White Paper

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Project Director: Jonathan Marc Pringle

Institution: Northern Arizona University

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White Paper

National Endowment for the Humanities grant number PF-50447-14

"Exploring Sustainable Practices for Cold Storage for At-Risk Collections"

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December 22, 2016

Project Activities

It is with enthusiasm that Cline Library reports on a successful planning project intended to facilitate implementation of cold storage to help manage the library's at-risk visual materials (photographic prints, negatives, transparencies, moving images) holdings. This planning process, which took place from October 1, 2014 to September 30, 2016 (two years), resulted in a schematic and supporting documentation that will allow Cline Library to focus on targeted development opportunities to support the implementation of a cold storage unit to accommodate these materials and plan for responsible growth of the collections. All planning documentation is attached to this white paper as appendices. It is hoped that other repositories can benefit from and build upon knowledge gathered through this planning process.

Year One

In the first year of the project (October 1, 2014-September 30, 2015), the project team met the following objectives as outlined in its project plan:

- Securing commitments from the collaborative planning team, which includes a preservation consultant (James Reilly, Executive Director of the Image Permanence Institute); the design team (Dick & Friesche Design Group (DFDG) and LSW Engineers, Inc.); and internal stakeholders from the university's Facility Services department. A full list of the project team is attached as **Appendix 1**.
- A two-day visit with the preservation consultant (Reilly) to conduct a collections-level survey of the library's visual materials holdings and the macro-level environment, from which observations and opportunities would yield specific recommendations for cold storage (agenda is provided as part of **Appendix 2)**; subsequent reporting (an executive summary) was provided in September 2015 and is attached as **Appendix 8**.
- Ordering and installing 10 PEM2 environment monitors in strategic areas across Cline Library, but predominantly in Special Collections and Archives; capturing one year of data (using eClimateNotebook to track data); these data are provided as **Appendix 9**.
- Deploying 1000 acid detection (A-D) strips in acetate film (sheet and moving image collections). The results (completed June 2015) established a new baseline for the acetate holdings. Results of this survey were recorded and are attached to this paper as **Appendix 10**.

During his visit, Reilly focused many of his observations on the macro-level environment in the library's Special Collections and Archives (SCA) department, where collections are stored. In particular, Reilly expressed grave concern for the outdated and complex HVAC and fire suppression systems that blanket collections areas. He also saw (and smelled) evidence of deterioration of at-risk visual materials formats, including degradation of acetate-based film ("vinegar syndrome") and fading of color-based negatives and transparencies. By the end of day one, Reilly stated that Cline Library was in need of cold storage to mitigate issues he observed. Subsequent data (PEM2 environmental monitoring; A-D strip analysis for acetate degradation) captured over the next several months would further support this recommendation.

On the second day of his visit, Reilly trained Cline Library staff on the proper placement and use of the newly-acquired PEM2 monitors and how they integrate with eClimateNotebook. He helped establish each monitor's location in ten unique locations throughout the library, seven of which would be in Special Collections and Archives. Three were placed in other areas of the library, in case there may be a potentially useful space for a cold storage unit outside the department. Reilly also trained SCA staff on proper methods for deploying 1000 A-D strips in the acetate collection in order to compile a representative average sample of existing conditions there.

By the end of the final day, Reilly sat down with project members from the library and provided oral observations and recommendations for next steps. Beyond confirming the library's need for a cold storage space for its at-risk collections, Reilly urged the project team to consider options for dealing with risky and outdated HVAC and fire suppression systems. He also identified a space in the library—within the Special Collections and Archives footprint—that would be more than adequate for accommodating collections that would be stored in cold storage (photos and a library map of the space is attached as **Appendix 3**). Sustainability was at the forefront of Reilly's conversation, and several of his recommendations (particularly regarding the cold storage unit) were made with long-term sustainability in mind.

After Reilly's visit, Cline Library and the primary investigator installed the PEM2 monitors and began collecting data from them. Shortly thereafter, relevant library building documentation (blueprints, schematics etc.) housed in the university's Facility Services department was digitized and shared with Reilly and the design team (DFDG/LSW). This would allow Reilly and DFDG/LSW several months to review these materials in anticipation of (1) Reilly's written executive summary (delivered in September 2015); and (2) the second collaborative visit (November 2015) when the same group, in addition to DFDG/LSW, would all be in attendance.

Year Two

The bulk of activities in the second year (October 1, 2015-September 30, 2016) revolved around a second round of in-person collaborations with all the major project team members, including the preservation consultant (James Reilly's second visit); the design team, Dick & Fritsche Design Group and LSW Engineers Arizona, Inc. (DFDG, LSW) from Phoenix; and all relevant internal team members from Cline Library and NAU's Facility Services department in November 2015. The agenda for this two-day meeting is attached to this paper as part of **Appendix 2**.

Another year of data was collected from the PEM2 monitors (from October 1, 2015 to present) that reconfirmed many of the same findings and recurring patterns from the previous year. Of note, a November 2015 recommendation by the preservation consultant to reduce the temperature in collections storage areas by two degrees was made. This was successfully implemented and carefully monitored to ensure there was no increased wear on the aging HVAC infrastructure. Temperatures in SCA collections storage areas have remained consistent at 66 degrees F over one year. Cline Library continues to monitor the HVAC infrastructure as part of ongoing systems care since making this change.

The first day of the second visit began with a discussion to reconfirm a commitment to cold storage and to articulate the need in a way that has the greatest impact to either internal resource allocators (university administration and development officers, etc.) and/or potential external donors who could help with funding the implementation. Unanimously, the team felt that a compelling case could be made to help support this project and that a serious planning process was critical to securing the necessary commitment(s) to fund implementation. Collaborative conversations with the preservation consultant and the university's Facility Services department helped form a proposal for the design team who would be joining the conversation on the second day of the visit. The details of this proposal included such specifics as:

- A cold storage space able to accommodate at least 1760 linear feet of material; the most critical materials (1467 linear feet of acetate films and photographs, predominantly, plus 20% anticipated future growth over the next 20 years) were considered as part of this measurement.
- A proposed location for the cold storage unit in an existing staff area in Special Collections and Archives, mitigating concerns about security and access outside the department.
- A targeted temperature of 35 degrees F and a relative humidity of 30% with a greater flexibility/swing of both to assist with sustainability initiatives (fewer resources needed to sustain a greater variance in both temperature and relative humidity).
    - As such, the unit would need dehumidification and cooling only and would not have other mechanical infrastructure designed to humidify and heat.
- Failsafe measures so that all mechanical functions would cease in the event of a failure; materials in cold storage would not experience sudden increases in temperature in such a scenario but would instead very gradually come to room temperature over the course of a number of days.
- Security features that would include card/pin access that tie into the library's existing security system.
- Fire suppression in the cold storage unit that is FM-200 chemical-based rather than a wet or dry pipe water suppression system.
- Compact shelving in the the cold storage space would maximize shelving capacity and be critical to accommodating the space required for the most at-risk collections.
- Nitrate-based negatives would be retained in standalone freezers, separate from the cold storage unit but located within the footprint of SCA.

Conversations with the design team on the second day emphasized the desire for this cold storage unit to be as sustainable as possible, including where materials are sourced and the selection of the mechanical system to reflect simplicity and decreased intervention for potential maintenance issues. By removing heating and humidification functions from the mechanical infrastructure--in addition to allowing for less rigorous control over fluctuations in temperature and relative humidity--sustainability would be further achieved.

Over the subsequent several months (into Spring 2016), the design team worked via telephone and email with the library and Facility Services project team to finesse appropriate planning documentation, including several schematic proposals and drafts of the mechanical systems, electrical, and plumbing narrative to accompany the final schematic. Several items were addressed related to the location of the mechanical system (ultimately recommending placement on the roof above the unit due to limitations with a proposed adjacent mechanical room and its insufficient load-bearing capacity); the deconstruction of existing infrastructure in the proposed cold storage unit location; and NAU-specific requirements for adherence to the American with Disabilities Act (e.g. ramp grading and rails). All documentation was shared with the preservation consultant and subsequent edits made from Reilly's feedback. The final determination for schematic selection was based on maximizing space in the cold storage unit; there would now be 1876 linear feet of total space available, an increase of nearly 100 linear feet from the original desired amount. The finalized schematic design and accompanying mechanical systems, electrical, and plumbing narrative are attached to this white paper as **Appendices 4 and 5**.

In addition to finalizing the schematic design and mechanical systems, NAU Facility Services assisted with the drafting of a comprehensive cost estimate for implementation, which included obtaining quotes from a number of vendors that design mechanical systems and estimates for direct costs, contractor costs, contingencies, and overall project management/administrative costs. An estimated total project cost for construction is **$902,000**; this cost and its associated detail is attached as **Appendix 6**. This cost estimate is critical for supporting the library's subsequent development strategies for the cost share of implementation; this may be through other grant funding opportunities, private or corporate giving, or a combination of both. To the best of the library's ability, funding for implementation will cover any and all anticipated costs in order for the project to be completed as efficiently and on-budget as possible. As of December 2016, the library is developing a significant funding proposal for a potential donor and hopes to advance it quickly within the next few months.

External publicity for this planning process has been minimal; two SCA blog posts (available at http://library.nau.edu/speccoll/blog/?s=cold+storage) were drafted early on in the process (July and November 2014). It is anticipated that--upon word of successful implementation funding--Special Collections and Archives will undertake a more formal mode of publicity and disseminate the implementation process (which highlight the supporting planning process) at regular intervals. SCA regularly discusses its cold storage project with existing and prospective donors and numerous conversations have been held with the library's director of development and the broader university's development office (NAU Foundation) about promotional strategies to engage both material and fiscal donors with project developments and to solicit support. A factsheet related to the project was designed to accompany these discussions and is attached to this paper as **Appendix 7**.

Accomplishments

As evidenced in the activities described above, the accomplishments sought for this project in the proposal were both met and exceeded:

- Special Collections and Archives now has an efficient method by which it captures consistent environmental conditions throughout the department; these duties and responsibilities are now managed through a new department Collections Manager (position created and staffed in 2016).
- Solid baseline data is now in place to support evidence of degradation of materials in existing storage environments, particularly in regards to the acetate negatives and films.
- A survey by an internationally-recognized expert in the field of visual materials preservation has been undertaken and builds on recommendations made in a previous 2013 preservation assessment.
- SCA recommitted to developing and maintaining a series of rigorous policies and procedures related to collections management and preservation; this process has greatly informed how those policies are developed.
- A collaborative team of experts was brought together to design a cold storage solution unique to the specific needs of SCA and the environment in which materials are managed.
- Sustainability is evidenced throughout the planning process with the simplification of the mechanical system.
- After a thorough and meaningful collaborative exercise, the design team presented Cline Library and NAU Facility Services with the requested schematic and associated documentation.
- Implementation for this project has been prioritized in the strategic goals of both SCA and by extension, the Cline Library.
- Broadly, the results of this project help inform the cultural resource preservation community with more data related to the management of materials housed in extreme dry conditions.

Widespread dissemination of this planning project to others will take place through this white paper and made available on the NEH website. Links to this information will be released to various Society of American Archivists (SAA) listservs and other organizations involved with the preservation of cultural resources. A proposed session for the Society of American Archivists and/or scholarly publication will follow once implementation is funded and underway/completed. In the meanwhile, increased fundraising efforts will utilize information gleaned from the planning process to secure the necessary funding to help realize implementation.

Audiences

The primary audience for this project are Cline Library's Special Collections and Archives staff and the library's partner organizations who rely on the library to hold their primary source visual materials collections in safe, secure long-term storage. The successes of this project directly impact the library's ability to manage collections effectively and efficiently, thus ensuring the trust of their donors and patrons. Closely connected as an audience are potential donors to support this project; data gathered through this planning process will greatly assist donors with a full understanding of our needs. Another audience is the university: it is goal-

driven to support student success and community engagement through access to a diverse set of resources that set Cline Library apart from other libraries in the region. In short, this project ensures that materials are physically available for multiple generations to enjoy and interpret; preservation allows for as-of-yet unknown discovery and use and whose multiple interpretations is at the heart of primary source research.

More broadly, this project's audience reaches out to other collections managers and curators in archival repositories who face similar challenges with rapidly degrading holdings. Documentation created as a result of this project and dissemination through this white paper can effectively aide repositories who have yet to take the first step in evaluating current conditions and potential solutions.

At an even broader level, the rigorous analysis and understanding of the impact on materials maintained in extreme dry climates provides the conservation community with a new set of data from which to develop long-term strategies that contribute to effectively preserving materials held in such conditions. Anecdotally, the preservation consultant noted how impressed he was with the condition of materials in SCA and that some commonly-held understandings about dry climates encouraging accelerated cracking and brittleness might be exaggerated and may not take into account how materials become acclimated to their environment they have been subject to since their creation. This is worth noting and may lead to further research once the cold storage unit is in place.

Evaluation

This project involved no direct (formal) evaluation upon completion, but several proposed ideas were discussed and modified as a result of these collaborations. Key to this project's success was the involvement of a team of experts in their respective fields; without each of their voices, a critical component (either from the archives, preservation, facilities, or design perspective) would have been absent.

Continuation of the Project

As previously mentioned, this planning project precipitates formal implementation. In fact--and as described in the proposal--this planning process is part 2 of a three part plan leading to the construction of cold storage in SCA. Part 1 was the broad preservation consultation of the entire department in 2013; part 2 is rigorous and detailed planning for cold storage (to address targeted items in the preservation consultation); part 3 will be construction of a cold storage unit. Continuation of this project, then, is hinged on successful efforts to procure the necessary funding to assist with implementation. Over the past several months development documentation was created to streamline these efforts and advocacy/awareness of this project is held broadly relative to development initiatives.

Long Term Impact

The most immediate long term impact is that Cline Library is in a very strong position to support the funding necessary for implementation of a cold storage unit. Without having gone through this process, SCA would not have been able to make as compelling an argument and may have

missed including voices important to making the project as meaningful and sustainable as possible. This project also provided SCA with data to support its ongoing policy and procedures writing and editing, particularly in relation to the department's preservation and collections management policies. Furthermore, the urgency realized through this project has enabled SCA and the library to articulate this need effectively to the broader university. Having gone through a nationally grant-funded project lends significant weight to the value of this project and shows our resource allocators that external agencies at the national level also value its significance.

For SCA patrons and donors, it is anticipated that this increased level of concern for the long term preservation of these materials will foster a deeper trust; this trust may increase material acquisitions and monetary donors to support the progressive and proactive preservation work performed by the library in SCA.

Grant Products

The deliverables associated with this project include a report from the preservation consultant; a schematic and support documentation from the engineering/architectural firm tasked with working collaboratively with the project team; a white paper to be disseminated publicly through the NEH website; and a potential Society of American Archivists proposal and/or publication that could also be used to highlight this project's successes. Many of these items have been completed and are included as appendices to this white paper. It is anticipated that results shared in this paper will be sent out broadly to relevant listservs, through the SCA blog, and to other organizations. A presentation and/or article submission will be much more compelling and relevant during or shortly after successful implementation. Thus, it is not anticipated that these dissemination pieces will be explored prior to implementation.

Appendices

1. Project Team Members (Page 8)
2. Agendas for Collaborative Visits (November 2014; November 2015) (Pages 9-11)
3. Photos and Map Location of Proposed Cold Storage Location in SCA (Pages 12-13)
4. Schematic Design (Dick & Friesche Design Group) (Page 14)
5. Mechanical, Plumbing, and Electrical Systems Design Narrative (LSW Engineers Arizona, Inc.) (Pages 15-17)
6. Schematic Design Estimate (Pages 18-25)
7. SCA Cold Storage Factsheet (Pages 26-27)
8. Executive Summary [Preservation Consultation] (James Reilly, IPI) (Pages 28-31)
9. PEM2 Datalogger Reports (Pages 32-41)
10. A-D Strip Analysis Report (Page 42)

Appendix 1: Project Team Members

Preservation Consultant
James Reilly, Founder & Director, Image Permanence Institute

Design Team
Chad Billings, Project Manager and Sustainability Director, Dick & Fritsche Design Group
John W. Dick, Project Director, Dick & Fritsche Design Group
Lance A. Jones, President and Mechanical Engineer, LSW Engineers, Inc.
Mark D. Ralston, Vice President and Electrical Engineer, LSW Engineers, Inc.
Becky Tomasek, Interior Designer and Programmer, Dick & Fritsche Design Group

Cline Library, NAU
Lauri Budzinski, Building Coordinator
Cynthia Childrey, Dean and University Librarian
Sean Evans, Archivist
Jill Koelling Friedmann, Assistant Dean
Jonathan Pringle, Archivist for Arrangement & Description and Co-Primary Investigator
Peter Runge, Head of Special Collections and Archives and Co-Primary Investigator

Facility Services, NAU
Drew Elliott, Fire Safety Systems Lead
Patrick Fahey, HVAC Supervisor
Andrew Iacona, Project Manager
Jason Palmer, Fire Safety Systems Specialist
Esteban Villarreal, HVAC Controls Mechanic

Northern Arizona University, Cline Library
Survey of and Planning for Cold Storage for Special Collections & Archives
First Onsite Meeting – Agenda
November 6 – 7, 2014

DAY ONE - AM

9:00-10:45 (James, Jonathan, Peter, Jill, Lauri, Cynthia)
Introductory Meeting – James Reilly, Image Permanence Institute and NAU Project Team

- **Review of project goals**
  - **Assess the current condition and long-term preservation needs of the Cline Library Special Collections & Archives**
  - **Develop a formal plan for a cold storage facility for the Library**

10:45-11:00 (Break)

11:00-12:00 (James, Jonathan, Peter, Jill, Lauri, Andrew, Pat, Drew)

- **Tour of SCA/Cline Library mechanical systems**

Lunch (12:00-1:30)

DAY ONE – PM

1:30-3:00 (James, Jonathan, Peter, Jill)

- **Walk through of Cline Library and Special Collections & Archives Storage Space**

3:00-3:15 (Break)

3:15–5:00 (James, Jonathan, Jill)

Discussion of collection types, condition, long-term needs

- **Historic and contemporary photographs**
- **Photographic negatives, transparencies and prints**
- **Moving images**
- **Materials on magnetic and electronic formats**

Overview of material decay issues and the role of environment in preservation

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DAY TWO – AM

9:00-12:00 (James, Jonathan, Sean)

Placement of PEM2 Loggers
Training in the use of PEM2s, eClimateNotebook software and A-D Strips

Lunch (12:00-1:30)

DAY TWO – PM

1:30-4:00 (James, Jonathan, Jill)

Presentation of Initial Assessment of Current Conditions and Opportunities for Improvement - James Reilly

- **Storage requirements**
- **Preservation needs**
- **Mechanical system operation**

Discussion of Plans for Cold Storage

Cline Library, Special Collections and Archives
"Exploring Sustainable Practices for Cold Storage for At-Risk Collections"
National Endowment for the Humanities funded project

Second Onsite Meeting - Agenda
November 2-3, 2015

DAY ONE – AM
8:00-10:00 (James, Jonathan, Peter, Jill)
"Gut Check" Meeting

- Review previous visit notes; collected data; physical extent of formats; cold storage requirements (inc. nitrates)
- Discuss rough estimates for cost and feasibility for implementation
- Confirm project goals and uniform commitment by project team

10:00-10:15 (Break)
10:15-12:15 (James, Jonathan, Peter, Jill, Andrew)
Develop a "Straw Proposal"

- Confirm linear footage (inc. room for growth) and formats to go in cold storage
- Determine temperature rating (45/35) in relation to materials and cost
- Determine shelving, fire suppression, lighting, security
- Identify potential constraints with top locations, including on existing/future mechanical infrastructure
- Identify potential top locations (room 200, 211, Phase 1 or 2, outside library)

12:15-1:30 (Lunch)

DAY ONE – PM
1:30-3:30 (James, Jonathan, Peter, Jill, Andrew, Facilities Services)
Present "Straw Proposal" to Facilities Services for feedback

- Project overview/refresher for Facilities Services
- Tour of proposed spaces (room 200, 211, Phase 1 or 2) in anticipation of selecting a preferred space for design team
    - Confirming spaces can handle infrastructure/mechanical needs
- Prep for anticipated questions to be asked by DFDG/LSW

3:30-3:45 (Break)
3:45-4:15 (James, Jonathan, Peter, Jill, Andrew)
Debrief from Day 1

DAY TWO – AM
9:00-9:45 (James, Jonathan, Peter, Jill)
Convene and prepare for design team
9:45-10:00 (James, Jonathan, Peter, Jill, Andrew, DFDG/LSW)
Meet design team
10:00-11:00 (James, Jonathan, Peter, Jill, Andrew, DFDG/LSW)
Project overview for DFDG/LSW

- Goals, constraints, anticipated deliverables

11:00-11:15 (Break)
11:15-12:15 (James, Jonathan, Peter, Jill, Andrew, DFDG/LSW)
Present "Straw Proposal" to DFDG/LSW

- Walking tour of top location(s) for cold storage
- Size of space needed considering formats/room for growth
- Temperature/RH needs and allowable swing
- Implications on existing infrastructure and mechanical systems

12:15-1:30 (Lunch – catered by NAU)

DAY TWO – PM
1:30-3:30 (James, Jonathan, Peter, Jill, Andrew, DFDG/LSW, Facilities Services, Cynthia)
Q&A between all project members

- Discuss any items (logistical, mechanical, structural, financial, sustainability etc.) requiring participation and input from all project members

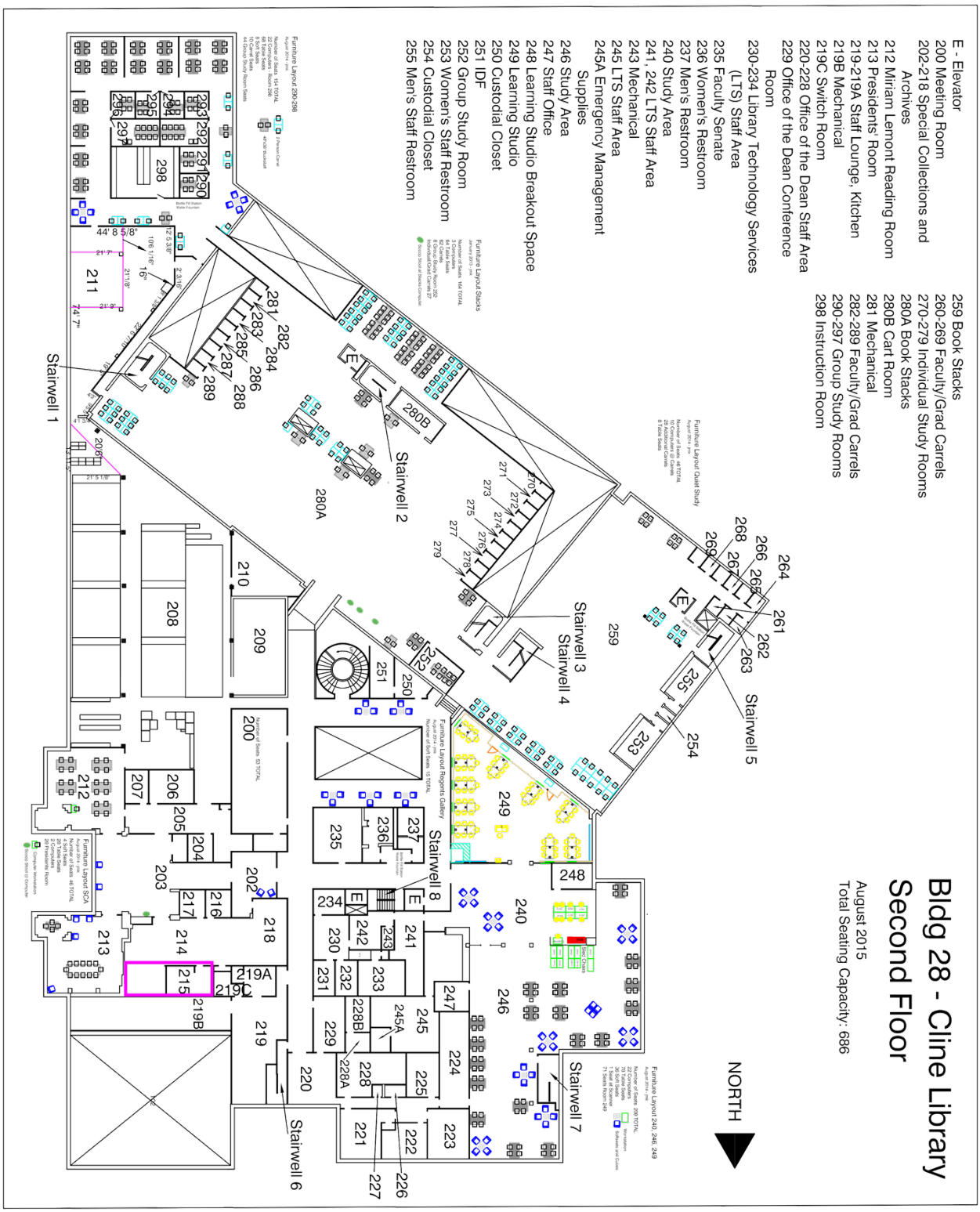
3:30-3:45 (Break)
3:45-4:15 (James, Jonathan, Peter, Jill, Andrew, DFDG/LSW)
Debrief from Day 2

- Final Q&A
- Anticipated deliverables from DFDG/LSW and Reilly

Appendix 3: Photos and Map Location of Proposed Cold Storage Location in SCA

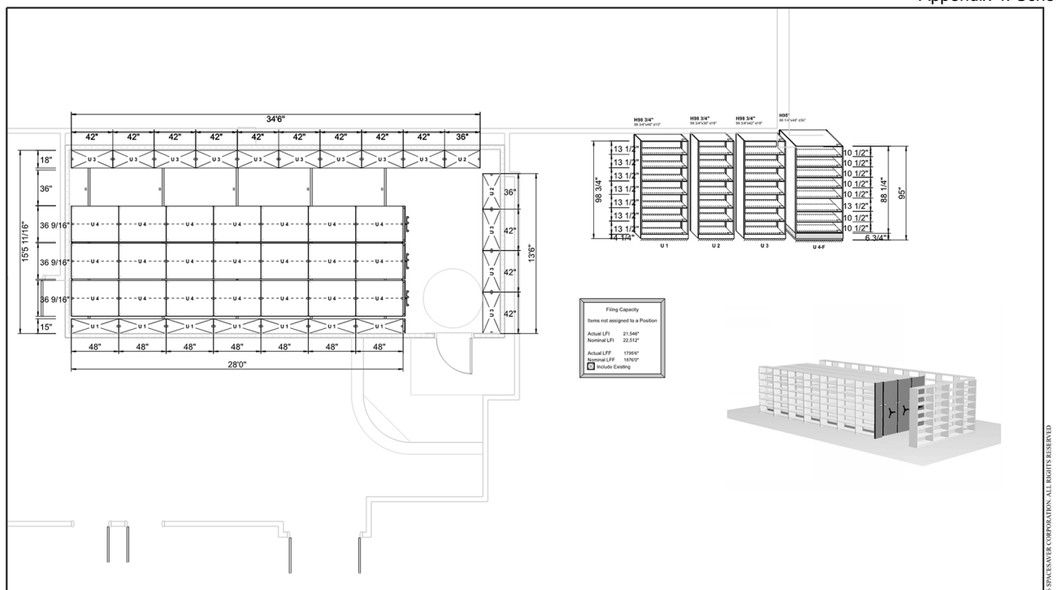
Looking NE in the SCA digitization space. To the left is a former photo developing lab that will be removed as part of tear-down of the space.

Looking NW in the SCA digitization space. To the right are a fume hood and deacidification unit that will be decommissioned as part of tear-down of the space.



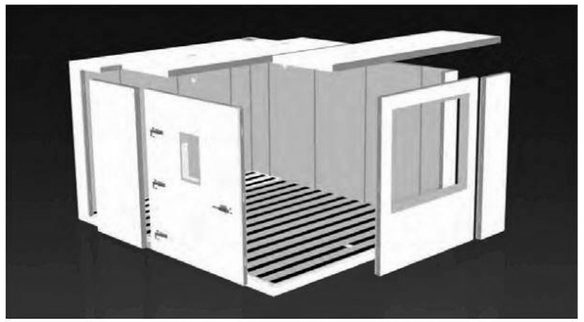
Map of the Cline Library's second floor. Special Collections and Archives is located in rooms 202-218, minus room 213. The proposed cold storage unit will be located in the area highlighted in pink (rooms 214/215).

SHELVING UNIT INFORMATION

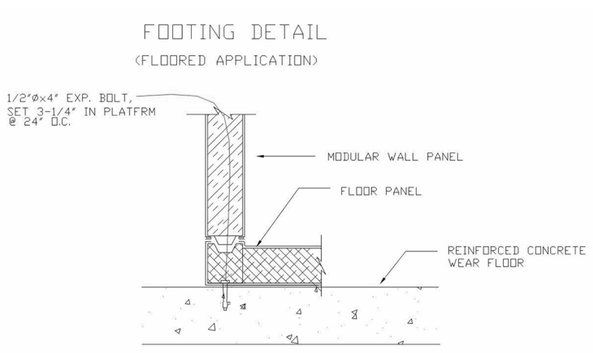


interior SOLUTIONS	Project Name: NAU Cline Library Cold Storage Rev 3		Project #: 104240
	Salesperson: ROHN,JACKIE	Scale 3/16" = 1'	Drawn by: K Kittle
		Rev level:	Date Printed: 03/24/2016

APPROVAL
This drawing Approved By:
Dated



Panels are easy to move-in and assemble. Tongue and groove assembly is held together with cam-latches and silicone sealant. Embedded metal banding links the cam-latches together, creating a secure, strong unit when completed.



Floor Panels: Minimum of (4 inches) (100 mm) of foamed in place urethane insulation with interior and exterior metal surfaces of (14 gage) (1.99 mm) galvanized steel capable of withstanding a minimum of (600 pounds per square foot) (23.5 kPa). Provide ramps at all doors, extending inside, as shown on the Drawings.

Flooring finish to be Commercial Vinyl Sheet with epoxy V-95. Refer to Floor Plan for recommended location transition.

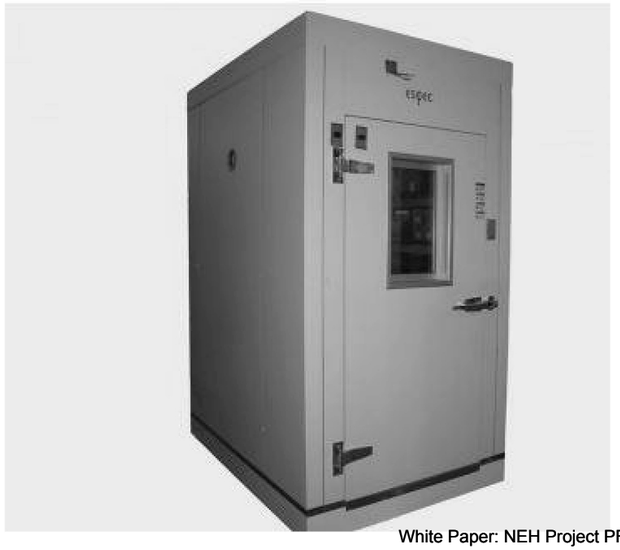
CEILING PANEL AND LIGHTING INFORMATION

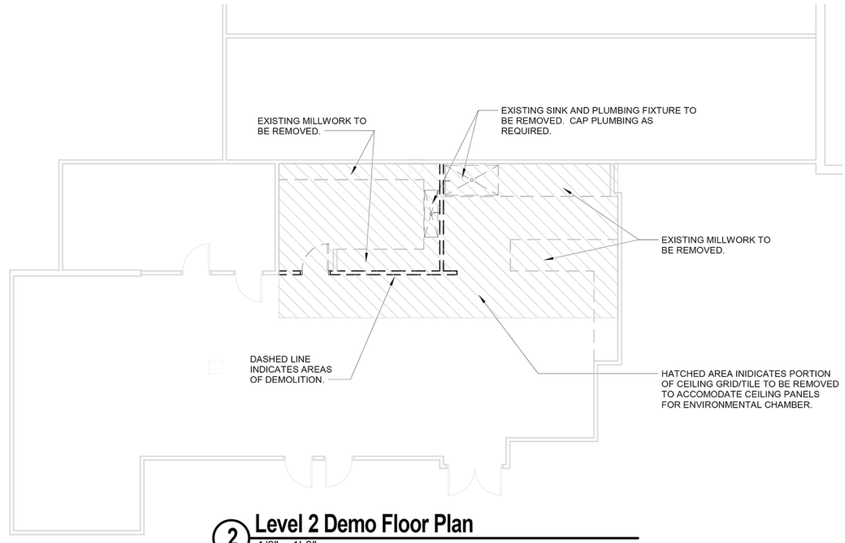
- Ceiling panel to be constructed with same modular panel sections as wall panels (Refer to Environmental Chamber Specifications). Ceiling height to be 8'-4" A.F.F.
- Lighting shall be sufficient to provide (70 foot-candles) (753 lx) of uniform illumination when measured at (36 inches) (910 mm) above the floor.
- Mount fixtures above the false ceiling panels.
- Fixtures: Vapor proof LED type with Iremote driver suitable for the temperature listed in the Environmental Room Schedule. Underwriters Laboratories approved 120/60/1.
- Lamps: Provide type specified under Division 16. For rooms at 0 degrees Celsius and below, provide low temperature lamps.
- Provide with pilot light and locate outside of the room next to the door.

FIRE DETECTION AND SUPPRESSION SYSTEMS

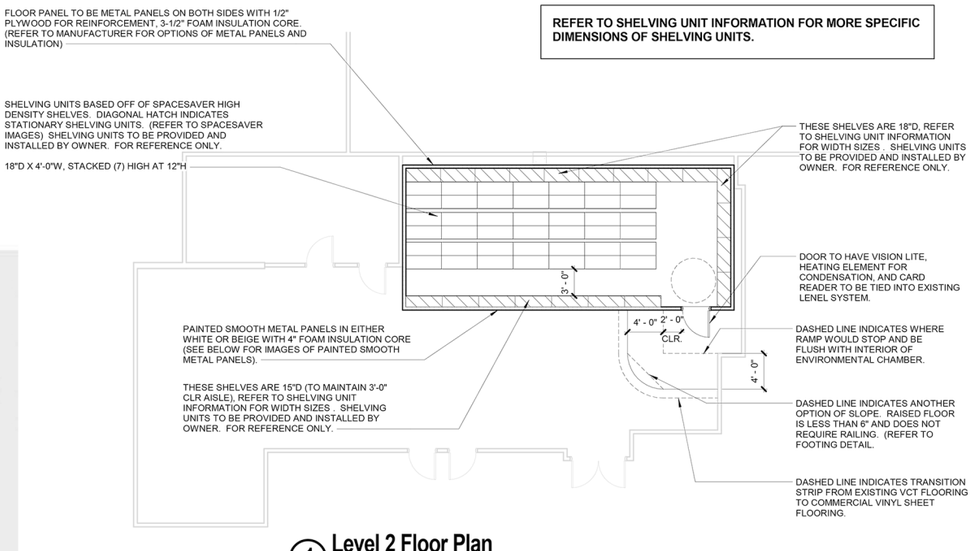
- Integrated into environmental chamber.
- Controls can (but not limited to) include: Abort-Auto Activation (False Alarm), Manual Activation, System Lock-Out
- Chamber can include pressure relief port to vent suppression gas upon release.

PAINTED SMOOTH METAL PANELS





2 Level 2 Demo Floor Plan
1/8" = 1'-0"



1 Level 2 Floor Plan
1/8" = 1'-0"

***FLOOR PLAN LAYOUT IS BASED OFF OF TYPICAL WALK-IN PANELIZED ENVIRONMENTAL CHAMBER. ALL INFORMATION IS BASED OFF OF TYPICAL SYSTEM WITHIN ALL THESE MANUFACTURERS.**

MANUFACTURERS CONSIDERED:
- ***BIOCOLD***
- ***SCIENTIFIC CLIMATE SYSTEMS***
- ***RUSSELLS TECH PRODUCTS***
- ***ESPEC***

White Paper: NEH Project PF-50447-14

DFDG
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WWW.DFDG.COM

PRELIMINARY NOT FOR CONSTRUCTION
REGISTERED ARCHITECT 11.18.14 ARIZONA U.S.A.

ISSUE

04.13.16 - SCHEMATIC DESIGN

REVISIONS

NAU Cline Library Cold Storage
1001 S. KNOLES DR.
PO BOX 6022
FLAGSTFF, AZ 86011-6022

1412
DFDG PROJECT NUMBER

PRE-DESIGN
LEVEL 2 DEMO, FLOOR PLAN & RCP

14 **A200**
PLOT DATE: 4/13/2016 9:43:38 AM SHEET NUMBER

NAU Cline Library – Cold Storage Addition

Mechanical and Plumbing Systems Schematic Design Narrative

The project is located in room 214 on the second floor of the existing NAU Cline Library Building. The mechanical scope consists of providing services to the new cold storage chamber and making utility changes necessary to facilitate the installation.

Mechanical and Plumbing Demolition

The demolition consists of removing the mechanical systems and ductwork in the area where the new environmental chamber will be installed.

Remove the exhaust hood and duct up through roof including removing the exhaust fan and capping the opening and insulate. Remove the exhaust downdraft hood and duct and fan systems. Remove the exhaust from the area above the dark room sink back to a point away from the new Cold Storage Unit and cap. Turn over the downdraft and fume hoods to the owner.

Remove the supply ductwork and diffusers that serve the Conservatory area in the location of the new cold storage. Remove the duct all the way back to the Heat Pump unit HW-07 in the adjoining mechanical room. Remove the Fire Smoke damper in the wall and leave ready for wall patch. Remove the heat pump and return to owner. Cap piping and services.

In the area of the dark room remove the supply ductwork and diffusers that serve the area currently and remove the duct back to the Heat Pump unit HW-07 above the space. Remove the Fire Smoke damper in the wall and leave ready for wall patch. Remove the heat pump and return to owner. Cap piping and services.

There are a couple linear diffusers need to be relocated on the system that serves the main room. Relocate the linear grilles and reconnect to the branch run outs and rebalance the system. Reroute the main trunk duct for the same system that runs over the new area to a location about 6 to 8 feet west to keep duct from running over the new unit. This will require removing the old fire smoke damper and installing a new one in the new location.
Make adjustments to the existing BMS to remove the existing Heat Pumps and Temperature sensors from the BMS. Relocate the sensor for the system to remain as it is in the area of the demolished wall.

Remove the sink in the corner of the main space. Demolish cold water, hot water, waste and vent piping back to a point near the points where services connected to the main and cap. Remove the sink in the darkroom. Demolish cold water, hot water, waste and vent piping back to a point near the points where services connected to the main and cap.

New Mechanical and Plumbing Construction

The new Cold Storage Unit will be conditioned by a rooftop mounted piece of equipment furnished and installed by the environmental chamber provider as a complete system. The unit will require connection to utility services. The duct to and from the new unit on the roof will be provided as part of the turnkey installation. The new unit will be at least 20’ in length and will require structural support. Controls for the new unit will be part of the turnkey system with only monitoring points output to the existing building BMS.

No gas seems to be available in the building so power will be needed to operate the desiccant dehumidifier regeneration.

Per the input from the archival specialist there will be no need for humidification with this unit so a water connection will not be required. A drain line for condensate will be required to be connected to the unit. Route the condensate drain line down through the roof and then to a floor sink in the adjacent mechanical room.

Re-route the condensate drain line from the heat pumps remaining in the conservatory space (HW-12, 07, 36) around to the west to avoid travel over the new chamber area.
Rebalance the heat pump systems that had ductwork modified and rebalance the exhaust fans and makeup air fans that served the area to accommodate the change in outside air requirements due to removal of exhaust systems.

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NAU Cline Library – Cold Storage Addition

ELECTRICAL SYSTEMS SCHEMATIC DESIGN NARRATIVE

The project is located in room 214 on the second floor of the existing NAU Cline Library Building. This project will consist of a demolition phase, new construction phase. It is anticipated that all work will utilize existing electrical facilities.

Electrical Demolition

The demolition will consist of removal of existing power and lighting within the area designated for installation of the New Cold Storage Unit. Remove light fixtures and branch circuiting back to nearest location to remain outside of the area of the new unit and make safe for future extension. Remove all receptacles and branch circuiting back to source panelboard and these existing circuit breakers to be made spare. Remove connections and branch circuiting for equipment designated for removal including mechanical equipment and existing lab equipment back to source panel and make spares. Power is routed to localized electrical room adjacent to space and existing Panels are located within that electrical room. All current panels are in service and will remain, scope of demolition work is mainly branch circuits for removal and make safe.

New Electrical Construction

Lighting

New General lighting will be by factory mounted fixtures within the Cold Storage Unit. Fixtures will be LED and vapor tight mounted interior to the unit. Branch circuit connection will be from local panelboard with system voltage as specified by the equipment provider. Control of light fixtures will be provided as a prewired portion of equipment by the equipment provider.

General Power

General power will be provided from the Electrical Room adjacent to the space where the new work is to be completed.

Receptacles will be provided within Cold Storage unit by the equipment provider. Connection point for branch circuit(s) will be coordinated and provided with branch circuit originating in Electrical room for the required voltage.

In addition, branch circuits will be provided for connection of Cold Storage Unit air handler on the roof. Heat in the unit for dehumidification will be electric since gas is not available, and so power needs will be greater than simple basic fan motors and compressor needs. Circuits will be routed to the unit as required from adjacent electrical room at the specified voltage as indicated by the equipment provider.

Telephone / Data

Telephone/data outlets will be provided as required and coordinated with the Architect and Owner. Specifically for communications and connection to Building Automation System for control monitoring of the Cold Storage Unit.

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Northern Arizona University
Cline Library Special Collections Cold Storage
Building 28

Schematic Design Estimate

6-Oct-16

Prepared for:
Northern Arizona University
Jill Friedmann

Prepared by
NAU Planning, Design, & Construction
Estimator: Andrew Iacona

CLINE LIBRARY SPECIAL COLLECTIONS
COLD STORAGE

Totals Summary

ITEM NO.	ESTIMATE SUMMARY		GRAND TOTALS
	Cline Library Special Collections Cold Storage		
1	Building Construction Costs		
	Direct Construction Cost		$424,456.00
	General Conditions	20.00%	$84,891.00
	Construction Inflation	3.00%	$12,734.00
	Construction Contingency	5.00%	$25,467.00
	TOTAL DIRECT CONSTRUCTION COST (DCC)		**$547,548.00**
	Contractors Fee	10.00%	$54,755.00
	General Liability & Builders Risk	1.50%	$9,035.00
	Bond	2.00%	$12,227.00
	Tax	8.95%	$55,815.00
	TOTAL ESTIMATED CONTRACTOR COSTS		**$679,380.00**
2	NAU 'Owner' Construction Costs		
	Owner Construction Costs	0.01%	$80.00
	Design Professional Fees	13.43%	$91,248.00
	Owner Contingency	12.61%	$97,151.00
	FF&E Owner Costs	0.06%	$500.00
	'Other' Owner Costs	0.85%	$7,369.00
	NAU Project Management Fees	3.00%	$26,272.00
	TOTAL ESTIMATED PROJECT COSTS		**$902,000.00**

CLINE LIBRARY SPECIAL COLLECTIONS
COLD STORAGE

Construction Estimate Detail

DESCRIPTION	QUANTITY (UNITS)	UNIT	UNIT COST	TOTAL
DIVISION 1 - GENERAL REQUIREMENTS				**$9,000**
Temporary Protection of Existing Surfaces	1.00	ls	$ 1,500.00	$1,500
Temporary Wall Protection	1.00	ls	$ 5,000.00	$5,000
Dumpster/Dump Fees	1.00	ls	$ 2,500.00	$2,500
DIVISION 2 - DEMOLITION				**$7,780**
Remove Existing Partition Walls	1.00	ls	$ 360.00	$360
Remove Existing Cabinetry & Shelving	1.00	ls	$ 720.00	$720
Remove & Cap Existing Plumbing Services (Including H2O Purifiers)	1.00	ls	$ 680.00	$680
Decon of Exisitng Hood	1.00	ls	$ 2,000.00	$2,000
Remove Existing Fume Hood Units & Duct Work	1.00	ls	$ 1,360.00	$1,360
Remove & Safe-Off existing Electrical	1.00	ls	$ 1,020.00	$1,020
Remove existing Duct Work & Heat Pump HW-07	1.00	ls	$ 1,020.00	$1,020
Remove existing & Prep Flooring	1.00	ls	$ 440.00	$440
Remove Existing Ceiling Grid & Tiles	1.00	ls	$ 180.00	$180
DIVISION 6 - CARPENTRY				**$26,916**
Curb for RTU	1.00	ls	$ 940.00	$940
Insulate & Cap Existing Roof Penetrations	1.00	ls	$ 1,890.00	$1,890
Patch wall @ Existing FSD that will be removed	1.00	ls	$ 210.00	$210
Structural Roof Support for new Equipment	1.00	ls	$ 23,600.00	$23,600
Relocate FEC	2.00	ea	$ 138.00	$276
DIVISION 7 - ROOFING				**$1,090**
Patch/Cap Existing Duct Penetrations not utilized	1.00	ls	$ 630.00	$630
Flash in New RTU Curb	1.00	ls	$ 460.00	$460
DIVISION 9 - FINISHES				**$3,800**
Replace Ceiling Tiles & Rework Grid at new Unit Perimeter	1.00	ls	$ 1,360.00	$1,360
Misc Paint & Drywall Touch-Up at new Unit Perimeter	1.00	ls	$ 1,155.00	$1,155
Flooring tie-in at new Unit Perimeter	1.00	ls	$ 860.00	$860
Install Rubber Base @ Perimeter & Tie In Areas to Match	1.00	ls	$ 425.00	$425
DIVISION 12 - FURNISHINGS				**$80,790**
High Density Storage Units (Sub # Turn Key)	1.00	ls	$ 80,000.00	$80,000
Mount Shelving to Exterior of Unit	1.00	ls	$ 790.00	$790
DIVISION 21 - FIRE SUPPRESSION				**$15,680**
Rework Existing Sprinkers above existing ceiling for new unit Layout	1.00	ls	$ 2,120.00	$2,120
Rework Existing Sprinkers at the new unit perimeter for proper room coverage	1.00	ls	$ 1,160.00	$1,160
FM-200 System for new unit interior	1.00	ls	$ 10,000.00	$10,000
Provide & Coordinate w/ HVAC New Fire Smoke/Dampers	2.00	ea	$ 1,200.00	$2,400
DIVISION 23 - MECHANICAL				**$268,640**
Environmental Chamber (Sub # Turn Key)	1.00	ls	$250,000.00	$250,000
Relocate existing Mechanical Systems	1.00	ls	$ 3,360.00	$3,360
Install new FSD	1.00	ls	$ 340.00	$340
Rebalance existing HVAC	1.00	ls	$ 1,500.00	$1,500
Controls Coordination with Existing BMS for new & existing tie-in	1.00	ls	$ 8,000.00	$8,000
Relocate two existing T-Stats	1.00	ls	$ 440.00	$440

CLINE LIBRARY SPECIAL COLLECTIONS
COLD STORAGE

Construction Estimate Detail

DESCRIPTION	QUANTITY (UNITS)	UNIT	UNIT COST	TOTAL
Commissioning	1.00	ls	$ 5,000.00	$5,000
DIVISION 26 - ELECTRICAL				**$7,560**
Electric feed for Condensor/Compressor	1.00	ls	$ 2,360.00	$2,360
Electric feed for Storage Unit Lighting	1.00	ls	$ 1,180.00	$1,180
LED Light Fixtures	1.00	ls	$ 2,500.00	$2,500
Pathways for Controls, Card Reader, & IT	1.00	ls	$ 1,520.00	$1,520
DIVISION 27 - TELECOM & IT				**$3,200**
Card Readers/Security Access	1.00	ls	$ 1,750.00	$1,750
Controls IT Drop	2.00	ea	$ 725.00	$1,450
BUILDING SUBTOTAL				**$424,456**

NORTHERN ARIZONA UNIVERSITY
Facility Services

FS#92

Date prepared:	9/13/2016

FS INTERNAL CPA BUDGET PREPARATION

PROJECT NAME: Cline Library Collections Storage
PROJECT #: 09.280.141
REVISION DATE:
PROJECT MANAGER: Andrew Iacona

PROJECT Sq Ft:		**1,200**
CMAR Pre-Construction Fees % of CMAR/GC Construction Costs:		**0.00%**
Design Fees % of CMAR/GC Construction Costs:		**11.75%**
Design Fees % of Total Construction Costs:		**11.75%**
Constr. Cost Sq Ft:	**$**	**647**
Total Cost Sq Ft:	**$**	**752**

PROJECT DESCRIPTION:
Install a new Cold Storage Unit in the existing Special Collections area at Cline Library.

SCHEDULE:	ORIGINAL CPA SCHEDULE	REVISED CPA SCHEDULE	
SCHEMATIC DESIGN:	4/13/2016	enter date	
DESIGN DOCUMENTS:	enter date	enter date	
CONSTRUCTION DOCUMENTS:	enter date	enter date	
BID DATE:	enter date	enter date	
CONSTRUCTION PERIOD (Months):	enter date	enter time frame	
OCCUPANCY DATE:	enter date	enter date	
TOTAL APPROVED FUNDING			

DESCRIPTION OF CAPITAL COSTS	ORIGINAL CPA BUDGET	REVISED CPA BUDGET	CURRENT CPA BUDGET
REVISION DATE:	**10/6/2016**	**enter date**	**enter date**
CONSTRUCTION COSTS			
CM@R or GC CONSTRUCTION COSTS			
Pre-Construction Services (by CM@R or GC)	$0	$0	$0
New Construction			
Construction Contract (CM@R/ Hard Bid/ Task Order)	$0	$0	$0
Fixed / Built-In FF&E	$0	$0	$0
Data Communication	$0	$0	$0
Security	$0	$0	$0
Audio/Video	$0	$0	$0
Renovation			
Construction Contract (CM@R/ Hard Bid/ Task Order)	$679,380	$0	$679,380
Fixed / Built-In FF&E	$0	$0	$0
Data Communication	$0	$0	$0

Security		$0	$0	$0
Audio/Video		$0	$0	$0
Site Development		$0	$0	$0
Parking Construction (new Parking costs only)		$0	$0	$0
Landscaping		$0	$0	$0
Utility Extensions		$0	$0	$0
Inflation / Material Cost Adjustment	0.0%	$0	$0	$0
Contingency (Owner)	14.3%	$97,151	$0	$97,151
SUBTOTAL CM@R/GC CONSTRUCTION COSTS		**$776,531**	**$0**	**$776,531**
% of CM@R/GC Construction Costs / (Construction Cost + Design Fees) =			***89%***	
OWNER CONSTRUCTION COSTS				
Asbestos Survey during Design		$80	$0	$80
Asbestos Abatement prior to Construction		$0	$0	$0
Asbestos Sampling during Construction		$0	$0	$0
Asbestos Air Monitoring/Abatement		$0	$0	$0
Asbestos Sub-Total		**$80**	**$0**	**$80**
Telecommunication by Outside Vendor		$0	$0	$0
Telecommunication Equipment by NAU ITS		$0	$0	$0
Telecommunication Lines/Hook-up by NAU ITS		$0	$0	$0
Telecommunication Sub-Total		**$0**	**$0**	**$0**
Audio/Video Infrastructure by Outside Vendor		$0	$0	$0
Audio/Video Equipment by Outside Vendor		$0	$0	$0
Audio/Video Equipment by NAU		$0	$0	$0
Audio/Video Sub-Total		**$0**	**$0**	**$0**
Security Infrastructure by Outside Vendor		$0	$0	$0
Security Hardware by Outside Vendor		$0	$0	$0
Security by NAU		$0	$0	$0
Security System Sub-Total		**$0**	**$0**	**$0**
SUBTOTAL OWNER CONSTRUCTION COSTS		**$80**	**$0**	**$80**
% of Owner Construction Costs / (Construction Costs + Design Fees) =			***0%***	
TOTAL CONSTRUCTION COSTS:		**$776,611**	**$0**	**$776,611**
% of Total Construction Costs / (Construction Costs + Design Fees) =			***89.49%***	
DESIGN PROFESSIONAL FEES				
Architect / Engineer Fee	12.0%	$0	$0	$0
Programming		$0	$0	$0
Conceptual Design		$0	$0	$0
Schematic Design		$0	$0	$0
Design Development			$0	$0
Construction Documents		$55,103	$0	$55,103
Bidding / GMP Negotiation		$0	$0	$0
Construction Administration		$20,937	$0	$20,937
LEED Certification		$0	$0	$0
Warranty		$0	$0	$0
Reimbursables (Not to exceed)		$0	$0	$0
Contingency	20.0%	$15,208	$0	$15,208
TOTAL DESIGN PROFESSIONAL FEES		**$91,248**	**$0**	**$91,248**
% of Design Fees / (Total Construction Costs) =			***11.75%***	
FF&E MOVABLE and AEDs				

Furniture for Classrooms		$0	$0	$0
Furniture for Labs		$0	$0	$0
Furniture for Offices		$0	$0	$0
Furniture for Common Space		$0	$0	$0
Fixed Seating for Lecture Hall		$0	$0	$0
White Boards		$0	$0	$0
Lecterns		$0	$0	$0
Window Covering		$0	$0	$0
AED - Defibrillators		$0	$0	$0
Trash receptacles, misc…		$0	$0	$0
Interior Signage		$500	$0	$500
Exterior Signage		$0	$0	$0
Dedication Plaques		$0	$0	$0
Move-in Costs		$0	$0	$0
Off-Site Rental Cost if relocation off Campus		$0	$0	$0
Other: _____		$0	$0	$0
TOTAL FF&E MOVABLE and AEDs		**$500**	**$0**	**$500**
OTHER UNIVERSITY COSTS				
3rd Party Estimating		$0	$0	$0
Building Commissioning		$0	$0	$0
Construction Audit		$0	$0	$0
Energy Modeling		$0	$0	$0
Field Inspection by NAU		$250	$0	$250
Geo-Tech Soil Report		$0	$0	$0
Material testing during Construction		$0	$0	$0
NAU Self-Performed Work Orders		$250	$0	$250
Parking Permits for Contractors		$1,500	$0	$1,500
Parking Stalls fees for Lay-Down area		$250	$0	$250
Plan Review (ICC, NAU Trades, UofA)		$0	$0	$0
Special Inspections by 3rd Party (Construction)		$0	$0	$0
Surveyor		$0	$0	$0
Other: _____		$0	$0	$0
Other: _____		$0	$0	$0
Construction Insurance: Risk Mgnt	0.34%	$2,950	$0	$2,950
Printing/Advertisement	0.25%	$2,169	$0	$2,169
Project Management Fee (3% w A/E) (10% if no A/E and over $10,000)	3.00%	$26,272	$0	$26,272
TOTAL OTHER UNIVERSITY COSTS		**$33,641**	**$0**	**$33,641**
PROJECT TOTAL COST		**$902,000**	**$0**	**$902,000**

Project Specifics	
Project Name	Cline Library Special Collections Cold Storage
Project Location	Building 28
Owner's Name	Northern Arizona University
School or Department	Special Collections
User Group Contact	Jill Friedmann
Contact Phone No.	928-523-
Project Description	Cold Storage Install
Project Total SF	

Estimate Specifics	
Type of Estimate	Schematic Design Estimate
Initial Estimate Delivery	10/6/2016
Bid Date & Time	10/6/2016
Assigned Estimator	Andrew Iacona

NORTHERN ARIZONA UNIVERSITY
Cline Library

SCA COLD STORAGE FACTSHEET

October 27, 2016

Cline Library, Special Collections and Archives (SCA) is the premiere repository for the preservation of and access to unique materials documenting the human and natural history of the Four Corners region of the American Southwest. SCA contains millions of primary source documents including manuscript material, maps, correspondence, oral histories, diaries, and visual material. SCA's extensive photographic collections are of global renown and document the Grand Canyon, Native Americans, and the early westward expansion of America. The most conducive environment to ensure the long-term preservation of visual materials is cold storage. A cold storage solution for SCA's photographic and moving image holdings ensures that the lifespan of these fragile and valuable holdings is extended from decades to *centuries*. SCA will construct an independent cold storage space that will house these materials.

- Total project costs for construction are estimated at $902,000.
- Planning for this storage space has been the result of two successful grants (totaling **$46,000**) from the National Endowment for the Humanities (NEH), beginning in 2013.
- Implementation grant funding for this project from NEH's Sustaining Cultural Heritage Collections program—a maximum of **$350,000** in grant funds—is the natural progression and all but guaranteed due to extensive planning and demonstrated progressive success.
- Lowering the temperature of this unique storage environment to 35 degrees will increase the long-term preservation of nationally significant visual materials holdings created by Emery Kolb, Josef Muench, Tad Nichols, PT Reilly, Bill Belknap, John Running, and Sue Bennett—among many others—by **nearly 1,000 years.**
- Special Collections and Archives also serves as the physical storage facility for four external partners – The Hopi Tribe, the Navajo Nation, Grand Canyon Historical Society, and the Arizona Historical Society, Northern Division. SCA's role as a centralized collection storage facility for the region ensures that these valuable resources are conveniently centralized, but underscores the added necessity for cold storage.
- Internationally recognized expert, James Reilly, founder and director of the renowned **Image Permanence Institute**, acted as preservation consultant throughout the planning process.
- Dick & Fritsche Design Group (DFDG), along with LSW Engineers—both Arizona-based—formed the project's design team and have provided schematics and other planning documents. DFDG/LSW previously collaborated on construction of the Arizona Historical Society's building in Tempe, as well as the Polly Rosenbaum State Archives building in Phoenix.
- NAU project team members include Jonathan Pringle, Archivist; Peter Runge, Head of SCA; Jill Koelling Friedmann, Cline Library Assistant Dean; Cynthia Childrey, Dean and University Librarian; Kathleen Schmand, Coordinator for Development and Communication; and Andrew Iacona, NAU Facility Services Project Manager.
- **Sustainability** will be demonstrated not only through the increased longevity of the materials themselves, but also with the use of minimized mechanical infrastructure and a greater allowance for anticipated temperature and relative humidity swings

- The proposed cold storage space will offer compact shelving, allowing for approximately **1800 linear feet of shelving** for materials.
- The project's planning team have located a space within the existing SCA footprint, greatly mitigating potential security threats and easing access to the materials.
- Due to the extremely dry climate in Northern Arizona, acclimation of materials coming out of cold storage will require only **one hour** of time prior to being made available for researchers.

September 17, 2015

Executive Summary

Consultant's Visit to Cline Library, Northern Arizona University, Special Collections and Archives on November 6-7, 2014

Prepared by: James M. Reilly, Rochester Institute of Technology, Image Permanence Institute

Project: Survey and Cold Storage Planning for Special Collections & Archives per NEH SCHC Planning Grant

Overview

Cline Library SCA has important photographic, magnetic and moving image media collections. Cold storage for these materials was identified as an important preservation goal during an initial preservation needs assessment in 2013 by Laura Hortz Stanton of CCAHA in Philadelphia. The purpose of this visit by James Reilly of IPI was to understand in greater depth the kind and extent of materials needing cold storage, to meet the staff and learn about the physical and mechanical arrangements currently in place for collection storage and to begin an environmental monitoring program. A subsequent visit planned for November 2-3, 2015, will focus on the development of plans to provide optimal and sustainable storage conditions for the collections. IPI will review plans and make recommendations for system design and operation and make recommendations based on an understanding of the preservation needs of the collections, the local climate, the building envelope, and the needs of occupants.

Visit Summary

James Reilly met with Jonathan Pringle, Curator of Visual Materials, Peter Runge, SCA Head, and Jill Koelling, Assistant Dean. Following a well-planned agenda, the visit included a tour of Cline Library and a chance to meet with a number of facilities, life safety and maintenance staff. Cline Library was built in three phases (1966, 1980, 1991). Special Collections and Archives are located in the 1991 portion of the library. The two earlier parts of the building have conventional mechanical systems (ducted air handlers) while Special Collections and Archives (in the 1991 building) is served by 27 water source heat pumps. Ventilation air is supplied by a separate duct system and exhausted via ceiling plenum. In water source heat pump systems, heat is derived from and rejected to water that circulates among the heat pumps. In the case of Cline Library, the water piping for the heat pumps is also the fire sprinkler system.

Facilities staff explained that in the nearly quarter-century since construction of the building, the disadvantages and maintenance issues associated with this approach have become quite onerous. Bacterial growth in the sprinkler piping is causing leaks. Failures and leaks in the above-the-ceiling heat pumps are common. NAU is considering a major project to address these concerns by replacing the heat pumps with a ducted system, but no decisions have been made.

During the first day of the visit, the collections and collection spaces belonging to SCA were toured, paying special attention to the audio visual and photographic materials. It is apparent that the SCA staff and the standard of care and professionalism applied to the collections are both first-rate. We discussed a number of photographic processes and formats in detail. The acetate and nitrate base film is mostly in reasonable condition, although acetate degradation is clearly present in some of the oldest collections. Color photography is present in large quantity and in various formats. Both color and cellulosic film supports in SCA collections clearly need and could benefit from cold storage conditions. Discussions on the second day of the visit turned to how to provide the cold storage necessary. The best possibility to investigate seems to be creation of a room-within-a-room insulated and humidity-controlled in the footprint currently occupied by the meeting room designated Room 200. This approximately 1500 sq. ft. space, if equipped with compact shelving, could likely accommodate all the materials that need cold

storage, according to shelf surveys and estimates prepared by Jonathan Pringle. A question of floor loading arose and was answered by facilities staff consulting construction documents. It seems that Room 200 can support up to 200 lbs. per sq. ft. of live load, which should be sufficient for the purpose. The next steps are to look more closely at the feasibility, desired environmental conditions, fire suppression options and other issues related to design of the space.

Results of Monitoring

As of this writing, 9 months of monitoring of environments in Cline Library have been completed—December 2014 through August 2015. Seven PEM2 dataloggers were placed in SCA spaces on the second floor of Cline Library. Two were placed in the 1966 'Phase 1' part of the building and 1 in the 'Phase 2' part (1980). The results show that Cline Library has reasonably good preservation environments overall, when compared with many university libraries—with one exception: dryness in winter and early spring. Like many university libraries, temperatures in Cline Library are maintained near 70 °F. The average temperatures for the period ranged from a low of 64 °F in the SCA vault to 74 °F in SCA exhibits.

During the 9-month period the average RH overall was 25%. The lowest RH values occurred in April (ranging from 5% to 16%). This is clearly undesirably and unusually dry for a library, but not unknown. At a college library in Maine, monitoring showed minimum RH values that were as low as 5% for a building heated to near 80 °F with steam radiators. The SCA vault in Cline was not quite as dry as the average, but its minimum RH was 16%. Maximum RH values occurred in July and August and ranged between 38% and 52 %. Low RH values tend to help slow the rate of spontaneous chemical reactions of decay. The preservation metric TWPI (Time-Weighted Preservation Index) is used to estimate the rate of such decay. The average TWPI for Cline Library was 71. This is very good for a library at room temperature. For example, compare the TWPI 71 value to that of a university library in Austin Texas that had a similar 70 °F average temperature for a January to September period, but a TWPI of only 39 (this indicates a collection decay rate that is nearly twice as fast as Cline Library's.) Why the difference? For the Texas library, the average RH was 51 %, not 25 %.

However, when RH values are a low as those in Cline during the winter and early spring, brittleness of paper and binding adhesives may lead to greater damage to book structures. The question—one being actively researched and discussed in the preservation science field—is how to definitively determine the impact of such conditions. Because this 9-month period covers both winter and summer, likely the data are representative of most years in the library's history. NAU's experiences may help shed light on the practical consequences of dry conditions.

Prepared by:

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Phase 1 2nd Floor Periodicals LC-ML

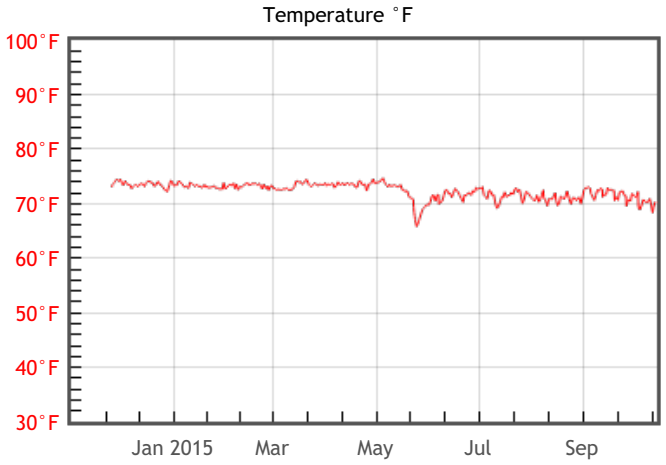
NAU Cline Library

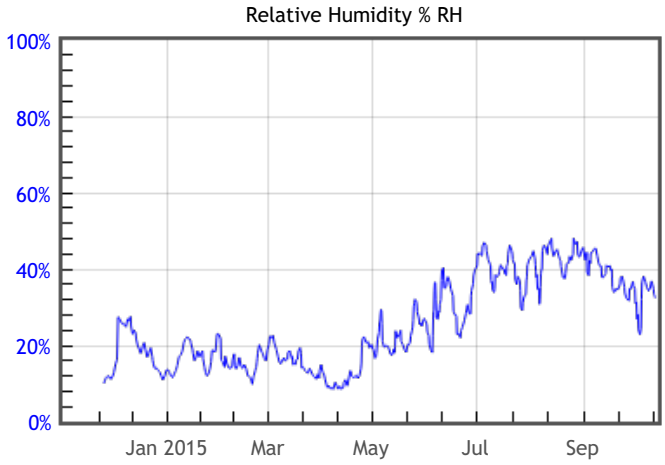
2014-11-25 to 2015-10-13
10 months, 19 days

Preservation Environment Evaluation

Type of Decay	Risks & Metrics	Evaluation & General Comments
Natural Aging Chemical decay of organic materials	OK TWPI = 63	Generally OK, but fast decaying organic materials such as acidic paper, color photographs and cellulosic plastics will be at elevated risk due to the cumulative effects of temperature and humidity
Mechanical Damage Physical damage to hygroscopic materials	RISK % DC = 1.57 % EMC min = 2.7 % EMC max = 8.3	Heightened risk of physical damage to any hygroscopic material, such as paintings, rare books, furniture, paper, leather, film, or color photos, due to extremely low or high levels of humidity, and / or excessive humidity fluctuation.
Mold Risk Mold growth in area or on collection objects	GOOD MRF = 0	Minimal risk of mold growth.
Metal Corrosion Corrosion of metal components or objects	OK % EMC max = 8.3	Generally OK, but archeological or salt-encrusted metals may corrode due to extended periods of moderately high levels of humidity.

Graphs





Statistics

Temperature		Relative Humidity		Dew Point	
T°F Mean	72.3	**%RH Mean**	26	**DP°F Mean**	32.5
T°F Median	72.8	**%RH Median**	22	**DP°F Median**	31.5
T°F Stdev	1.6	**%RH Stdev**	12	**DP°F Stdev**	11.4
T°F Min	65.6	**%RH Min**	6	**DP°F Min**	2.5
T°F Max	75.3	**%RH Max**	50	**DP°F Max**	52.9

Phase 1 3rd Floor Alerton 12

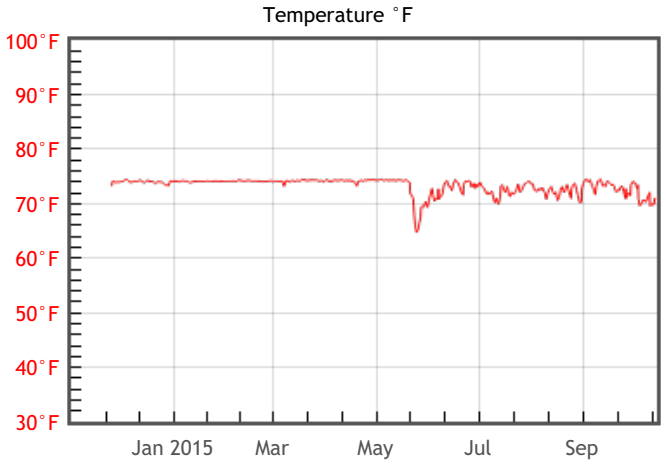
NAU Cline Library

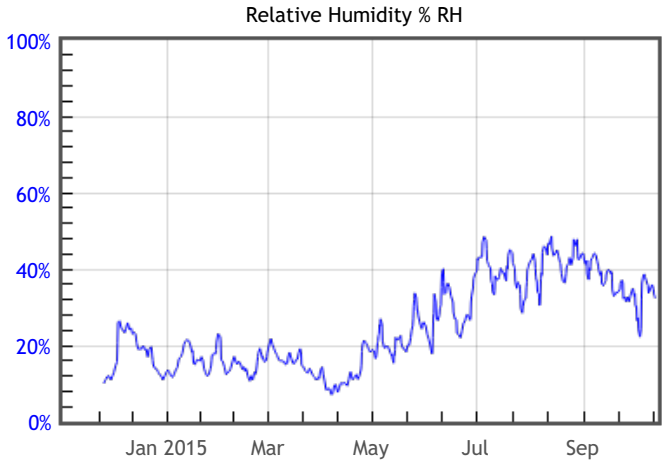
2014-11-25 to 2015-10-13
10 months, 19 days

Preservation Environment Evaluation

Type of Decay	Risks & Metrics	Evaluation & General Comments
Natural Aging Chemical decay of organic materials	OK TWPI = 60	Generally OK, but fast decaying organic materials such as acidic paper, color photographs and cellulosic plastics will be at elevated risk due to the cumulative effects of temperature and humidity
Mechanical Damage Physical damage to hygroscopic materials	RISK % DC = 1.53 % EMC min = 2.7 % EMC max = 8.1	Heightened risk of physical damage to any hygroscopic material, such as paintings, rare books, furniture, paper, leather, film, or color photos, due to extremely low or high levels of humidity, and / or excessive humidity fluctuation.
Mold Risk Mold growth in area or on collection objects	GOOD MRF = 0	Minimal risk of mold growth.
Metal Corrosion Corrosion of metal components or objects	OK % EMC max = 8.1	Generally OK, but archeological or salt-encrusted metals may corrode due to extended periods of moderately high levels of humidity.

Graphs





Statistics

Temperature		Relative Humidity		Dew Point	
T°F Mean	73.2	**%RH Mean**	25	**DP°F Mean**	32.8
T°F Median	74.1	**%RH Median**	21	**DP°F Median**	31.7
T°F Stdev	1.6	**%RH Stdev**	12	**DP°F Stdev**	11.5
T°F Min	64	**%RH Min**	7	**DP°F Min**	6.3
T°F Max	75	**%RH Max**	50	**DP°F Max**	53.2

Phase 2 3rd Floor Alerton 3-6

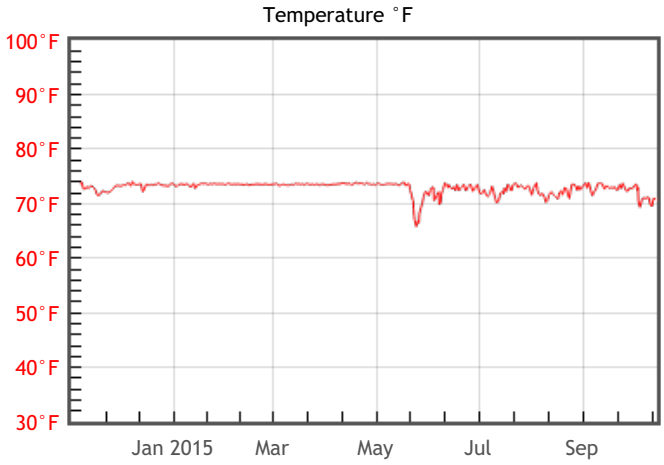
NAU Cline Library

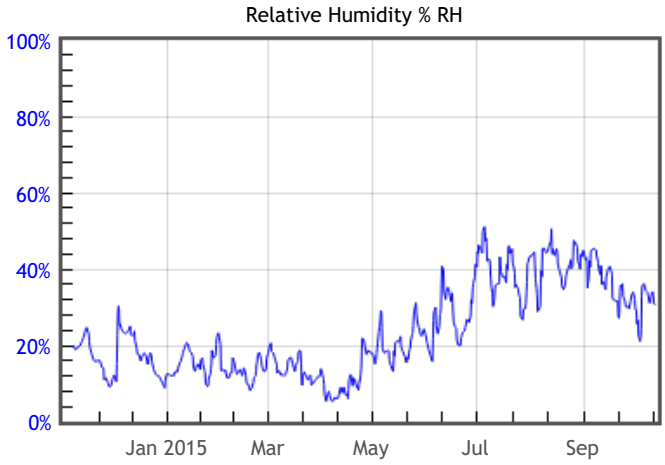
2014-11-07 to 2015-10-13
11 months, 7 days

Preservation Environment Evaluation

Type of Decay	Risks & Metrics	Evaluation & General Comments
Natural Aging Chemical decay of organic materials	OK TWPI = 63	Generally OK, but fast decaying organic materials such as acidic paper, color photographs and cellulosic plastics will be at elevated risk due to the cumulative effects of temperature and humidity
Mechanical Damage Physical damage to hygroscopic materials	RISK % DC = 1.65 % EMC min = 2.2 % EMC max = 8.1	Heightened risk of physical damage to any hygroscopic material, such as paintings, rare books, furniture, paper, leather, film, or color photos, due to extremely low or high levels of humidity, and / or excessive humidity fluctuation.
Mold Risk Mold growth in area or on collection objects	GOOD MRF = 0	Minimal risk of mold growth.
Metal Corrosion Corrosion of metal components or objects	OK % EMC max = 8.1	Generally OK, but archeological or salt-encrusted metals may corrode due to extended periods of moderately high levels of humidity.

Graphs





Statistics

Temperature		Relative Humidity		Dew Point	
T°F Mean	72.8	**%RH Mean**	24	**DP°F Mean**	30.5
T°F Median	73.2	**%RH Median**	20	**DP°F Median**	29.4
T°F Stdev	1.3	**%RH Stdev**	12	**DP°F Stdev**	12.5
T°F Min	65.6	**%RH Min**	5	**DP°F Min**	-1.8
T°F Max	75.3	**%RH Max**	52	**DP°F Max**	53.5

SCA 208 Monographs

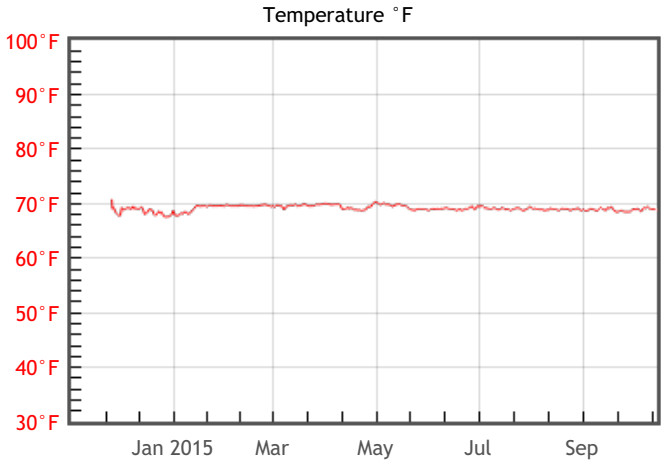
NAU Cline Library

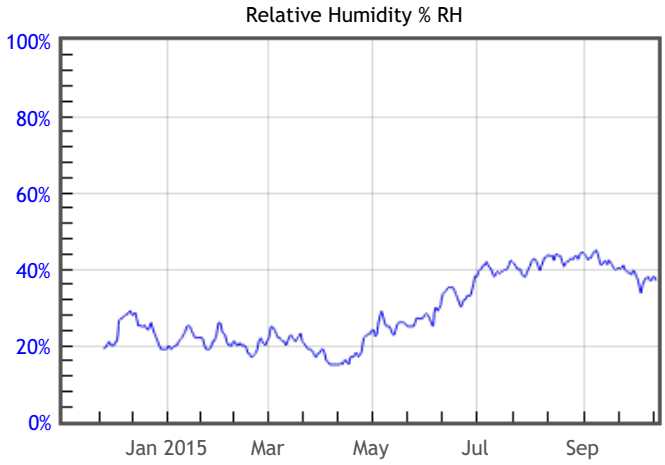
2014-11-25 to 2015-10-13
10 months, 19 days

Preservation Environment Evaluation

Type of Decay	Risks & Metrics	Evaluation & General Comments
Natural Aging Chemical decay of organic materials	OK TWPI = 70	Generally OK, but fast decaying organic materials such as acidic paper, color photographs and cellulosic plastics will be at elevated risk due to the cumulative effects of temperature and humidity
Mechanical Damage Physical damage to hygroscopic materials	RISK % DC = 1.18 % EMC min = 3.9 % EMC max = 8.2	Heightened risk of physical damage to any hygroscopic material, such as paintings, rare books, furniture, paper, leather, film, or color photos, due to extremely low or high levels of humidity, and / or excessive humidity fluctuation.
Mold Risk Mold growth in area or on collection objects	GOOD MRF = 0	Minimal risk of mold growth.
Metal Corrosion Corrosion of metal components or objects	OK % EMC max = 8.2	Generally OK, but archeological or salt-encrusted metals may corrode due to extended periods of moderately high levels of humidity.

Graphs





Statistics

Temperature		Relative Humidity		Dew Point	
T°F Mean	69.1	**%RH Mean**	29	**DP°F Mean**	34.3
T°F Median	69	**%RH Median**	26	**DP°F Median**	32.7
T°F Stdev	0.5	**%RH Stdev**	9	**DP°F Stdev**	8.1
T°F Min	67.6	**%RH Min**	15	**DP°F Min**	19.3
T°F Max	71.4	**%RH Max**	45	**DP°F Max**	46.9

SCA 208 University Archives

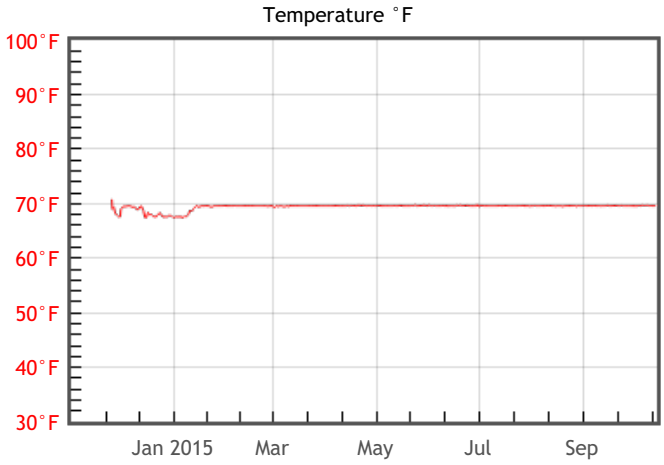
NAU Cline Library

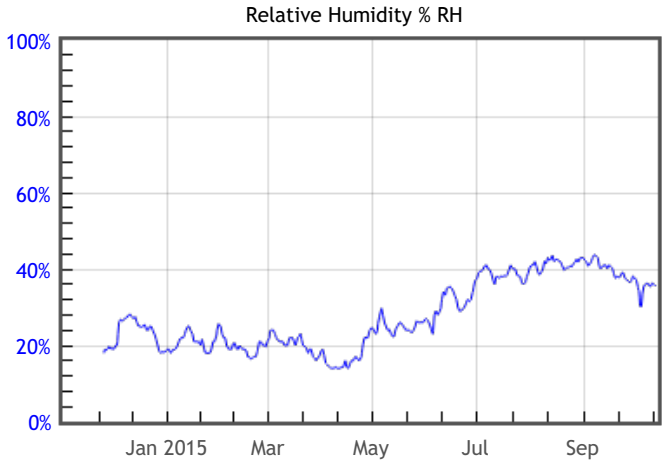
2014-11-25 to 2015-10-13
10 months, 19 days

Preservation Environment Evaluation

Type of Decay	Risks & Metrics	Evaluation & General Comments
Natural Aging Chemical decay of organic materials	OK TWPI = 71	Generally OK, but fast decaying organic materials such as acidic paper, color photographs and cellulosic plastics will be at elevated risk due to the cumulative effects of temperature and humidity
Mechanical Damage Physical damage to hygroscopic materials	RISK % DC = 1.19 % EMC min = 3.7 % EMC max = 8	Heightened risk of physical damage to any hygroscopic material, such as paintings, rare books, furniture, paper, leather, film, or color photos, due to extremely low or high levels of humidity, and / or excessive humidity fluctuation.
Mold Risk Mold growth in area or on collection objects	GOOD MRF = 0	Minimal risk of mold growth.
Metal Corrosion Corrosion of metal components or objects	OK % EMC max = 8	Generally OK, but archeological or salt-encrusted metals may corrode due to extended periods of moderately high levels of humidity.

Graphs





Statistics

Temperature		Relative Humidity		Dew Point	
T°F Mean	69.4	**%RH Mean**	28	**DP°F Mean**	33.6
T°F Median	69.6	**%RH Median**	25	**DP°F Median**	32.2
T°F Stdev	0.6	**%RH Stdev**	9	**DP°F Stdev**	8.3
T°F Min	67.1	**%RH Min**	14	**DP°F Min**	18.1
T°F Max	73	**%RH Max**	44	**DP°F Max**	46.9

SCA 209 Vault

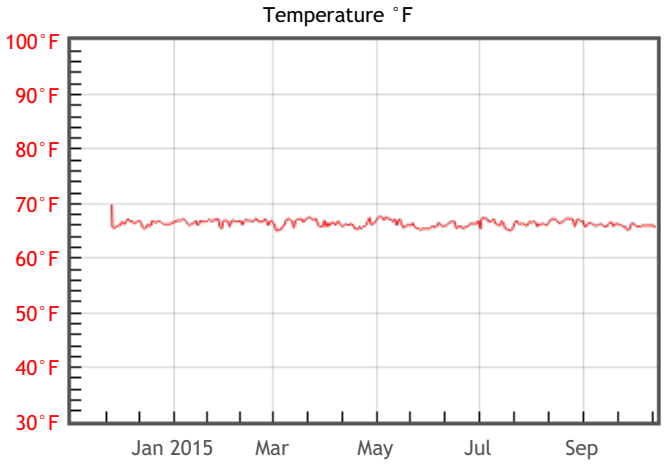
NAU Cline Library

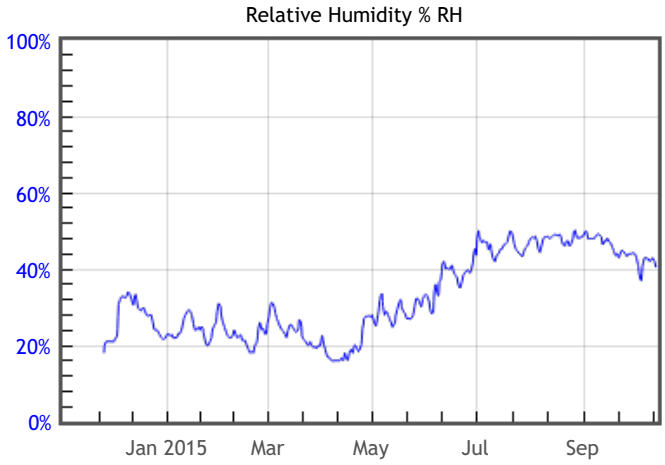
2014-11-25 to 2015-10-13
10 months, 19 days

Preservation Environment Evaluation

Type of Decay	Risks & Metrics	Evaluation & General Comments
Natural Aging Chemical decay of organic materials	GOOD TWPI = 77	Slow rate of chemical decay in organic materials such as paper, leather, textiles, plastics and dyes
Mechanical Damage Physical damage to hygroscopic materials	RISK % DC = 1.34 % EMC min = 4.1 % EMC max = 9	Heightened risk of physical damage to any hygroscopic material, such as paintings, rare books, furniture, paper, leather, film, or color photos, due to extremely low or high levels of humidity, and / or excessive humidity fluctuation.
Mold Risk Mold growth in area or on collection objects	GOOD MRF = 0	Minimal risk of mold growth.
Metal Corrosion Corrosion of metal components or objects	OK % EMC max = 9	Generally OK, but archeological or salt-encrusted metals may corrode due to extended periods of moderately high levels of humidity.

Graphs





Statistics

Temperature		Relative Humidity		Dew Point	
T°F Mean	66.4	**%RH Mean**	33	**DP°F Mean**	35
T°F Median	66.3	**%RH Median**	30	**DP°F Median**	33.7
T°F Stdev	0.6	**%RH Stdev**	11	**DP°F Stdev**	8.4
T°F Min	64.9	**%RH Min**	16	**DP°F Min**	18.1
T°F Max	69.8	**%RH Max**	51	**DP°F Max**	48

SCA 211 Triangle

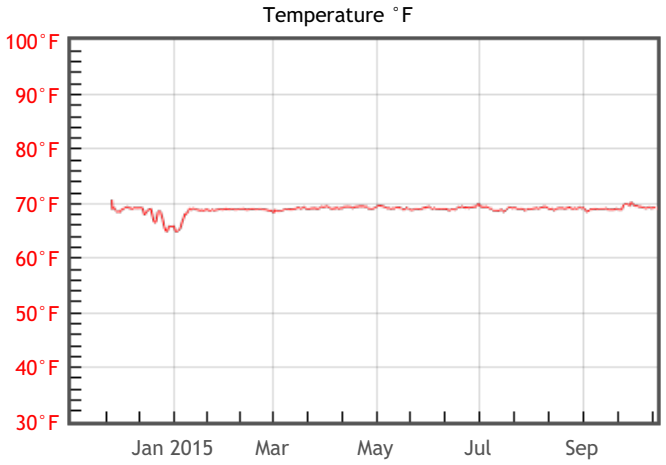
NAU Cline Library

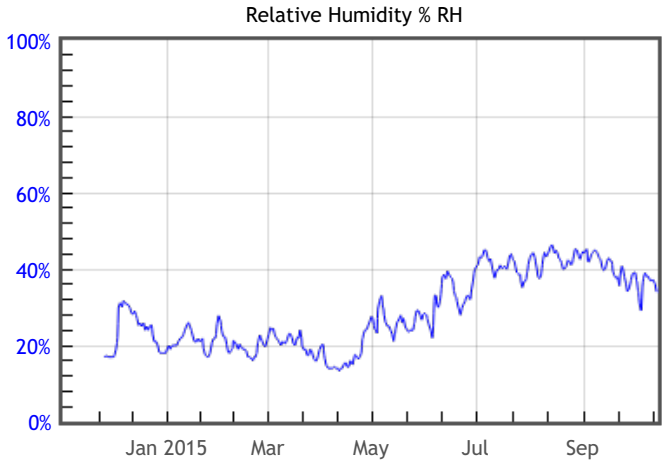
2014-11-25 to 2015-10-13
10 months, 19 days

Preservation Environment Evaluation

Type of Decay	Risks & Metrics	Evaluation & General Comments
Natural Aging Chemical decay of organic materials	OK TWPI = 70	Generally OK, but fast decaying organic materials such as acidic paper, color photographs and cellulosic plastics will be at elevated risk due to the cumulative effects of temperature and humidity
Mechanical Damage Physical damage to hygroscopic materials	RISK % DC = 1.24 % EMC min = 3.7 % EMC max = 8.2	Heightened risk of physical damage to any hygroscopic material, such as paintings, rare books, furniture, paper, leather, film, or color photos, due to extremely low or high levels of humidity, and / or excessive humidity fluctuation.
Mold Risk Mold growth in area or on collection objects	GOOD MRF = 0	Minimal risk of mold growth.
Metal Corrosion Corrosion of metal components or objects	OK % EMC max = 8.2	Generally OK, but archeological or salt-encrusted metals may corrode due to extended periods of moderately high levels of humidity.

Graphs





Statistics

Temperature		Relative Humidity		Dew Point	
T°F Mean	68.9	**%RH Mean**	29	**DP°F Mean**	33.9
T°F Median	69	**%RH Median**	26	**DP°F Median**	33
T°F Stdev	0.8	**%RH Stdev**	10	**DP°F Stdev**	8.8
T°F Min	64.7	**%RH Min**	13	**DP°F Min**	16.3
T°F Max	73.5	**%RH Max**	47	**DP°F Max**	49.5

SCA 212 Reading Room

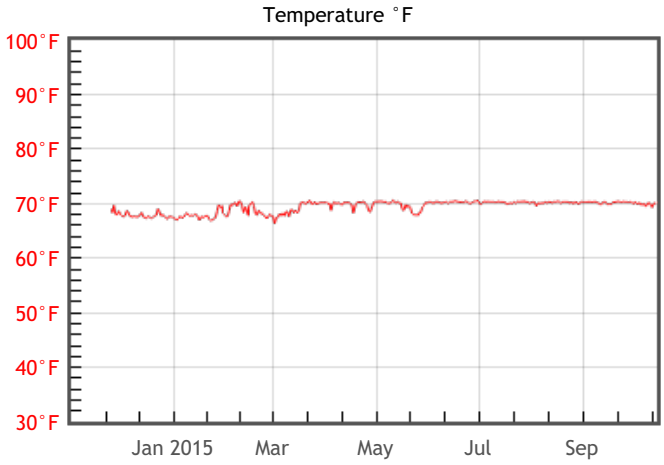
NAU Cline Library

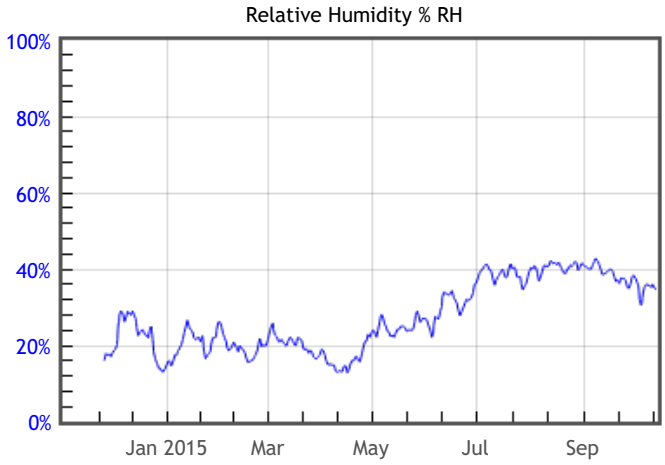
2014-11-25 to 2015-10-13
10 months, 19 days

Preservation Environment Evaluation

Type of Decay	Risks & Metrics	Evaluation & General Comments
Natural Aging Chemical decay of organic materials	OK TWPI = 73	Generally OK, but fast decaying organic materials such as acidic paper, color photographs and cellulosic plastics will be at elevated risk due to the cumulative effects of temperature and humidity
Mechanical Damage Physical damage to hygroscopic materials	RISK % DC = 1.15 % EMC min = 3.7 % EMC max = 7.9	Heightened risk of physical damage to any hygroscopic material, such as paintings, rare books, furniture, paper, leather, film, or color photos, due to extremely low or high levels of humidity, and / or excessive humidity fluctuation.
Mold Risk Mold growth in area or on collection objects	GOOD MRF = 0	Minimal risk of mold growth.
Metal Corrosion Corrosion of metal components or objects	OK % EMC max = 7.9	Generally OK, but archeological or salt-encrusted metals may corrode due to extended periods of moderately high levels of humidity.

Graphs





Statistics

Temperature		Relative Humidity		Dew Point	
T°F Mean	69.4	**%RH Mean**	27	**DP°F Mean**	33.2
T°F Median	69.9	**%RH Median**	25	**DP°F Median**	31.8
T°F Stdev	1.2	**%RH Stdev**	9	**DP°F Stdev**	9
T°F Min	64.9	**%RH Min**	12	**DP°F Min**	13.5
T°F Max	74.4	**%RH Max**	44	**DP°F Max**	47.3

SCA 214 Lab

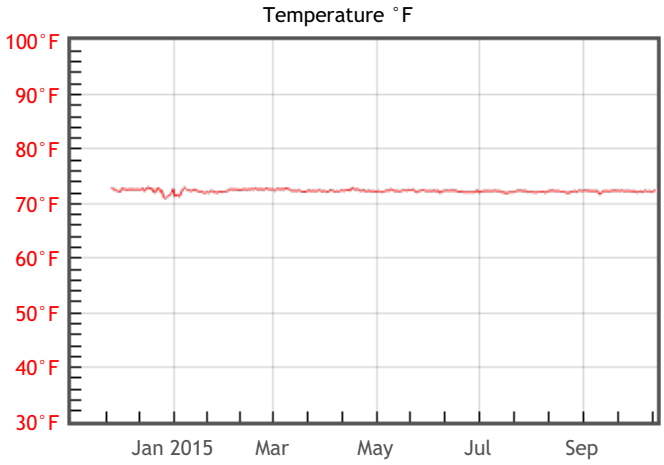
NAU Cline Library

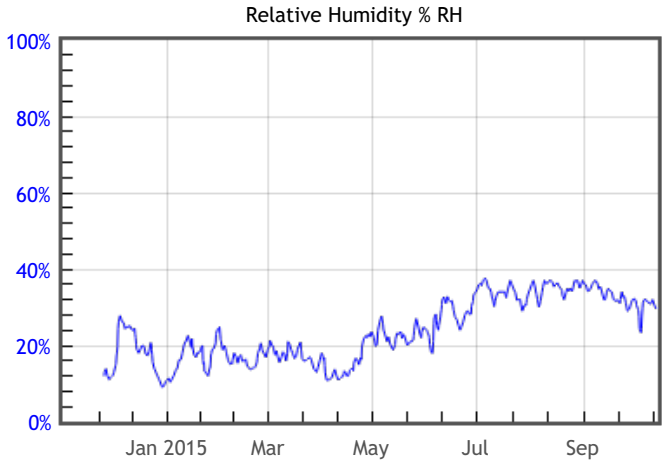
2014-11-25 to 2015-10-13
10 months, 19 days

Preservation Environment Evaluation

Type of Decay	Risks & Metrics	Evaluation & General Comments
Natural Aging Chemical decay of organic materials	OK TWPI = 67	Generally OK, but fast decaying organic materials such as acidic paper, color photographs and cellulosic plastics will be at elevated risk due to the cumulative effects of temperature and humidity
Mechanical Damage Physical damage to hygroscopic materials	RISK % DC = 1.05 % EMC min = 3.3 % EMC max = 7.1	Heightened risk of physical damage to any hygroscopic material, such as paintings, rare books, furniture, paper, leather, film, or color photos, due to extremely low or high levels of humidity, and / or excessive humidity fluctuation.
Mold Risk Mold growth in area or on collection objects	GOOD MRF = 0	Minimal risk of mold growth.
Metal Corrosion Corrosion of metal components or objects	OK % EMC max = 7.1	Generally OK, but archeological or salt-encrusted metals may corrode due to extended periods of moderately high levels of humidity.

Graphs





Statistics

Temperature		Relative Humidity		Dew Point	
T°F Mean	72.3	**%RH Mean**	24	**DP°F Mean**	31.9
T°F Median	72.3	**%RH Median**	23	**DP°F Median**	32.4
T°F Stdev	0.3	**%RH Stdev**	8	**DP°F Stdev**	9.2
T°F Min	70.7	**%RH Min**	9	**DP°F Min**	9.5
T°F Max	77.1	**%RH Max**	38	**DP°F Max**	48.1

SCA Exhibits

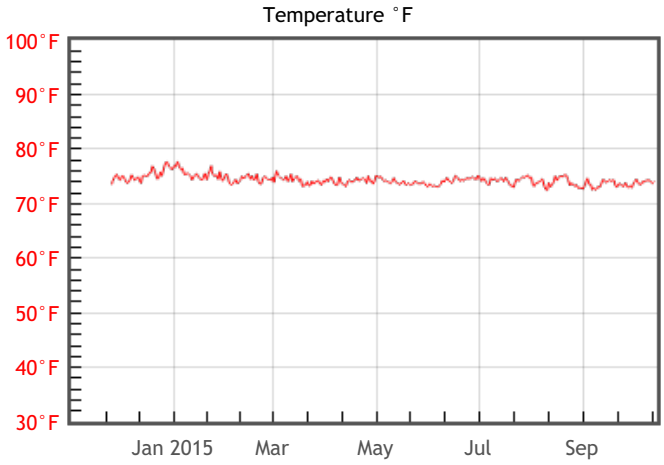
NAU Cline Library

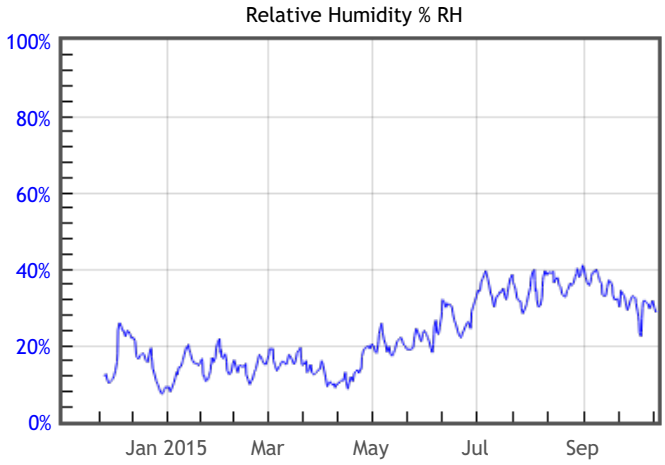
2014-11-25 to 2015-10-13
10 months, 19 days

Preservation Environment Evaluation

Type of Decay	Risks & Metrics	Evaluation & General Comments
Natural Aging Chemical decay of organic materials	OK TWPI = 59	Generally OK, but fast decaying organic materials such as acidic paper, color photographs and cellulosic plastics will be at elevated risk due to the cumulative effects of temperature and humidity
Mechanical Damage Physical damage to hygroscopic materials	RISK % DC = 1.2 % EMC min = 2.9 % EMC max = 7.2	Heightened risk of physical damage to any hygroscopic material, such as paintings, rare books, furniture, paper, leather, film, or color photos, due to extremely low or high levels of humidity, and / or excessive humidity fluctuation.
Mold Risk Mold growth in area or on collection objects	GOOD MRF = 0	Minimal risk of mold growth.
Metal Corrosion Corrosion of metal components or objects	OK % EMC max = 7.2	Generally OK, but archeological or salt-encrusted metals may corrode due to extended periods of moderately high levels of humidity.

Graphs

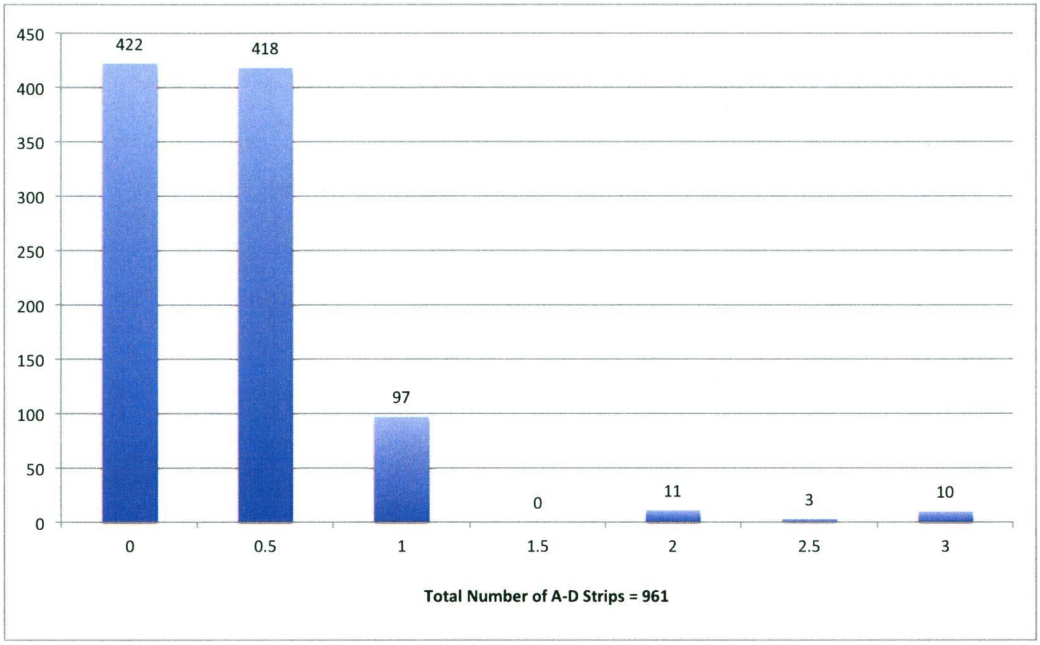




Statistics

Temperature		Relative Humidity		Dew Point	
T°F Mean	74.3	**%RH Mean**	23	**DP°F Mean**	31.8
T°F Median	74.1	**%RH Median**	20	**DP°F Median**	31.1
T°F Stdev	1	**%RH Stdev**	9	**DP°F Stdev**	10.6
T°F Min	68.5	**%RH Min**	7	**DP°F Min**	7.5
T°F Max	80.4	**%RH Max**	41	**DP°F Max**	48.9

0	422	0-0.49
0.5	418	0.5-0.99
1	97	1-1.49
1.5	0	1.5-1.99
2	11	2-2.49
2.5	3	2.5-2.99
3	10	3-3.49
	0	



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