

Setting Appropriate Parameters

IMAGE PERMANENCE INSTITUTE
TRAINING SUSTAINABLE ENVIRONMENTAL MANAGEMENT TEAMS FOR CULTURAL INSTITUTIONS

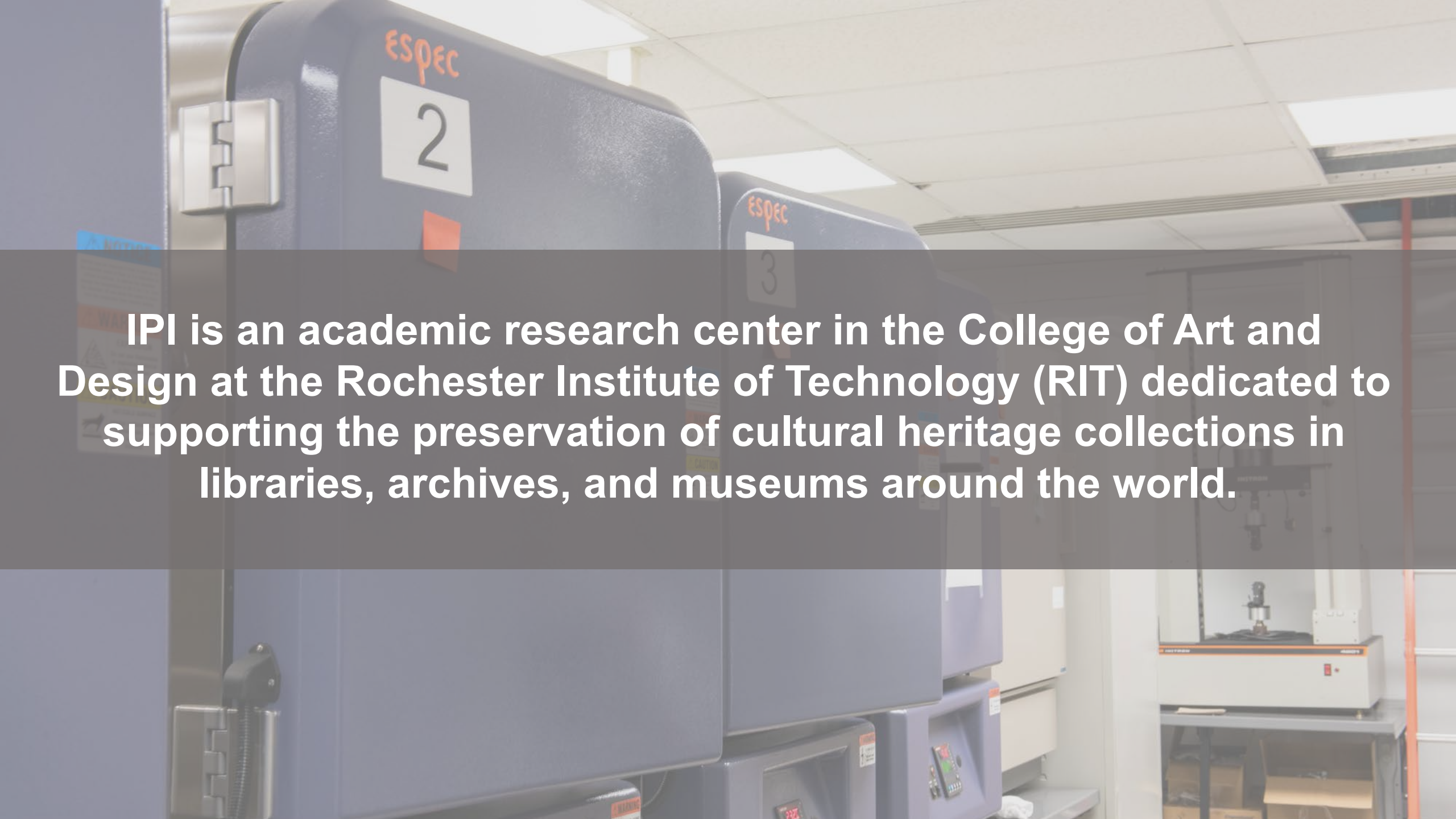
Today's Webinar

- ▶ Funding provided by the National Endowment for the Humanities Education and Training grant

- ▶ Series I: Environmental Management
- ▶ Series II: Environmental Data Analysis
 - ▶ Understanding Fluctuations and Equilibrations
(recorded)
 - ▶ Responding to Issues: July 9



NATIONAL
ENDOWMENT
FOR THE
HUMANITIES



IPI is an academic research center in the College of Art and Design at the Rochester Institute of Technology (RIT) dedicated to supporting the preservation of cultural heritage collections in libraries, archives, and museums around the world.

Your Presenters



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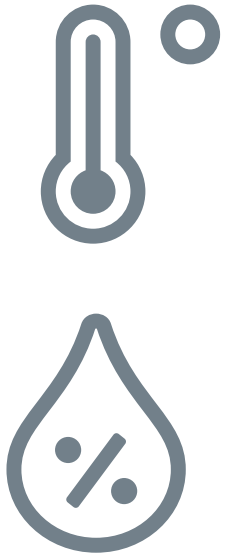
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How do you set **appropriate** parameters?

Review



▶ **Temperature**

- ▶ Cooler temperatures increase collection longevity for many materials
- ▶ Sustained high temperatures have the greatest negative effect on preservation

▶ **Relative Humidity/ EMC**

- ▶ Generally safe within a moderate range (~30-60%RH)
- ▶ Sustained high relative humidity matters most for preservation

Change thinking:

Not looking for a single number but an **operating philosophy**



What role do **standards** play?

How do standards play a role in setting parameters?

Sources

- ▶ International standards
- ▶ National committees
- ▶ Institutional mandates
- ▶ Inherited practice
- ▶ Loan agreements
- ▶ Human comfort

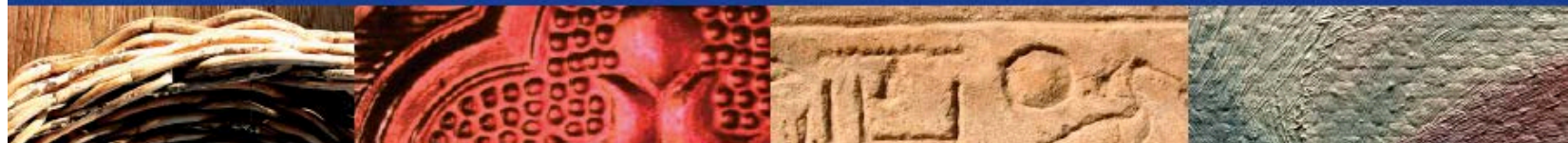
AIC: For the majority of cultural materials, a setpoint in the range of 45-55% RH with an allowable drift of +/-5%, yielding a total annual range of 40% minimum – 60% maximum, and a temperature range of 59-77°F is acceptable. Fluctuations must be minimized.

The relative humidity set point for most NPS collections lies between 45 – 55 %. Ideally, fluctuations should not exceed $\pm 5\%$ from the set point.

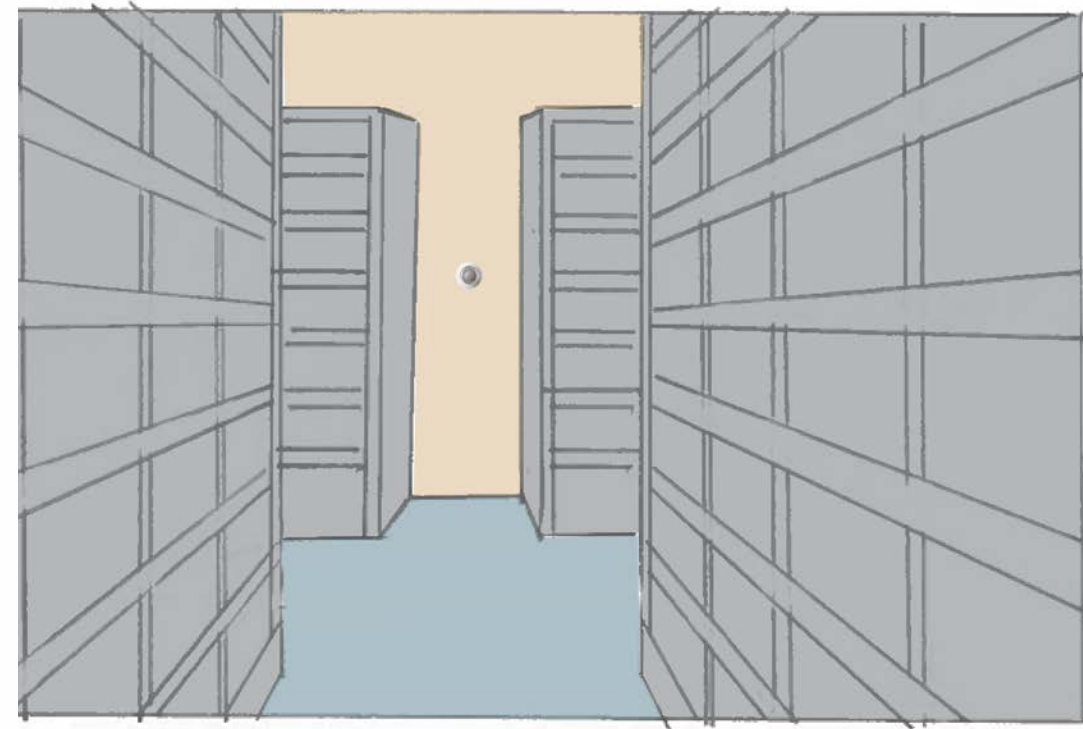
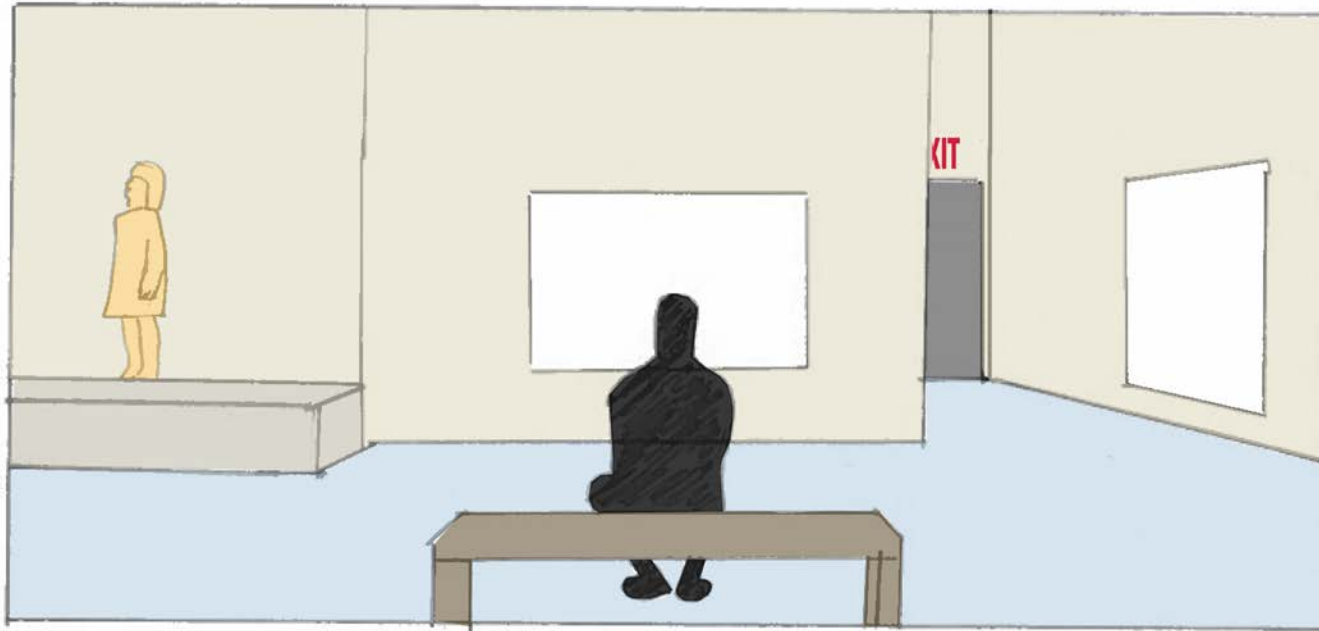
Wherever your collections are located, keep RH within the permissible range and avoid abrupt fluctuations to promote long term collections preservation.

PAS 198:2012

Specification for managing environmental conditions for cultural collections



Types of collections environments



How do standards play a role in setting parameters?

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- ▶ International standards
- ▶ National committees
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- ▶ Inherited practice
- ▶ Loan agreements
- ▶ Human comfort

History

- ▶ Previously:
 - ▶ Tight, universal
 - ▶ Recognized lack of research
- ▶ Now:
 - ▶ Context-driven
 - ▶ Sustainability
 - ▶ Ex. PAS 198:2012, ASHRAE 2019

4.6 General storage

4.6.1 The temperature for collection items in general storage shall conform to 4.2 to 4.5.

4.6.2 Collection items shall be stored at ambient temperatures only if their chemical stability at those temperatures is acceptable in accordance with 3.5. Any collection items that would deteriorate rapidly at ambient temperatures shall be placed in cooled storage or cold storage.

NOTE 1 Most materials found in collections are chemically stable and will have an expected lifetime of centuries at room temperatures below 30 °C but many plastics, films and acidic papers have an expected lifetime of only decades at 25 °C.

NOTE 2 Some organic materials can have acceptable expected lifetimes at 20 °C, but their expected lifetimes will fall to approximately one-half at 25 °C and one-quarter at 30 °C.

NOTE 3 The annual average outdoor temperature in the UK varies from 8.5 °C to 11 °C. Where average outdoor temperatures are below temperatures normally maintained for human comfort, general storage can take advantage of both higher chemical stability and lower energy demand by operating below human comfort temperatures, as long as RH requirements are also met.

NOTE 4 While it is preferable to maintain a stable annual average by means of design of the collection space, it is also acceptable to allow slow and gradual seasonal changes in temperature to improve energy economy, as long as the environmental specification of 3.5 is met.

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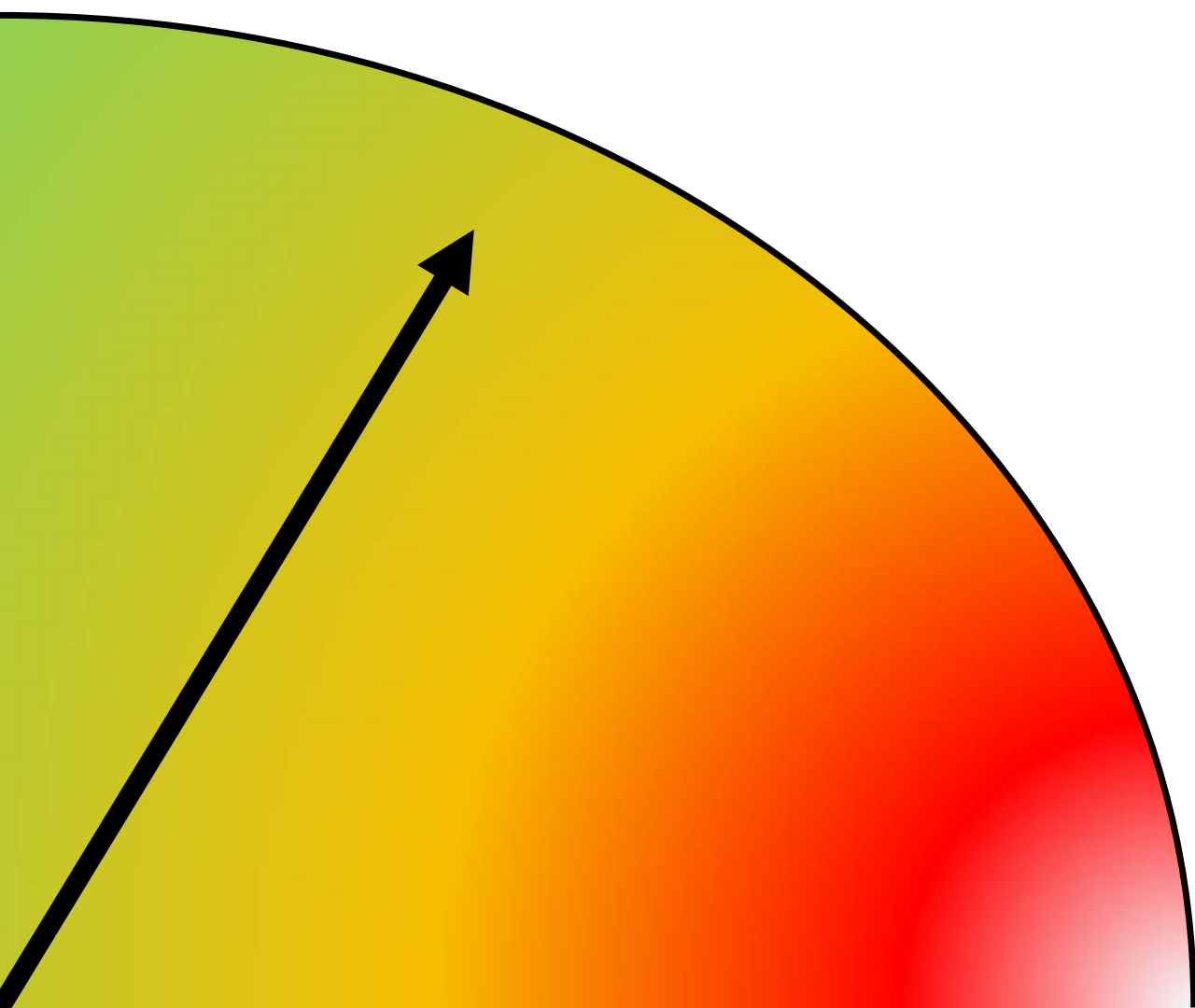
History

- ▶ Previously:
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Application

- ▶ Advice for preservation (ex. archival materials)
- ▶ Guides for discussion

Benchmarking

- 
- ▶ Examples:
 - ▶ Preservation Index
 - ▶ Energy management
 - ▶ Uses:
 - ▶ Show need
 - ▶ Provide a goal
 - ▶ Quantify results

What is **possible** in this specific context?

What determines boundaries

- ▶ **Mechanical system limitations**
 - ▶ Balancing risks
- ▶ **Mixed zones for supply and/or return**
 - ▶ Occupancy
 - ▶ Open to other zones
- ▶ **Building and/or room envelope**
 - ▶ Invasive to retrofit
- ▶ **Limited space prevents box-in-box**
- ▶ **Costs**
- ▶ **Access, time out of storage**

Local climate

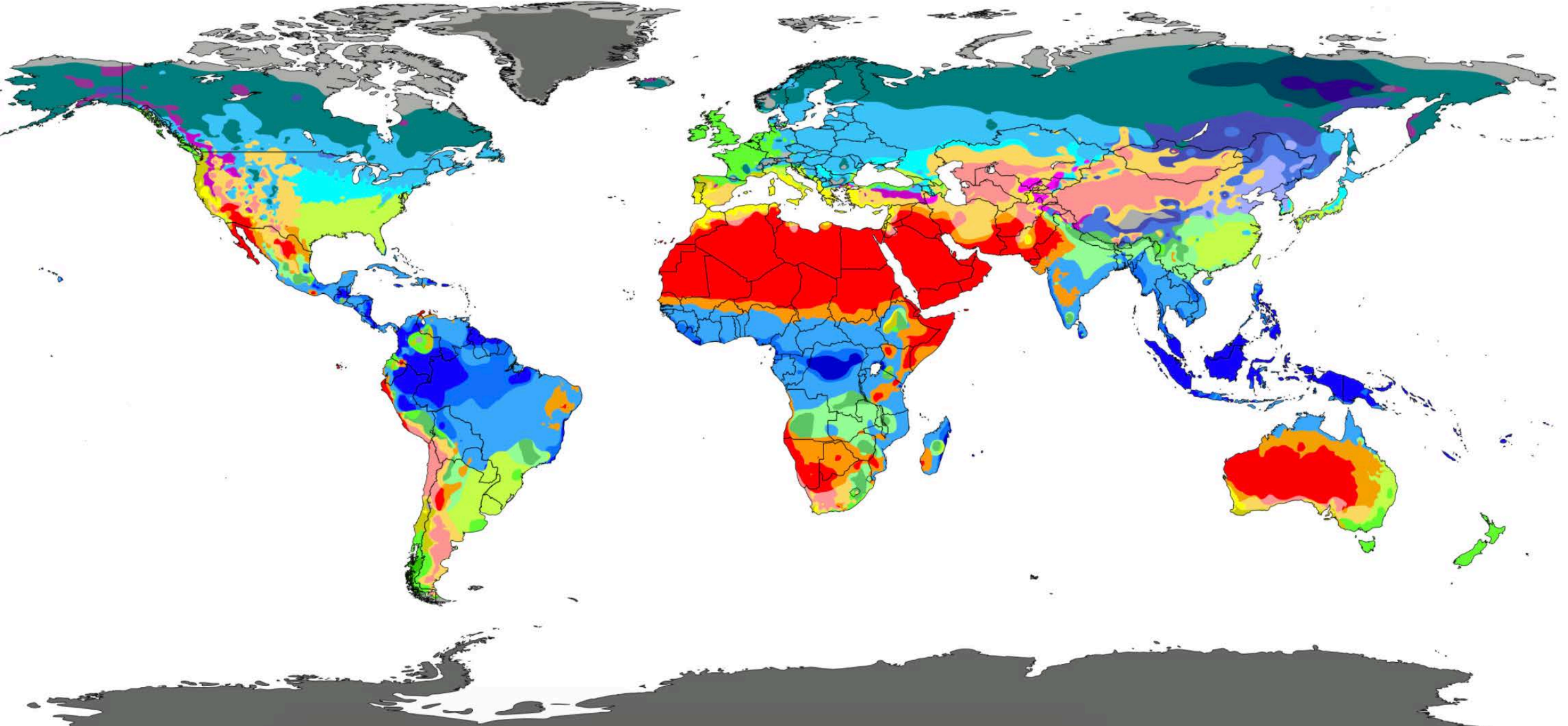
Building envelope

Mechanical system

Room

Enclosures

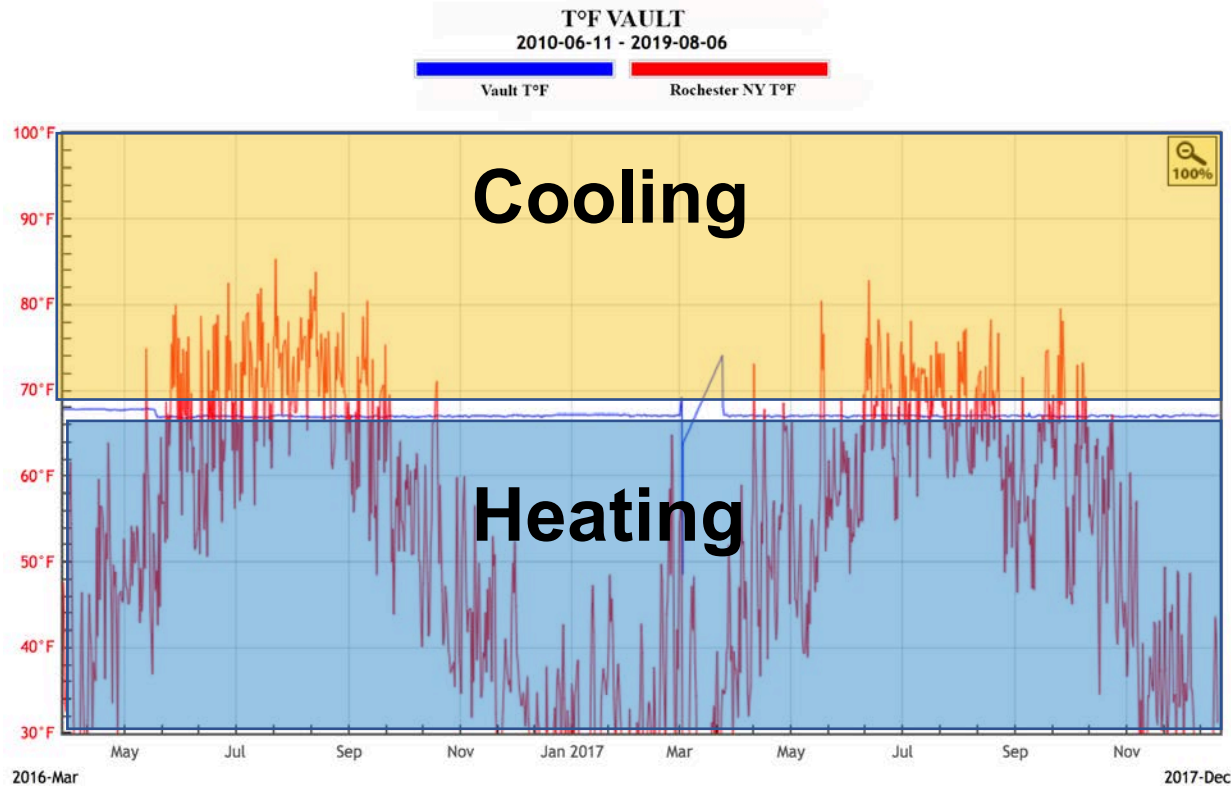
World map of Köppen-Geiger climate classification



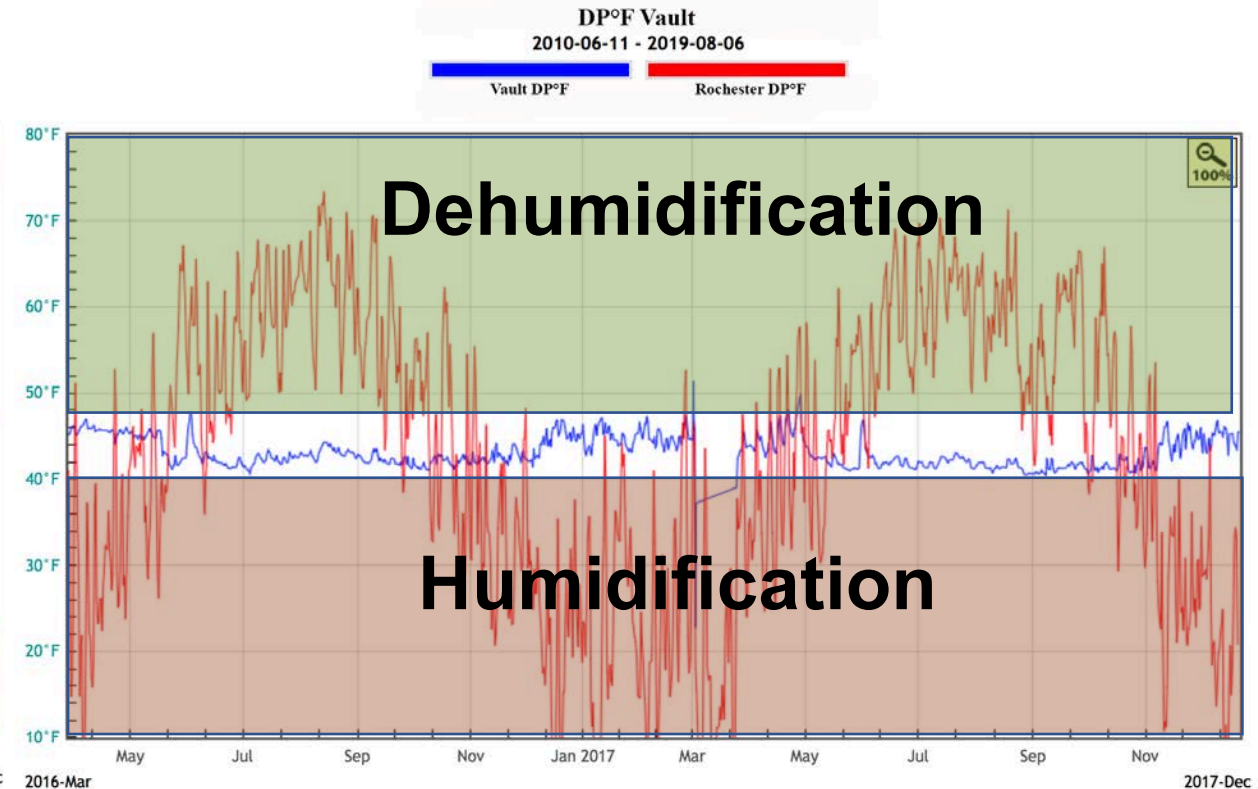
<https://www.homerenergy.com/products/pro/docs/latest/index.html>

Outside vs. desired conditions

Temperature

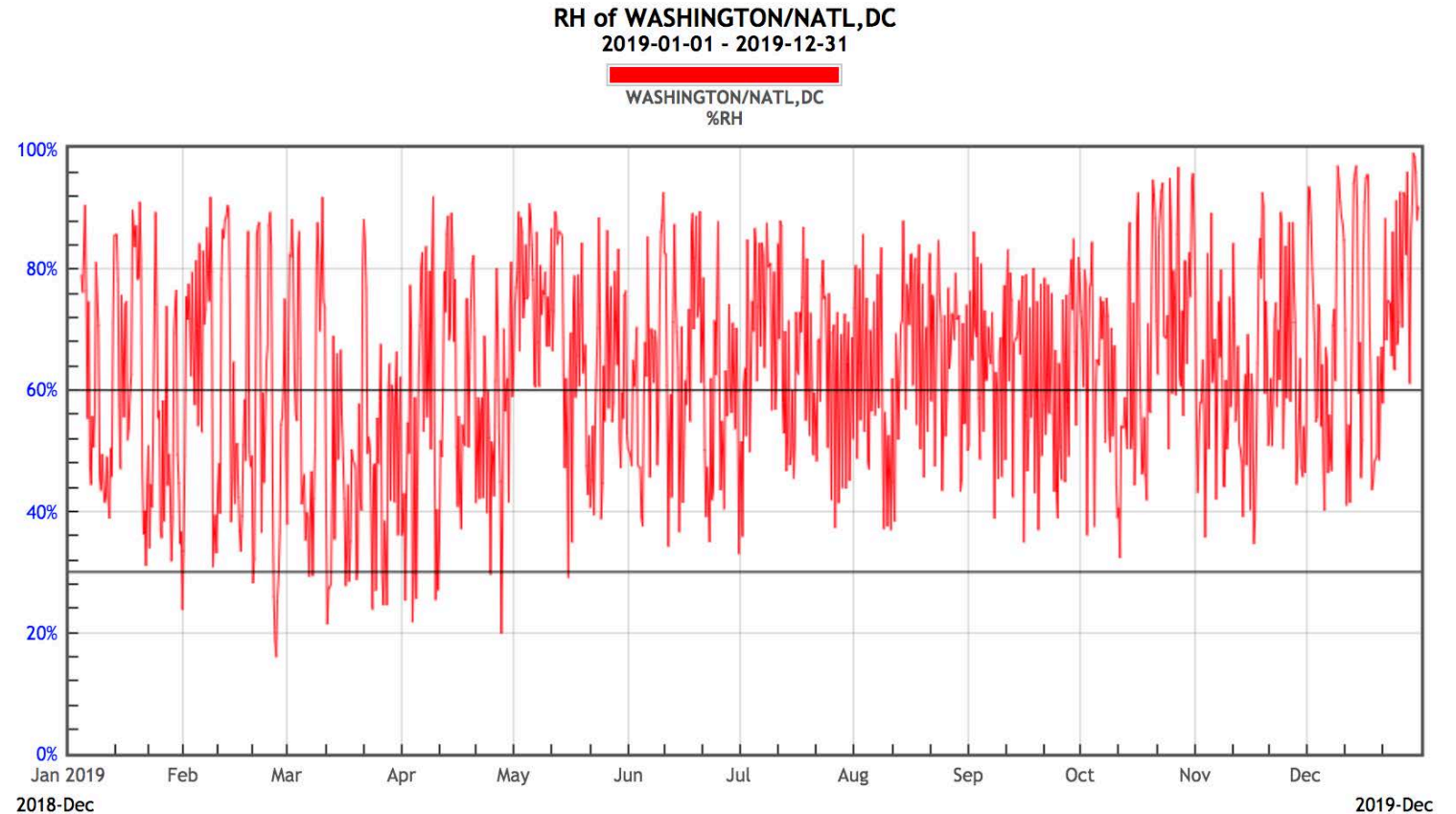


Dew Point



Relation to parameters

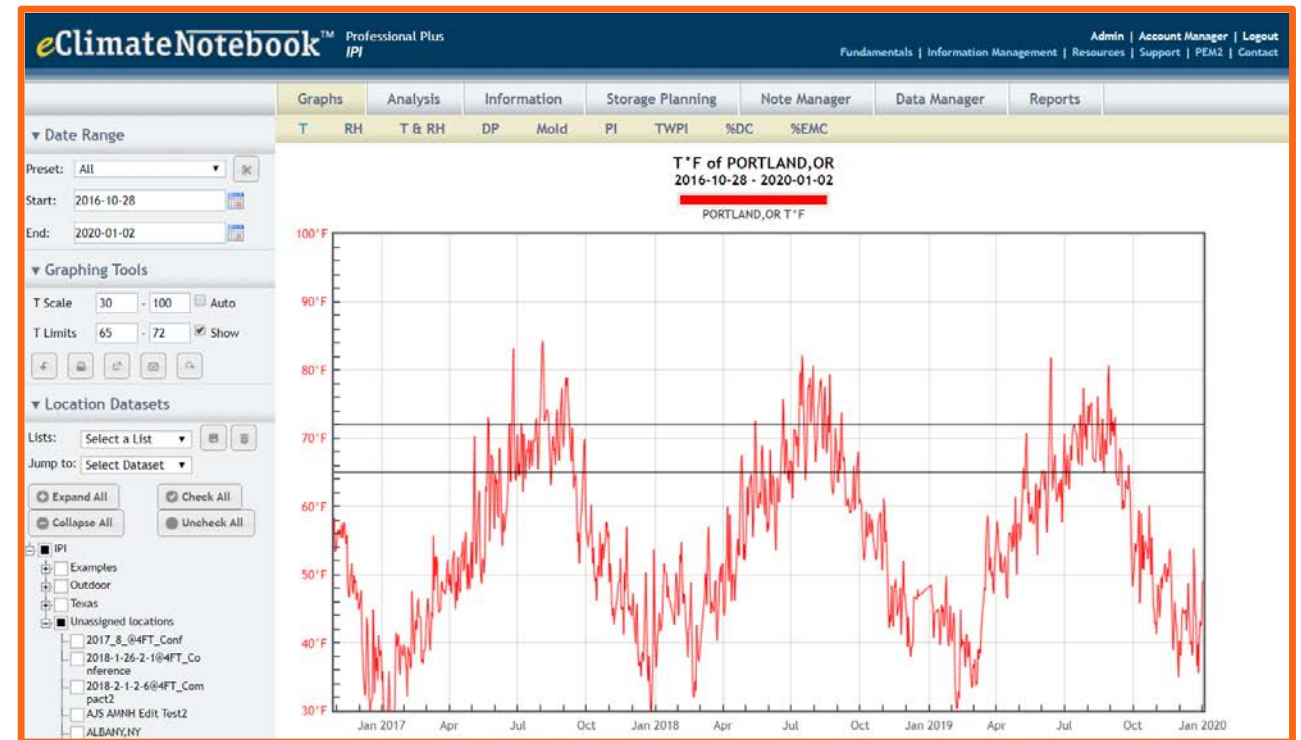
Relative humidity outside is within 45-50% only 10% of the time, but 30-60% over 40% of the time.



eClimateNotebook®

IPI's web-based tool for environmental data management

- ▶ Data storage
- ▶ Risk analysis
- ▶ Preservation Metrics
- ▶ Reporting



Building Use

- ▶ Understanding your building history is equally important
- ▶ What the building was used for can help identify what types of issues may arise

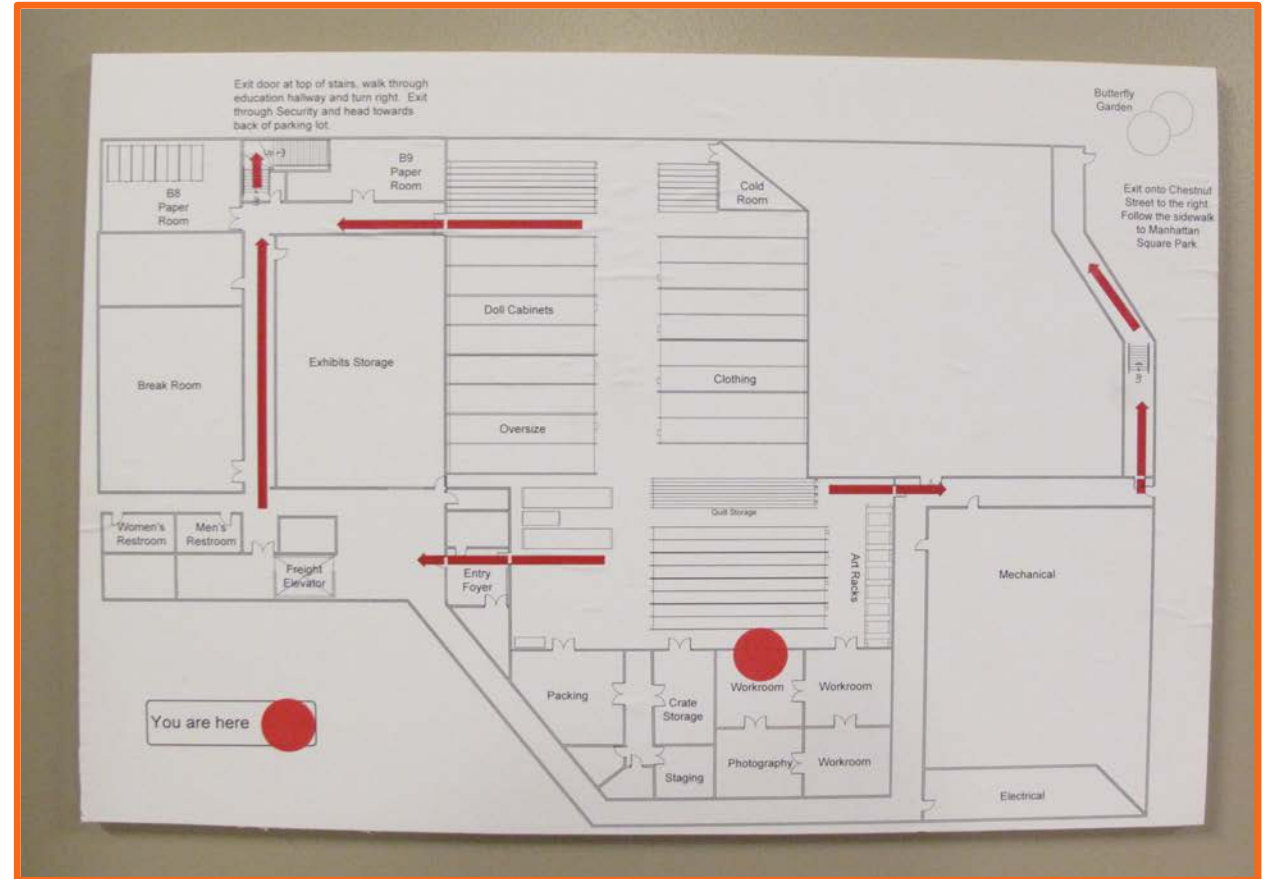
We have seen collection spaces that were once:

- ▶ Roller skating rinks
- ▶ Car dealerships
- ▶ Janitor closets
- ▶ Offices
- ▶ Cisterns
- ▶ Rifle range
- ▶ Apple storage
- ▶ Etc.

Building Use

Walk through the facility and make a map of the spaces

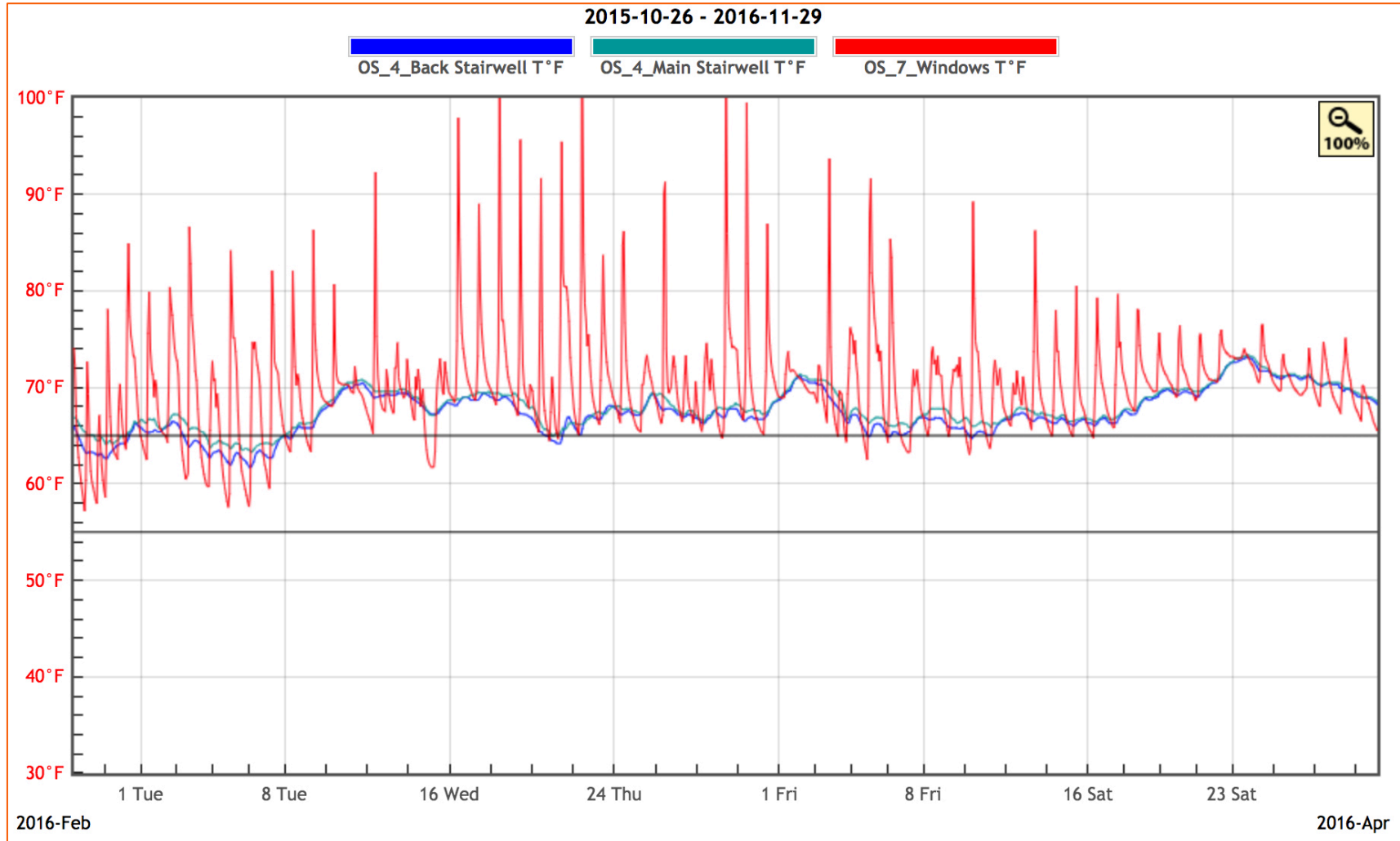
- ▶ Offices
- ▶ Collection
- ▶ Public
- ▶ Staff



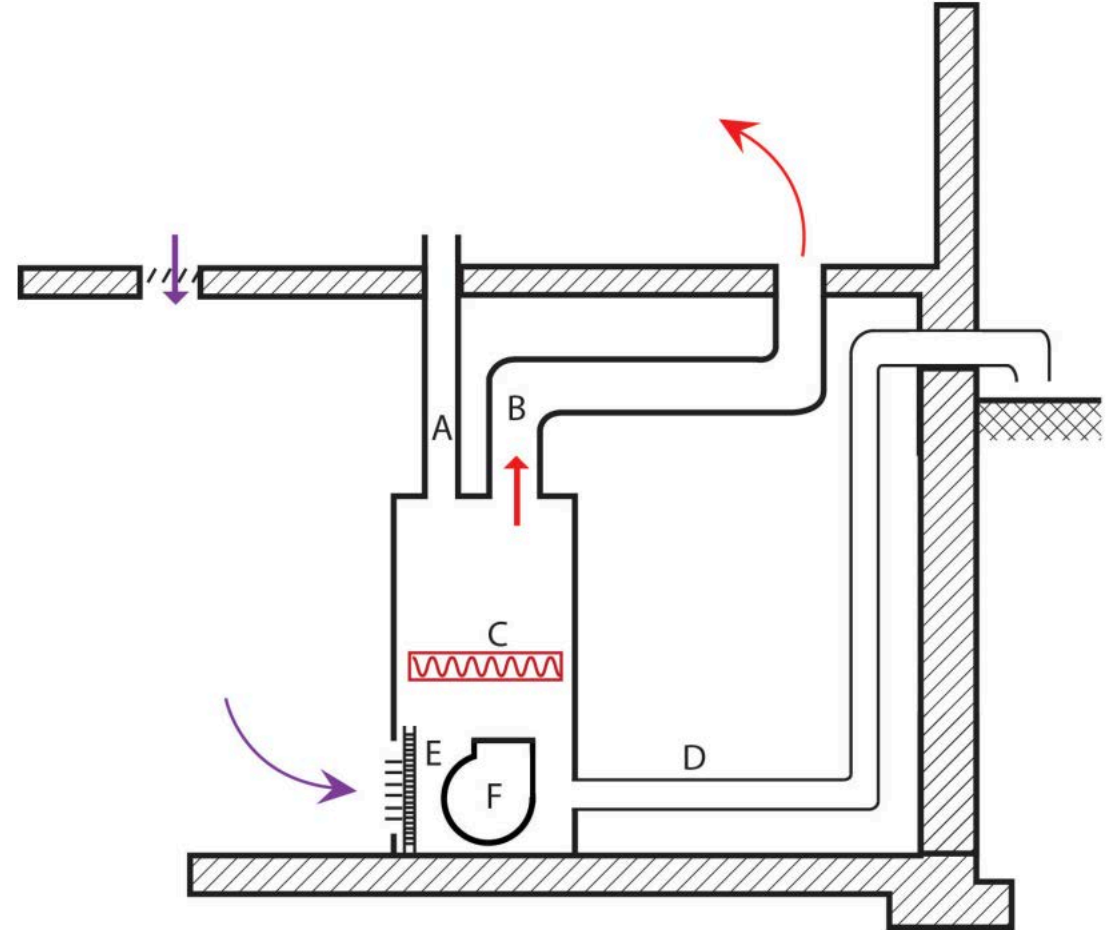
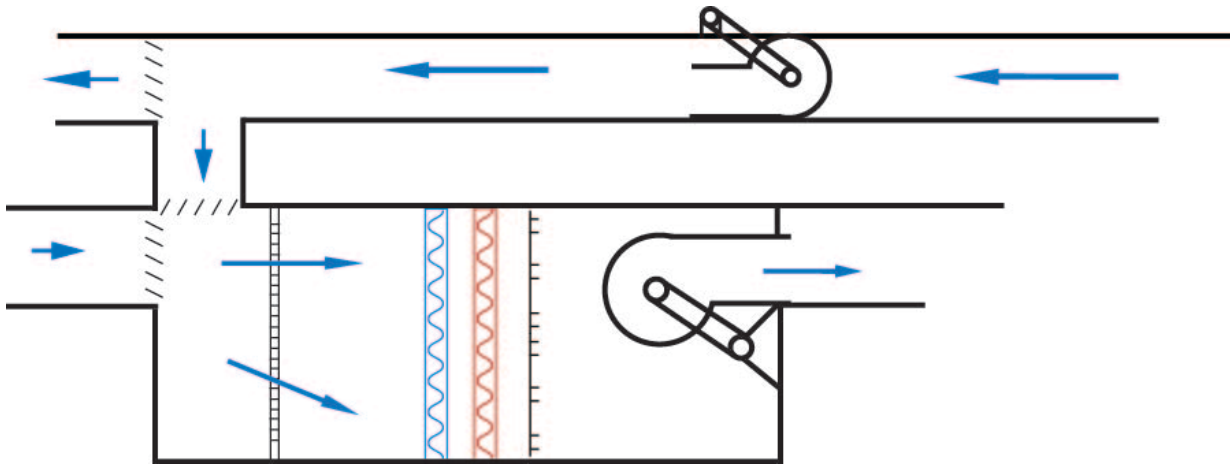
Building and Room Envelopes

- ▶ **Heat loads and sources of moisture:**
 - ▶ Solar load
 - ▶ Transmission through exterior
 - ▶ Infiltration from surrounding spaces
- ▶ **Openings (windows, doors, holes, structural design)**
- ▶ **Construction materials**
- ▶ **Presence of insulation, vapor barriers**
- ▶ **Within space (lights and electronics, people)**

Example: Effect of Windows



Mechanical system



Mechanical system

Dew Point Calculator

- ▶ Assess environmental conditions before they are implemented
- ▶ Evaluate mechanical system dew point
- ▶ Determine appropriate seasonal temperatures and safe temp and RH ranges

Dpcalc.org

The screenshot shows a web-based Dew Point Calculator interface. At the top, a dark grey bar contains the text "Click to Solve for:" followed by three radio buttons: "Temperature", "% RH", and "Dew Point". The "Dew Point" button is selected. Below this bar, there are three vertical sliders. The first slider is red and has a value of 55 displayed above it. The second slider is blue and has a value of 40 displayed above it. The third slider is black and has a value of 31 displayed above it. Each slider has a horizontal bar at its base. At the bottom of the interface, a dark grey bar contains the text "Temperature Scale:" followed by two radio buttons: "°F" and "°C".

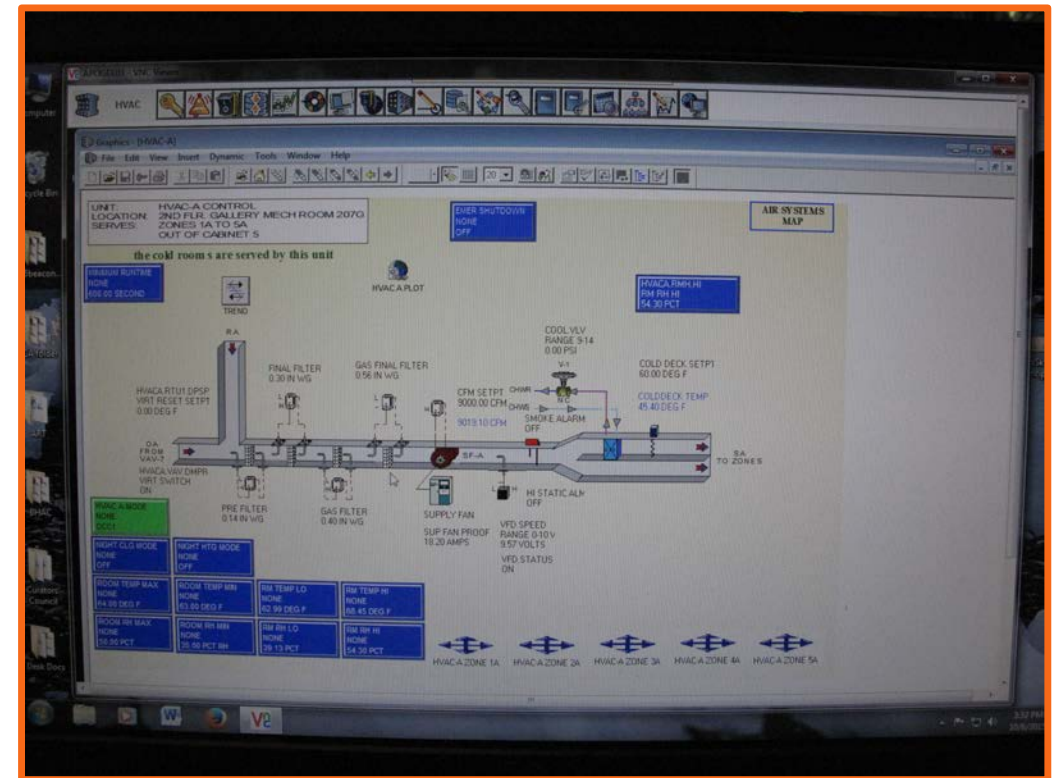
Typical issues with mechanical systems

- ▶ Dew point off of the unit
- ▶ Poorly functioning equipment
- ▶ Lack of control
- ▶ No humidification



Building Management Systems

- ▶ Modern BMS software can store and export data
- ▶ Real-time export to eClimateNotebook now possible
- ▶ Reliable sensors can provide additional data monitoring points
 - ▶ Temp and RH must be present



Other factors

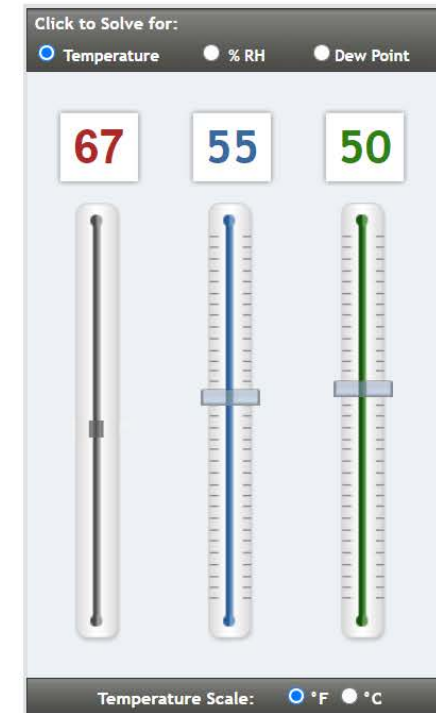
- ▶ **Salts in air, proximity to water source**
- ▶ **Dust storms, wildfires**
- ▶ **Campus policies (ex. availability of chilled water)**
- ▶ **Remoteness (availability of maintenance)**

Example: Summer set point (non-desiccant):

Enter
achievable
dew point

Consider
higher limit
of %RH

Lower
temperature

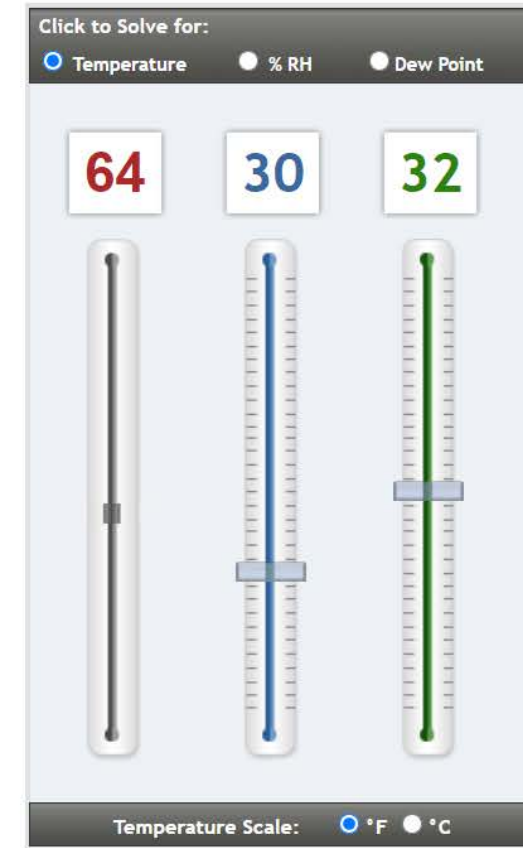


+ limitations, goals, etc.

Example: Winter set point

Consider lower
limit of %RH

Reduce reheat
operation



+ limitations, goals, etc.

Room



Storage Furniture and Housing

- ▶ Collections may be protected from the environment depending on the buffering capacity of their housing.
 - ▶ Vitrines
 - ▶ Compact shelving
 - ▶ Boxes

How does an historic building impact this process?

Importance of building

New Orleans Charter for Joint Preservation of Historic Structures and Artifacts

- ▶ Measures which promote the preservation of either the historic structure or the artifacts, at the **expense of the other, should not be considered.**
- ▶ Appropriate preservation strategies should be guided by the **specific needs and characteristics** of the historic structure and artifacts.
- ▶ The most appropriate action in a particular case is one which attains the desired goal with the **least intervention** to the historic structure and the artifacts.
- ▶ Proposed preservation strategies should be **appropriate to the ability** of the institution to implement and maintain them.

Building



Building

- ▶ Damage to the structure
- ▶ Condensation within the walls
- ▶ Loss of efficiency

This becomes more of an issue the greater the difference is between the interior and exterior environment

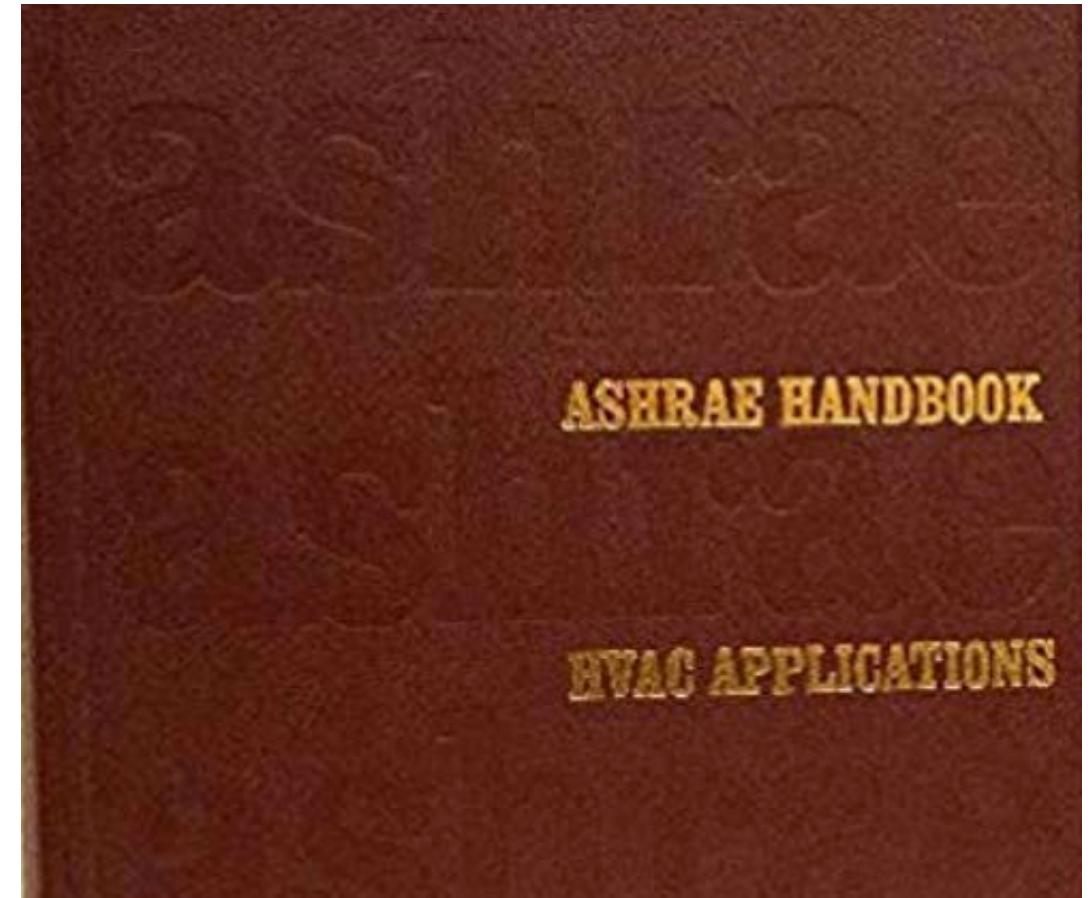


ASHRAE 2019

(American Society of Heating, Refrigerating and Air-Conditioning Engineers)

- ▶ **Table II: Type of Control, Climate Zone, Typical Envelope Performance Necessary**

- ▶ **Different levels of control**
 - ▶ “needing to reduce stress on their building (e.g., historic house museums), depending on climate zone”
 - ▶ “Collections in open structured buildings, historic houses”



What is **ideal** in this specific context?

Start with the big picture

- ▶ **Focus on reducing extremes first**
- ▶ **Consider a broad range, then handle specific needs as microclimates:**
 - ▶ Box-in-box construction
 - ▶ Sealed cabinets, freezers
 - ▶ Museum cases



Prioritize and plan

- ▶ **Not all spaces, not all materials benefit from certain conditions to the same extent**
 - ▶ Prioritize (sensitive materials, deteriorated)
- ▶ **Locate materials strategically**
 - ▶ Choose between rooms
 - ▶ Within room microclimates



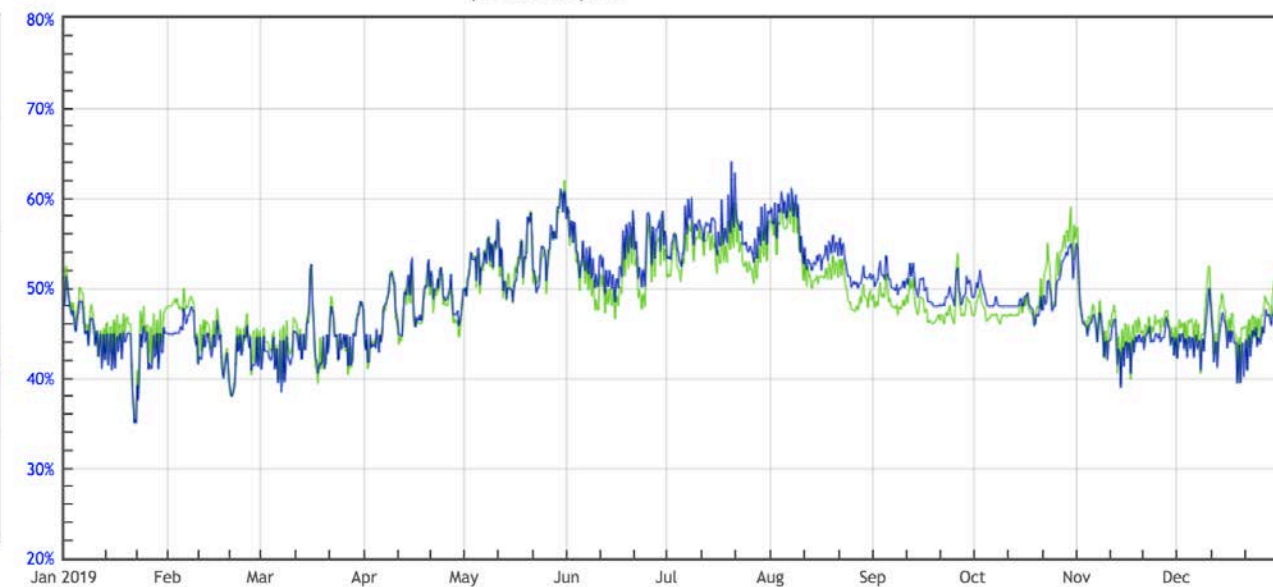
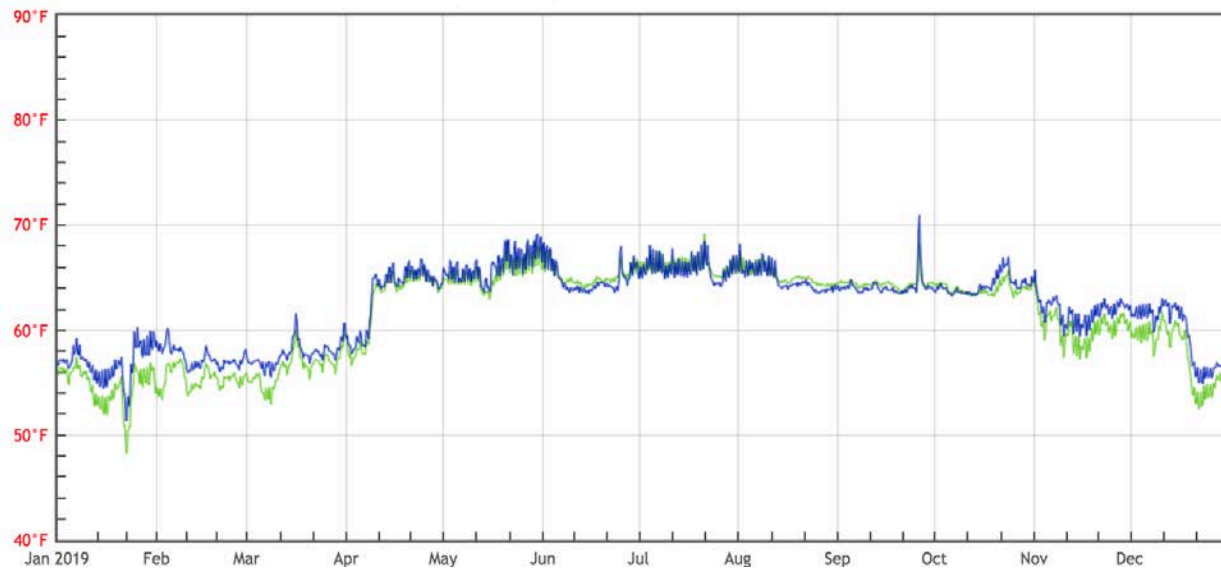
Use policies and planning to your advantage

- ▶ **Pull together resources with other institutions**
- ▶ **Manage people**
 - ▶ Separate collections and occupancy
 - ▶ Minimize time in collection spaces

Operate mechanical systems strategically

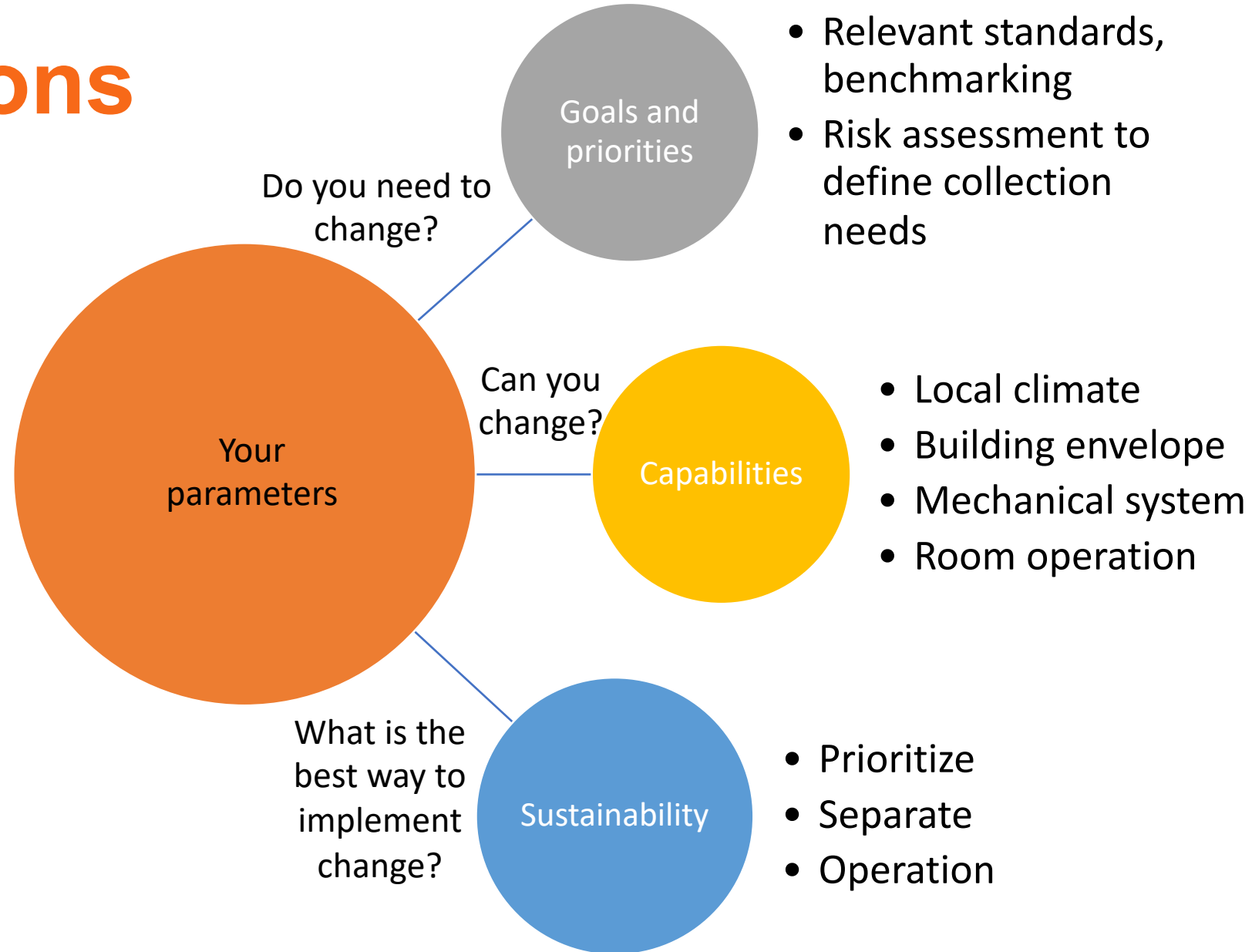
- ▶ **Address issues of loads**
- ▶ **Maximize use of non-mechanical methods**
 - ▶ Natural ventilation of historic structures
 - ▶ Promote air mixing
 - ▶ Insulation
- ▶ **Only meant to trim extremes**

Example: Seasonal set points



<https://www.imagepermanenceinstitute.org/education/publications.html>

Conclusions



Thank you

**Please complete the brief post-webinar survey
to provide us valuable feedback!**

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