovations or new facilities costing over $500.000. You may also do an informal value analysis for small- to medium-sized collection storage spaces costing less than $500,000.

A value analysis includes an informational phase, a creativity phase, an evaluation phase, a development phase, and a recommendation phase. The informational phase includes a full examination of the collection storage function. You will need to fully understand and state the needs of the collection storage function. The standards and requirements for collection storage should guide the informational phase.

4. *Who should I consult with when considering building, renovating or upgrading a space for storage?*

Consult with a structural engineer or other structural design expert, an architect or an historical architect as appropriate, the facility manager and your regional curator when building, renovating or repurposing a space for use as storage. A significant addition of new storage equipment and/or collections to existing storage space also requires expert consultation. Discuss the following considerations:

- type of materials in the collection that will be stored
- quantity of materials in the collection that will be stored
- type and quantity of storage cabinets and other equipment, including size and weight, and whether multiple units will be stacked on top of each other
- use of moving equipment (power lift stackers, pallet trucks, forklifts, etc.)

5. *What storage space alternatives should be examined?*

The creativity phase of the value analysis presents alternatives for achieving the collection storage requirements. Consider the alternatives below.

***Modify or retrofit the existing storage space.***
This alternative may range from re-arranging storage cabinets to removing/modifying walls and ceilings. Projects might include:

- installing new environmental, fire protection, and security systems;
- installing a mobile or compactor storage system;
- repainting or replacing the flooring.

Use floor plans and other drawings to plan and represent the changes to the space.

Document all changes. Describe how existing conditions can be corrected to conform to NPS requirements.

Retrofitting may involve the use of an insulated modular structure (see description in the NPS *Tools of the Trade*, VI:6) and Section H "Using Storage Equipment to House Objects" (question 2).

***Locate other storage spaces in the park***.
This alternative involves looking at and evaluating other spaces in the building or in other buildings in the park. Provide a description of the actions needed to adapt space(s) to conform to NPS storage standards and requirements. You may use an insulated modular structure to adapt an alternate location such as a historic structure into acceptable space.

In each instance, gather and record the pertinent information to assess the appropriateness of the space. Use floor plans and other drawings to detail use of the space. Refer to Section E "Assessing the Current Storage Facility or Space" (question 6) for information to put on the floor plan.

***Develop new space.***
Develop new space, either in a dedicated facility or in an existing facility where it would share, but be separated from, other park functions such as a visitor or research center.

Use floor plans and other drawings to detail proposed usage of the space. Refer to Section E "Assessing the Current Storage Facility or Space" (question 6) for information to put on the floor plan.

***Investigate off-site storage in new or leased space.***
Use floor plans and other drawings to detail use of the space. Refer to Section E.2 for information to put on the floor plan.

***Store the collections in a NPS center or regional repository***.
You may house collections in off-site storage centers or repositories. Several NPS centers specialize in storing collections from archeological projects. These centers provide space and manage materials loaned from parks. The centers also conduct archeological research and provide scholars with access to the collections. Centers that specialize in archeological collections include the Southeast Archeological Center in Tallahassee, Florida; the Midwest Archeological Center in Lincoln, Nebraska; and the Western Archeological and Conservation Center in Tucson, Arizona.

Other repositories accommodate all types of collections. It may be necessary for you to store your collection off-site in a NPS regional repository when your park lacks:

- acceptable space to house objects safely
- qualified curatorial staff to provide day-to-day care for the collection

*Store the collections at a university, college, museum or other non-NPS institution.*
Your regional curator can assist in making arrangements with non-NPS repositories for the storage and curation of collections. ***Institutions that house park museum collections must meet NPS standards and requirements for museum object preservation and protection***. NPS collections should be clearly identified and kept as separate as possible from the institution's own collections.

***Consolidate storage with another park***.

You may find it necessary or advantageous to arrange to store your collection with a park that has available space and staff to care for it. Some larger parks also provide storage and care for the collections of nearby smaller parks. Contact your regional curator for information.

***Make no changes to the existing storage space.***
List the reasons why your current storage area meets requirements. Or, if your storage area does not meet storage requirements, list possible consequences to the collection.

6. *What occurs in the evaluation, development, and recommendation phases of a value analysis?*

In the evaluation phase, you assess alternatives for meeting the storage requirements. Consider all alternative locations for museum collections storage. Visit and examine each possible location and record pertinent data. Indicate the potential of each alternative space to satisfy the collection storage requirements. You may use the evaluation process used by the NPS called "Choosing by Advantage" (CBA) at this phase. Incorporate start-up and life cycle costs. Document the alternatives you evaluate.

In the development phase, you *reevaluate* the best alternatives.

In the recommendation phase, you *select* the best alternative.

7. *What other factors should I consider?*

Consider the following when planning collection storage:

- Phase the project to allow improvements to occur as funding becomes available. For example, rehabilitate the space one year; install environmental control equipment and security and fire protection systems in the second year; purchase replacement and new equipment in the third year.

- Prepare appropriate programming documents. Refer to Chapters 1 and 12 of this handbook for guidance on NPS planning documents for programming and funding curatorial projects.

- Maintain and store only museum collections that are identified in the park's approved Scope of Collection Statement.

- Maintain museum collections for easy access. The park can make better use of the collection if it is readily accessible on-site.

- Store archival and manuscript collections in boxes on shelves or in folders in map cases (for oversize items). Do not store archive collections in file cabinets or fireproof cabinets.

## G. Developing Storage Planning Documents

1. *Why should I create planning documents for my collection storage space?*

Planning for museum storage is essential to ensure maximum preservation and optimum access to the collection. Creating planning documents for collection storage will help ensure that the necessary requirements are met. The process of collection storage planning may focus on:

- the development of a new facility

- the rehabilitation or upgrading of an existing space or facility

- a specific aspect of museum storage such as determining equipment and space requirements for a collection, determining a special layout of equipment, or outlining specific techniques for housing museum objects on shelves or in cabinets

In the National Park Service, the product of collection storage planning may be a Collection Storage Plan (CSP), a chapter or section on museum collection storage in a Collection Management Plan (CMP), a Collection Condition Survey (CCS), or an archival assessment. Regardless of the product, some or all of the elements of a CSP, described below, are incorporated into the planning process.

*2. What is a Collection Storage Plan (CSP)?*

A Collection Storage Plan (CSP) is an official stand-alone document developed to help a park or center improve the storage conditions for a museum collection. It may be prepared to solve specific storage problems, guide renovation of an existing space into collection storage, or guide the design of a new facility.

A CSP must include the following core elements:

- a determination of the size of storage space needed

- a determination and listing of specialized storage equipment needed

- a floor plan illustrating a recommended layout of equipment

- an assessment of object storage techniques and methods and recommendations for improvement

- a solution for park-specified or urgent storage problems

A CSP may also include the following:

- an assessment of the nature of the collection

- an assessment of the existing collection storage facility and/or space(s)

- an assessment of the existing storage conditions in comparison with NPS standards and requirements for storage

- identification and discussion of storage space alternatives

The specific nature of the collection and the availability of funding and staffing are factors to consider when selecting alternative storage options.

3. *What does the collection storage chapter or section of a CMP, CCS, or archival assessment contain?*

The storage chapter or section of a CMP, CCS, or archival assessment contains some or all of the elements of a CSP. It is incorporated into the larger report rather being a stand-alone document.

4. *Who can write a collection storage planning document?*

For objectivity and diversity of views, NPS curatorial staff from outside the park usually prepare a collection storage planning document. You can also procure the services of a museum professional or architectural/engineering firm with expertise in collection storage planning. Contact your regional curator for guidance on writing a storage planning document. The Park Museum Management Program can provide examples of a CSP.

5. *How do I calculate the cost to prepare a storage planning document?*

Determine the cost to produce a basic CSP (incorporating the core elements) by calculating what funds are required for:

- approximately 2-4 weeks of the preparer's time
- travel and expenses for a 1-2 week site visit
- printing and duplicating the document

To produce a CSP with more than the core elements will require additional time and increased costs. Consult the Cost Estimates Figure in Appendix F: NPS Museum Collections Checklists, for a current estimated cost to produce a CSP or storage planning document.

6. *Where do I get funding to do a collection storage planning document?*

Possible funding sources to produce collection storage planning documents include:

- Cultural Resources Fund. All project funds, including the Cultural Resources Preservation Program (CRPP) and the Museum Collection Preservation and Protection Program (MCPP) are now grouped together within this fund.park or center base funding
- park cooperating association donation account
- special funding initiatives that may be announced

To obtain storage planning project funding, you must identify the need for a collection storage planning document:

- in the "NPS Checklist for Preservation and Protection of Museum Collections" using the Automated Checklist Program in ICMS.

  Identifying the need in the checklist links the project to the NPS Strategic Plan (Goal Ia6) and the Government Performance and Results Act.

- as a project statement in the Resource Management Plan (RMP).
- as a project statement in the Performance Management Information System (PMIS).

7. *Where do I include technical supporting information and drawings such as floor plans in the storage planning document?*

Use appendices or attachments for technical information such as product/source information, environmental monitoring data, illustrations for constructing specialized equipment, and floor plans. Preparers should consult their regional/curator and the Park Museum Management Program for assistance in gathering material for appendices.

## H. Using Storage Equipment to House Objects

1. *Why is it important to use specialized museum storage equipment?*

Specialized museum storage equipment provides vital "front line" protection for museum objects, reducing or eliminating exposure to many of the agents of deterioration. Equipment for storing museum collections is specially designed and fabricated to protect collections.

***Museum cabinets*** have synthetic gaskets that help create an interior microclimate to minimize climate fluctuations.

> ***A well sealed cabinet creates a stable interior climate that buffers against temperature and relative humidity fluctuations, and deters damage caused by light, dust, airborne pollution, and pest infestations. It provides an extremely efficient "passive" way to house collections and minimize energy costs***

***Shelving units*** provide physical protection for objects too large, awkward, or heavy to fit within museum cabinets. Specially designed racks accommodate and provide physical protection for hard-to-store objects.

***Special building systems*** create quality space inside other structures, such as historic structures without adequate insulation or a vapor barrier. See prefabricated modular structures below.

***Equipment made from unstable or sub-standard materials may harm objects rather than protect them***. Do not use cabinets, shelves, and other equipment designed for non-museum purposes unless they are made from materials that can be identified as safe (i.e. non-reactive, not off-gassing)

2. *What types of equipment does the NPS use to store museum collections?*

The NPS uses the following types of equipment to house collections:

***Cabinetry***

The NPS generally uses three primary types of cabinets to form a basic modular system that facilitates efficient organization and access to objects. Refer to *COG* 4/1, "Museum Storage Cabinets." These three cabinets are the standard museum cabinet, the doublewide museum cabinet, and the wardrobe cabinet. In addition, a wide variety of specialized entomology and herbarium cabinets, map cabinets, large flat storage cabinets, and utility cabinets are available from reputable vendors. Require that cabinets have an Air Exchange Rate (AER) of no more than one (1) per every two to four (2-4) days. These will maintain a stable microclimate without additional buffering. Use ultrasound leak detecting for welds and doors. Refer to the NPS *Tools of the Trade* for descriptions and sources for available types of museum cabinetry

***Shelving***

Several types of *fixed shelving* are available. Refer to the NPS *Tools of the Trade* for descriptions, uses, and sources of available museum shelving. Steel shelving units, pallet racks, and slotted angle racks are frequently used. Steel shelving is recommended for boxed archival and manuscript collections. Pallet racks and

slotted angle racks are useful for storing furnishings and other larger, heavier items. Slotted angle racks are constructed using lengths of metal angle that can be custom cut. You can configure and construct a slotted angle rack for objects with specific support or space requirements. The shelf decking can be made from metal panels or other appropriate materials.

*Shelving on casters* that allows for limited but convenient movement, is used to house a variety of materials, including painting racks, rolled textiles, and large objects.

***Prefabricated modular structures***

A prefabricated building system can be used to create a collection storage facility that is economical to construct, efficient to operate, and effective in creating appropriate environmental conditions. The building system is made of highly insulated, foam-core, metal sheathed panels. It should be used only inside a host structure and will require an internal fire protection system. For information on these structures, consult the following NPS publications:

- NPS *Preservation Tech Note*, "Museum Collection Storage in an Historic Building Using a Prefabricated Structure."
- *CRM* Supplement, "Collection Storage – Making a Case for Microenvironments."
- *COG* 4/7, "Museum Collection Storage Space: Is an Insulated Modular Structure Right for your Collection?"
- *COG* 4/8, "Selecting Environmental Control Systems for Insulated Modular Structures."

These publications provide discussions and give guidance in using this special building system for museum storage. The NPS *Tools of the Trade* provides information on sources for this building system.

3. *What are some other considerations when using museum storage equipment?*

Consider the following when using museum storage equipment:

- In planning for cabinets and shelving, examine all objects in the collection. To the extent possible, organize objects by material type and size rather than by accession or catalog information.

- Ideally, do not install cabinets and shelving units against exterior walls. This arrangement may lead to condensation inside the cabinets.

- Ensure that museum cabinets are free of rust, have intact gaskets to provide good sealing action, have smooth operating doors, and have working keyed or combination lock mechanisms.

- Keep loads in museum cabinet drawers below 50 pounds. Do not stack museum cabinets more than two high.

- Raise museum cabinets and shelving units off the floor 4 inches, preferably 6 inches. Raising cabinets off the floor reduces the chances of damage to objects in case of flooding and facilitates the cleaning of floors and inspection for pests

- Use metal risers to raise cabinets and shelving units off the floor. Level the sanitary bases and check the leveling of cabinets once installed on the bases.

Adjust cabinet doors using manufacturer supplied washers so that doors close properly and seal well.

***Housing objects in well sealed, gasketed cabinet is an effective way to create a stable microclimate within a larger storage space that may be prone to relative humidity and temperature fluctuations.***

After receiving new cabinets, carefully inspect and test all drawers, doors, and gaskets. Make sure there are no cracks or gaps in the cabinet. Test this by placing a flashlight (or other portable light source) inside of the cabinet and turning off the lights in the room. If any light shines through, contact the manufacturer to correct the problem.

4. *How does layering or containerizing create a stable environment?*

The more layers or containerization, the more stable the object's environment and the greater its protection. Each successive layer or enclosure further stabilizes the object environment. See Figure 7.1. Multi-layered protection of an object.

5. *How should I organize the equipment in my collection storage area?*

Organize equipment to maximize space while maintaining easy and safe access to collections. Number and label the storage space, furniture/equipment, and all shelves, drawers, and racks in a thoughtful, consistent manner. Maintain a current floor plan of your organizational schema. Uniquely identify each piece of furniture (cabinet, shelf, rack, etc.). Use letters or numbers (or a combination of both) to sequentially number cabinets, drawers, and shelves. For example, a collection storage space might contain:

- Ten storage cabinets (C1 - C10), each with shelves 1-5 or drawers 1-9
- Three open shelving units (A - C) with shelves 1-6

An organizational system such as this makes identifying object locations easy and allows you to record object location on the catalog card. Sequentially number equipment to accommodate any additions or removals without compromising the numbering scheme.

6. *What role does housekeeping play when selecting and organizing storage equipment?*

Proper housekeeping is essential to a park's preventive conservation program. Select and arrange your storage equipment to facilitate good housekeeping by following the guidelines below..

- Equipment should have white or light colored finishes (inside and out) to provide easy detection of dust or pest debris.
- Ensure cabinetry has 4" or higher legs to allow vacuum cleaning of the floor underneath
- Arrange equipment with doors so that they do not prohibit the doors of neighboring equipment to fully open (for proper access during cleaning).

## I. Using Containers and Supports to House Objects

1. *Why is it important to use storage containers and supports?*

Museum storage containers and supports provide a buffer between the object and its surrounding environment. A multi-layer storage system, provides increased protection. See Figure 7.1. The use of boxes, bags, or other sealed containers

creates an internal microenvironment that protects the object from environmental fluctuations, as well as physical forces, pollutants, and light.

Supports such as specimen trays and cradle mounts reduce the potential for damage or loss when storing or handling items requiring special support. Consistent use of specialized, quality containers and supports can also help organize and increase accessibility of the collection.

Cover objects stored on racks or shelving units in the open with muslin, Tyvek or flame retardant plastic to protect the objects from dust. Where possible, cover the entire shelving unit like a tent, see *COG* 4/2, Creating a Microclimate for Oversized Museum Objects.

2. *What kinds of containers and supports should I use for storing museum collections?*

The containers and supports listed below are widely used to store museum collections:

***Boxes**:* Museum quality boxes come in a variety of types, shapes, and sizes. Most are made of acid-free, corrugated paper board. They are available in pH neutral (unbuffered) or slightly alkaline (buffered) varieties. Corrugated polypropylene or polyethylene boxes are also used to store materials and are generally more rigid and durable. Archival boxes can house documents files, records, rare books, prints, photographs, and textiles. See Appendices J, K, and R as well as *Tools of the Trade.*

***Specimen trays**:* Specimen trays are made of alkaline (buffered) acid-free board. They can be used to hold natural history specimens in museum cabinets and can provide layered storage in archival boxes. A variety of sizes are available. Note that alkaline (buffered) board paper can damage pigments and proteins in bird and mammal specimens. For these types of specimens, use unbuffered, pH neutral trays or line buffered trays with polyethylene sheeting (to block the direct migration of alkalis). See *MH-I*, Appendix T and *Tools of the Trade*.

***Folders**:* Museum quality folders are composed of acid-free, buffered or unbuffered cardstock material and are used to house and protect historic documents. Folders come in many types, including file folders (both letter and legal size), herbarium sheets and folders, manuscript and map folders for oversize items. See Appendix J and *Tools of the Trade*.

**Note:** Alkaline (buffered) folders can damage blueprints and other pH sensitive papers with acidic print processes.

***Photo enclosures**:* Photo enclosures of made of acid-free, unbuffered paper are used to house photographic prints and negatives. Various sizes and varieties including sleeve type (sealed on three sides) and folding type (4 fold) are available. See *MH-I*, Appendix R and *Tools of the Trade*.

***Bags**:* Polyethylene interlocking "zipper" seal bags can be used to house archeological materials and other small objects for storage in archival boxes and cabinets, for cold storage of some photographic materials, and to provide protection from pests. Bags without "zipper" seals are also available for objects that do not require or should not be stored in a sealed container.

Avoid the use of bags developed for food storage and home use because of printing inks and dyes. These contain butylated hydroxyl toluene (BHT) which leaches into specimens and objects and renders scientific analyses invalid. Bags for the storage

of museum objects are available through *Tools of the Trade*.) See *MH-1*, Appendix I and *Tools of the Trade*.

***Liners**:* Protect objects from coming into contact with metal drawers or shelves with 1/8" or 1/4" thick polyethylene foam as a liner. This foam is inert, closed-cell, and resistant to moisture. See *Tools of the Trade*, IV:4.

***Cavity packing**:* Planks of polyethylene foam together with a smooth liner, such as Teflon, can also be used to cavity pack certain objects. Cavity packing creates secure compartments for objects. Spaces the size and shapes of the objects are cut into the foam to create a cavity that separates objects and restricts movement, providing support/cushioning and still allowing for easy access. See *MH-I*, Appendix I and NPS *Tools of the Trade*, IV:4.

***Cradle mounts**:* Polyethylene foams are also used to create cradle mounts. These mounts are used to support structurally weak objects in order to alleviate stress on the weakest points. The foam is cut to the shape of the object and provides it a secure base to rest on. See *MH-I*, Appendices I and P.

***Ring supports**:* Polyethylene foam can be used to provide stability for round or spherical objects stored on shelves or in cabinets. A circle of foam is cut out, then the interior is cut out (like a donut) to the appropriate size and shape for the object to be supported. Vases and pots are commonly recipients of ring supports and together with smooth liners if they have friable surfaces.

***Tie-down supports**:* Objects are secured to platforms of polyethylene foam or corrugated board. Then, using Teflon tape, the objects are tied to the platform to prevent movement. Long, slender objects with a tendency to roll can be secured using this method.

### 3. *What role can specialized microclimates play in housing objects*

The creation of local, specialized microclimates with a humidity-buffering agent (such as pre-conditioned, enclosed packets of gel or silica gel) can be an effective part of a multi-layered storage approach for certain materials. Specialized microclimates are useful in protecting selected objects from inappropriate and damaging relative humidity. The buffering agent placed inside the microclimate regulates the amount of humidity in the enclosed space housing the objects.

**Note:** A well sealed case rarely needs a specialized microclimate. However, microclimates can be created for certain types of materials, such as actively oxidizing pyritic fossils or metals corroding due to the presence of chloride salts that need to be maintained at 20% RH. Once installed, closely monitor the microenvironment.

Before deciding to create a specialized microclimate, first monitor and determine what the microclimate is inside a cabinet over a period of at least 6 months to determine if the object(s) need a specialized microclimate. Evaluate your findings to determine whether a specialized microclimate is needed or if the cabinet environment is sufficiently stable.

For guidance in the creation of microclimates, see the following *Conserve O Grams*:

- *COG* 1/8, "Using Silica Gel in Microenvironments."
- *COG* 4/4, "Creating a Microclimate for Oversized Museum Objects."
- *COG* 4/16, "Creating a Microclimate Box for Metal Storage."

4. *Where do I find additional information on techniques for storing museum objects?*

The appendices in this handbook as well as the *Conserve O Gram* series provide information on the curatorial care and housing of different types of objects, specimens, and archival collections. Figures 7.6-7.11 below illustrate some of the equipment and techniques for storing museum objects.

See also the selected bibliography in each appendix for additional references. *Tools of the Trade* and the appendices list the recommended materials to use.

## J. Collection Storage in Historic Structures

NPS *Management Policies* 2006, Section 5.3.1.4 states:

*"When museum collections are housed in a historic structure, the needs of both the collection and the structure will be identified and evaluated, weighing relative rarity and significance, before environmental control measures are introduced."*

It is critical to be aware of, and balance the needs of the objects and the historic structure in which they are housed in order to avoid damage to one or both.

1. *What are the concerns about storing collections in historic structures?*

Storing collection objects in historic structures poses a number of challenges. These include:

- Stabilizing and controlling temperature and relative humidity
- Blocking ultraviolet radiation
- Blocking and/or minimizing exposure to visible light
- Pest exclusion
- Logistic and structural issues (moving and housing objects and/or storage equipment)
- Safety (security and fire protection)

Difficulty in controlling these variables, in particular temperature, relative humidity, light levels and pests can result in severe damage to the objects, the structure itself, or both.

***Temperature and relative humidity***

Most structures pre-dating the mid 20$^{th}$ century were not designed to accept modern HVAC systems. In many cases, the installation of complex HVAC systems can introduce a new set of problems to walls, ceilings, and floors that were not well-insulated. The introduction of vapor retardants (moisture barriers) may also create problems. The installation of modern HVAC systems as well as attempts to control and maintain a specific climate (temperature and humidity) can result in moisture condensation, mold, warping, and other problems within the walls of the structure.

***Light***

Most historic structures were designed for human use and comfort. Most have windows that allow in large amounts visible light and ultra-violet radiation. UV

and visible light causes irreparable damage to objects and also makes control of temperature and RH difficult. Given that many historic furnished structures are routinely opened to the public, it is important to work with park staff, including interpreters and the facilities manager, to find viable and historically appropriate and sympathetic ways to block light, such as shutters or curtains, or UV filtering film.

***Pests***

Historic structures are generally not well-sealed against pests. Sliding or rolling doors, gaps under doors and roofs, and around windows, cracks in floors and ventilation openings in floors and walls allow intrusion of insects, rodents and other pests. A good IPM used in conjunction with exclusions, including steel and bronze wool, hardware cloth, door sweeps and other barriers, is essential in combating pests. Work with the cultural resource manager, facilities manager and building maintenance staff and your IPM co-coordinator to ensure damage to the fabric of historic structures and use of chemicals is kept to a minimum, and exclusions are maintained.

***Logistics***

Narrow doors, hallways, and steep stairs can make it difficult to move cabinets or other equipment into the building. They also make moving large collections or unwieldy objects hazardous. Historic structures are likely to have limited load bearing (capacity) and may not be able to accommodate heavy weights.

***Security***

Historic fabric, such as doors or locks may not be modified without damaging the historic fabric of the building. Work with your facilities manager to provide unobtrusive and non-damaging ways to secure the collections.

2. *Should I store collections in a historic structure or send them off-site?*

Moving collections to more environmentally secure off-site storage can greatly enhance their long-term preservation. However, it makes collections less accessible to staff and visitors on-site. Consider and carefully weigh the following:

- Long-term preservation needs of the object
- Long-term preservation needs of the structure
- Accessibility of collections for interpretive or program needs
- Costs and risks of transporting objects between sites
- Security of the site
- Concerns within the local community about relocating objects of great interest or significance

When long-term preservation is the only consideration, a modern, off-site storage facility is preferable to on-site storage in a structure that lacks adequate environmental, security, or other controls.

3. *How can I create the best possible collection storage in a historic structure?*

There are a number of practical measures that can be taken to improve the storage environment in a historic structure:, including:

***Containerization***

Placing objects within layered and enclosed containers will minimizes the impact of temperature and relative humidity fluctuations. For example, house objects within sealed containers within a museum cabinet that is placed away from the exterior wall or windows. See Figure 7.1. Multi-layered protection of an object. This approach, combined with sustainable, modest efforts to control extremes in temperature and relative humidity, can greatly improve the long-term preservation of collections stored in historic structures.

***Microclimates***

When combined with containerization, the use of humidity-buffered microclimates (e.g. using silica gel) can further deter damaging fluctuations in relative humidity.

***Blocking agents of deterioration***

Light, whether visible or ultraviolet, can be readily blocked in storage spaces without damaging the historic fabric of a building. UV filtering film and shutters or heavy curtains sympathetic to the period provide a sustainable way to control light and minimize temperature and relative humidity extremes and fluctuations.

***Pre-fabricated modular storage***

The use of a modular, pre-fabricated storage facility constructed within a room inside the existing building, allows you to maintain collections at optimum conditions with minimal impact on the historic fabric of the building. See NPS Preservation Tech "Museum Collection Storage in an Historic Building Using a Prefabricated Structure" and the following:

- CRM Supplement, "Collection Storage – Making a Case for Microenvironments"
- COG 4/7, "Museum Collection Storage Space: Is an Insulated Modular Structure Right for your Collection?"
- COG 4/8, "Selecting Environmental Control Systems for Insulated Modular Structures."

When storing or exhibiting collections in historic structures, work closely with your facilities manager, the park interpreter and the regional curator, as well as colleagues at other historic structures to find practical, sustainable, and historically sympathetic solutions that best balance the needs of the collection, the historic structure, and the interpretive programs that serve visitors.

## K. Storage of Museum Collections Subject to the Native American Graves Protection and Repatriation Act of 1990 (NAGPRA)

### 1. *What is NAGPRA?*

The Native American Graves Protection and Repatriation Act of 1990 (25 USC Chapter 32) addresses the rights of lineal descendants, culturally affiliated Indian tribes (including Native Alaskan villages or corporations), or Native Hawaiian organizations to certain Native American human remains, funerary objects, sacred

objects, and objects of cultural patrimony with which they are affiliated. The law requires federal agencies and museums that receive federal funds to:

- conduct inventories and summaries of such items in their collections
- repatriate (return) items identified pursuant to NAGPRA to the appropriate lineal descendants, culturally affiliated Indian tribes, or Native Hawaiian organizations if requested

***Items repatriated pursuant to NAGPRA must be deaccessioned in accordance with Museum Handbook, Part II (MH-II), Chapter 6, Section N: Native American Graves Protection and Repatriation Act.***

For additional information concerning NAGPRA, see *MH-I*, Appendix A, *MH-II*, Chapter 6, Section N, and *Cultural Resource Management Guideline*, Appendix R.

2. *What types of items subject to NAGPRA are found in NPS museum collections?*

Your park's museum collection may contain items subject to NAGPRA, such as human remains, pottery, beads, prayer bundles, clothing, weapons, pipes, or other funerary, sacred, and cultural objects that are determined to belong to one or more lineal descendants, Indian tribes, Native Alaskan villages or corporations, or Native Hawaiian organizations. The culturally affiliated organization or lineal descendant with standing may request the repatriation of these items.

The individual, tribe, or organization requesting repatriation may be unable to take immediate possession of the materials, or they might prefer that certain items continue to be housed at your park. Under these circumstances, the individual, tribe, or organization with standing may want to be involved in determining how the items are preserved and stored at your park. Park management and staff will need to consult with parties with standing. Confer with your park and regional NAGPRA coordinator once such a request is made.

3. *Are there any special storage requirements for items subject to NAGPRA?*

Treat collections subject to NAGPRA with great sensitivity, because of their cultural significance, sacred importance to descendants, tribal leaders, elders, and traditional religious leaders.

Because of their special status, you may need to separate collections subject to NAGPRA from other museum collections. Consult with the lineal descendants, culturally affiliated Indian tribes, Native Alaskan villages or corporations, or Native Hawaiian organizations concerning access, storage, and use. Accommodate the affiliated organizations' or descendants' requirements where possible, and institute any needed revisions to your park's Museum Collection Access Procedures, planning documents, and standard operating procedures.

4. *How should I store collections subject to NAGPRA?*

Protect collections subject to NAGPRA from fire, theft, pests, and environmental and other threats as you would any other museum object. However, you may need to use additional and/or alternative handling and storage methods and materials to show sensitivity and proper respect for these items in accordance with the affiliated individual's or group's request.

Consult with the lineal descendants or culturally affiliated organization with standing. Ascertain their preferences related to proper handling and storage techniques and materials, and defer to their wishes where possible. You may be asked to use some of the following storage methods, procedures, and materials when caring for culturally affiliated items:

- Store human remains aligned in a particular direction (such as the cranium toward the east).

- Construct special storage containers (possibly using wood, plant, or animal products native to the tribe's homeland).

- Ensure that only organic materials touch the items. Possible methods to avoid direct contact with archival foams include:

  – covering the foam's surface with archival tissue paper or unbleached muslin

  – wrapping the item in archival tissue paper or unbleached muslin

- Store newly collected natural plant materials (such as bundles of tobacco) with the items. (You can construct special outer enclosures or boxes to house these materials separately from other collections and to protect against pest infestations.)

- Allow tribal members access to storage areas for relevant religious or ceremonial purposes. This may include actions to protect:

  – individuals working with or viewing the items

  – the facility, collections, and items from a negative force

These are just a few of the possible techniques and procedures that you may be asked to follow with items subject to NAGPRA. This list is not all-inclusive or universal, as one tribe's methods may not be appropriate for another. Consult with the lineal descendants or culturally affiliated organization with standing for guidance.

Document all new or revised procedures and guidelines for handling, storage, and use of collections subject to NAGPRA following the consultation process. This may include notations, additions, or revisions to catalog records, catalog or accession folders, planning documents, access procedures and other standard operating procedures, or other relevant park documents.

5. *Whom should I contact for assistance?*

Contact your regional NAGPRA liaison, regional curator, regional ethnographer, or local tribal members for assistance. Before beginning the consultation process, determine the proper protocol and be sure to follow it whenever you contact tribal authorities, council members, elders, and traditional religious leaders. (Consult with your regional NAGPRA liaison, regional curator, regional ethnographer, or local tribal members with issues of protocol.)

Consult with the lineal descendant, tribe, or culturally affiliated organization with standing concerning proper handling and storage guidelines, appropriate storage materials, and other procedures related to collections subject to NAGPRA at your park.

Many tribal governments have cultural resource management specialists, NAGPRA coordinators, museum staff, or archeologists who can help you. Contact your regional NAGPRA liaison, regional curator, regional ethnographer, or the

appropriate tribal headquarters for contact information.

When asking for help or guidance during the consultation process, members of the culturally affiliated organization may not provide it willingly because the discussion of such topics may be offensive or uncomfortable for them. Even within one tribe there may be different views on procedures. Be aware that this might happen and always show proper respect for these views.

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**Levels of Containment**

**Level I. Facility**

- structure
- spaces within the structure
- systems or infrastructure:
  - mechanical
  - electrical
  - utility

**Level II. Museum Equipment (Furniture)**

- cabinets
- shelving
- specialized furniture and racks

**Level III. Containers**

- folders, sleeves, envelopes
- specimen trays
- boxes
- mounts, supports

**Figure 7.2 Levels of Containment in a Collection Storage System**

**Findings and Recommendations for Upgrading Storage Techniques for Existing Storage Units**

| Storage Unit/Type | Drawer/Shelf | Code |
|---|---|---|
| Cabinet A | | * |
| Standard Cabinet | 1 | M,O |
| | 2 | M,X |
| | 3 | * |
| | 4 | N |
| | 5 | K |
| | 6 | U |
| Cabinet B | | * |
| Standard Cabinet | 1 | * |
| | 2 | M,O,X |
| | 3 | X |
| | 4 | M |
| | 5 | X |
| | 6 | * |
| Cabinet C | | A |
| Standard Cabinet | 1 | * |
| | 2 | J |
| | 3 | K,S |
| | 4 | K,S |

**Figure 7.2a. Sample Assessment Worksheet**

**Assessment Codes**

***Cabinet/Shelving Unit Specific (indicate cabinet or shelving type.)***

A Gasket is damaged, wrong type, or ineffective. Install retrofit gasket kit. See *COG* 4/3.

B Cabinet has no lock. Install sash lock or other locking device.

C Cabinet or unit is damaged. Repair or replace as required.

D Cabinet or unit is dusty or dirty. Vacuum or dry wipe interior and exterior of cabinet or unit.

E Cabinet or unit paint surface is chipped or scratched. Contact manufacturer for touch-up kit or replace if damage is severe.

F Cabinet is directly on floor or shelving unit bottom shelf is not adequately raised off the floor. Raise cabinets on platforms, appliance rollers, or caster bases so that they are 4"–6" off the floor. Adjust shelving unit bottom shelf to be at least six inches off the floor.

G Wooden rack or shelving unit components are being used. Replace or seal with impermeable, inert material.

H Drawer not being held in place by glides. Consult with manfucturer to repair or replace drawer hardware.

I Shelving unit in earthquake zone lacks shelf retainers. Install shelf retainers to prevent objects from falling off shelves during earthquakes.

J Objects in open or on shelving units are coated with dust. Install appropriate dust covers (See *COG* 4/2).

***Drawer/Shelf Specific***

K Objects are loose and unprotected in drawers or on shelves. Place objects in specimen trays and/or cavity pack.

L Objects too large for specimen trays rest directly on drawers or shelves. Place polyethylene foam pads under objects to form an inert cushioned surface on which the objects can rest.

M Objects in cabinets or on shelving are unstable and are in danger of damage by sliding or rolling. Pad, cavity pack, or cushion objects with appropriate tissue or foam.

N Objects are stacked and/or overcrowded. Rearrange or move objects to allow adequate separation.

O Weight of objects exceeds fifty-pound drawer weight limitation of standard and double wide cabinets. Remove objects as needed.

P Objects stored in inappropriate cabinet or rack. Place objects in appropriate cabinet, rack, or shelving unit as indicated.

**Figure 7.2b. Assessment Codes for Collection Storage Techniques**

***Object Specific***

Q Documents or books are loose and unprotected. Place documents in archival folders or envelopes and then in document boxes. Place books in book boxes (see *COG* 19/2). Place document or book boxes in cabinet or on shelving.

R Photo positives and negatives are loose and unprotected. Place photos in appropriate neutral pH photo enclosures and in photo enclosure boxes. Boxes can be placed in cabinets or on shelving. See *COG* 4/9 and *Tools of the Trade* for appropriate usage of enclosures.

S Maps and oversized prints are stored loose and unprotected. Place objects in appropriately sized neutral or alkaline-buffered pH map folders (blueprints and cyanotypes go *only* in unbuffered folders) and store flat in appropriate cabinet. See *COG* 19/9.

T Framed artwork is stored horizontally or stacked leaning against each other. Place artwork on a rack that will separate pieces and store them vertically. See *COG* 12/1. Use dust covers.

U Unframed artwork or large documents are stored loose and unprotected. Interleave with pH neutral, inert storage materials and/or store in boxes or cabinets as appropriate.

V Artwork framed with acidic mat board. Consult with conservator regarding re-matting with archival mat board.

W Incompatible objects stored in close proximity. Off-gassing or chemical properties of objects could harm others nearby. Separate materials according to type and consult a conservator; a Collection Condition Survey (CCS) may be necessary. See Chapter 3 for information on conducting a CCS.

X Objects stored in containers or labeled with tags made of acidic materials. Replace acidic containers or tags with ones made of archival materials.

Y Objects have active deterioration, mold or physical damage. Conservation survey should be requested.

Z Evidence of pest infestation observed. Integrated Pest Management program needs to be implemented or improved.

XX Other as indicated

* Proper Storage

**Figure 7.2b. Assessment Codes for Collection Storage Techniques (continued)**

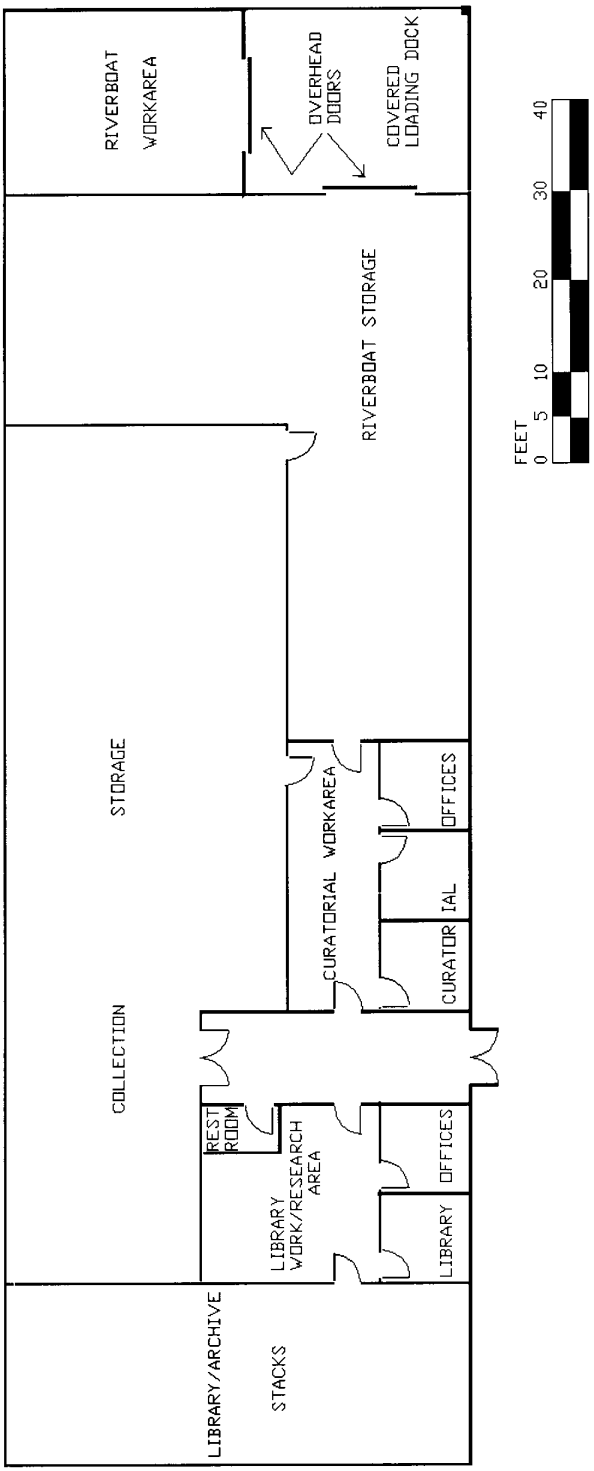


**Figure 7.3. Sample General Floor Plan of a Museum Collection and Library**

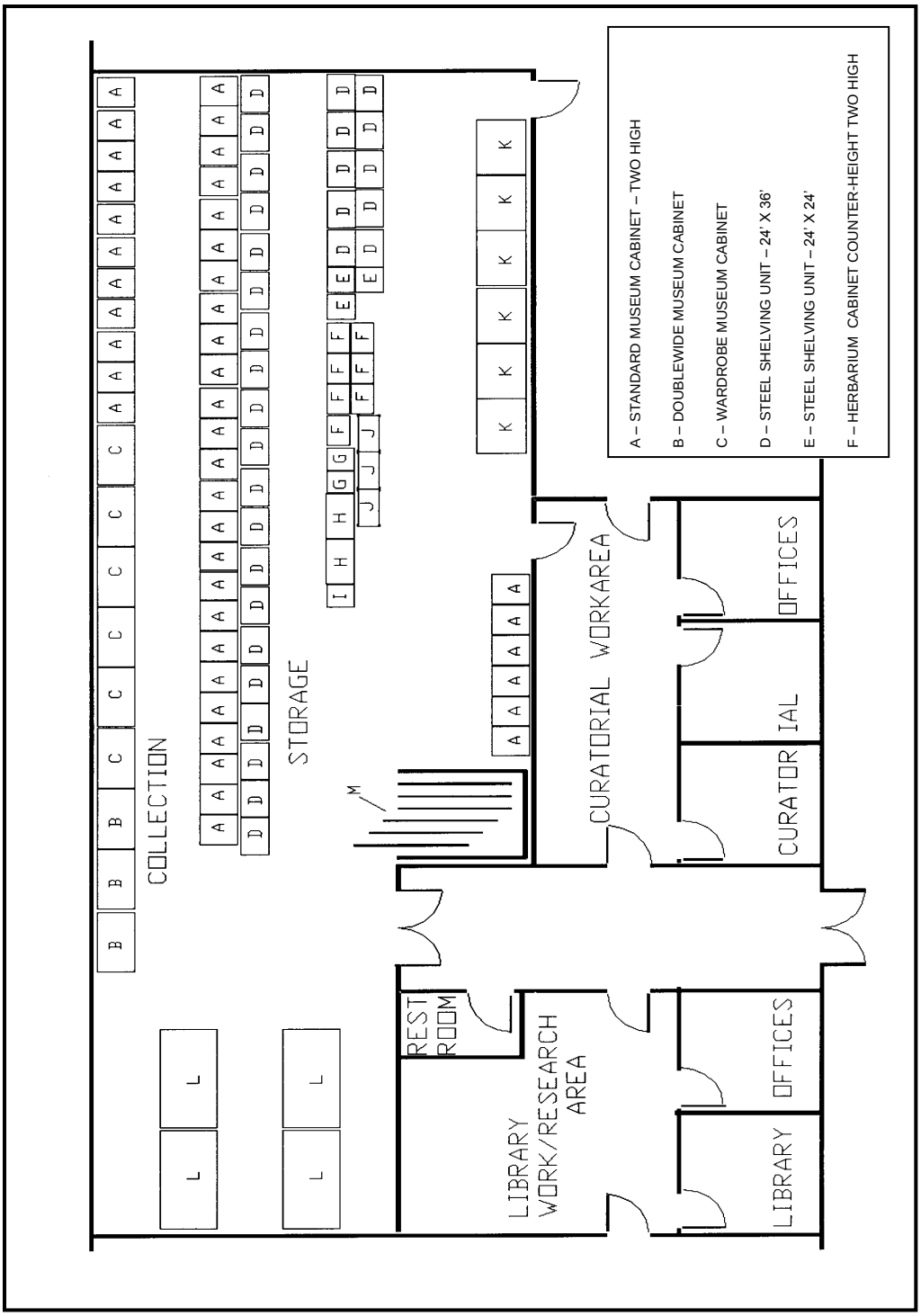


**Figure 7.4. Sample Detailed Floor Plan of Museum Collection and Work Space**

**Figure 7.5. Cavity Storage.** Small objects cavity packed in individual boxes within a standard museum cabinet drawer.

**Figure 7.5a Cavity Storage** (detail)

**Figure 7.6. Basket Storage**. Round bottomed baskets on fitted custom made ethafoam supports in an acid free box.

**Figure 7.7**. **Clothing and Footwear Storage**. Padded clothing and footwear attached with cotton ties to mat board covered with acid free paper in a cabinet drawer.

**Figure 7.8. Bottle Storage**. Bottles anchored in custom made ethafoam at the neck in a cabinet drawer.

**Figure 7.9. Ceramic Storage**. Round bottomed certamic vessels on ethafoam rings on open shelving. Tags containing information minimizes handling.

**Figure 7.10. Wood and Jewelry Storage.** Wooden paddles and jewelry attached tied to ethafoam supports in a cabinet drawer.

**Figure 7.11. Specialized Microclimate Storage.** Objects housed in plastic containers in a cabinet drawer. Containers provide buffering against RH and temperature fluctuations.

**Figure 7.12. Large Objects Housed on Mobile Storage Shelves (l) and Steel Shelving on Wheels (r).** Metal surfaces are lined with polyethylene foam. On open shelving, muslin and fire resistive plastic covers can protect objects from dust. Wheels allow the unit to be moved.

**Figure 7.13. Rolling Unit for Large Objects**. Movable custom designed storage equipment fabricated from slotted angle iron.

**Figure 7.14. Racks for Large Objects.** Slotted angle iron is used to construct racks for large objects.

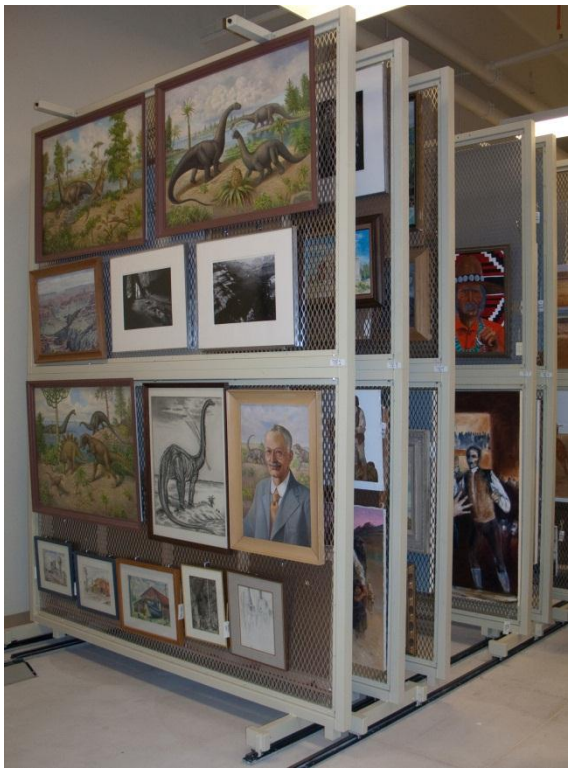

**Figure 7.15. Painting Rack Storage**. Painting and framed2-D items rack constructed of slotted angle iron and 2" mesh welded wire fencing.

**Figure 7.16. Lithic and Stone Storage**. Large stone lithic material in bottom shelves and boxed materials on upper shelves in mobile storage.

**Figure 7.17. Rolled Textile Storage.** Textiles rolled on acid free core and covered in plastic, tied with cotton ties.

**Figure 7.18. Map Cabinet.** Map cabinet holding blue prints separated by neutral pH, unbuffered paper.