7 DESIGN NARRATIVE

7.1 Sustainability

To support the District of Columbia's sustainability objectives and building code requirements, this project will pursue LEED Gold Certification through USGBC. The building is eligible for certification under LEED v4 Building Design and Construction. Should the design phase and LEED Online registration commence prior to October 31, 2016, this project will also have the option to elect the LEED v2009 New Construction rating system.

At the beginning of the design phase, a kickoff charrette will identify appropriate sustainability measures to achieve this objective. Should a particular sustainability goal run contrary to an archival design guideline or standard, priority will be given to adhering to the archival design standards and the team will work with DGS to identify alternative approaches that will achieve the LEED project goals without negatively impacting the archival functions of the project.

7.2 Landscape

The landscape of an archival facility should be designed for water control, integrated pest management, and low maintenance. General requirements for the landscape design include:

- Omit vegetation within 18 inches of the exterior wall.
- Vegetation free zone must be sloped away from the foundation and consist of gravel or decorative aggregate with appropriate drainage.
- Trees and shrubs should not obstruct pedestrian lighting
    - Include under story plants no higher than 3 feet.
    - Include a tree canopy with limbs at least 7 feet above the ground.
    - Maintain a minimum of 15 feet between building and the drip-line of trees at full maturity.
- Omit pools, fountains and their related equipment.
    - If present, additional protection must be taken. If present, locate a minimum of 75 feet from the facility and 10 feet below the lowest level where archival records are stored.

7.3 Site

General Requirements

The DC Archives facility first and foremost needs to be located in Washington DC. Driving factors in site selection include: location, cost, availability.

Specific criteria for site selection for the DC Archives include:

- Located within short response time for emergency services.
- Quick evacuation.
- Protected from dangers from neighboring spaces and buildings.

- Accessible to visitors
- Accessible to related agencies and to other cultural institutions.
- Accessible by main roads and public transportation
- Eligibility for site-related LEED credits

Many of the dangers that threaten an archival facility can be avoided by careful site selection and site work. In addition to location, cost, and availability, the site selection must consider other potential risks, including:

- Vandalism, terrorism, and intrusion.
- Natural disasters, such as earthquakes, landslides, etc.
- Fire and explosions
- Hazardous locations or materials
- Flooding from natural sources or water mains.
- Ground and air pollution
- Rodents and insects

The entire site and ancillary structures on the site should be a minimum of 5 feet above and 100 feet away from any 100-year floodplain area.

Site Size

The site for an archives/records center facility must be large enough to accommodate:

- Building footprint
- Site access and service roads
    - Roads, fire lanes, and parking areas should be designed to permit unrestricted access for emergency vehicles
- Sufficient parking
- Space for storm water management
- Separation between drop off areas, parking, loading, and the building
- Turning radii for large delivery and trash vehicles
    - 53 foot truck is recommended

In addition, the site should accommodate future growth.

Site Evaluation

Conduct a site survey and consider the adequacy of the site using the above listed criteria (see Chapter 9 for Preliminary Site Evaluation, pg 211). Also complete a geotechnical investigation and a security risk assessment. If needed, conduct an archeological assessment.

Special Utility Requirements

The water supply, sewer, and storm drainage systems should all be readily available and meet the requirements outlined by codes and NARA 1571's requirements.

The primary electric power from the network to the building must run underground in conduit. All conduits for the primary power must have at least 50% spare conduit capacity. Consideration should be given to a redundant primary feeder.

7.4 Structural

1. Structural Systems

a. General

Architectural design and programming for this project is at an incipient stage, and therefore a selection on the structural systems of the proposed Archives Facility has yet to be determined. A variety of occupancies are anticipated and include reception, research, storage, and other work and operations related spaces. Storage spaces may include shelving that ranges from low density fixed static shelving to high density compact mobile shelving. These spaces may require long spans with column free zones.

New building construction is envisioned as either a steel beam and column structure with concentrically braced frames, or a conventional cast-in-place concrete structure with ordinary reinforced concrete shear walls. Different variables such as site restrictions, the proposed building floor plate and geometry, proposed building height, adjacent structures, or a number of other design considerations may help to inform the practicality and economy of one structural system over another.

Lateral overall building deflection due to wind will be limited to H/500, while inter-story drift ratios will be limited to H/400. The allowable story drift due to seismic load will be limited to H/250.

While a site has yet to be selected for this project, for the purposes of determining structural design criteria, the project is located in Washington, DC, Zip Code 20003, Latitude 38.8898, Longitude -77.0035.

b. Foundations

A comprehensive geotechnical study will be performed for this project, and will form the basis for the design of the proposed new building's foundations. The soil conditions in the Washington DC area are highly variable, so until site-specific geotechnical information is established, a recommended foundation system cannot be determined. Due to the typically less than favorable soil conditions and the nature of the heavy loading imposed by archive-type structures, either a deep foundation system, a heavy mat slab foundation, or conventional shallow spread footing foundations with a soil improvement system may be anticipated.

c. Slab-on-Ground

The typical building slab-on-ground will consist of a 5-inch thick slab reinforced with #5 bars at 18" on center each way. Where especially heavy storage areas or high density shelving units occupy space on the slab-on-ground, construction will consist of a 7-inch thick slab reinforced with #6 bars at 18" on center each way.

Slabs-on-ground will be designed according to the floor flatness and levelness numbers described in ASTM E 1155. Typical slabs must meet overall Ff and Fl values of 25/20, and local Ff and Fl values of 17/13, respectively. Slabs with specialty flooring materials, and slabs with sensitive shelving units may need to meet more stringent flatness and levelness specifications.

A vapor retarder will be installed under all slabs-on-ground to prevent vapor drive through the slabs.

d. Typical Floor Construction

While the floor construction has yet to be determined, the structural systems will be designed to accommodate a Class 9 superflat floor surface as defined in the ACI 302.1R, Guide to Concrete Floor and Slab Construction. A Class 9 floor will be required to achieve the anticipated surface tolerances, which will be specified by the high density shelving equipment suppliers. Overall Ff and Fl values of 60/40 is the minimum flatness/levelness for Class 9 floors, and a bonded topping slab is anticipated in order to accommodate this criteria.

2. Structural Design Criteria

a. Codes and Standards

1. District of Columbia Building Code, 2013 (based on the 2012 International Building Code)
2. Minimum Design Loads for Buildings and Other Structures (ASCE 7-10)
3. Building Code Requirements for Structural Concrete (ACI 318-11)
4. Building Code Requirements for Masonry Structures (ACI 530-11)
5. Specifications for Structural Steel Buildings (AISC 360-10)
6. Seismic Provisions for Structural Steel Buildings (AISC 341-10)
7. Structural Welding Code—Steel (AWS D1.1-10)

b. Materials

1.	Cast-in-place concrete (general):	f'c = 4,000 psi
2.	Concrete, footings	f'c = 3,000 psi
3.	Concrete, frost walls:	f'c = 4,000 psi
4.	Concrete, slabs-on-ground:	f'c = 3,500 psi
5.	Concrete, slabs on metal deck:	f'c = 3,500 psi
6.	Reinforcing steel:	ASTM A 615, Grade 60
7.	Structural steel:	ASTM A 992, SQ
8.	Steel tubes:	ASTM A 500, Grade B
9.	Steel plates and angles:	ASTM A36
10.	Anchor rods:	ASTM F1554, Grade 36
11.	High strength bolts:	ASTM A 325
12.	Vapor retarder:	15 mil reinforced

c. Live Loads

1.	Classrooms:	40 psf +15 psf partition (use 80)
2.	Offices:	50 psf +15 psf partition (use 80)
3.	Library Reading Rooms:	60 psf + 15 psf partition (use 80)
4.	Lobbies, First Floor corridors:	100 psf
5.	Corridors above First Floor:	80 psf
6.	Stairs and exits:	100 psf
7.	Assembly areas:	100 psf
8.	Mechanical rooms:	150 psf (or weight of equip)
9.	Storage rooms:	125 psf
10.	Library Stack rooms:	150 psf

d. Snow Loads

1.	Ground snow load, Pg:	25 psf
2.	Uniform flat roof snow load, Pf:	30 psf
3.	Snow Importance factor, Is:	1.0
4.	Snow exposure factor, Ce:	0.9
5.	Thermal factor, Ct:	1.0
6.	Terrain Category:	B (Fully Exposed)
7.	Risk Category:	II

e. Wind Loads

1.	Ultimate Design Wind Speed (V3s ULT):	115 mph
2.	Nominal Design Wind Speed (V3s ASD):	90 mph
3.	Wind Importance Factor, Iw:	1.0
4.	Exposure:	B
5.	Risk Category:	II
6.	Internal pressure coefficient:	+/-0.18
7.	Wind analysis procedure:	ASCE 7 Analytical Procedure

f. Seismic Loads

1.	Analysis Procedure:	Equivalent Lateral Force
2.	Site Class:	D (assumed)
3.	Risk Category:	II

4. Seismic Design Category B
5. Seismic Importance Factor, Ie: 1.0
6. Mapped Spectral Response Acceleration, Short Periods: S_s = 0.118
7. Mapped Spectral Response Acceleration, 1-Second: S_1 = 0.051
8. Design Spectral Response Acceleration at Short Periods: S_{DS} = 0.126g
9. Design Spectral Response Acceleration at 1-Second: S_{D1} = 0.081g

g. Live Load Reductions

1. Live Load reductions will be used per the 2013 District of Columbia Building Code, and applied to the columns, where applicable. However, the maximum live load reduction for columns will be limited to 50% of tabulated live load capacity, L_0.

7.5 Exterior Closure

The new DC Archives and Records Center facility shall provide an attractive building, constructed of durable materials, that is economical and easily maintained. Should a partial or complete retrofit option be selected, any additions to the existing facility will be complimentary and coordinated with the site and any adjacent uses.

The envelope design will contain the following key features:

- Wall and insulation system shall exceed required R-values provided by code. The exact R-value will be optimized in conjunction with an energy analysis to provide energy efficiency and temperature stability in a loss of power event.
- Vapor barrier and insulation system shall maintain the individual climate requirements in the archival and records center facilities without producing condensation inside these facilities.
- Building materials shall be provided to reduce the off-gassing of volatile organic compounds (VOC's), especially materials used in archival and records center storage areas.
- All exposed concrete slabs should be sealed or coated to prevent moisture migration and dust.
- Membrane roofing system shall be designed such that roofing penetrations over the archival and records center storage facilities are minimized. Roofing material to be high-SRI to minimize heat gain.
- Accessible, lockable, weather tight roof hatch will be provided in mechanical room for access to the roof. Provide access from roof of mechanical room to all adjoining roofs as needed; provide fall protection and anchorage points at ladders and roofs.
- Provide a dedicated walking surface on all roofs with guardrails to facilitate maintenance and inspections.
- Expansion capabilities will be incorporated into the design of the archival storage, records center storage, and key service corridors. One example is the inclusion of knock out panels for doors to a future expansion.

Envelope Commissioning

Envelope commissioning will include all archival and records center storage facilities. Ancillary spaces including the access corridor and the mechanical rooms will not be commissioned. Archival facilities require an envelope that minimizes air

leakage into and out of the storage facilities to protect the collection and minimize the energy required to maintain the specified interior environmental conditions. Provide envelope commissioning in accordance with ASHRAE 189.110.3.1.2.4 b & c.

A continuous vapor retarder with a minimum of openings in the vapor retarder shall be provided to protect the collections and minimize the energy required to maintain the specified interior environmental construction. The vapor retarder shall be provided on all six sides of archival and records center storage facilities.

Smoke vents in the roof of the archival and records center facilities shall be provided to allow for the release of smoke should a fire event occur within the storage facilities. Air leakage and the transfer of water vapor through the smoke vent should be minimized consistent with commercially available products.

Thermal Imaging of the archival and records center storage facilities will be done to identify thermal short circuits through the building envelope.

An OSHA fall protection system for the building shall be provided in compliance with OSHA, Appendix C to 1910 Subpart F, Personal Fall Arrest Systems.

Figure 7.1 Sample Exterior Closures Satisfying Thermal, Moisture, and Durability Requirements

7.6 Interior Construction

Interior construction shall include the following features:

- Steel bollards, guards, and bases will be designed to protect the interior finishes from impacts by the order pickers in the archival and records center storage facilities and the circulation corridor.
- In general, office spaces and reading rooms will have low pile carpet flooring, acoustical ceilings and painted walls.
- Public spaces such as lobby/reception and exhibit gallery may have a more durable harder floor finish such as terrazzo.
- Storage areas require low VOC content and as such finishes will be determined that are hard, durable, and low VOC such as concrete.
- Loading dock areas will have sealed concrete floors.

- Other special spaces such as Processing Rooms and Labs will have finishes conducive to the function, such as low VOC and easy to clean flooring, walls, and ceilings.
- Formaldehyde-based insulation and foam in place insulation are not acceptable for records storage, processing, labs, and exhibit galleries.

7.7 Materials & Finishes

In addition to proper climate and filtration conditions, archival collections require storage environments that contain materials and finishes that minimize the off gassing of volatile organic compounds (VOC) and other chemicals that can contaminate the air and degrade the records. Materials that contain biological contaminants or might invite mold must also be avoided in records storage environments. All materials and finishes used in archival facilities must meet the requirements of the building life safety and fire codes. Furthermore, because archival facilities are usually constructed to last decades, if not centuries, the materials and finishes selected should be of the highest quality and both durable and attractive.

Off gassing should be a major consideration when carrying out building planning, especially for records storage rooms. Release of harmful substances from building materials and finishes should be minimized in the areas where records are handled or displayed, including processing areas, exhibit areas, laboratories, and research rooms. In reality, most adhesives and coatings, including those labeled "green," do not dry, or cure, instantaneously; moreover, nearly all give off some gas or vapor while curing. The goal for selecting materials and finishes for archival facilities is to avoid unstable or slow curing materials. As much as possible, paints, sealants, caulks, wood products, foams, and other materials selected for archival facilities should have low or no VOC emissions.

Prohibited Materials

Certain materials must be prohibited from archival storage rooms and exhibit cases where original documents are displayed. Prohibited materials should also be avoided in processing, records holding, laboratories, and exhibit spaces. Materials and finishes deemed "prohibited" have been identified by conservators, chemists and archivists as such because of their deleterious properties that are known to rapidly degrade records. Prohibited materials include:

- asbestos
- cellulose nitrate
- lacquers and adhesives
- acid-curing silicone sealants and adhesives
- materials containing sulfur
- pressure sensitive adhesives
- formaldehyde
- unstable chlorine polymers (PVC).

Refer to Appendix B - Prohibited Materials (pg 237) for a complete list of prohibited materials for archival facilities. It should be noted that some materials listed as prohibited are currently unavoidable in some building materials but every attempt should be made to substitute safer materials as they become available. For example, electrical cables are common construction materials that often contain PVC, which is listed as a prohibited material.

Selection and Testing

Within the last twenty years, much new information has been developed about the types and use of materials and finishes in archival facilities. Archives, museums, conservation laboratories, and related industries share information about dangerous or questionable building materials through technical publications and their websites. Specifically, institutions such as the National Archives and Records Administration (NARA) and the Canadian Conservation Institute (CCI) provide guidance on a variety of materials and finishes. NARA cites its facility standards and outlines test methods for certain products in the specifications for their archival facilities. For example, NARA has standard test methods for painted or powder coated finished metal surfaces. A list of the products that have been tested by NARA's Research and Testing Lab, such as tapes, inks, and boxes is published on its website, www.archives.gov. The Canadian Conservation Institute has a wide variety of useful publications including those on the nature and use of coatings and on the acidity of wood species.

Unfortunately, it is not possible to identify all of the materials and products that should be avoided or used in archival facilities and even tested materials change formulas and ingredients and must be continually checked and monitored. Evaluation and testing is needed as new and reformulated products are proposed for the archival facilities. There has been a sizeable growth in "Green" products being marketed over the last five years. However products labeled "green" or "sustainable" may be better for the environment but are not necessarily safer for archival collections. These newer materials and finishes must be tested and evaluated with the same care as older products.

Institutions that are considering using new or untested products in areas where records are stored, exhibited or used should review the Material Safety Data Sheets (MSDS) for these products. One place to start is checking the items against those substances listed on the Prohibited Material list in Appendix B (pg 237) or discussed in NARA and other standards. Further consultation with certified laboratories, conservators, chemists, and experts in this field should be considered, especially for new products to be used in records storage areas.

Building Materials

The external building materials for an archives facility should ensure the permanence of the records and meet the storage and public demands of the building. Materials must be durable, provide appropriate protection from fire, heat, cold, humidity and moisture, be easy to maintain and keep clean, and meet the facility's program requirements. Whenever possible, the external building materials should be limited to those known to be stable and inert, and that will minimize the emission of harmful substances such as smoke and soot in the event of a fire. Particular attention should be paid to insulation, adhesives, epoxy materials and caulks. All exposed concrete walls and slabs, including spaces beneath raised floor systems, should be sealed or coated to prevent moisture migration and dust.

Internal building materials also must be selected with care. In particular, formaldehyde-based insulation and foam in place insulation are not acceptable for records storage, processing, labs, and exhibit galleries.

Building Acclimatization

In newly constructed or renovated facilities, time should be allotted for the building materials to dry, or cure before staff or collections move into the building. This allows the internal environments to stabilize and vapors from off gassing to dissipate before any archival records move into the building. A minimum of four weeks is recommended to acclimatize an area within the building, although a longer time period is preferred for the stacks.

All building air handlers should be in continuous exhaust mode during the acclimatization period to reduce the level of pollutants. Air filters should be changed before archival material is moved into the building. Air filters, ducts, and other

equipment should be checked and adjusted after moving in archival materials because the move will create new dirt and dust.

Records Storage Areas

The records storage areas should have the highest level of cleanliness and best environmental conditions in the archival facility. Stacks must be limited to the storage of the archival collections. Consequently, they should contain only the components necessary to house and store the collections. Equipment typically used in records storage rooms include shelving; cabinets; boxes or containers housing the collections; and mechanical lifts, book trucks and carts used to move and transport records. Staff workstations, copiers, excess equipment, and unnecessary furniture must never be located in records storage rooms.

Carpet, vinyl tiles, and wall coverings must not be used in records storage areas. General requirements include sealed concrete floors and water based latex paint. Specific requirements are detailed in the SAA Standard for Archival Facilities and in NARA 1571.

Figure 7.2 Materials and Finishes for Records Storage Areas

Other Facility Areas

Processing areas, the holding room, labs, and exhibit galleries will be occupied by staff and temporarily by archival records. Floor materials and finishes should be durable, attractive, and easy to clean and maintain. As much as possible, care should be taken to develop an environment that is identical to the records storage areas.

In particular products that should be avoided in processing rooms, holding, labs, and exhibit galleries include:

- plywood and other wood composites
- woods and oil based finishes
- bamboo with formaldehyde binders

Other products for these areas are recommended with reservations.

Staff and visitors will occupy research rooms while they temporarily review the collections. As much as possible, care should be taken to develop an environment that is similar to the stacks understanding that the area also needs warmth, inviting

décor, and sound absorption. The guidelines are not as stringent for research rooms since the archival materials are out for a short time.

In particular:

- Wood floors should be avoided.
- Low or no VOC low pile carpet or carpet tiles with non-wet, acrylic adhesive are recommended if carpet is used. Book trucks and carts should be able to easily travel across the floor.
- Solid wood and composite wood products are not recommended. However, it is often used for furniture because it is readily available and attractive. If used, select wood that is low in harmful emissions. See NARA and SAA guidelines for specific details.

Materials and finishes used in the remaining areas of the archival facility should also be carefully considered. At a minimum, all materials proposed for the archival facility should be checked against the prohibited materials list and current archival facility standards.

7.8 Equipment & Furnishings

Equipment and furnishing shall include:

- Mobile Compact Metal shelving (15 high) by a vendor such as "Spacesaver" will be required.
- Normal office furniture will be needed along with specialized equipment for the Archival facility. Chapter 6, Detailed Space Requirements (pg 53) indicates the program use and equipment that will be needed in those rooms to properly function. In addition to operating costs, DC will need to budget for the equipment and furnishing based on those requirements.

Figure 7.3 Compact Mobile Shelving (15-high)

7.9 Conveying Systems

It is assumed that the facility will have more than one floor. Therefore elevators will be required. We will assume for early programming that 1 passenger elevator and 1 service elevator will be required. The passenger elevator should provide easy access of the patrons to the reading rooms. The service elevator should provide easy access from the loading docks, processing areas and storage areas and will need to be heavy duty and oversized to accommodate the loads.

7.10 Plumbing Systems

The design of the plumbing systems will accommodate the entire building and will be in accordance with the 2013 District of Columbia Building Code.

Site Utility Coordination

The plumbing systems design shall include the coordination of sanitary drainage and storm drainage laterals, domestic water and fire services, and natural gas service with the available utility locations indicated on the civil site utilities plan. All utilities will be coordinated with the civil engineer to include systems, sizes, and inverts. The systems will be shown on the plumbing drawings leaving the building to a point 5 feet outside the building envelope and indicated to continue on the civil plans.

Coordination with Archival Spaces

The design of the plumbing systems serving the facility shall be closely coordinated with the architect to ensure that no roof drains, storm drainage piping, sanitary drainage piping, or natural gas distribution or vent piping is located above or within spaces containing archival holdings. In instances where this program requirement cannot be met, a containment piping system shall be designed for the portions of the systems that present a hazard to the collections.

Domestic Water Systems

An entrance room shall be provided adjacent to the exterior wall of the building to accommodate the domestic water service entering the building from municipal water supply in the street. The water supply shall enter the building through the wall of the water service room into a reduced pressure zone backflow preventer, and a water meter. All portions of the building plumbing fixtures and equipment shall be protected from static pressures greater than 80 psi by the installation of pressure reducing valves.

The water service piping material shall be ductile iron.

1. **Domestic Cold Water Distribution**

    - Domestic cold water shall be extended to all plumbing systems within the building that require water. The distribution system shall consist of vertical risers at various locations to serve the upper floors. Shut-off valves shall be provided at all floor levels and service stops at all plumbing fixtures. The domestic water distribution system shall be sized in accordance with the recommendations of the International Plumbing Code.
    - Potable water piping will be sized to maintain a minimum pressure of 30 psig at the furthest flush valve and at the hydraulically most remote safety shower or equipment requiring these pressures for operation. Provisions will be made to reduce any water hammer with water hammer arresters and hydroneumatic tank.
    - All above grade piping shall be type "L" copper tubing with wrought copper fittings. All domestic cold-water piping shall be insulated.

2. Domestic Water Heater

- The water heater shall be a central storage type water heater. Hot water shall be piped to all the plumbing fixtures requiring hot water. A hot water circulating pump shall be installed if the overall distance to the fixtures from the tank exceeds 50 feet. The hot water circulating pump shall operate from an aquastat.
- The water heater tank shall be equipped with heat trap, expansion tanks, vacuum relief valves, and pressure and temperature relief valves.
- Water heater efficiency shall comply with ASHRAE 90.1

3. Domestic Hot Water Distribution System

- The domestic hot water system shall serve all plumbing fixtures requiring hot water within the building. Hand washing facilities at all common area public lavatories shall be equipped with tempering valves in accordance with ASSE1070 and shall limit the tempered water to a maximum of 110 degrees F.
- All domestic hot water piping shall be type "L" copper tubing with wrought copper fittings. All hot water piping shall be insulated with fiberglass insulation and factory applied jacket.

Figure 7.4 Typical Archival Plumbing System

Storm Drainage System

Roof Drains

The roof drainage system shall consist of roof drains, gutters and downspouts. The roof shall slope at 1/4 inch per foot slope toward roof drains. No roof drains or storm drainage piping shall be located above archival records storage spaces. The roof drains shall be cast-iron bodies with sump receivers and dome strainers. Overflow roof drains shall be elevated 3 inches above the roof deck at the low point or shall have 3-inch high water dams.

Drainage System

The storm water drainage system shall serve all roof drains, area drains, and planter drains within the building. The system risers shall be routed from the upper floor to the lowest floor with as few offsets as possible. A base clean-out shall be installed at the bottom of all vertical risers. The drainage pipe shall be sized based on the square footage of water collection, and based on 3.2 inches of rainfall per hour. The pipe material shall be cast iron. All storm drainage piping shall be insulated to protect against condensate drip.

Sanitary Drainage System

The sanitary drainage and vent system shall serve all plumbing fixtures with integral drains. The sanitary system shall be designed to limit the length of horizontal runs above grade. Multiple risers shall be installed to drain the upper floor systems. A cleanout shall be installed at the base of all risers. The sanitary drainage system material shall be no-hub cast iron for systems above grade. Systems below grade shall be schedule 40 PVC. All drainage piping less than 3 inches in diameter shall be installed at 1/4 inch slope per foot of run. All piping 3 inches in diameter and larger shall be installed at 1/8-inch slope per foot of run.

The vent system shall run vertically through the building at each sanitary riser and connect at the base. The vent risers shall terminate on the roof. Common venting shall connect horizontally to the risers. The vent material shall be no-hub Cast-iron, PVC, or DWV copper.

All emergency floor drains shall be equipped with trap primers to maintain the trap seal.

Plumbing Fixtures

- Water closets, flush valve wall mounted with elongated front, open seat with handle and no cover.
- Lavatories, wall mounted vitreous china with single handle chrome plated faucet and grid drain.
- Pantry sinks, 304 stainless steel with gooseneck chrome plated faucet, disposer, and dishwasher connection.
- Other specialty fixtures as needed to support laboratory or other specialized process operations will be identified during the schematic design phase of the project.

Natural Gas System

The natural gas system shall be served from the house gas meter. The gas system shall serve the water heater boilers and HVAC equipment. The natural gas piping shall be schedule 40 black steel with threaded and/or welded fittings. The gas system shall be 2 psi from the gas meter to the secondary PRV at each appliance.

A separate gas meter and system shall be provided to serve the emergency generator.

Water Conservation

All plumbing fixtures shall be "water-sense" type or comply with the following:

PLUMBING FIXTURE RATE OR QUANTITY	MAXIMUM FLOW OR FIXTURE FITTING
Lavatory, public, (metering)	0.25 gallon per metering cycle
Lavatory, public (other than metering)	0.5 gpm at 60 psi
Shower head	1.5 gpm at 80 psi
Sink faucet	2.2 gpm at 60 psi
Urinal	0.5 gallon per flushing cycle
Water closet	1.28 gallons per flushing cycle

7.11 Heating, Ventilating, & Air Conditioning (HVAC)

Overview

The purpose of the HVAC systems in DC new archival and records center facility is to provide a safe, clean, comfortable, and healthy environment for the occupants and to ensure the preservation of the collections. Initial design strategies are provided and will be further developed after site selection.

1. Reference Codes & Standards

- 2013 D.C. Building Code, based on the 2012 IBC, International Building Code.
- SAA Archival and Special Collections Facilities Guidelines, 2009.
- NARA 1571 and 1571S, Design Standard for Presidential Libraries (Archival Requirements), 2014.
- 36 CFR 1234, Facility Standards for Records Storage Facilities
- NFPA 232, Standard for the Protection of Records, 2012.+
- NFPA 90A, NFPA 10, NFPA 13, NFPA 20, NFPA 30, and NFPA 70
- ASHRAE Standard 15-1994, Safety Code for Mechanical Refrigeration
- ASHRAE Standard 34-1992, Number Designation and Safety Classification of Refrigerants
- ASHRAE Standard 55-2010, Thermal Environmental Conditions for Human Occupancy
- ASHRAE Standard 62.1-2010, Ventilation for Acceptable Indoor Air Quality
- ASHRAE Standard 129-1997: Measuring Air-Change Effectiveness
- ASHRAE Standard 90.1-2010, Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings
- American Society of Testing and Materials (ASTM) Standard
- ASHRAE Handbooks: Fundamentals 2013, HVAC Systems and Equipment 2012, HVAC Applications 2015 & Refrigeration 2014
- 2013 International Mechanical Code
- 2013 International Energy Conservation Code
- Sheet Metal and Air Conditioning Contractors National Association (SMACNA).

2. Construction

Required Features

The Building Codes and Energy conservation codes have determinate requirements for construction. The specific construction, orientation, materials, insulation, fenestration, shading and other construction parameters can have significant impact on mechanical system and energy efficiency. Comprehensive HVAC requirements and guidelines are detailed in NARA's Design Standards and in the SAA's Archival Facility Standards. Certain assumptions can be made about the design criteria about DC's new facility, but specific details will be determined once a site is selected. Below is an overview of the HVAC requirements for a new DC Archives/Records Center.

3. Design Issues

The Archives/Records Center facility must be designed to so that the specified environmental criteria is met and sustained. Maintaining an effective preservation environment for archival records depends on the building's basic architectural design (e.g., windows, vapor retardants), use of appropriate building materials, and the building's operation (e.g., hours of operation, availability of tempering sources). Proper and robust temperature, relative humidity, and air filtration systems are critical to protecting the collections and offering a safe and healthy environment for the staff and visitors.

In a building of the size proposed for DC, records storage, processing rooms, and other critical areas such as labs and exhibit gallery should be served from a separate, dedicated HVAC system than those serving the rest of the building. Separate systems for collection and noncollection areas allow isolation of environments and can reduce project costs for noncollection areas.

The environmental criteria for records storage should not be compromised at any time. The HVAC engineer should be involved early in project planning to ensure that space layout does not present unnecessary problems or costs.

4. Building Envelope

The building envelope must be designed to be airtight, with fresh air, outside air, and make-up air intake achieved through a deliberate system. A building-wide air filtration system must be installed to provided particulate filtration in all public and staff areas. Additional filtration will be required for records storage areas. The envelope must be humidity tolerant, allowing the relative humidity standards to be maintained without damage to the structure. A new building must be designed to be humidity-tolerant. The ability of an existing building to withstand the relative humidity standards must be carefully considered. An existing building may require specialized weatherproofing or insulation products and design. The records storage areas must be provided with sufficient insulation to support a stable, continuous level of relative humidity and temperature.

5. Loads.

Certain load characteristics of collection buildings should be considered in system design. The HVAC system should be designed to operate 24 h/day, but with flexibility for adjustment. Some rooms tend to have high occupancy only at certain times. The system should be designed to handle this load as well as the more common part-loads. Many engineers design to 20 ft^2 per person because part of the room is never occupied. In other facilities, where the space is extensively used for receptions, openings, and other high-traffic activities, even higher density assumptions may be justified.

Lighting loads vary widely from space to space and at different times of the day. The lighting loads, as input for mechanical load calculations, will be taken from electrical designer.

6. Mechanical Systems

In designing the HVAC system, it is important to establish a cooperative relationship among the mechanical engineer, architect, other discipline designers, and owner, especially the staff responsible for preserving the collection. The mechanical systems in an archival facility provide a safe, clean, and healthy environment for the building's occupants and ensure the preservation of its collections. The systems should be durable, designed for energy efficiency, and allow for ease of maintenance. The Mechanical system, along with the structure, design and other building systems must address the nine types of threats for collections:

a. Light damage

b. Relative humidity

c. Temperature

d. Air pollution

e. Pest infestation

f. Shock and vibration

g. Natural disasters

h. Theft and Vandalism

7. Primary Elements and Features

The following primary HVAC elements and features provide a good preservation environment for an archival facility, as in Figure 6 (Lull 1990)- ASHRAE HVAC APPLICATIONS:

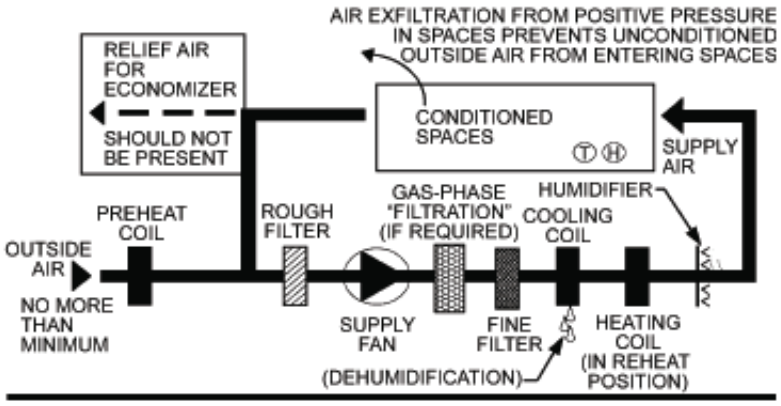

Figure 7.5 Primary Elements of Preservation Environment HVAC System, Figure 6 (Lull 1990)- ASHRAE HVAC Applications

8. Constant Air Volume

Air should be constantly circulated at sufficient volume, regardless of tempering needs, to ensure good circulation throughout the records storage space. In general, perimeter radiation and other sensible-only heating or cooling elements should be avoided, because they can create local humidity extremes near collections. The conditions need to be maintained in all parts of the records storage spaces. Effective air circulation is critical.

9. Cooling System

Several systems are available, including direct expansion (DX) cooling, glycol, and central chilled water. Screw compressors are recommended to generate chilled water at 36°F for use in chilled-water coils, which generally have copper fins and tubes. Conventional, DX, and chilled-water systems have a limitation in producing 36°F chilled water; therefore, desiccant systems may be considered instead. Ice storage systems with glycol also could be used.

10. Heating System

Several systems are available to generate heat, including steam and oil with converter, modular boilers, and scotch marine boilers. Hot water is circulated through heating and reheat coils for temperature and humidity control in the space.

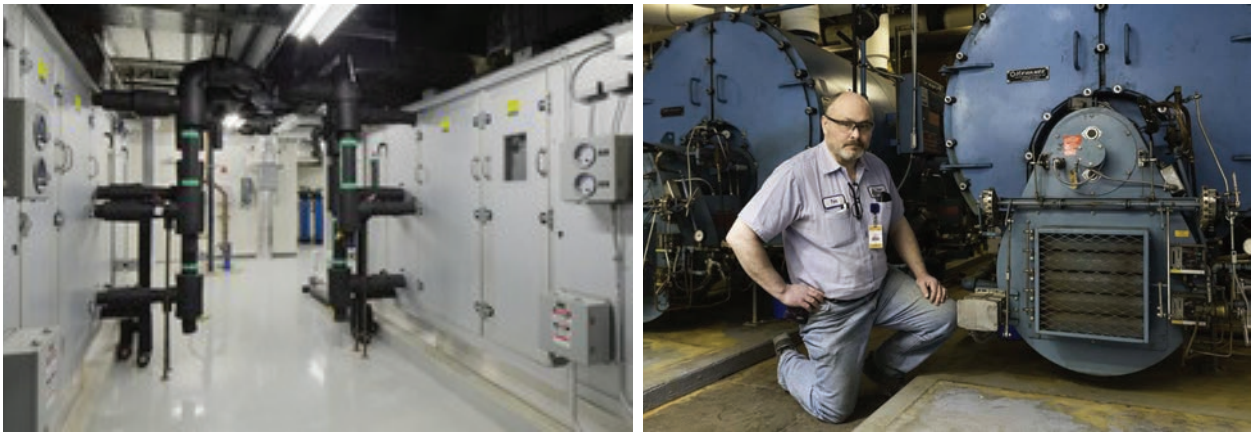

Figure 7.6 Sample Archival Cooling and Heating Systems

11. Humidification

Humidification should be provided by steam or deionized water introduced in the air system. Evaluate the moisture source for risks of pollutants. Often heating steam is treated with compounds (especially amines) that can pose a risk to the collection (Volent and Baer 1985). Systems should be selected and designed to prevent standing pools of water, and should follow good humidification design as per 2012 ASHRAE Handbook—HVAC Systems and Equipment. Humidification methods include electronic steam humidifiers, clean steam humidifiers, evaporative pan humidifiers, spray-coil wetted element systems, and ultrasonic humidification. All materials in humidification equipment should be selected to minimize microbial growth and degradation of system components.

Unlike most other applications, HVAC design for this building type is often more concerned with humidity control than temperature control. The averaging effect of a common mixed return air and common humidifier on a central system is preferred, but sometimes zone humidifiers have been necessary to recover from unsatisfactory conditions, even when the same humidity level is desired in each zone on the same system.

Maintaining widely different conditions in zones using the same air handler can be difficult to achieve and wastes energy. If possible, different zone conditions should have the same absolute moisture content, using zone reheat to modify space humidity for different relative humidity requirements.

12. Dehumidification

The most common problem in archival facilities is inadequate or ineffective dehumidification. Modest dehumidification can be achieved with most cooling systems, limited by the apparatus dew point at the cooling coil, and requiring adequate reheat. Most problems derive from compromises in the cooling medium temperature or lack of reheat. Some chilled-water systems may not reliably deliver water that is cold enough, or may have chilled-water temperature reset or cooling coils that are too shallow for dehumidification to occur. Zone reheat is essential to maintaining necessary conditions in the spaces.

Sebor (1995) suggests the following typical approaches to more aggressive dehumidification:

a. Low-temperature chilled water, usually based on a glycol solution, offers familiar operation and stable control but requires glycol management.

b. DX refrigeration tends to be better for small systems and has lower capital costs, but generally is less reliable, requires more energy, and may require a defrost cycle.

c. Desiccant dehumidifiers can be quite effective if properly designed, installed, and maintained. Economy of operation is very sensitive to the cost of the regeneration heat source. Liquid desiccant systems eliminate (1) the need to cool the air below the dew point, and (2) reheat, both of which are very important cost factors for sustainability.

Desiccant systems (Figure-7 right - ASHRAE HVAC APPLICATIONS) may be a good solution in many cases that require humidity between 30 and 35% RH year-round. Desiccant regeneration is required. Silica gel and rotary wheel dehumidifiers are commonly used. For libraries or archives requiring cool, dry conditions, a desiccant system may be required.

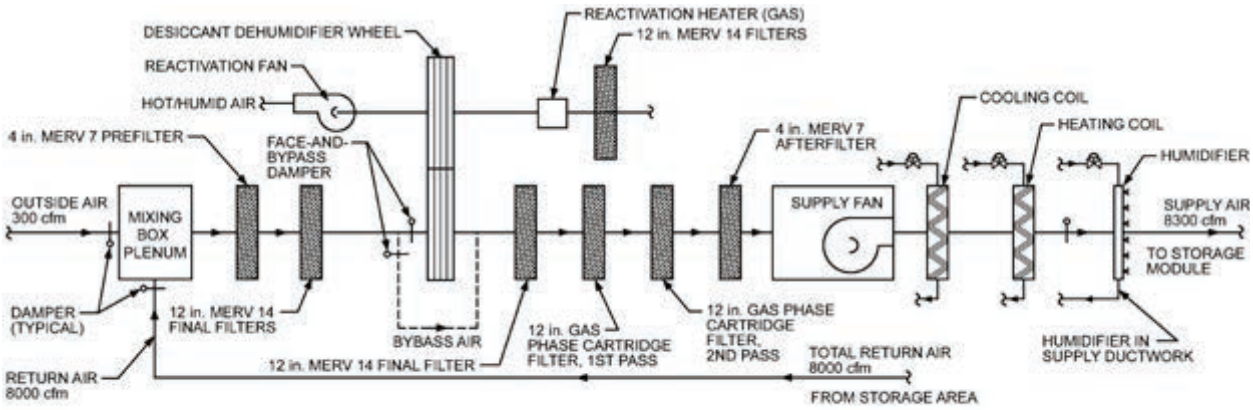

Figure 7.7 Packaged Desiccant Dehumidification Unit (Setty 2006)

13. Mechanical Environmental Control

a. Temperature Control

i. Heating, cooling, air circulation and ventilation equipment

ii. Mechanical Ventilation

iii. Insulation in building envelope

iv. Minimized solar load during cooling season

v. Lighting controls

vi. Regularly scheduled inspections and maintenance for building and environmental control systems

vii. Operational controls

b. Relative Humidity Control

i. Humidification, dehumidification, and air circulation equipment

ii. Air conditioning (cooling) equipment

iii. Temperature control

iv. Vapor barrier in building envelope

v. Regularly scheduled inspections and maintenance for building, plumbing, environmental control systems

vi. Operational controls

c. Pollutant Control

i. Filters in the HVAC system

ii. Non transferring Energy recovery systems

iii. Careful selection of materials and finishes used inside the building

iv. Separate ventilation for kitchen

v. Operational controls

14. Design Criteria

The mechanical systems for an archival facility should be designed so that the environmental criteria are achieved and not compromised at any time.

a. In larger facilities, stacks and other critical areas should be served from a separate, dedicated Heating, Ventilation, and Air-Conditioning (HVAC) system(s) than those serving the rest of the facility.

b. Records storage rooms, processing areas, and exhibits must be isolated from sources of pollutants, such as the loading dock, machine rooms, or spaces where cooking, painting, exhibit production, and other such activities take place.

c. The entire building should be under positive air pressure. In particular, records storage areas should be kept under positive air pressure.

d. Areas such as the loading dock, food preparation areas, and exhibit production areas should be kept under negative pressure in relation to adjacent spaces.

e. The building envelope should be airtight with fresh air, outside air, and make-up air controlled through the mechanical system.

f. Climate control for the records storage areas must be accomplished by fixed systems. Portable heating, air conditioning, or humidity control equipment must not be used in stacks.

15. Location

Mechanical equipment should not be placed on the roof. Equipment on roofs can damage the roofing system. In addition, the necessary maintenance activity, including the walking to and from roof equipment locations, stresses the roofing system. If equipment must be placed on the roof, it should not be located over stacks, processing, exhibition, or laboratory areas. If mechanical rooms are provided, then these rooms shall be separate from other rooms in the building.

Boilers, furnaces, humidification, dehumidification, air conditioning, and other climate conditioning equipment that serve the stack must not be located within the stack enclosure. In addition, all controls for utilities that serve stacks must be located outside of the stack so that access to the controls does not require entry to the stack.

Ducts and pipes that do not serve the stack must not enter or pass through the stack. Any pipe that serves a stack must have its point of penetration through the wall completely filled with cement or other approved grouting.

Mechanical spaces and water piping should not be located above or adjacent to records storage areas. Leaks in mechanical spaces are common, and even with optimum waterproofing, liquids can enter adjacent areas. If a mechanical room must be located above a stack, then additional water proofing measures must be installed, up to and including a "roofing" system with appropriate drains under the mechanical room that removes any water that leaks through the mechanical room floor. Install water sensors in the records storage rooms to detect leaks that might originate from the roof, mechanical spaces, or bathrooms. If appropriate, consider installing water sensors in mechanical spaces for early leak detection.

Ductwork inside records storage and processing rooms must be kept at a minimum, while supplying the required critical environments. Ductwork must not pass through a records storage room to supply another area. Location of the vents and return ducts must provide air mixing and a constant environment throughout the space while maintaining and maximizing usable space for shelving and storage equipment.

Holdings must not be housed directly adjacent to vents or returns. This necessitates coordination between the HVAC system design and the layout of the shelving.

When mechanical rooms are located adjacent to stacks, special precautions should be taken to guard against water infiltration through walls. Walls should be water proofed and additional floor drains installed to rapidly remove any accumulation of water within the mechanical spaces. In addition, depending on the type of mechanical room, vapor barriers in the walls may also be necessary to maintain appropriate environmental conditions in adjacent archival storage areas.

Access for service and replacement parts for the mechanical systems must be designed so that its components are accessible without entering archival storage spaces, except for those specifically located within the archival space (e.g. lighting, fire and smoke alarm components, sprinkler piping, etc.)

16. Equipment Redundancy

HVAC system redundancy in stacks should be considered for archival facilities. This can be accomplished through cross-feeding from chillers, installing additional ducts, or allowing air to be circulated from multiple air handlers. In all cases, spare parts should be stocked to permit more rapid repairs in the event of equipment failure. Redundancy will be provided in accordance with owner's requirements.

17. Access and Maintenance

Sufficient space should be allocated to allow easy access for expeditious replacement of major components of the systems.

18. Exterior Air Intakes

Exterior air intakes should be located to ensure that pollutants do not enter the building air supply. They should be at least 10 feet [3 meters] above grade level. In addition to gaseous pollutants from vehicles and industries, designers should consider that significant pollution from fertilizers, insecticides, and dust can occur from farm or landscaping activities.

19. Piping

With the exception of fire protection sprinklers, no water, condensate supply or return lines, plumbing, or other water pipes should be run through archival spaces, especially stacks.

20. Loading Dock and Garage Mechanical Systems

A major source of airborne pollutants comes from trucks and vehicle engines idling in garages and loading docks. Whenever these areas are placed within the building, they should be under negative air pressure to prevent combustion gases from entering the building.

21. Floor Drains

Screening should be added to all floor drains to prevent insects and vermin from entering the building.

22. Mechanical Ducts

All mechanical ducts serving the stack must be provided with an automatic, combined fire and smoke damper that is equipped to completely close the duct opening and shut down fans that serve the duct in the event of fire. The individual damper or combination thereof must provide equivalent fire resistance rating to the stack wall.

Duct smoke detectors should be provided in the supply and return ducts of the air handling systems and be designed to shut down the individual air handler unit if smoke is detected in the system.

There should be a main shut-off of the air handling systems. It should be possible to shut down the air handling system manually and override the automatic controls during a fire emergency. This shut-off switch should be located in the fire control panel.

23. ENVIRONMENTAL MECHANICAL SYSTEMS (HVAC)

a. Large Records Storage Areas

Records Center Storage: Climate control for large stacks measuring over 25,000 square feet [2,323 square meters] is generally achieved with HVAC systems that use chilled water for cooling and hot water for heating. In general, these systems can produce environments of about 70ºF [21.1°C] and 55% RH in summer and heating climates and about 70ºF [21.1°C] and 45% RH in winter. These environmental conditions are generally satisfactory for records center storage for periods under 10 years and when the records are paper-based or the modern more-stable films and polyesters. Preferred temperature is 65 -70°F and 45% RH for paper records in records centers. Preferred temperatures for special media, including film and electronic media is 55-68°F and 30-40% RH. For additional information about criteria for records center storage, see 36 CFR 1234, Facility Standards for Records Storage Facilities.

Archives Storage: HVAC systems using glycol solutions for chilled water can achieve the lower temperature and relative humidity conditions of 60ºF [15.6°C] and 40% RH, which support the long-term storage of paper-based records as well as many of the film-based records.

b. Small Records Storage Areas

Archives Storage: Climate control for stacks measuring less than 25,000 square feet [2,323 square meters] can use HVAC systems that use direct expansion cooling (dx) and either hot water or electricity for heating. These systems are available in the commercial market and are reasonably economical to operate. They can produce environments of about 65ºF [18.3°C] and 45% RH in summer and heating climates up to 70ºF [21.2°C] and 50% RH in winter. These HVAC systems can also produce colder and drier environments in the winter. These

environmental conditions are generally satisfactory for the long-term storage of paper-based records as well as many of the modern more-stable films and polyesters.

Archives Storage: The HVAC systems designed to achieve a cold storage environment of 50°F [10°C] and 30%RH require special refrigeration equipment. The most common methods employ the use of desiccants in conjunction with dx refrigeration equipment or special dx refrigeration equipment in pre-engineered commercial food grade walk-in coolers or vaults. On a small scale, a commercial grade refrigerator can be used to achieve the 50°F [10°C]; however, the stored records need to be kept in sealed containers with preconditioned silica gel in order to maintain a stable 30% RH.

c. Types of Systems

The type of HVAC system used is critical to achieving project environmental goals. Proper airflow filters the air, controls humidity, and suppresses mold growth. Minimum airflow criteria vary from 6 to 8 air changes per hour. These needs are usually best met with a constant-volume system.

Central air-handling stations keep filtration, dehumidification, humidification, maintenance, and monitoring away from the collection. The investment in added space and the expense of the more elaborate duct system provide major returns in reduced disruption to the collection spaces and a dramatically extended service life for the distribution system. Renovating the old system is economical, with most renovations confined entirely to the mechanical rooms. This is in comparison to common duct distribution systems (e.g., terminal reheat, dual-duct, and variable-air-volume), where renovations often require a new duct system and terminal equipment, involving major expense from demolishing the old ducts, installing the new duct system, and reinstalling architectural finishes.

Overhead and decentralized air handling systems are not recommended for archival facilities. The problems most often overlooked are maintenance access and risk to the collection from disruptions and leaks from overhead or decentralized equipment. Water or steam pipes over and in collection areas present the possibility of leaks, as do air-handling units. Some systems can provide full control without running any pipes to the zones, but others require two to six pipes to each zone, which often must be run over or in collection areas and are, unfortunately, the pipes most likely to leak. Leaks and maintenance can prevent effective use of spaces and result in lost space efficiency.

For further specifics about the standards for HVAC systems for archival facilities, see NARA's 1571 Standards for Presidential Libraries.

d. Constant-Volume Reheat

A constant-volume reheat system can present problems if improperly applied. In many institutions, terminal reheat with steam or hot-water coils located near or over collection spaces cause chronic problems from steam and water leaks. Efficient zone-level humidification often suggests placing the humidifier downstream from the reheat coil; if the reheat coil is located near or over collection spaces, preventive maintenance on humidifiers further complicates maintenance problems. Constant volume reheat systems are very effective when reheat coils and humidifiers are installed entirely within the mechanical space, instead of at the terminal, feeding through what is effectively a multi-zone distribution system.

e. Multi-zone System

A multi-zone air handler with zone reheat and zone humidification can be a stable and relatively energy efficient solution. However, multi-zone systems without individual zone reheat and individual zone

humidification have proved problematic in many institutions, requiring retrofit of zone equipment for stable humidity control. With proper layout and equipment complement, a multi-zone system can reduce the amount of reheat and be very energy efficient.

When air handlers are outside collection areas (as recommended), the best choices are constant-volume and multi-zone with bypass, and dual-duct. When other systems are used, the client must be made fully aware of the possible compromises in performance, cost, and serviceability.

f. Dehumidification Coil

An important feature of multi-zone and dual-duct air handlers is a separate dehumidification coil up-stream of both the hot and cold decks. This separate cooling coil, distinct from the one in the cold deck, is used during dehumidification demand. Air can be cooled to dew point even if it eventually flows through the hot deck. Without this feature, moist return air could be warmed in the hot deck and delivered back to the room without being dehumidified. An alternative is to locate a single cooling coil upstream of both decks, where the cold deck simply bypasses the hot deck, although this configuration can increase energy use.

g. Fan-Coil Units

Fan-coil units should not be placed in or above records storage areas. Fan-coil units create problems when placed in and above collection areas. Fan-coil units expand and decentralize maintenance, requiring maintenance in collection areas and a net increase in overall facility maintenance. Because they cool locally, they need condensate drains, which can leak or back up over time. As all-water systems, they require four pressurized water pipes to each unit, increasing the chance of piping leaks in collection areas.

h. Variable Air Volume (VAV)

VAV, though appropriate for other types of buildings, tends to be inappropriate for collection housing because of poor humidity control, inadequate airflow, maintenance disruption, leaks in the collection spaces, and inflexibility to meet environmental needs. VAV systems can save energy compared to constant-volume systems, but usually at the collection's expense.

If used, a VAV system should look much like a constant-volume reheat system, with the minimum airflow to prevent mold growth, contamination buildup, and uneven conditions in the conditioned space. Terminal equipment should include reheat for each zone and be located in mechanical rooms or other spaces where access and service do not endanger a collection.

i. Fan-Powered Mixing Boxes

These are usually inappropriate for archival facilities. Although fan-powered mixing boxes can help ensure air circulation to suppress mold growth, they do not allow effective air filtration for particles and gases. These fans also increase local maintenance requirements and present an added fire risk. If they include reheat, there is an added risk from water (with water or steam reheat) or fire (with electric reheat).

j. HVAC system Controls

HVAC control system is critical for maintaining precise temperature and humidity control. The control system should be able to monitor and control humidity, temperatures, airflow, filter pressure drops, water alarms, capacity alarms and failure scenario. See NARA 1571 for specific details on monitoring and controls.

Sensors, thermostats and humidistats must be located in the collection spaces, not in the return airstream. It is important to specify a control system that is matched to the user's complexity of requirements. In general, it is

best to propose a system that is industry generic so that it can be serviced by any knowledgeable technician. The control system should be user friendly with good graphic displays; able to track and measure all system functions for at least one year; and be web based for remote access and diagnostics.

Units shall have their own factory-installed self-contained control systems with independent DDC and associated controllers contained in a unit-mounted control panel. Programs and logic required for the functions and sequence of operations (SOO) shall reside within the unit-mounted controllers. Controllers and associated programs shall operate completely independently, and shall also be connected to and interoperating with the facility's building automation system (BAS) using bacnet protocol or an open-source non-proprietary DDC protocol appropriate for the existing systems, and approved by the GSA prior to project implementation. No specialized or proprietary hardware, software, firmware, or middleware shall be required to accomplish set-point adjustments, to fulfill the SOO, to alter the programmed SOO, or to expand the HVAC systems or controls by the end user after project turn-over. Performance of the self-contained control systems shall be totally integrated with the BAS for full and seamless operation, including capability to read, trend, and archive all data points and change all set points from the controls station.

24. TEMPERATURE and RELATIVE HUMIDITY SPECIFICATIONS

a. Temperature and Humidity

All archival materials are subject to deterioration over time due to heat, humidity, harmful particulates and fumes, and frequency of handling. The materials are fragile and subject to biological, chemical, and physical damage. It is critical to provide stable and constant temperature and relative humidity levels and removing damaging particulates and gases from the air.

25. Fluctuations in climate conditions

In general we know that high temperatures, relative humidity that is either too high, too low, or fluctuates beyond a material's ability to harmlessly accommodate the changes, and particulate and gaseous pollutants all threaten these irreplaceable materials.

There currently are a variety of storage preservation standards and guidelines for archival records. Some of these standards speak to mixed collections while others specify different storage conditions for each type of media. Ongoing research into the effects of environment on these fragile materials continually leads to new information and revised recommendations.

The general conclusion is that large fluctuations in temperature or relative humidity can cause irreversible damage to sensitive records, and that climate conditions must be kept constant. The standards for preservation do not necessarily take into account the building and records storage room's design and location, its building materials and finishes, its mechanical and lighting systems, the local climate, and how the materials are used and handled. The targets and ranges specified for archival storage should be analyzed in conjunction with the design and operation of the new facility.

The following list shows the current consensus of the recommended temperatures and relative humidity for archival records storage and the allowable fluctuations in relative humidity from a set point over a 24-hour period. Fluctuations in temperature are generally easily controlled to +/- 2°F [+/-1.1°C].

26. TEMPERATURE AND RELATIVE HUMIDITY Criteria

The following page lists the current standards of the National Archives and Records Administration (NARA).

- Paper textual records
  65°F max/[18.3°C] 35-45% RH +/- 5%
- Black & white, non acetate photograph and film, microforms, audio tapes and other special media
  65°F max/[18.3°C] 35% RH +/- 5%
- Black & white acetate photographic and film media
  35°F max/[1.7°C] 35% RH +/- 5%
- Color Photo and film media
  35°F max/[1.7°C] 35% RH +/- 5%
- Magnetic/electronic media
  46-65°F/[7.2-18.3 °C] 35% RH +/- 5%

27. AIR FILTRATION

Air filtration measures of particulates and gaseous pollutants must be considered for archival facilities, particularly for records storage and other records holding spaces. Filtration is accomplished by introducing filter media into the HVAC system air handler that serves the stack(s). Filtration technology is complex and continues to change. Designers must consider the archival facility's location, size, budget, and design when planning an air filtration system for the preservation of archival materials.

Filtration to remove gaseous pollutants from stacks is especially important in dense urban locations. The majority of the gaseous pollutants are emissions from vehicle exhausts, stationary combustion sources, and other pollution-generating sources consisting of unburned hydrocarbons, elemental carbon, ozone, sulphur dioxide, and nitrogen dioxide. Other gaseous pollutants are a result of the off gassing of building construction materials, furniture, carpeting, and the collections themselves. All gaseous pollutants are very damaging to records and when possible should be filtered.

Special filtration systems are required for collections that off gas volatile organic compounds (VOC) such as cellulose nitrate, cellulose acetate microfilm, negatives or film, and some types of paper and plastics. Often these kinds of collections are isolated or stored off site. If collections off-gassing VOCs are stored in an archival facility, then the air filtration system must be designed to manage the measured quantities of VOCs produced by these records.

Below are the filtration criteria for particulate and gaseous in archival storage rooms, processing rooms, labs, and exhibit cases.

- Particulates: MERV 14 or higher
- Sulfur Dioxide: 1 ppb; 2.7 micrograms per cubic meter
- Nitrogen Dioxide: 2.6 ppb; 5.0 micrograms per cubic meter
- Ozone: 2.0 ppb; 4.0 micrograms per cubic meter
- Formaldehyde: 4.0 ppb; 5.0 micrograms per cubic meter
- Acetic Acid: 4.0 ppb; 10.0 micrograms per cubic meter

28. Types of Filtration.

a. Particulate Filtration

Particulate filtration is essential for removal of contaminants that could foul the HVAC system, as well as particles that might degrade or deface artifacts being preserved. Particulate filtration is addressed here in two steps: pre-filtration and fine-particulate filtration.

b. Pre-filtration

Pre-filtration is required to prevent fouling in cooling coils and build-up of dust in the fan, ductwork, or other HVAC components. It is also required to protect and prolong the functional service life of gas-phase filters and fine-particulate filters. These fouling-sized particles are generally considered to be the MERV E-3 (ASHRAE Standard 52.2) range particles or the 3 to 10 μm size range. Achieving at least 50% removal of the E-3 particle size range requires MERV 7 filtration.

Higher efficiencies may be possible with media configurations that operate at lower pressure loss. MERV 11 or higher pre-filters can operate at similar or lower pressure drop and provide more protection for HVAC components and gas-phase filters.

c. Fine-particulate filtration

Fine particulate filtration protects artifacts and collections in the facility. This particle size is commonly referred to as the "accumulation" size and falls in the MERV E-1 range of particles (0.3 to 1 μm). Removal efficiencies of a minimum of 85% of the E-1 range are sufficient for preservation of most collections. MERV 15 filters are minimum 85% in the E-1 range, and minimum 90% in both the E-2 (1 to 3 μm) and E-3 (3 to 10 μm) ranges.

Some collections may require higher efficiencies than MERV 15 for long-term preservation. Options include microenclosures with minimal airflow and separate filtration, or HEPA (99.97% at 0.3 μm) filtration for the entire common area. Whenever HEPA filtration is used as the final filtration, serious consideration should be given to upgrading the pre-filtration to protect the life of the HEPA filters.

d. Gas-Phase Filtration

Gas-Phase Filtration. Outdoor air infiltration of gaseous pollutants, materials off gassing in new construction, and similar off gassing of furnishings and cleaning agents may threaten the stability of some collections. Sensitive collections of valuable holdings (e.g., low-fire ceramics, some metals and alloys, film, rare books) should use active control of gas-phase pollutants.

The primary compounds of concern include acetic acid, formaldehyde, hydrogen sulfide, nitrogen dioxide, ozone, and sulfur dioxide, all of which are removable with molecular filtration. The specific sorbent must be chosen for the various gaseous contaminants indigenous to the facility, because removal and retention properties are not all the same. Some gases are easily removed with activated carbon, whereas others may require treated carbon or potassium permanganate beds.

29. RECORDS STORAGE AREAS

Air filtration measures must be considered for archival storage stacks.

a. Airborne particulates

To filter airborne particulates, including ordinary dusts and fibers, the air handler should contain a pre-filter with a Minimum Efficiency Reporting Rating (MERV) of at least 7 (previous filtration system 30% efficient) and a final filter of at least MERV 14 (previous 95% efficient). These pre-filters are usually an inexpensive throwaway filter measuring 2 to 4 inches [5 to 10 centimeters] deep. Depending on the geographical location

of the archives facility and the levels of pollutants, the air handler should also contain a gas phase contaminate filter located downstream from the pre-filter followed by a special high efficiency particulate filter (HEPA).

b. Gaseous pollutants

To filter gaseous pollutants, the current research shows that a mixed media gas-phase filter bed of activated carbon and potassium permanganate provides the best removal of these pollutants. These gas-phase filters are approximately 24 inches [61 centimeters] deep and require a larger amount of space within the HVAC system. The gas-phase filters are more costly than the pre-filters to replace and it can be difficult to know when they need replacement. Some suppliers offer a service that can test these filters to determine their useful life.

Downstream from the gas-phase filter, there should then be a final particulate filter with an efficiency of at least MERV 18 (previous system 99.97% efficient or HEPA). This filter is used to remove fine particles from the gas-phase filter and very small particles, such as mold spores and bacteria, from the stack air. These filters are approximately 12 inches [30.5 centimeters] deep and like the gas-phase filters, take up a large amount of space and are more costly to replace. Sometimes a less expensive second pre-filter, with an efficiency of MERV 12 or 14 (previous system 70% to 90%), is placed in the air handler to remove intermediate-sized particulates first and thereby extend the life of the more costly final HEPA filter.

30. MIXED USE AREAS

Good quality particulate and gas-phase filtration are important elements in the preservation of archival materials and should be used in areas where records are temporarily stored and used by staff. A reasonable particulate filtration level in mixed-use spaces is MERV 12 (previous system 70%). Using particulate filters with higher efficiency such as the HEPA filters is not practical and does not give much value in occupied spaces.

It is good practice to reserve space in the HVAC system air handler design for future filtration measures as the local pollutant conditions may change.

31. EXHIBITS

In exhibit spaces the best way to control airborne particulates and gaseous pollutants is to keep the exhibited records in an enclosed case or vitrine. Otherwise, the space should be considered to be the same as an open stack space and incorporate good quality particulate filtration with, at a minimum, activated carbon gas-phase filtration.

Exhibit cases should be designed to protect the collection from environmental extremes. Sealed or vented cases are typically used. Sealed cases rely on isolation from the ambient environment in the exhibition room and usually require passive or special conditioning systems independent of regular room air. Because sealed cases are subject to build-up of contaminants, they should be made of inert or low-emission materials, or those that emit gases benign to objects in the case. In a properly conditioned space, exhibit cases that are within, built into, or back up to this space can be vented.

These systems are not configured like typical HVAC systems and have additional features, such as desiccant beds to stabilize supply air humidity. Lights should always be housed in a separate ventilated compartment from the one housing the artifacts.

High spaces are prone to thermal stratification. Appropriate return and supply air may be required to ensure air motion across the entire space. Supply air should not blow directly onto collections. If collections are on

the wall, diffusing supply air along a wall should be avoided. Floor supply should also be avoided because particles at foot level become entrained.

REFERENCES:

Archival and Special Collections Facilities: Guidelines for Archivists, Librarians, Architects, and Engineers, Edited by Michele F Pacifico and Thomas P. Wilsted, 2009 by the Society of American Archivists

Architectural and Design Standards for Presidential Libraries, National Archives and Records Administration, NARA 1571, July 2014

ASHRAE Handbook – HVAC Application, Chapter 23, 2015.

Airborne Pollutants in Museums, Galleries and Archives (2003), p. 33. Jean Tétreault.

Facility Standards for Records Storage Facilities, 36 CFR 1234

Sustainable Preservation Practices. University of Texas, September 2010, James M. Reilly, Image Permanence Institute

7.12 Fire Protection

1. REFERENCE CODES & STANDARDS

- 2013 D.C. Building Code, based on the 2012 ICC, *International Building Code*.
- SAA Archival and Special Collections Facilities Guidelines, 2009.
- NARA 1571 and 1571S: Architectural and Design Standards for Presidential Libraries, 2014.
- 36 CFR 1234, Facility Standards for Records Storage Facilities
- NFPA 232, *Standard for the Protection of Records*, 2012.

2. CONSTRUCTION

Archival facilities, because of their unique, irreplaceable holdings, require a higher level of fire safety than is normally required for commercial buildings. In particular, records storage rooms and other areas housing archival materials must be constructed to resist the entry of fire, smoke, water and toxic gases.

Comprehensive fire protection requirements and guidelines are detailed in NARA 1571, NARA's Design Standards and in the SAA's Archival Facility Standards.

Required Features

The Building Code has limited requirements for construction of an archival storage facility. The specific construction type and structural fire resistance ratings depend on the height and area of the building. Based on the program area, a range of construction types including both noncombustible and combustible construction could be permitted.

There are no code requirements for compartmentation or fire separation for archival storage areas. Fire separation of specific spaces, such as exit stairs, vertical openings, and high hazard areas, may be required.

Recommended Features

Construction Type: Non-combustible construction, minimum Type IIB (not less than required by IBC based on height/area).

Structural Fire Resistance: Minimum 2-hour fire rating for structural columns within archival areas. Spray-applied fireproofing not permitted.

Compartmentation: To prevent migration of fire, the quantity of archival holdings stored in a single fire compartment must not exceed 125,000 cubic feet.

- A records center facility may not store more than 250,000 cubic feet in a single storage area.

Fire Separations: Minimum 2-hour fire rating between compartments to adjacent spaces. Fire/smoke dampers for all duct & air transfer openings.

Optional Features

Higher levels of protection are preferred for archival storage where design constraints allow. If possible, improve upon the recommended construction featured above.

- increase construction type
- structural fire resistance ratings
- fire separations - decrease compartment sizes

3. FIRE PROTECTION

Required Features

The Building Code requires an automatic sprinkler system and manual fire alarm system for the building.

Recommended Features

Sprinkler Protection: Automatic Wet-pipe sprinkler protection must be provided throughout the building.

- Engineered sprinkler system design based on conservative NFPA, FM and NARA requirements for specific storage configuration (e.g., rack, shelves, compact storage).
- Performance goal to limit fire event loss in archival storage areas to 300 cubic feet maximum per NARA criteria.
- Electric compact mobile systems require wet pipe sprinkler system with 165° F quick response sprinklers although consideration should be given to using lower temperature (135° or 155° F) sprinkler heads.
    - Shelving must have ability to separate to create minimum 5 inch aisles upon activation of a smoke detector, water flow alarm, or manual alarm.

Hose Systems: Fire department hose connections (2.5-in., 1.5-in.) located outside of stack areas.

Fire Alarm: Automatic fire alarm system throughout with manual activation devices, sprinkler flow monitoring, and audible/visible notification.

Fire Detection: Automatic smoke detection throughout; high-sensitivity smoke detection (e.g.,VESDA) for archival storage areas. Duct detectors in all supply / return ducts of air handling systems with controls at central fire panel.

Smoke Exhaust: Engineered smoke control system for archival storage areas greater than 500 SF.

Cold Storage Rooms: Clean agent systems that comply with NFPA 2001 or pre-action sprinkler systems.

Optional Features*

Gaseous Suppression: Clean agent suppression system in addition to automatic sprinkler protection for "high value" archival storage areas.

Water Mist Suppression: High-pressure water mist system in lieu of automatic sprinkler protection for "high value" archival storage areas where exposure to water is significant concern.

Low Oxygen System: Potential application for archival storage areas with automatic retrieval systems and limited / no occupancy.

* *The feasibility and appropriateness of these systems would require further study based on selected building and design approach.*

4. LIFE SAFETY

Required Features

The Building Code requires minimum life safety requirements for means of egress, emergency lighting, exit signage, etc.

Recommended Features

The recommended fire protection features will have an allied effect of increasing the level of fire safety in the building. No additional improvements are deemed necessary.

7.13 Electrical

This summary addresses the fundamental electrical design requirements and considerations for a New Archives facility located in Washington DC. Only initial design strategies are discussed in support of establishing a program of electrical requirements for the project.

1. Power Distribution Systems

- The electrical utility service to the facility is recommended to be a 460Y/265 volt, 3-phase, 4-wire system routed via an underground concrete encased duct bank from the PEPCO utility transformer, to serve the electrical needs of the building. The local utility will provide the conductors and the project construction scope will provide the underground duct bank from the property line to the C/T Cabinet and Switchboard, located in the main electrical room of the facility, consistent with the power company requirements.
- The facility should have a main electric room located along an exterior wall at grade level or at the floor immediately below grade. The room shall be sized to house the main electrical service equipment and carry a minimum 2-hour fire rating.
- The main electrical room shall house the Main Switchboard with an integral C/T Cabinet, emergency tap sections, main breaker disconnect and branch distribution sections. The 460/265V, 3-phase, 4-wire service and switchboard size shall be determined as design progresses and additional programming information is made available. The Switchboard will also be specified to have transient voltage surge suppression. The power distribution system shall serve all of the HVAC, plumbing, lighting, receptacle, elevator and miscellaneous electrical loads of the facility.

- A step-down transformer also installed within the main electrical room and fed via the Switchboard shall serve the 120/208V loads in the building via a Low-voltage Main Distribution Panel "LMDP". Additional branch distribution panels installed within supplementary electrical closets shall serve the local loads in each respective area.
- The electrical power distribution system shall include all the elements necessary to conduct electricity in an approved, safe manner to all lighting fixtures, receptacles, HVAC equipment, plumbing equipment, and signal and communication equipment serving the facility.

2. Emergency Power Distribution Systems

- An emergency/standby generator is recommended to serve the emergency power distribution system for the facility. The generator can utilize natural gas or diesel as a fuel source and sized as the design progresses and additional programming information is made available.
- If the generator is located outdoors, it shall be housed in a minimum Level 2 weatherproof enclosure. The generator will be sized to provide emergency power to life safety systems including egress lighting, alarm systems, telecom equipment, elevator, fire pump and mechanical service equipment whose failure to function will cause hazard to life or property. Additionally, the generator shall also support standby loads that are critical to maintaining the operating standards of the Archives facility.
- Automatic transfer switches shall be strategically configured along with distribution equipment to maintain the emergency power distribution to the various emergency and standby systems. All emergency distribution equipment shall be housed in a dedicated room that shall carry a minimum 2-hour fire rating.

Figure 7.8 Sample Emergency/Standby Generator

3. Wiring Devices

- Duplex convenience receptacles will be provided throughout the building as required to comply with the requirements of each space. All corridors shall have duplex outlets at a minimum of 50 feet on center and a minimum of one duplex receptacle will be provided in each typical utility and storage room space. Additionally, convenience outlets will be provided within 25 feet of all mechanical equipment mounted either on the roof or outside the building. All receptacles exposed to the elements will be in NEMA 3R enclosures

and protected via Ground Fault Interrupter (GFI) type breakers. GFI type receptacles will be also be provided within 6 feet of all sink areas, in the pantry, restrooms, and where required by code.

- Receptacle and telecom outlets shall also be provided in all public and large assembly areas in compliance with all owner guidelines to meet the intent of each space. In each of the administrative offices and at each of the workstations, power and telecom outlets will be provided as needed per owners requirements.
- All the motors will be provided with motor controllers and disconnect switches. All major equipment will be provided with either fused or non-fused safety switches, based on equipment name plate data. All motor controllers/starters will be at minimum NEMA Size 1, unless required otherwise due to environmental conditions. All disconnect switches will be heavy duty, either NEMA Type 1 or 3R, depending on the conditions of the installed location. All fans with fractional horsepower motors will be wired via motor rated switches provided with thermal overload protection.
- All branch circuit wiring will be with 600 volt rated copper conductors, type THWN or THHN, minimum #12 AWG in minimum 3/4-inch conduits. All interior conduits will be Electrical Metallic Tubing (EMT) unless required otherwise by the code. All exterior exposed conduits will be Galvanized Rigid Steel (GRS) and all exterior underground conduits will be PVC Schedule 40, except where required otherwise by the code.

7.14 Lighting

Natural Lighting

The design shall seek to minimize lighting costs and energy use by providing natural lighting in spaces that will not contain archival holdings such as the lobby, offices (if non records-containing offices), conference rooms, break rooms.

Natural lighting is not recommended for the spaces in the facility that will occasionally contain records, or that always contain a rotating flow of records such that the records present in the space are only in the space temporarily. However, if appropriate measures for diffusing and filtering UV and IR radiation are implemented in accordance with the guidelines and standards for archival facilities design, natural lighting in these types of spaces can potentially be considered.

Natural sunlight for some treatment work is preferred in labs. However the windows must be ultraviolet filtered and outfitted with shades or blinds.

Archival storage spaces must not have windows, skylights, or clerestories. In the case of a renovation, any existing sources of natural light must be completely blocked.

Electrical Lighting

The lighting system for the building shall be designed to conserve energy and minimize glare while providing a pleasant, comfortable and functional environment. The guidelines set forth by the Illuminating Engineering Society (IESNA) shall be used in conjunction with the NARA standards and SAA guidelines to establish target-maintained illumination levels throughout all spaces. Specific influences of glare, task complexity, surface reflectance characteristics, ceiling brightness, and usage shall be addressed with this procedure.

1. Energy Conservation

- To enhance energy savings, LED lighting will be considered as the basis of design for all fixtures. The fixtures may be pendant, surface or recessed mounted into ceilings as applicable. Selected areas may also be equipped with downlights, or supplemented with other specialty luminaires to address functional requirements and create visual elements in the space. Each workstation shall further be specified task lighting integrated with occupant sensing and dimming capability to allow the user to adjust light levels specific to their task.
- It is recommended that the typical interior lighting LED modules shall be field serviceable from below in non-accessible ceilings. LED's shall be RoHS compliant, 80 CRI (minimum), with a maximum of 2.5 step McAdam ellipse color consistency. LED data shall be tested in compliance with IESNA LM-70, LM-80 and TM-21 protocol. Lamp life shall carry a minimum rating of 50,000 hours at L70. Intended LED current (mA) and driver shall be fully compatible, as stated so by both manufacturers.

2. Emergency Lighting

- Emergency lighting shall be provided throughout all interior areas of egress and accomplished by installing select light fixtures fed via the emergency power distribution panels for generator backup. Emergency lighting systems serving spaces that always or sometimes contain records shall be designed such that the emergency fixtures are not always on. In these instances, the emergency lights shall only illuminate when there is a loss of regular power.
- Exit sign fixtures shall be strategically located and provided throughout all interior areas of egress as well. The exit signs shall be specified with a LED light source and red or green color lettering.

3. Lighting Control

- An occupancy sensor control system will be used with manual override switches to control all interior non-emergency lighting in the facility.
- Occupancy sensors shall be specified for open and common area spaces for auto-on, auto-off functionality, whereas vacancy sensors shall be specified for all enclosed spaces such as administrative offices, conference rooms, single occupant restrooms, utility and storage closets for manual-on, auto-off functionality.
- Additionally, daylight sensors shall be specified in all perimeter spaces to help reduce the average watts per square foot value and in turn improve energy efficiency for the building.
- Additionally, with the intent to pursue LEED certification and further enhance energy savings, a central digital lighting management system is proposed to allow increased controllability of the light fixtures in the facility. The occupancy and day light harvesting systems shall be directly compatible with the central system, and each light fixture shall be installed with a digital dimmable ballast to allow the ability to program the light fixtures to the requirements of each individual space while maintaining an evenly illuminated plane throughout. Furthermore, the system shall be wireless in nature and have time clock functionality. The digital dimmable ballasts shall further provide flexibility to program for a specific after-hours control strategy and also provide the ability to tune the high and low end output of each fixture thereby further enhancing the energy savings.

Figure 7.9 Sample Lighting Controls System

4. Exterior Lighting

- Similar to the interior space, all exterior lighting fixtures shall be specified with a LED light source. Additionally, all exterior fixtures shall be of full cut-off type. The site may be illuminated via a combination of pole-mounted light fixtures of varying height, bollard fixtures, recessed step lights, recessed in-ground fixtures and wall-pack fixtures attached to the building. The height of the poles shall be finalized as design progresses after a review of the local ordinances to determine if pole height restrictions exist.
- All exterior building mounted light fixtures shall be controlled via a photocell and time clock. The photocell shall be located on the roof of the building, facing north. All site lighting shall be designed in accordance with the IESNA guidelines to eliminate spillover and light pollution to properties adjacent to the site.

7.15 Security

The information below summarizes the various security aspects typical for archival facilities. Both the recommended minimum features and optional features are derived from the SAA Archival and Special Collections Facilities Guidelines and the NARA Design Standards for Presidential Libraries. Because the referenced NARA Design Standard is intended to address the unique security issues of a Presidential Library, many of the NARA mandated requirements exceed what would be typical of a Federal, State or Municipal archival facility. Thus, the NARA requirements are listed in a separate section of this document.

Where appropriate, options are provided for consideration. Because little is known of the proposed facility or its location at this time, the options vary widely. Generally, options are listed in ascending order of security effectiveness and cost. Options can, and in some cases should, be combined for optimal security and cost effectiveness.

Both of the referenced documents require that a security risk assessment be conducted prior to the design phase for any archival facility. The risk assessment will establish the Design Basis Threat (DBT) against which all security features will be determined. It is assumed the District has evaluated the various options for the construction and location for this facility and has conducted and documented such an assessment.

1. Reference Guides & Standards

- SAA ARCHIVAL AND SPECIAL COLLECTIONS FACILITIES GUIDELINES, 2009.
- NARA 1571, DESIGN STANDARD FOR PRESIDENTIAL LIBRARIES (ARCHIVAL REQUIREMENTS), 2014.

- 36 CFR §1228, SUBPART K, FACILITY STANDARDS FOR RECORDS STORAGE FACILITIES
- ANSI/ASIS PAP.1-2012 PHYSICAL ASSET PROTECTION
- ASIS GDL FPSM-2009 PHYSICAL SECURITY MEASURES GUIDELINE
- NFPA 730 GUIDE FOR PREMISES SECURITY
- NFPA 731 STANDARD FOR THE INSTALLATION OF ELECTRONIC PREMISES SECURITY SYSTEMS
- ILLUMINATING ENGINEERS SOCIETY OF NORTH AMERICA, PUBLICATION #IESNA G-1-03, GUIDELINE FOR SECURITY LIGHTING.

2. Perimeter Security

a. Recommended Minimum Features

i. If Site layout permits:

1. Provide a 100 foot set back around all portions of the building. Design vehicle approaches to limit speed and direct access to the facility.
2. Provide a credential based parking access system with electrically controlled gates within the setback for employee and authorized vehicle parking.
3. Provide a physical barrier system (fencing, wall or natural barrier) to limit pedestrian access to the facility's parking area.
4. Provide a separate Visitor parking area outside of the set back zone.
5. Provide a screening area for all delivery and Vendor vehicles.

ii. If Site layout does not permit for a 100 foot set back, provide as much set back as possible, items 2, 4 and 5 above and:

1. Limit close vehicle access to the building to authorized vehicles only.
2. If the building has a street exposure, designate such exposures as no parking areas.

iii. Provide lighting levels as recommended in IESNA G-1-03 Guideline for Security Lighting, for parking areas and pedestrian walkways.

iv. Provide a physical barrier system (fencing, wall or natural barrier) to limit pedestrian access to the facility's parking area.

b. Optional Features

i. Provide monitored and recorded video surveillance for the parking area and pedestrian walkways.

ii. Provide emergency power backup for all security lighting fixtures.

iii. Provide a manned security booth with full control of the parking access, intrusion detection and video surveillance systems.

iv. Provide electronic perimeter intrusion system to alert security personnel in the event a person or persons breach the perimeter boundary.

v. Provide retractable vehicle barriers which may be deployed locally at the security booth and remotely at the on-site security control center

vi. Reinforce all openings for blast and ballistic penetration.

vii. If the building has a street exposure, designate such exposures as no parking areas, provide security bollards along exposure and reinforce exterior, street facing walls.

3. Entry Security

a. Recommended Minimum Features

i. Manually inspect all mail and packages once received at the facility.

ii. Provide high security mechanical locks on all doors.

iii. Provide a dedicated public entrance separated from all archives storage, research rooms, processing and lab areas, and shipping/receiving areas.

iv. Provide Security Guard(s) to monitor public entrances during public hours.

v. Provide an intrusion detection system, covering all doors, windows, and other openings monitored by a Central Monitoring Station.

vi. Provide individual component battery backup for any electronic security system provided.

vii. Provide monitored and recorded video surveillance of public entrances.

b. Optional Features

i. Provide electronic screening of all mail and packages received.

ii. Provide an on-site security command center.

iii. Provide an electronic access control system on select exterior entrance doors.

iv. Provide electronic locks and access readers on all exterior doors that are openable from the outside. This will provide the ability to "lock-down" the facility should the need arise.

v. Provide an electronic access control system, utilizing a single technology (access card, key fob etc.) on select interior doors.

vi. Provide electronic visitor screening (X-ray, magnetometer) at public entrances.

vii. Provide emergency generator feed to any security systems provided.

4. Interior Security

a. Recommended Minimum Features

i. Provide a visitor control and screening system (sign-in/out log, photo ID check).

ii. Provide paper stick-on self-expiring visitor passes to be worn by visitors at all times.

iii. Provide employee photo ID's to be worn by employees at all times.

iv. Provide roving Guard patrols during public hours.

b. Optional Features

i. Provide photo ID's for long term vendor and contractors to be worn at all times when on site.

ii. Provide roving Guard patrols 24/7.

iii. Establish an asset value, or mission critical ranking of interior spaces. Provide increasing levels of security for the doors, windows and other non-window openings to these spaces as deemed appropriate for each ranking.

iv. Provide a video surveillance system (recorded) covering all publicly accessible areas.

v. Provide recorded video surveillance at shipping and receiving areas.

vi. Establish an asset value, or mission critical ranking of all interior spaces. Provide video surveillance at the entrance/exits and within these spaces as deemed appropriate for each ranking.

5. Should the District decide to provide a facility meeting the NARA Architectural and Design Standards for Presidential Libraries, the following features are considered mandatory:

a. NARA Mandatory Features

The following categories of general mitigation approaches include blast and ballistic protection, intrusion detection systems (IDS), closed-circuit television systems (CCTV), physical access control systems (PACS), door security hardware, utility security, general building security and other mitigation, protection of project documentation, background investigations, and guard service coverage. Much of the minimum mitigation indicated below is derived from the ISC Standard, "Physical Security Criteria for Federal Facilities," Facility Security Level (FSL) IV, requirements. The following security features must be provided:

b. General blast and ballistic protection.

i. Exclusive security stand-off zone.

1. Exclusive security stand-off (buffer) zone of at least 100 feet around all portions of the building.
2. Stand-off zone must be capable of excluding a 15,000 pound vehicle traveling at 30 miles per hour and protection against a 220 pound bomb outside the 100 foot stand-off zone.
3. Blast resistant construction and window glazing or treatment.
4. Controlled employee parking and handicapped and ceremonial drop-off areas may be located within the exclusive security stand-off zone provided the access point(s) are controlled by active vehicle barrier systems. Vehicle barriers must be controllable from the access point and also remotely (on-site) from the security control center.

ii. Control of Parking.

1. Limit the number of vehicle access points.
2. Control vehicle access to underground/in-building parking and on-site surface or structured parking.
3. Post "No Parking" signage where parking is restricted. All parking within the setback distance must be controlled.

4. Limit authorized parking within the setback distance to employee vehicles, screened visitor vehicles, and approved government vehicles. Unscreened visitor parking should be located as far from the facility as practical using assigned employee and government parking to establish a "buffer zone."
5. Provide vehicle barriers to protect parking entrances from penetration.

iii. Site Circulation.

1. Design to prevent high-speed approaches by vehicles.
2. Provide a vehicle screening area with adequate lighting to illuminate the vehicle exterior and undercarriage.
3. Provide CCTV coverage of the screening area.
4. Use barrier systems to ensure vehicles cannot pass beyond the screening checkpoint (if designated) until cleared.
5. Site configuration permitting, vehicle inspection areas should be located beyond the setback distance.
6. Provide pedestrian barriers around controlled parking areas designed to prevent casual access and increase the visibility of unauthorized access attempts.

iv. Full Personnel and Package Screening.

1. Provide a security vestibule prior to the facility entrance. The security vestibule cannot be part of a code-required emergency exit path.
2. Provide a visitor screening area within the vestibule. Provide a ballistic protective barrier in the utilization of guard booths, desks, or podiums where armed guards and other security personnel are stationed when interacting with unscreened personnel.
3. Screen all mail and packages using X-ray in a dedicated mail receiving facility located away from the facility's main entrances, areas containing critical services, utilities, distribution systems, and important assets. Provide an outside wall, door, or window of the mail receiving facility designed and constructed to relieve blast pressures. Physically inspect items that cannot be passed through screening equipment.

v. Blast resistant design features.

1. Exterior walls (including glazing and doors) and structure must provide a "medium" level of protection (LOP) in accordance with the current Interagency Security Committee Design Basis Threat (DBT). The LOP must be able to protect against a 15 pound man-portable device placed against the exterior structure at the closest possible point to the protected setback.
2. Provide tempered or high strength glass on interior windows unless the DBT device for vehicle born or hand carried IEDs would not create pressures greater than 1 psi on interior windows (due to setback and other protective measures).
3. The lobby queuing area shall also be protected in accordance with blast resistance for windows in critical vulnerable areas. The boundaries between the lobby and the remainder of the facility must be constructed to protect the building from the air blast occurring on the unsecured side of the lobby.

4. The Security Control Center must be located within the building core (i.e., not adjacent to any exterior wall) and must be protected against ballistic attack. Any Security Control Center glazing to an interior corridor must be ballistic rated.

5. Locate critical systems and areas at least 25 feet away from loading docks, entrances, mailrooms, personnel and package screening locations, and uncontrolled parking, or implement standoff, hardening, and venting methods to protect critical areas from the DBT at these locations. Critical systems and equipment may include security and life-safety systems, power distribution, communications and data, and other mission-critical equipment.

6. Position publicly accessible trash containers, mailboxes, vending machines away from building entrances. Trash containers must be a minimum of 30 feet away from entrances and be removable for periods of heightened alert.

c. General Intrusion Detection System (IDS)

i. The specific intrusion detection devices and access control features will be as determined by the risk assessment.

1. The general IDS must:

a. Monitor all exterior doors, windows, and designated interior spaces.

b. Be a high-quality, commercial system meeting the requirements of UL Standard 1076, Proprietary Burglar Alarm Systems, UL Standard 639, Intrusion Detection Units, and UL Standard 634, Connectors and Switches for Use with Burglar Alarm Systems at the Grade/Class "A" level.

c. Alarms and trouble/tamper indicators must be displayed on a terminal capable of displaying graphically the location of the alarm. The terminal must also be capable of displaying pre-programmed response instructions specific to the individual alarm condition.

d. All intrusion alarms must be interfaced with the CCTV system to provide automatic call up and display of cameras in proximity of the alarm.

e. All alarm and trouble transactions must be logged to a printer and be maintained in system memory for a minimum period of seven days.

f. Two terminals are required:

i. One terminal located in the Security Control Center which must be capable of displaying all alarm and trouble conditions, and provide for guard acknowledgement (comment capability is highly recommended but not required), but must not be capable of reprogramming system parameters (inclusive of date, time, and secure/access mode changes) or shunting alarm points;

ii. A second, supervisory, terminal must be located in the facility manager's office, and must be capable of producing event logging reports and reprogramming system parameters and shunting alarm points. The supervisory terminal must be protected by a physical access barrier (e.g. high security key lock or "token" access control), in addition to having password access protection.

g. The system must be capable of sending alarms and supervisory signals by reliable and secure (128-bit encryption) communication to an off-site central monitoring station.

h. The system will be integrated with the buildings Physical Access Control System (PACS).

d. General Closed Circuit Television (CCTV) System

i. State-of-the-art digital CCTV monitoring system must be provided. Closed circuit television monitoring of the entire exclusive security stand-off zone, with additional coverage of exterior public parking areas, access drives, loading and building exits and at other locations, as determined by the risk assessment.

1. All cameras are to be high resolution, network (IP video) cameras either fixed with electronic pan-tilt-zoom (PTZ) or traditional PTZ design.

2. The CCTV system shall be an enterprise class client/server based video management system and TCP/IP networked video recorder(s).

3. A console must be provided in the Security Control center with access to all features of the CCTV system. The system must be supported by an Uninterruptible Power Supply (UPS), capable of supporting all systems and monitors for at least 10 minutes.

4. The CCTV system must be integrated with the IDS and PACS.

e. General Physical Access Control (PACS) System

i. Provide a state-of-the-art physical access control system utilizing "proximity smart card" and contactless based access system capable of being integrated with the IDS and CCTV systems.

ii. A console must be provided in the Security Control center with access to all features of the PACS. The system must be supported by an Uniteruptable Power Supply (UPS) capable of supporting all systems and monitors for at least 10 minutes.

iii. For new construction, entrance to the Security Control Center must be via a "man-lock" vestibule, with both doors controlled by the building access control system.

iv. For existing/renovated facilities, NARA recommends that entrance to the Security Control Center be via a "man-lock" vestibule, with both doors controlled by the building access control system.

f. General Door Security Hardware

i. Doors.

1. Door hardware must be security type and heavy duty for maximum wear resistance and must also comply with all applicable Americans with Disabilities Act and Rehabilitation Act requirements.

2. Mechanical and electronic locking hardware (including magnetic locking systems) must be capable of withstanding a pull of over 1,200 pounds at the door handle without failure of the electronic lock.

3. Doors with electronic locks will lock upon closure.

4. Door locking arrangement must be coordinated with Building Code requirements.

5. All single-leaf exterior doors must have externally mounted security astragals.

6. Doors designed solely for emergency exit use must have non-removable hinges and no external hardware.
7. Multiple leaf external doors equipped with panic hardware must be monitored by CCTV and be alarmed during secure mode.
8. Electronic locks must "fail safe" only for exterior emergency exit doors. All other access system controlled electronic locks must "fail secure", if such measures do not conflict with applicable fire and building codes.
9. Secure emergency exit doors using an automatic door closer and exit hardware that are compliant with applicable fire and building codes and standards.
10. Use delayed egress hardware at emergency exits from critical or sensitive areas, if fire and building codes allows.
11. Forced entry resistance of all doors will be as determined by the risk assessment and based on response time for security and local law enforcement personnel.

ii. Locks.

1. All the building locksets must be high security mechanical or electronic locks. Logic digital keys and cylinders shall be used.

Figure 7.10 Sample Electronic Lockset and Logic Digital Key

g. General Utility System Security

i. Utility Power Systems.

1. Locate utility power systems at least 25 feet away from loading docks, entrances, mailrooms, personnel and package screening locations, and uncontrolled parking, or implement standoff, hardening and venting methods to protect utilities from the Design Basis Threat (DBT) at these locations. All access points to the power service must be controlled. If utility systems cannot be located away from high-risk areas, service feeds, equipment, or equipment rooms must be hardened.

2. Install emergency and normal power distribution systems (including electric panels, conduits, and switchgears) at least 25 feet apart.

3. Emergency generator shall be secured against unauthorized access.

   a. Locate the emergency generator and fuel tank at least 25 feet away from loading docks, entrances, parking, or implement standoff, hardening, and venting methods to protect utilities from the DBT at these locations.

   b. If the emergency generator is installed outdoors at grade, it must be protected by perimeter walls and locked entrances.

   c. The generator must not be located in any areas that are prone to flooding.

   d. Provisions for securing refueling and shut-off valves in fuel lines within or in close proximity to the building must be addressed.

ii. HVAC Systems.

1. Provide separate isolated HVAC systems for lobbies, loading docks, mailrooms and other locations susceptible to Chemical, Biological, and Radiological attack that are isolated from other building areas.

2. Provide emergency shutdown switch in the facility security control center for air intakes. Install a one-step shut-off for air handlers.

3. Control movement of elevators, and close applicable doors and dampers to seal building.

iii. Water Supply.

1. Secure handles, control mechanisms, and service connections at on-site publicly accessible locations with locks or other anti-tamper devices.

iv. Perimeter Lighting.

1. Install exterior lighting at entrances, exits, parking lots, garages, and walkways from parking areas to entrances.

2. Minimum lighting levels shall be in accordance with Illuminating Engineers Society of North America, Publication #IESNA G-1-03, Guideline for Security Lighting.

h. General Building Security and other Special Mitigation

i. Walls and non-window openings.

1. Protect non-window openings such as mechanical vents and exposed plenums to resist forcible entry.

   a. The degree of penetration resistance must be commensurate with the delay necessary to protect assets while security and law enforcement personnel are notified and respond.

2. All non-window openings greater than 96 square inches in perimeter walls must be secured with grilles, bars, or alarms.

ii. Security Control Center.

1. A Security Control Center console must be provided in the Security Control Center with access to all features of the security and building systems.
    a. The console shall be designed such that a single operator must be able to clearly view the CCTV monitors, the intrusion detection system graphic display, access control system display, HVAC control system display, fire control panel and annunciation graphic display, and emergency generator and stand-by power status.
    b. The console must be supported by an Uninterruptible Power Supply (UPS), capable of supporting all systems and monitors for at least 10 minutes.
    c. The Security Control Center shall also be equipped with communications equipment for the guard force and building emergency communications systems (public address system).

iii. Research Room Monitoring Station.

1. Provide at least a 6" elevated platform upon which a desk will be placed to provide staff a clear view of customers in all monitored rooms.
    a. The desk shall be of sufficient size to house a CCTV monitoring station, desktop computer, and telephone.
    b. The desk must be equipped with a duress button.
    c. All elevated surfaces must comply with applicable ADA and Rehabilitation Act access requirements.

iv. Entry screening equipment.

1. Entry screening equipment shall be provided and located in the main entry lobby and loading dock for screening personnel, bags, packages, and other belongings.
    a. X-ray equipment will be provided to screen packages during personnel building entry.
    b. A façade will be designed matching the entry lobby décor to encase the x-ray equipment.
    c. Magnetometers will be provided to screen personnel during building entry.

v. Exit screening station.

1. An exit-screening device for random selection of searches and furniture (table) shall be provided at the employee exit to permit exit screening.
2. Furniture shall also be provided at the research exit to permit exit-screening searches.
3. Sufficient space must be provided at both locations for the furniture and exit-screening device as appropriate.
4. All elevated surfaces must comply with ADA access requirements.

vi. Exhibit Glass.

1. Cases in the permanent exhibit gallery, including case fronts and smaller case bonnets, shall be glazed with safety glass.
2. Glazing shall meet the blunt force resistance requirements of either ASTM F1233, or EN 356-P5A.