Chapter 10: Emergency Planning

CHAPTER 10: EMERGENCY PLANNING

A. Overview

Museum and archival collections inevitably deteriorate over time. You, as a member of the museum staff, minimize this collection deterioration through preventive conservation such as proper housing and handling. Although you are unlikely to frequently encounter fires, floods, volcanic eruptions, and similar events, ***ultimately no park is immune from emergencies***. Once neglected or handled inappropriately, an emergency goes out of control and becomes a disaster.

Your goals are to:

1. ***Identify, anticipate, and avoid preventable emergencies.***
2. ***Mitigate damage when an emergency occurs so that disaster is avoided or minimized.***
3. ***Recover from disasters as quickly and professionally as possible so that no human life is lost and minimal collection damage and loss occurs.***

Disaster is often sudden and unpredictable. Catastrophes like the Florence, Italy, flood; the Mount St. Helens eruption; and the North Ridge, California earthquake are the stuff of newspaper headlines and curatorial nightmares. This chapter explains how to:

- ***assign responsibility*** for emergency planning, management, and response
- ***gather essential planning tools*** such as those described in the bibliography and Appendix G
- ***understand and manage the various generic types of risk that exist for museum collections***, including how to prepare for them, manage risks during an emergency, and survive them
- ***analyze your park's own particular risk level*** for the various types of hazards (potential natural and cultural threat factors) and vulnerabilities (likelihood of sustaining damage)
- ***begin salvage*** during the first 24 hours following an emergency
- ***prepare a Museum Collection Emergency Operation Plan (MCEOP) as part of the park's Emergency Operations Plan (EOP***) to cover the protection and prioritized salvage of the park's museum and archival collections based upon all the likely contingencies that form part of the park's risk

- ***stockpile essential emergency response equipment and supplies***
- ***train staff*** in emergency planning, management, and response activities
- ***test, evaluate, and update your MCEOP***

Advance planning is the key to effective emergency response and the recovery of museum and archival collections. Your planning today will control how effectively damage is mitigated in tomorrow's emergency. No park has the equipment, supplies, and expertise necessary to cope professionally with a significant emergency without a good MCEOP. Strive for thoroughness, clarity, and practicality when preparing your plan**.** Keep your plan simple, flexible, and based upon existing museum routines so as to make it easy to implement.

1. *Who can help me with emergency planning?*

Emergency planning involves:

- ***coordinating with the park's EOP coordinator*** to ensure that the museum collections will be integrated into the park's EOP and with local emergency services agencies to identify sources of assistance. Work with the EOP coordinator to identify who will be responsible for managing and updating the museum component of the plan.
- ***working with the Regional Curator and others*** such as the Regional Office's Division of Ranger Activities and your regional/Support Office (SO) curator to identify individuals who should be involved in the museum component of the plan.
- ***working with contract personnel*** as necessary. Contractors can help you regularly reexamine assumptions about risks to collections so you can update the plan and training. See Section C and Appendix G: Museum Collections Protection.

2. *Why should I plan for emergencies?*

There are many good reasons to plan for emergencies, including:

- saving lives
- preserving collections
- saving time and resources

Practically speaking, when you are in the midst of responding to emergencies you are probably not thinking clearly. During an emergency is not the time to conduct research on how to salvage collections. You need the knowledge before the emergency, to reduce the risk of human injury and resource damage and loss.

3. *What authorities and federal guidance exist on emergency planning and disaster prevention?*

Consult the following:

- 36 CFR 1236, Vital Records During an Emergency Executive Order
- 44 CFR 101-2, Occupant Emergency Plan

- 12656, Assignment of National Security and Emergency Preparedness Responsibilities, November 18, 1988
- Executive Order 12148, *Federal Emergency Management,* July 20, 1979
- Federal Preparedness Circular 61, Emergency Succession to Key Positions of the Federal Departments and Agencies
- Federal Preparedness Circular 62, Predelegation of Emergency Authorities
- Federal Preparedness Circular 64, Continuity of the Executive Branch of the Federal Government at the Regional level during National Emergencies
- *Federal Response Plan* (Federal Emergency Management Agency)
- Federal Response Planning Guidance FRPG 01-94, *Continuity of Operations,* December 4, 1994

B. Museum Collections Hazards, Vulnerabilities, and Disaster Prevention

Museum collections risk is composed of two key elements:

- ***hazards,*** which are the natural factors (such as storms, fire, and flood), your park's landscape and location risk factors (proximity to a tidal river or coast, volcano, or placement in a valley or near a nuclear reactor), and social factors (such as civil unrest, terrorism, and vandalism) that threaten museum collections
- ***vulnerabilities,*** which is the likelihood that your collection will sustain damage, due to the:
  - composition of the park museum collection (such as ceramics, glass, and friable media)
  - structures housing your materials (such as older wooden structures or flat roofed masonry structures)
  - staff-training level (explicit or textbook-type knowledge), hands-on experience-level (implicit knowledge), and state of preparedness

Your job is to understand the hazards that afflict your region, the vulnerabilities of your structure and collection, and therefore the risks you must manage. Don't forget materials in exhibition areas, research rooms, workspaces, and separate on-site or off-site structures when planning for emergencies. Park records, particularly museum records, also must be

salvaged immediately or your ability to use your collections effectively in the future will be compromised. This chapter serves as an introduction to the various hazards, vulnerabilities, and risks of museum collections. For more information, go to the sources listed in the bibliography.

1. *What kinds of emergencies exist?*

Emergencies may take many forms, including civil unrest, earthquakes, explosions, fire, flood, hazardous materials accidents, storms, structural collapse, terrorism, transportation accidents, and utility failures. They can cause damage to museum collections from bacteria, chemical change, heat, physical damage due to movement (called kinetic damage throughout this chapter), soot, water, and many other agents.

2. *What do I need to know about fire hazards?*

Fire is the most serious single threat to all park museum collections. It may lead to loss of life, loss of collections, and loss of building structural integrity—causing great physical damage to the unburned collections. During fire suppression, water, chemical, and physical damage may all occur and mold may later result. Fire hazards vary by region, with forested areas and dry plains being at particular risk of wildfires.

Fire vulnerabilities: The museum materials most vulnerable to fire are:

- botanical collections
- black powder weaponry and similar weapons and ordnance
- nitrate (nitrate) film, including negatives, motion picture film, and X-rays (***Note:*** These are particularly dangerous if the nitrate exists in quantities greater than 35 pounds.)
- paper-based materials, including artwork, documents, and museum documentation
- plastics, particularly those with antioxidants, dyes, toxic fire retardants, and other additives (dioxin, lead, and antimony), for example, vinyl chloride plastics
- specimens in alcohol and formaldehyde
- textiles
- vehicles, motors, and equipment containing oil and gasoline
- wooden objects, particularly older wooden furniture

Classic fire damage includes:

- consumption and loss of materials, particularly organic materials
- embrittlement of most organic materials
- explosions due to nitrate fires, leading to structural collapse and collection loss

- heat and smoke from fire causing accelerated aging of materials not consumed by the fire
- loss or damage of museum records, park records, and archives and manuscript collections
- melting
- mold, insect, and vermin outbreaks in the water damaged materials following fire fighting
- oxidation of metals
- fading, scorching, charring, staining, or accelerated aging of wood, paper, and textiles
- subsidiary water damage due to fire suppression (See Water damage and Floods below.)

Fire prevention: To stop fires, you need to stop ignition sources, remove potential fuel—particularly fuel that can self-ignite such as nitrate film—and maintain a proper environment that isolates museum storage, work, exhibit, and research room spaces from other spaces that may not be as well controlled. Don't allow smoking in the museum building. Allow cooking in the museum building only when precautions are taken, such as the use of fire-resistant surfaces and evening shut-down procedures that ensure heat sources are turned off. A good fire alarm, fire extinguishers, heat and smoke detectors, and a fire suppression system, including sprinklers, are also helpful. Select fire extinguishers based on the type of collections you have and the chemicals being stored in the museum building. For guidance, see *MH-I,* Chapter 9: Museum Collections Security and Fire Protection.

Maintaining good housekeeping, preventing smoking, placing highly flammable materials such as nitrate off-site, maintaining electrical systems to standards, and removing trash often will be the most important steps in preventing fires.

Museum staff should be aware of how the alarm systems, fire extinguishers, sprinklers, and other systems work. Occupational Safety and Health Administration (OSHA) and the Code of Federal Regulations (CFR 1910.157[g][2]) mandate that all staff receive training in fire extinguisher use annually. The museum building must have two usable escape routes from all areas—whether exhibit, storage, work, or reference space. All exits must be clearly visible and labeled from all locations and points-of-view. Federal law (29 CFR 1910.36[c][2]) requires that all exits, fire doors, panic bars and bolts, fire protection, and fire detection alarm systems be fully operative while any workers are in the building. If a fire system is damaged, the MCEOP should contain information on how to contact the firm for repair work. See *MH-I,* Appendix F: Collections Management Checklists, Checklist for Preservation and Protection of Museum Collections

(Checklist), Questions 1-12 under Fire Protection.

Chose fire-resistant furniture, equipment (such as UL listed appliances), and carpeting or ceramic tiles. Store museum records in fireproof cabinets. For shelved items, keep a full two feet of space between the top of the shelving unit and the ceiling to avoid blocking sprinklers and fire fighting activities. Don't store collections near vents or flammable chemicals. Keep only small, carefully labeled quantities of flammable chemicals in appropriate fire-rated storage cabinets outside of museum storage areas. Provide up-to-date OSHA surveys of the chemicals or toxic collections materials to local fire fighters and emergency workers, and include them in your MCEOP. Hazardous materials (HAZMAT) storage spaces should be labeled with the appropriate OSHA warning label. See Appendix F: Collections Management Checklists, Checklist for Preservation and Protection of Museum Collections (Checklist), Fire Protection, Question 3.

Check vents of all equipment, including computers, electrical equipment, photocopiers, and similar devices to ensure that they are not obstructed. Avoid using carpeting and map case interior dust covers that contain polyvinyl chloride (PVC). Check all appliance cords regularly and unplug them at night. Replace fluorescent light bulb ballasts—particularly those over lamps that are older than 15 years—with thermally protected Class P ballasts. Keep all brush, vegetation, and trash away from your buildings. Prohibit smoking in your buildings. Keep all walkways and aisles free to facilitate fire fighting and evacuation. ***Keep exits unobstructed.***

Fire survival: If you are present during a fire, activate the fire alarm immediately. During evacuation keep close to the ground. If smoke is bad, place a wet cloth over your face. Don't open windows. Check the elevator for trapped individuals. Help disabled or injured people evacuate safely without using elevators. As you evacuate, close all doors behind you. If possible, take the visitor log and your MCEOP with you to help you account for everyone in the building. Call the fire department and park fire protection staff (a ranger, park police, or maintenance) immediately.

Your MCEOP should indicate whom to contact and list their numbers (telephone, fax, beeper) and e-mail addresses. Provide the fire fighters with your MCEOP building plans and visitor log to help them in their efforts. Check to ensure all staff and visitors have departed the building. Move to a safe distance from the affected area. Try to determine if everyone has safely evacuated the building. Alert professional rescue personnel about any missing or trapped individuals and their probable location.

Never allow a fire to get between you and the door. If the fire is very small and you have time before departing with no risk to yourself, disconnect electrical equipment. Shut down the air intake system and HVAC. Place plastic sheeting over collections. Use a handheld fire extinguisher on a small non-toxic (not plastic or nitrate burning) fire, as long as you have the

appropriate type of extinguisher and have been trained in its use.

Never jeopardize your safety by trying to put out a nitrate or plastics fire. Be aware of the extreme danger posed by the off-gassing of burning materials,

such as nitrate and PVC. Stay away from soot and smoke, as it may be carcinogenic. If plastic or nitrate materials are in museum storage, evacuate as fast as possible during a fire. See *MH-I,* Chapter 9: Museum Collections Security and Fire Protection, for further guidance.

Before attempting to salvage museum collections, maintenance and fire staff must determine if the space is safe to enter. Once the fire is out and the structure has been stabilized for access, the composition of the soot should be determined to ensure that no carcinogens or toxic substances, such as lead, polycyclic aromatic hydrocarbons (PAH), polychlorinated biphenyls (PCBs), hazardous residues, or lethal molds or bacteria are present. Museum staff may be expected to take samples of substances with cotton swabs, scotch tape, or agar slides for immediate delivery to the testing lab for toxicity tests.

If requested to take samples of mold or hazardous substances work with the park's hazardous materials coordinator. Wear protective clothing (nitrile gloves and a smock) and an appropriately rated breathing apparatus that has been fitted to you. The MCEOP should indicate the location of testing laboratories that can identify whether the materials encountered after the fire are potentially toxic, such as P&K Micro, Unit L, 19050 Old Cuthbert Rd, Cherry Hill, NH 08034 (Tel: 609-427-4044). If large quantities of toxic substances are found in the soot or other residues, a professional abatement team may need to be hired.

After determining that the space is safe to enter and no safety hazards exist for salvage, follow salvage procedures as described in the National Task Force on Emergency Response *Safeguarding Our Cultural Heritage, Emergency Response and Salvage Wheel* and similar sources listed in the bibliography and Figure 10.13, First 48 Hours Emergency Response Checklist. If you plan to use museum personnel in response to fire emergencies, read OSHA, Emergency Plans and Fire Prevention (1910.151, 1926.50). See *MH-I,* Chapter 9: Museum Collections Security and Fire Protection, for additional guidance. Also see the U.S. Fire Administration Website at <http://www.usfa.fema.gov/>.

3. *What do I need to know about water damage and floods?*

Water damage is perhaps the second most common type of museum collections damage. Floods are the most widespread form of natural disaster after fire. Floods and flash floods occur in all 50 states according to the Federal Emergency Management Agency (FEMA). Since 1900 over 10,000 people have died in flooding in the U.S. Dam failures are the most dangerous form of flood.

Water damage is often the result of fire-fighting activities, storms, and structural damage, but may also be due to flash floods; floor drainage back-ups; leaking HVAC systems, pipes, roofs, and skylights; seepage and slow-rising floods; and tidal waves. Loss of life is always the greatest risk for

floods.

Flood and water damage vulnerabilities: The materials most vulnerable to water damage are:

- archival materials, such as architectural drawings, plans, and blueprints; coated paper books and documents; parchment and vellum documents; documents on heavily sized paper; documents with water soluble media, such as some ballpoint or fiber tip pen ink or friable media such as charcoal or graphite; and historic photographs and film, including nitrate

- artworks**,** such as chalk, charcoal, collages, conte crayon, gouache, montages, paintings (paintings on canvas or panels), polychrome sculpture, and watercolors

- bone and ivory, which are hygroscopic—particularly thin sections, which warp easily

- basket and other fibrous materials with applied paint or decoration or repairs

- furniture/wood with applied gilt, fine veneer, inlays, lacquer, or attached ironwork

- furs, leather, and skin–particularly under tension (such as drums) or with applied paint–including parchment and vellum and other alum tawed leathers

- glass and ceramics with mends or that are heavily adulterated with non-silica materials

- metal objects made of bronze, brass, copper, iron, and steel

- natural history specimens**,** particularly extinct or endangered species or type specimens, water sensitive geological specimens (particularly shale), and paleontological specimens

- previously moldy items

- textiles**,** particularly thinly woven materials

- unfired clay

Classic water damage includes:

- adhesion of art, book, paper, and photographic items to other objects of organic materials

- bleeding of color from one object to another

- corrosion and rusting of metals

- erosion of stone or masonry
- finish loss on art works, photographs, textiles, and wood
- lifting of veneers on furniture
- loss or damage to museum records, park records, and museum archives and manuscript collections
- loss of dimensional stability of paper, textiles, and wood
- mineral deposits on ceramics, metal, meteorites, minerals, and stone
- molding and rotting of animal and botanical specimens, books, furniture, paper, parchment, photographs, textiles, and vellum
- pigment and dye loss on artworks, books, paper, photographs, textiles
- ripping or splitting of animal skins, paper, photographs, and fragile textiles
- separation of emulsion layers on photographs
- splitting of skins and of leather on bound volumes
- staining and deposition of contaminants on bone, ivory, paper, shell, and textiles
- structural integrity loss for paper, plaster objects, and textiles
- swelling and pressure damage that cracks or destroys nearby objects
- warpage of board, paper, thin sections, and wood
- weakening of fibers in paper, textiles, and some wood

Flood and water damage prevention: To stop floods and water damage:

- locate your collections far from dams and flood plains
- locate collections in buildings with good structural seals (including a sound and sealed roof, windows, and basements)
- keep all storage equipment at least 4 inches off the floor, preferably 6 inches off the floor
- use only spaces that will not flood if pipes break or drains back up
- See Appendix F: Collections Management Checklists, Checklist for Preservation and Protection of Museum Collections (Checklist), Museum Collections Storage, Questions 4, 5, 7, 9, and 20.

Be aware of whether your building is located on an underground stream, a swamp, or other water source or near a tidal river or coastline area. Find out if you live in a flood-prone area from your local emergency management office or Red Cross chapter. FEMA offices are listed on the FEMA Website at <http://www.fema.gov/>. The National Oceanic and Atmospheric Administration (NOAA) Website at <http://iwin.nws.noaa.gov/iwin/nationalwarnings.html> also contains excellent flash flood and flood warnings. Know the area flood stage water table level so that you can avoid storing items below this level, thus placing them at risk.

Avoid using spaces with overhead pipes, whether for water, waste, steam, fuel, or other liquid. See Appendix F: Collections Management Checklists, Checklist for Preservation and Protection of Museum Collections, Museum Collections Storage, Questions 5 and 9. Don't store materials in particularly vulnerable spaces, such as attics or basements. Ensure that all drainage and water removal systems are functioning well. Have check valves installed in building sewer traps to prevent floodwaters from backing up in sewer drains. Know where your water and utility shut-off valves are and how to operate them. Work with park maintenance to ensure they keep your building in excellent repair, regularly checking and testing foundations, walls, windows, roofs, door seals, piping, sprinkler systems, gutters, and other structural components. In particular check to ensure that the building is firmly attached to the foundation. Work with park landscapers to ensure that the landscape drains away from the buildings.

Chose storage equipment and supplies that will not cause additional damage in case of flooding. Avoid using wooden storage equipment as it:

- floats (***Note:*** Also avoid metal cases with sealed air spaces that promote floating.)
- feeds insects
- may swell and crush materials housed inside
- drains poorly, holding water
- weighs a great deal when wet, potentially leading to excessive floor loading and structural collapse

Be aware of how different decorative materials and storage furniture may hold water and humidity when designing a museum storage space. For example, wallpaper, wood furniture, and carpeting hold humidity and water, while paint, metal furniture, and tile don't. When decorating your structure, use tiles, metal storage furniture, and paint, rather than wallpaper, wooden furniture, and carpeting. Avoid using acidic cardboard housing as it may stain paper and textiles if wet. Avoid using water-soluble markers on file labels and boxes, as they may wash off. Avoid using staples and metal clips as they may rust; use plastic clips instead. Select polyethylene storage boxes, where possible, as they won't collapse spilling contents if wet. Boxes with several small vents in their bottoms to allow water to run out are ideal. Poke several small drainage holes (<3 inches) in the empty boxes.

Flood watches and warnings: Know the difference between a flood watch and a flood warning. A watch is advance notice, first announced when a threat is noticed—often up to 36 hours before the event. A warning tells you it is about to happen within the next 24 hours.

- ***Flood watch:*** If you are in the museum when a flood watch is announced, listen to local emergency broadcast system radio and/or a National Weather Service (weather band) radio at 162.475 MHz-FM. Ask local disaster planning experts for their predictions. Check the Floodcast Website at <http://www.earthsat.com/flood/floodcast.html>

  and the NOAA Website at <http://iwin.nws.noaa.gov/iwin/nationalwarnings.html> for predictions of areas that will flood or experience flash floods or severe thunderstorms within 24 hours. Alert the MCEOP team that they are on stand-by status. Listen for alarms and updates. Listen for emergency alarm signals. To find the other six frequencies and 530 transmitters NOAA Weather Radio uses, go to <http://www.noaa.gov/nwr>.

  As you wait for updates, unplug all non-essential electrical equipment and secure the building. Check battery-powered equipment, alternative power and communications systems, and emergency supplies. Ensure that batteries on water alarms are fresh and in place. Place water alarms near all collection storage areas to provide you with early warnings in case of roof or window leaks or backed up drains.

  Fill evacuation vehicle gas tanks. Collect clean water in jugs for clean-up activities. Secure all loose objects outside, preferably by bringing them into the building. Tape windows and then pad them with bubble wrap before closing the storm shutters. If you lack storm shutters, tape windows. Use additional tape to attach plastic sheeting over the entire window well area, attaching the sheeting to the surrounding wall to provide some additional insulation and a humidity barrier. Disconnect non-essential electrical equipment. Back-up all computer files. Move unnecessary vehicles to high ground. If time allows, prepare to evacuate collections to an alternate storage location on high ground using designated vehicles as described in the MCEOP. Be prepared to drive significantly inland to get away from washed out bridges and coastal flooding. Notify authorities of any safety problems along the route.

- ***Flood warning:*** Evacuate and close the museum. Check to ensure that everyone has left safely. Mobilize the MCEOP team. Turn refrigerators and cold storage units to the coldest settings and tape them shut as early as possible to give them some residual cold to carry them through the crisis. Move designated high-risk materials, key documentation, and one copy of your MCEOP to the upper floors of the storage structure as indicated by the museum MCEOP. If there is no time to move the rest of the collection to the upper floor, move all easily movable collection items off the floor to the highest-level storage space available within the room. Place plastic sheeting over all vulnerable collections and tape in place if necessary.

Use dehumidifiers and sump pumps as necessary in the fight to prevent water damage. Place heavy screens over floor drains to keep small items from washing away. Lock all cabinets and move equipment away from windows and out of basements. Secure non-movable items. Gather emergency supplies. Just before you leave, shut down all utilities, turn off electricity at the building's main circuit breaker, unplug all electrical equipment on lower floors, seal all doors and windows, and secure the building.

Flood survival: If you are in the museum when a flood occurs, stay in the building and go to the top floor. Contact authorities by cellular phone to alert them to your situation and request rescue. Be extremely cautious around

electrical appliances and outlets. If necessary go onto the roof as long as no thunderstorm is in progress. If time allows, take a copy of the MCEOP, protective clothing, a bright rain poncho, and a colorful blanket with you to help rescue personnel locate you.

Don't try to walk or drive through water once the flood has started. Even six inches of rapidly moving floodwaters can sweep you off your feet. If you are caught outdoors or in a car, drive to high ground. Don't stay with a stalled car in rapidly rising water. Cars can be swept away by just two feet of moving water. Flash floods can tear down trees and destroy buildings and bridges.

Don't return to the building after evacuation until it is judged safe by the individuals designated in the MCEOP, usually your maintenance liaison. The maintenance liaison may need to check the safety of floors, walls, and stairways, as well as checking to ensure that the building meets federal codes and OSHA requirements. See Section D.5. When re-entering the building, watch for broken or leaking gas lines, flooded electrical circuits, submerged furnaces and appliances, flammable or explosive materials that entered the building as a liquid, contaminants that are health hazards (gas, biological waste), and biological problems, including vermin, snakes, mold, and similar problems.

Wear nitrile gloves and use sticks or shovels when poking through debris. Working in water cooler than 75°F (24°C) can result in hypothermia, so avoid working alone or without heavy clothing and rubber boots. If working near floodwaters, wear a life vest.

After the flood, be prepared to remove water, commercially dehumidify the building, air dry and/or wrap and freeze designated collections in priority order according to the MCEOP. Collection removal work will have to be done speedily and in priority order, for many items must be salvaged within 48 hours to prevent significant deterioration.

Pump no more than a third of the water out each day to avoid structural collapse and allow the building to settle gradually. Be cautious when working with gas or diesel-powered pumps as they often give off carbon

monoxide, and can't be operated indoors without a significant risk of suffocation.

For help, see the First 48 Hours Emergency Response Checklist (Figure 10.14) and the National Task Force on Emergency Response: *Safeguarding Our Cultural Heritage, Emergency Response and Salvage Wheel* and other sources listed in the references for guidance. Also see the Websites under ***Flood watch*** and the National Institute for Occupational Safety and Health (NIOSH) Website for warnings of hazards of flood cleanup work at<http://www.cdc.gov/niosh/flood.html>.

4. *What do I need to know about storms?*

Storms are perhaps the most varied form of emergency, as they include blizzards, electrical storms, hail, hurricanes, sleet, tornadoes, and other wind and winter storms. On average, the U.S. gets 10,000 thunderstorms, 1,000 tornadoes, and about 10 tropical storms annually, 2 of which develop into major hurricanes. Use the NOAA Website at <http://iwin.nws.noaa.gov/iwin/nationalwarnings.html> and the Earth Watch Weather on Demand Website at <http://www.earthwatch.com/STORMWATCH/stormwatch.html> for maps of U.S. storms and predictions of upcoming storms.

Storms may cause fires, floods, and structural collapse that threaten loss of life and damage museum collections as well as:

- explosions
- hazardous material accidents
- transportation accidents
- utility failures

Storm vulnerabilities: Storms may cause fires and floods, noted above. In addition, a storm may cause significant kinetic damage (movement, impact, or abrasion) due to high winds, structural movement, and structural damage. The materials most frequently damaged by movement due to winds include:

- artwork in frames or under glass
- bone and ivory, particularly thin sections or slices of these materials
- brittle metal objects,
- ceramics, glass (including glass photographic plates), and mirrors
- specimens in alcohol and formaldehyde and collections housed nearby
- furniture and wood
- materials under tension, such as drums
- paper and photographs, including museum archives and documentation

Classic storm damage includes:

- broken bone, ceramic, glass, ivory, metal, and mirror items
- contamination of dry collections with alcohol or formaldehyde from wet specimens
- cracked, smashed, or otherwise damaged furniture, glass plate images, herbaria, and wet specimen jars

- missing objects that have been carried away by the winds

- soaked or water damaged archeological or ethnographic specimens, archival materials, artwork, books, furniture, museum documentation, and specimens

Storm damage prevention: Know whether you are located in an area vulnerable to major storms, such as "tornado alley," which includes parts of Arkansas, Iowa, Kansas, Missouri, Nebraska, Oklahoma, and Texas. For example, the states with the highest rate of thunderstorm-linked lightening fatalities are in the South and Southwest, particularly Arizona, Arkansas, Mississippi, and New Mexico. Tornadoes usually occur at the end of a thunderstorm. Use the FEMA Website at <http://www.fema.gov> and the NOAA Website at <http://iwin.nws.noaa.gov/iwin/nationalwarnings.html> to identify the level of risk your park has from each of the various types of storms and to track storms as they develop.

Familiarize yourself with emergency broadcast stations on television and radio (particularly the National Weather Service radio station at 162.475 MHz-FM), with the Websites listed above, and with alarm sirens. Work with your park EOP coordinator and local emergency personnel. Ensure that your park is listed as a "must call" on telephone calling trees for storm alerts and that the MCEOP team leader is on the park EOP coordinator's "must call" list. Storms can make access to the park to assess the collection condition difficult or impossible without an all-terrain vehicle and extensive help to remove downed trees and rubble.

Protect your collections from storms by locating your collections on level plains or slight inclines, not in valleys or flood plains, or on hill or mountaintops. Install storm shutters on your windows. Install lightning rods. Place museum storage, work, exhibit, and research rooms in buildings with good structural seals on the roof, windows, and basements. Avoid using fragile historic structures, attics, or basements for museum storage. Work with park maintenance staff to ensure that the museum structure roof, HVAC, and similar large structural elements are bolted with heavy-duty fasteners. Consult with your cultural resource management specialist before making changes to historic structures.

Place pressure-sensitive UV filtering film over glass to help minimize glass shard projectiles and window breakage. Cover windows with storm shutters and secure after first padding them with a sheet of polyethylene foam or bubble wrap to prevent shock damage. Place sandbags near doors. If possible, bolt the structure itself to the foundation and install tempered glass in museum windows. Also secure all fences and outbuildings to the building and to the ground. Some of these actions have historic structure ramifications and must be coordinated with your park historic preservation or cultural resources officer.

Ensure that all drainage and water removal systems are functioning well. Request emergency power back-up systems for environmental controls when possible. Avoid placing any materials near or in the museum that might

function as projectiles in a high wind, including gravel, tiles, roof slates,

benches, statuary, trash cans, and outdoor displays. Cut back all dead branches on trees near your building. Attach guy wires to large trees near the museum building to prevent them from damaging the museum during high winds.

- ***Storm watch:*** Hurricane watches are issued by the National Weather Service when 74 mile-per-hour winds or greater or dangerously high water and rough seas are expected within the next 24-36 hours. A severe thunderstorm watch is issued when damaging winds of 58 miles or more or hail of 3/4 of an inch or more is expected A tornado or winter storm watch is issued when the National Weather Service identifies classic danger signs, such as approaching storm clouds or a severe thunderstorm.

  If you are in the museum when the storm watch is announced, turn on an emergency broadcast (EBS) station on radio or television or listen to National Weather Service radio at 162.475 MHz-FM for information. Listen for emergency alarm signals.

  Tie down loose items outside or move them indoors. Disconnect all non-essential electrical equipment. Ensure all vehicle gas tanks are full for emergency evacuation as necessary after the storm. Check all battery-powered equipment and power back-up sources and fire fighting equipment, emergency exit lights, and back-up security systems. Capture clean water in clean jugs in case you are stranded or must do emergency clean up. Locate emergency response equipment.

- ***Storm warning:*** A National Weather Service storm warning indicates that a storm is imminent (within the next 24 hours). For thunderstorms, tornadoes, and hurricanes, open windows very slightly on the side away from the direction of the storm's approach. Move collection items in priority order away from glass, doors, and windows and out of basements to a safe space designated in the MCEOP. Cover collections with tarps and polyester sheeting and lash down to the heaviest furniture and to wall braces if possible.

  Clear away all loose items to padded storage (use polyethylene foam or bubble wrap) in cabinets or cupboards that can be secured. Cover non-movable items, such as architectural fragments and sculptures, with plastic sheeting. Shut-off electricity and gas mains. Close storm shutters, tape unprotected windows, and lock up. Shut down all utilities, including electric appliances. Evacuate to the designated storm area, taking the visitor log and the MCEOP with you. Leave as soon as possible, avoiding flooded or washed out areas and structures. You may need to drive 20-50 miles inland to avoid hurricanes and their subsequent tidal waves and flooding.

- ***Storm survival:*** If you are in the museum when a storm strikes, remain in the building. Don't use elevators, matches, candles, or lighters. Stay away from upper floors, windows, glass doors, overhead lighting, and areas with unsecured furniture including filing cabinets, museum

storage equipment, shelving, and small-unsecured objects. For example, don't go into wood or metal shops or into offices with lots of unsecured office

supplies. ***Avoid all rooms or spaces with wide span roofs*** such as barns or garages, as well as attics or top floor areas. Either get into a windowless closet toward the center of the lower floors or stay in the center of a small windowless room, as the corners tend to accumulate debris. ***Get under a sturdy piece of furniture if possible, such as a heavy desk and use your arms to protect your head and neck.***

- ***If the storm is a tornado,*** go to the designated shelter, basement, or an empty interior hallway or windowless closet. Stay away from upper floors. If you are stranded on an upper floor, go to a small windowless closet or hallway. Get under sturdy furniture and hang on. ***Note:*** The Fujita tornado scale runs from F-0, winds of up to 72 miles an hour with accompanying tree and chimney damage; to F-5, with winds of up to 318 miles per hour causing complete structures to be carried off their foundations.

- ***If the storm is a hurricane,*** go to the ground floor (not the basement). Get into an empty interior hallway or windowless closet. Hurricanes frequently lead to flooding so stay above the water table or flood level. Hurricanes have a lull period, called an "eye," during which the storm seems to have ended. Instead, the storm will return with all of its original ferocity. After the "eye," the hurricane winds will come from the opposite direction. Don't try to evacuate during the "eye." Get under sturdy furniture, protect your head, and hang on.

- ***If the storm is a thunderstorm,*** use only battery operated equipment and avoid all telephones, televisions, bathtubs, outlets, water faucets, sinks, metal structural elements, and outlets. If you notice your hair is standing on end (which indicates lightening is about to strike), bend forward and place your hands on your knees. Keep your feet together and crouch low. To estimate your distance in miles from a thunderstorm, count the number of seconds between the flash of lightning and the next clap of thunder, and then divide by five.

- ***If the storm is a winter storm,*** find blankets and emergency heating equipment, such as space heaters. Use such equipment carefully to avoid the risk of fire. Avoid evacuating until sleet and hail have ended and authorities state that roads are passable. If stranded in a car, stay with the car unless you can clearly see nearby shelter with heating.

- ***If you hear hissing or smell gas,*** open a window and evacuate the building immediately. If possible, turn off the gas main valve as you leave. If you see sparks or smell smoke ensure that the power is turned off at the main fuse box or circuit breaker. If you must step through water to get to the circuit breaker, don't attempt to do so. Take the MCEOP and visitor log with you if possible. Try to

determine if everyone has safely evacuated. Notify authorities of any missing or trapped individuals and their probable location. Wait until the maintenance liaison uses a flashlight to check for broken utility lines before turning utilities back on.

– ***If outside during a storm***, don't try to outdrive a storm. Try to get into a building. If no building is available, stay in the car for an electrical storm or winter storm, but get out and into a ditch for a hurricane or tornado. If in a ditch, lie down facing away from the storm.

5. *What do I need to know about medical emergencies?*

Medical emergencies can happen at any time to almost anyone.

Medical emergency vulnerabilities: Staff are vulnerable if they are inadequately trained or equipped, or if they are required to work at a pace that doesn't allow them to use appropriate safeguards. Visitors may be vulnerable if the exhibit area or research areas are improperly equipped or located. For example, if the research room is on the seventh floor and there is no elevator, a visitor might either fall or have a stroke in attempting to get to the space.

Classic medical problems include:

- accidents, such as falls resulting in broken limbs or concussion
- health hazard induced medical problems, such as those resulting from working around asbestos, chemicals, mold and nitrate (respiratory damage); ticks (Lyme disease); birds (histoplasmosis), or vermin (hantavirus)
- medical conditions such as epileptic seizure or heart attack or stroke from over exertion

Medical emergency prevention: Clearly label all exits; keep the museum storage, work, exhibit, and research areas clean and unobstructed. Attach all carpeting and mats to the floor firmly. Clearly mark and light all hazards, such as uneven floors or stairs. Check all furniture and equipment regularly to ensure that it functions well. Replace old or worn-out equipment and furniture. Limit access to dangerous areas where chemicals or high voltage equipment is stored. Get first aid training. Obtain the proper protective clothing and personally fitted rated breathing apparatuses before exposure to potentially hazardous materials. Document staff exposure.

Be aware that you must not let untrained staff onto a disaster site or expose them to any equivalent health and safety risk, or you may be subject to OSHA fines and citations. All workers at a disaster site must have training, proof of comprehension of training (such as quizzes), appropriate equipment, and a written plan. For more information on OSHA requirements, see Section D.5 and the OSHA Website in the bibliography on:

- blood-borne pathogen standard

- emergency plans and fire protection
- hazardous waste operations and emergency response
- medical services and first aid
- personal protective equipment
- respiratory protection

Know which hospital is closest and who has advanced first aid training within the park. Keep a list of emergency help sources, such as local doctors and hospitals. Train staff in CPR and other basic first aid. Post a basic first aid manual and supplies in the building. Ask all staff to have a tetanus immunization. Ensure that all staff knows how to lift without hurting themselves.

Teach all staff how to identify and protect themselves from health hazards such as animal waste, asbestos- or arsenic-contaminated materials, bacteria- and virus-contaminated materials, insects, mold, nitrate fumes, and similar health hazards.

Medical emergency survival: Remain calm. Contact the hospital immediately for assistance. Tell the hospital or ambulance staff:

- the location of the victim
- your name and telephone number
- the nature and extent of the emergency
- how the emergency happened
- any hazards that might be encountered by the ambulance on route to pick up the victim

Have someone wait outside to show the ambulance staff to the victim. Avoid moving injured or ill individuals unless they are at great risk from their surroundings. Wear nitrile gloves if blood is visible on the emergency site. Assess the level and extent of injury and deal with the most endangered individuals first, unless their problems are beyond your skill level.

Don't try to administer first aid without consent unless the victim is unconscious. Don't ever try to administer first aid beyond your training and skill level. When administering first aid, check first for life threatening conditions. Clear the victim's airway, if necessary. Don't apologize or talk about the incident or its cause to the victim, the family, or the press, other than to reassure the victim or determine the extent of the injury. Complete a case incident report for future records. Follow the park medical emergency reporting and documentation requirements.

6. *What do I need to know* Utility failures may make it impossible to begin emergency recovery without

about utility failures?

back-up power and water sources. Light, drinking and washing water, heat, and a bathroom facility must be established as soon as possible to allow for emergency recovery. Often it is the temporary lack of light, clean water, and heat that can incapacitate a park during the vital first 48 hours of museum collections emergency recovery, regardless of the original type of emergency. For a summary of the OSHA requirements for salvage, see D.5.

Utility failure vulnerabilities: You may injure yourself or cause physical damage while trying to find doors, emergency equipment lights, and telephones. Vulnerabilities include:

- personal safety
- all collections lacking good alarm systems with alternative sources of power and law enforcement protection
- all collections housed in buildings with inadequate emergency lighting
- all materials housed incorrectly, maintained improperly in research room areas, or kept in spaces with inadequate walkways
- items easily destroyed by mishandling, such as bone, ceramics, glass, ivory, paper, and specimens in alcohol
- all collections susceptible to motion (kinetic) damage (See the vulnerabilities section under Storms.)

Classic utility failure problems include:

- accelerated aging of most organic collections due to environmental instability
- accidents
- breakage of brittle items, such as bone, ceramics, glass, ivory, and glass jars of specimens in alcohol and formaldehyde
- contamination of other collections from shattered specimens in alcohol and formaldehyde
- failure of cold storage for nitrate and special frozen materials leading to deterioration and potential fire hazard
- medical emergencies due to dislocation and confusion in a darkened room

Utility failure prevention: To avoid utility failures, ask your maintenance staff to regularly inspect all utilities. Work with your park EOP to meet with regional utility authorities to ensure you are alerted when an outage is planned or likely. Your space should have a back-up power source for essential services, such as emergency exit lights, HVAC, and security lighting. Consider solar powered exterior lights. Test all back-up power sources on a regular basis. Set up a regular schedule for changing and

checking such batteries.

Teach all staff how to evacuate in case of a power failure. Install battery-powered emergency lights near electrical, fire, and security panels and along the evacuation route. Keep bushes, leaves, trees, and trash far from the building and any outside HVAC units. Keep a log of problems. Ask staff to use UL rated surge suppressors on all major equipment. Unplug non-essential equipment at night. Keep extra supplies of fuses, bulbs, and other materials near where they are needed. Ensure that the elevator has an emergency alarm, a working phone that goes to a 24-hour monitored area, and a trap door.

Utility failure survival: If you are in the museum during a power failure, stay calm and find your flashlights. Then, move single file from room-to-room along the evacuation route, preparing to evacuate via the stairs. Take the MCEOP and visitor log with you. The first person in line should have a flashlight. The first person in line opens all window shades along the evacuation route to increase illumination. Don't open the windows themselves. The last person in line closes the shades and doors as he or she departs.

As you leave the building, check to see if anyone was caught by the outage in the elevator. If so, reassure them that you are getting help. Secure the facility and don't allow public access until regular services and security can be restored. Help the disabled or injured to safety. Once outside, assemble in the designated area and check to see if anyone is missing. Alert designated rescue staff about missing or trapped individuals. Then contact the groups designated in the MCEOP as emergency utility contacts. Be prepared to search visitor bags, coats, and parcels if the evacuation involves entering normally restricted spaces. If a theft is discovered, notify law enforcement personnel, but don't attempt to restrain the perpetrator. Instead, note down the individual's appearance, license plate number, and type of vehicle, and collect the names of witnesses.

The team leader should close fresh air ducts, intakes, vents, and secure doors and windows as you leave to help maintain the internal environment. If the utility that fails is the sewer or water supply, which is causing flooding, follow the Section on Floods and Water Damage, in Section B.3. For long-term outages, ensure that the environmental monitors are still working. Before reentering, the maintenance liaison should use a flashlight to check for downed utility lines. If the utility line is down, use the main shut-off valves to disconnect the utilities. Follow the salvage procedures designated in the MCEOP.

7. *What do I need to know about hazardous materials accidents?*

Hazardous materials accidents may result from broken fuel pipelines, civil unrest, earthquakes, explosions, fire, fuel spillage, high-level smog, smoke, storms, terrorism, transportation accidents, volcanic fumes, warfare, and other problems. These accidents can make it impossible for staff and researchers to use collections, requiring total reformatting (copying) of all materials affected.

Hazardous materials vulnerabilities: These include hazardous objects and contamination when materials are exposed to hazardous chemicals, such as:

- any item that might weaken or lose structural integrity, such as repaired or treated materials
- archival materials, such as paper and photographs, which may stain or discolor
- textiles, which can be damaged by absorption of radiation or hazardous chemicals or which may stain or dissolve
- explosive ordnance
- glass, mirrors, ivory, ceramics or metal, which may break
- images with applied color or pigment, which may dissolve
- ivory, paper, photographs, and textiles, which may stain
- metals such as brass, bronze, copper, and silver which may corrode

Classic hazardous materials damage might include:

- adhesion of art, book, paper, and photographic items to other objects
- contamination of objects, so that they can't be routinely handled and must be treated or reformatted
- corrosion and rusting of metals
- erosion of stone or masonry
- finish loss on most materials, particularly photographs, textiles, and wood
- loss of museum records and documentation
- loss of object due to explosion
- rotting of leather
- pigment and dye loss of most painted objects
- staining and deposition of contaminants on objects, particularly bone, ivory, paper, shell, and textiles
- structural integrity loss for plaster and terra cotta
- swelling and pressure damage of wood and paper

Note: The type of damage is entirely dependent upon what is spilled. Spillages can range from toxic waste, radioactive materials, and biological waste, to gasoline. Consult a conservator for specific guidance.

Hazardous materials accident prevention: To avoid hazardous materials accidents, house your collections far from chemical storage areas, construction sites, fuel storage areas, garages, highways, laboratories, and nuclear reactors. Maintain an inventory of all hazardous materials maintained in the museum, including locations and quantities. Share copies of this inventory with your local fire department, MCEOP and EOP coordinators, and park hazardous waste coordinator. Place one copy of the inventory in the MCEOP and clearly label one map with the location of the chemicals and include this also in the MCEOP.

Label the chemicals and their storage spaces according to park hazardous waste guidance and OSHA requirements. See the OSHA Website in the bibliography and Section D.5 for an overview of OSHA requirements. Inform staff of any collection materials that may be hazards in both normal use and contaminants that may appear after a disaster. Train park staff in safe handling of chemicals, including cleaning chemicals, and contaminants. Provide regular refresher hands-on training to expand staff expertise. Provide in-depth training to the MCEOP team. Gather and maintain proof of staff and MCEOP team comprehension of training, such as tests. See the *MH-I*, Chapter 11: Curatorial Health and Safety, for more detailed guidance.

Provide staff with necessary preventive equipment as required by OSHA, including fume hoods, nitrile gloves, rated breathing apparatus fitted to the user, and washable smocks. Know the properties of the chemicals you store, such as ammonia and bleach interactions. Keep only enough chemicals for a short-term use. Select fire extinguishers based upon the types of chemicals held by the museum. Maintain a local file of how to handle exposures to these materials. Establish local eyewash and shower stations and note them on the building plans in the MCEOP. Place OSHA emergency action charts on the wall near chemical usage areas.

Be aware of how your air-intake and HVAC systems function so you can turn them off to avoid bringing contaminated air into your building. Check seals on all wet specimens regularly. Place a fixed and padded railing around shelving units holding wet specimens to limit the chance of materials falling and shattering due to heavy vibration, a storm, or earthquake. Discourage use of pesticides in or around the building.

Check potentially hazardous objects or specimens in storage before handling them or providing them to researchers if you have reason to believe they may be hazardous, such as:

- arsenic contaminated taxidermy mounts
- geology specimens that are radioactive
- historical batteries or motors

- historical farming equipment with chemical residues
- historical medical equipment
- historical motors and vehicles with gasoline and lubricants still inside
- items contaminated with vermin, feces, and other biological waste
- live ammunition
- nitrate negatives and film
- war souvenirs contaminated with radiation

If you are uncertain, have them tested before providing them. Train all staff in how to identify, handle, and work with hazardous materials. Never pour chemicals into the ground or down a drain. Work with your NPS park hazardous waste coordinator.

Hazardous materials accident survival: Evacuate the area immediately, using stairs instead of elevators. Assess risks as you evacuate (spills, power lines down, fires) so you can alert authorities. Check to ensure that no one is trapped in the elevator. Help injured or disabled people. Don't open doors and windows as you evacuate. Keep the building shut down with air handling off. Contact authorities immediately. Avoid re-entering the area. Move to a safe distance from the affected area, taking your visitor log and MCEOP with you. You may have to move several miles distant if fumes are evident. Try to determine if everyone has safely evacuated the building. Alert professional rescue personnel about any missing individuals and the nature and extent of the disaster. Call the hospital for emergency medical help.

As soon as possible, set up a triage area for administration of first aid. Use nitrile gloves to remove contaminated clothing and wash affected skin with much fresh water as soon as possible. Follow the instructions under medical emergencies, but ***don't attempt mouth-to-mouth CPR on unconscious persons who may have breathed in fumes,*** as you place yourself at risk. Follow the MCEOP guidelines on specific actions for the types of hazardous materials your park holds.

8. *What do I need to know about transportation accidents?*

Transportation accidents may result in standing pools of fuel, which are fire and explosion hazards; toxic fumes from fires; spillage of chemicals and hazardous wastes, and similar contaminants that can pose severe health and safety threats to staff, as well as museum collections.

Transportation accident vulnerabilities: See storm damage and hazardous materials accidents vulnerabilities.

Classic transportation accident damage: See hazardous materials accidents.

Transportation accident prevention: Don't place museum storage, work, exhibit, or research rooms within proximity to active train tracks, major airport flight paths, major highways, and similar transportation routes.

Transportation accident survival: Evacuate the building, if possible. Assess risks as you leave, for example, fires and major fuel spills. Check the elevator for trapped people. Help injured or disabled people. Contact authorities immediately. Avoid re-entering the area. Move to a safe distance from the affected area. Try to determine if everyone has safely evacuated the building. Alert professional rescue personnel about any missing or trapped individuals. Contact park and local authorities. Provide first aid assistance as necessary.

9. *What do I need to know about civil unrest, vandalism, and terrorism?*

Civil unrest, vandalism, and terrorism can limit access to collections or cause their damage or destruction. Planning for them is challenging, as it involves being aware of potential political and social issues related to your park. Try to anticipate potential problems, such as demonstrations that are symbolically or politically linked to your park. Terrorism is a relatively unlikely risk for most parks when compared to the much greater risk of fire or flood damage. However, terrorism is increasingly a force in modern life. Museums must protect themselves from such activities. The highest risks for demonstrations and terrorism are sites that embody American history or that have high symbolic value, such as the Statue of Liberty, Mount Rushmore, or the Washington Monument

Civil unrest, vandalism, and terrorism vulnerabilities: The materials most vulnerable to damage include:

- collections lacking good alarm systems and nearby onsite park police protection
- materials inadequately housed
- items easily destroyed by mishandling, such as ceramics, glass, paper, specimens in alcohol or formaldehyde, and textiles
- items in parks with employee relations problems

Classic civil unrest, vandalism, and terrorism damage includes:

- explosion damage resulting from bombs
- fire and smoke damage
- fouling of collections with food, garbage, and human waste
- graffiti marking on objects, such as paper

Civil unrest, vandalism, and terrorism prevention: To avoid problems with civil unrest, vandalism, and terrorism, house your museum collections storage, work, and research room areas in secured park areas away from

ceremonial spaces or public spaces. Secure collections if demonstrations are planned. Maintain security, particularly key control and alarm systems. Ensure that you have back-up power sources for your security system and emergency evacuation lighting in case of emergency utility failures. Follow established access procedures as described in *Museum Handbook*, Part III *(MH-III),* Chapter 1: Evaluating and Documenting Museum Collections Use. If a researcher becomes distraught, contact park police for assistance. Never physically restrain a visitor or staff member.

Civil unrest, vandalism, and terrorism survival: To survive, notify park and local authorities immediately of any incidents. Follow their instructions. Remain calm. Never argue with armed individuals. Stay away from windows and glass doors. Evacuate as instructed by authorities after first ensuring that no bombs or other hazards exist on the evacuation route. Check the area to which you are evacuating as well for hazards and bombs. Be aware that bombs often are planted to go off serially. Help injured and disabled individuals evacuate. Assess risks as you leave, for example, the number and location of armed individuals and the nature of barricades. Close all doors and windows as you leave. Check all elevators and bathrooms as you leave for trapped individuals. Take your MCEOP and visitor log with you as you leave so you can share them with bomb squad personnel. Call for medical help immediately. Have park law enforcement fill out a case incident report. Work with your park law enforcement and public relations officers on follow-up actions.

10. *What do I need to know about explosions and bombs?*

Explosions are a greater threat to most parks museum collections than terrorism. Nitrate based still photographic negatives and motion picture film are perhaps the greatest explosion threat to museum collections. Copy nitrate film, inspect it, and don't store it in parks for longer than it takes to copy it (less than 5 years). See *MH-III,* Appendix M: Management of Cellulose Nitrate and Ester Film.

Explosion and bomb vulnerabilities: See hazardous materials accidents and storm damage. Explosion vulnerabilities include:

- black powder and other weaponry or supplies, such as ordnance
- nitrate negatives or motion picture film in quantities of more than 35 pounds or that are deteriorated or largely motion picture or large format negatives and X-ray film (See Appendix M: Management of Cellulose Nitrate and Ester Film.)
- gas appliances older than 10 years that are not regularly inspected
- nearby fuel storage or transportation storage facility such as a garage or service station
- substantial wet specimens in a building where smoking is allowed
- vehicles, power tools, and motors in collections that have not been adequately drained of fuel

Classic explosion and bomb damage: See fire damage, hazardous materials damage, and storm damage.

Bomb threat: If you experience a bomb threat, listen for background noise and try to distinguish the caller's age, sex, and accent. Write down every word said, paying particular attention to when the bomb will explode, where it is, what kind of bomb it is, and why it was placed. Contact law enforcement immediately, unless the explosion is imminent. If the explosion is imminent, evacuate immediately, sounding the fire alarm as you leave.

Otherwise, if the explosion is not imminent, investigate the evacuation route and staging area to ensure that there is no bomb there as well. Then, evacuate the area, sounding the fire alarm, if possible, and closing all doors and windows as you depart. Help handicapped or injured individuals evacuate and check all elevators for trapped individuals. Take the MCEOP and the visitor log with you as you evacuate. Immediately contact park and local police from a separate building. Keep well away from the area. Try to determine if everyone has left the building. Notify rescue personnel if anyone is missing.

Explosion and bomb survival: If you are in the museum during an explosion, take cover under a sturdy table or desk. Stay far away from windows, mirrors, exhibit cases, unsecured equipment, museum storage areas, office bookcases, and file cabinets. Watch for falling objects.

> *Expect additional explosions, so evacuate with care along routes that have been checked for safety to assemblage areas that have been checked for hazards and additional bombs.*

Evacuate via stairs, not elevators. Help injured or disabled individuals. Don't light matches, candles, or lighters, as gas lines may be broken. Stay away from areas with small hard objects such as machine or wood shops, kitchens, or museum storage. Call authorities as soon as you are outside and safely away from the building. If a fire results, stay well clear of the fumes, particularly if the fire is a nitrate fire. Fill out a case incident report.

11. *What do I need to know about structural collapse?*

Structural collapse caused by accidents, earthquakes, explosions (particularly nitrate explosions), fires, floods, storms, terrorism, and neglect pose a significant threat to museum collections. Structural damage leads to broken, cracked, or buried items. Structural collapse may cause fires due to broken gas lines, as well as water damage to collections from broken pipes, and sewer, fuel, and power lines.

Structural collapse vulnerabilities: See Storm Vulnerabilities and Explosion Vulnerabilities.

Classic structural collapse damage: See Explosion, Fire, and Storm Damage Sections.

Structural collapse prevention: To avoid structural collapse, have your building inspected by park maintenance and the regional architect if you see any physical problems such as cracked or weakening support beams or worse, sagging floors or ceilings. See Earthquake Prevention in Section B.12 for further guidance. Avoid excessive floor loading until structural integrity and floor loading capacity can be determined. To minimize potential problems, bolt non-historic bookcases, file cabinets, and heavy equipment and furniture to walls.

Structural collapse survival: If you are in a building when it collapses, take cover under a sturdy desk or table or in a supported and reinforced doorway, preferably in the center of the building. Avoid all spaces with wide span roofs, such as auditoriums, barns, and garages. Stay away from filing cabinets, bookcases, overhead lights, electrical equipment, mirrors, glass doors, and rooms with many unsecured objects, such as metal shops. Before evacuating, inspect the evacuation route and staging area to ensure that they are safe and not in a state of collapse. Stay out of elevators, but listen for trapped individuals.

Once the collapse has stopped, evacuate cautiously using the stairs or a door or window. Don't use matches, candles, or lighters for illumination as gas pipes may be broken; use flashlights. Take the MCEOP and visitor log with you if possible. Help handicapped or hurt individuals to move to a safe and stable evacuation assemblage area that has been checked for problems. Avoid running for the stairs at the first sign of trouble, as they may be broken or full of stampeding people. Move cautiously. Be prepared for additional shocks and structural instability.

Stay away from glass windows, doors, exhibit areas, overhead lighting fixtures, and bookcases as you evacuate. Avoid tall, heavy, and unsecured furniture. Call authorities once you are safely away from the building. Try to determine if everyone has safely evacuated. Notify authorities of missing or trapped individuals and their likely location. Set up a medical triage station. Call for medical assistance. Help care for injured people to the extent of your medical knowledge and skills.

12. *What do I need to know about earthquakes?*

FEMA experts estimate that 39 out of 50 states in the U.S. are at risk of an earthquake. We can't yet predict earthquakes accurately; however, we are getting much better at estimating earthquake probabilities. For example, scientists predict a 60 percent chance of an earthquake greater than 6.7 magnitude in Southern California in the next 30 years. Based on long-term records of the U.S. Geological Survey (USGS), scientists expect about 18 major earthquakes (7.0 magnitude or greater) and one great earthquake (8.0 or greater magnitude) annually worldwide.

Of the last 15 large earthquakes in the U.S., 10 were in Alaska and 3 in California, while the others were in Hawaii and Missouri. On the continental U.S. the last 15 largest earthquakes include 8 in California; 3 in Missouri; and 2 in Nevada; with the others being in Montana and Idaho. Alaska far exceeds all other earthquake zones in the U.S., with over 82

major quakes of 7.0 or greater since records were first kept in the late 18th century.

Earthquakes may abrade, break, smash or damage items and buildings or drown them in mudslides, flooding, or under collapsed buildings. Earthquakes can also be an aftereffect of volcanic activity. Almost all kinds of damage listed under "Fire," "Flood," and other emergencies covered in this Section may happen during earthquakes as well. Generally earthquake damage levels depend upon the earthquake magnitude, duration, distance from the epicenter of the quake, the type of structure, the type of ground on which your structure rests, and the level of preparedness. ***Note:*** The thicker and looser the soil on which your structure rests, the more amplified the earthquake effect will be.

Earthquakes may lead to explosions from broken gas mains, floods from broken water lines, and similar damage. In addition, earthquakes may cause a major loss of original order for archeological objects and archives and records. For archeological and archival materials, the original order of the collection may provide information on the circumstances of creation or usage and relationship to other materials within the collection. Losing this arrangement through an earthquake, flood, or other disaster can significantly diminish the value of the collection.

Earthquake vulnerabilities: If your collections are housed in an unreinforced structure in an earthquake zone, you are at risk if basic prevention steps aren't taken. Vulnerability of collections is also dependent on what steps you have taken to mitigate risk, such as placing restraining bars or cords on shelving. See *MH-I,* Appendix F: Collections Management Checklists, Checklist for Preservation and Protection of Museum Collections, Question B.23. Be aware of tectonic plate fault lines in your area and of your region's estimated probability of an earthquake. In many areas experts have predicted the actual size and impact area of future earthquakes. See the Bibliography under Earthquakes for sources. Work with park architects and maintenance staff to reinforce your building and storage equipment appropriately. See Fire, Hazardous Material Accident, and Storm Vulnerability for further information.

Classic earthquake damage: See Fire, Hazardous Material Accident, and Storm Damage.

Earthquake damage prevention: Avoid placing museum storage, work, exhibit, or research spaces on or near geological fault lines. If this is impossible, follow the guidance in the resources in the bibliography on how to secure collections and furniture to avoid destruction in an earthquake. Select a building that has been built or modified to withstand an earthquake. Standard earthquake modifications include the addition of sheathing on roofs and floors and of steel braces, frames, or brackets. Reinforce walls, beams, chimneys, and damaged mortar. Securely install track-type lighting. Have the building inspected by a structural engineer and your park maintenance staff to ensure that it is structurally sound. Identify risks from surrounding structures or trees. Cut down dead limbs. If necessary, place

guy wires on nearby trees.

For masonry, bolt roofs to walls and walls to foundations using steel brackets. Reinforce building openings, such as crawl spaces, doors, and windows by placing steel frames around them or steel beams in them. Repoint mortar as necessary. Check with park architect and maintenance staff for help or talk to

your regional/SO curator. Keep all aisles, walkways, and doorways clear when planning your space.

Select steel shelving with welded frames and cross-braces but without tightly sealed and enclosed air pockets that may promote floating during a flood. Bolt shelving, filing cabinets, map cases, and major furniture to solid structural components, such as walls, ceilings, and floors, far from doors, escape routes, and computers. Pad all shelving with polyethylene foam sheets to limit kinetic damage. Store fragile items, such as ceramics, glass, and bone, in hollowed out blocks of polyethylene foam or use fishing line or cloth straps to hold the items to their shelves. Place small items in polyethylene padded drawers of cabinets, map cases, or small boxes. Pad large, tall, or heavy items, then place them horizontally on bottom shelves. Use restraining bars or cords and similar devices to prevent materials from rolling off open shelves.

Remove artwork from glass-covered frames. Store unframed artwork flat in solandar boxes. If you decide not to remove artwork from frames, use steel S-hooks or double-end bolt snaps to secure framed objects at their top and bottom to storage screens. Replace glass shelves in exhibit cases and housing with tempered glass or Plexiglas. Slip a wooden rod into the handles of filing cabinets to ensure that they are held closed. Purchase Velcro type tie-downs for computers.

Earthquake survival: Stay inside. Go to a small windowless room in the center of the building. Stay out of rooms with wide span roofs, such as barns and garages, and away from museum storage areas or any space with lots of furniture and loose materials, such as metal shops or libraries. Get under a heavy piece of furniture, such as a desk. Duck, cover your head, and stay curled up until the shaking is over. Stay away from windows, overhead fixtures, bookcases, filing cabinets, loose tools, and electrical equipment. Prepare for aftershocks. Put out small fires. Follow the guidance under structural collapse (Section B.11) and fires (Section B.2) above.

13. *What do I need to know about volcanoes?*

More than 80% of the earth's surface above water is of volcanic origin. There are currently about 53 historically active volcanoes in the U.S. of which 43 are in Alaska according to *Volcanoes of the World***.** According to FEMA, all parks in Alaska are at the highest level of risk. Moderate-risk parks include those in the Pacific Rim states of California, Hawaii, Oregon, and Washington. Montana and Wyoming are at a slightly lower level of risk. All other states are at a still lower level of risk with a few isolated exceptions, such as Hot Springs National Park.

Some parks have active or previously active hot springs and volcanoes, such as Capulin Volcano National Monument, Crater Lake National Park,

Haleakala National Park, Hawaii Volcanoes National Park, Hot Springs National Park, Lassen Volcanic National Park, Lava Beds National Monument, Mount Rainier National Park, and Sunset Crater Volcano National Monument. Such parks need to be very alert to increased levels of risk. Besides the obvious concern of being buried by lava if museum storage is too close to lava tubes or pathways, volcanoes emit hot ash and acidic gases and cause mudslides, flash floods, tidal waves, earthquakes, rock falls, and explosive lateral blasts that shoot hot rocks for up to 20 miles. Noxious and

occasionally lethal fumes can spread up to 100 miles. Acidic and corrosive ash can spread over 1,000 miles. For lists of active volcanoes see <http://www.volcano.und.nodak.edu/wvdocs/volc-images/>.

Volcano vulnerabilities include:

- *all collections on open shelves*, which can be coated with corrosive and acidic volcanic ash
- *archival materials*, particularly architectural drawings and plans, documents, electronic records, photographs and film, and sound recordings, which may suffer abrasion, embrittlement, oxidation, loss of data (magnetic and electronic), and silvering out
- *artworks*, particularly chalk, charcoal, collages, conte crayon, gouache, montages, paintings, both on canvas and on panels, polychrome sculptures, and watercolor
- *bone and ivory*, which may be discolored or lose applied color or be stained
- *baskets and similar fibrous materials*, such as sandals, which may be stained or lose color
- *ceramics*, which may be abraded or scratched or lose color
- *furniture/wood*, which may loose surface finish or suffer oxidation of attached metals
- *glass*, which may be abraded or scratched
- *metal objects*, which may be scratched or oxidized—silver may corrode due to fumes and toxic gases
- *natural history specimens*, which may be stained or covered with ash
- *textiles*, which may suffer from staining or weakening

Classic volcano damage: These volcanic gases, mud, lava, and ash pose particular threats as they:

- *corrode and oxidize* metal and photographs

- *damage surface finishes* on paper, photographs, wood, textiles, and other objects

- *destroy magnetic media*, particularly audiotapes, digital files, software, and videotapes

- *embrittle* paper, photographs, textiles, and other objects

- *fade and/or stain* art work or paper

Volcano damage prevention: Avoid placing museum storage, work, exhibit, or reading room areas near active volcanoes. Be aware of any road, or river, valley, or other geological feature that could lead the lava and mud to the museum. Purchase vacuuming equipment with a water filtration system. Check on purchasing special furnace filters for screening out particulate ash. Know how to totally shut down the museum air intake system and tape up all ducts, valves, vents, and windows.

Volcanic activity alert: If a volcanic activity alert is announced, evacuate visitors and non-essential staff first. Then work with essential staff to evacuate collections to the extent possible to a safe alternative facility at least 20 miles from the volcano. Before evacuation, staff should change into long-sleeved shirts and pants and locate goggles and dust-masks or rated breathing apparatuses that have been fitted to each staff member. Turn off all air intake equipment and ensure that the ducts and vents are taped shut. Disconnect all electrical equipment except essential emergency equipment. Shut down utilities. Tape shut all window gaps and poorly grouted areas. Place coverings over chimneys.

Wrap fragile materials and shelves in plastic to prevent volcanic ash build-up. Remove all sources of humidity, such as dehumidifier pans and standing water, as volcanic ash combined with water can produce sulfuric acid. Try to keep the humidity low.

Check all emergency supplies and emergency equipment. Fill evacuation vehicle gas tanks. Don't leave car engines running longer than necessary as volcanic ash and fumes can destroy car and truck engines. Extinguish all fires in non-essential appliances and unplug them. Evacuate, providing assistance to disabled and injured people as necessary. Ensure that no one is left trapped in the building, such as in an elevator. Take the MCEOP and visitor log with you. Travel on high ground as much as possible, avoiding areas where potentially lethal lava, mudslides, and fumes can accumulate. Attempt to get at least 20 miles from the volcano; some danger from fumes and gases still exists up to 100 miles away. Avoid routes with numerous bridges, valleys, tunnels, or bottlenecks.

Volcanic activity survival: Evacuate as ordered when the alert occurs. Wear breathing apparatus and goggles, if possible; otherwise keep a damp cloth over your mouth and nose. People can die from breathing toxic volcanic fumes. Stay away from low lying areas and all lava flows, volcanic ashfall areas, and mudflows. Go to high ground and keep moving away from the volcano. Use a cell phone or mobile phone, if possible, to

determine if your evacuation route is safe and that all bridges are still available. Assist disabled and injured individuals. Notify authorities of any trapped individuals and their likely location.

Don't return until an "all clear" is announced and park authorities indicate it is safe. Wear goggles, a scarf or hat, and an appropriately rated breathing apparatus fitted to the wearer, as well as a long-sleeved smock and slacks during recovery work. Clear roofs, gutters, and drains of ash fall as it can become heavy enough to collapse buildings. Don't turn on the air handling system until the air has cleared and ash has been removed. Keep doors and windows closed. Keep the environment very dry. Put mats outside the

building to avoid tracking ash inside. Place plastic sheeting on the floors near any entry points and windows to capture ash. Vacuum everything. Wash nothing. Avoid rubbing, wiping, or washing surfaces. Change building air filters very frequently.

C. Analysis of Risk to Your Park's Museum Collections

Not all parks are at equal risk for all types of emergency. For example, Statue of Liberty National Monument is at greater risk of from flooding, storms, terrorism, than it is volcanoes and mudslides. Hawaii Volcanoes and to a lesser extent Mount Rainier are at greater risk of volcanic activity and mudslides than of terrorism.

Each park and center has a unique blend of:

- ***existing hazards*** (such as a river, high water table, or near-by cliff or highway), *and*
- ***collection vulnerabilities*** (the size and type of collection housed in each at-risk structure and the level of the loss occurring when a disastrous event of a certain magnitude and type occurs)

Taken together, hazards and vulnerabilities equal risk.

Risk assessment is a matter of:

- ***analyzing the hazards and vulnerabilities*** of a park's museum collections (See Figure 10.2.)
- ***defining acceptable risk levels*** for each type of potential emergency
- ***making decisions*** about acceptable prevention and mitigation (contingency response actions)

All emergencies have one common characteristic: if not dealt with rapidly, thoroughly, and thoughtfully, emergencies get significantly worse and become disasters.

1. *How do I assess the level of risk to my park for various kinds of emergencies?*

Use the risk assessment worksheet (Figure 10.2) to determine the risk and hazard factors your park faces for each type of emergency. Mitigate these risks, wherever possible. Request funding to mitigate risks that the park can't afford. If after completing the worksheet you determine that your park has many more risks for fire than for earthquake, spend your park's money on more fire mitigation than on earthquake mitigation.