How to Monitor

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May 10, 2011

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Management of Environment

- Depends on having knowledge of conditions experienced by the collections
  - Need T & RH data in a form that can be effectively analyzed and used
- Monitoring is essential if institutions are pursuing sustainable building operation
  - Risks to collection from changes in set points and shutdowns

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Institutional Roles and Cultures

- Facilities managers and building operators manufacture the environment
  - Traditional role of maintenance and response to comfort complaints
- Collection staff or collections care staff are used to management approach of asking for specific T and RH
  - Traditionally don't have knowledge or involvement with building systems

In Our Experience

- Best practices
  - collections care does its own monitoring
  - When it's someone's job to both collect data and proactively relate to facilities staff
  - When effects on collections can be measured and documented
  - When collections preservation can be balanced with energy savings

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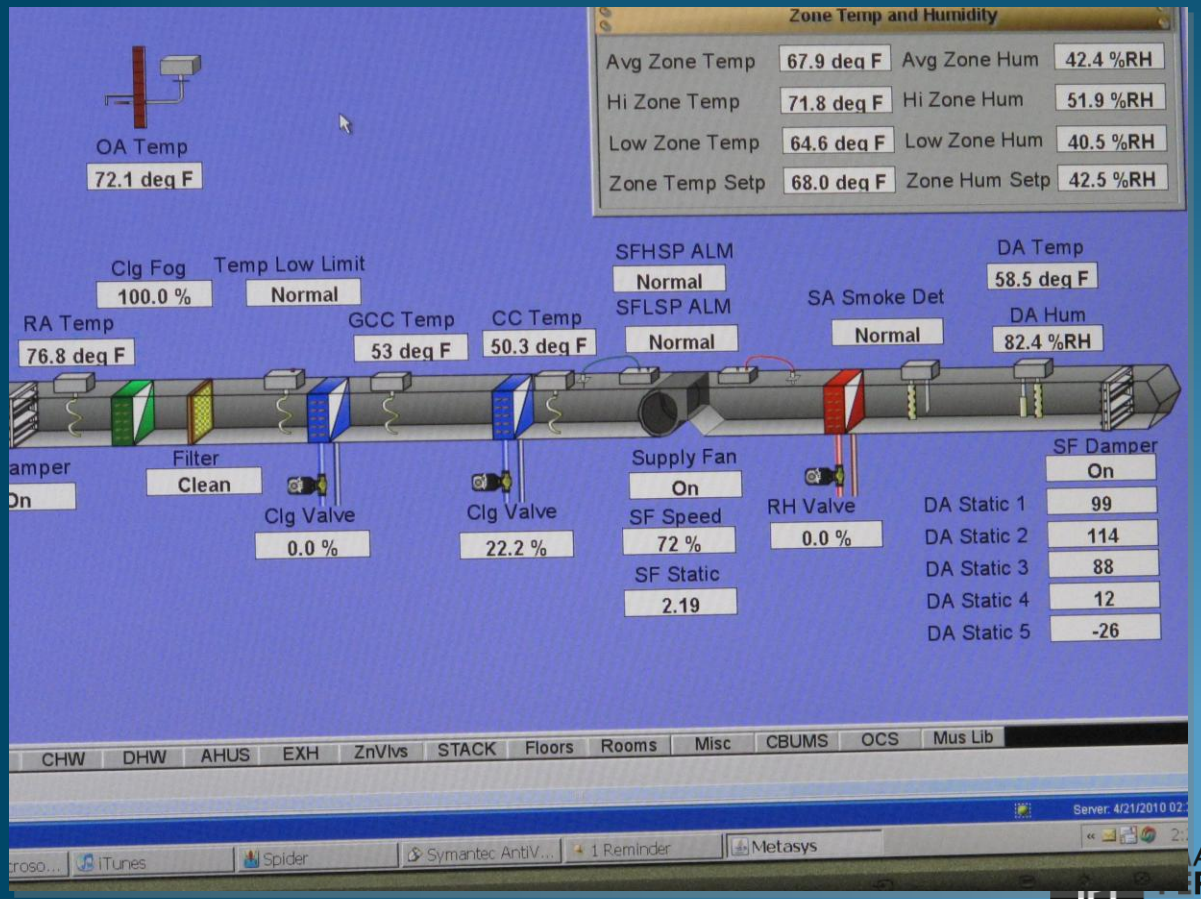
Data Sources

- Building Management Systems



Why Can't Preservation Use Data from Building Management Systems?

- Separate, proprietary, secure
- BMS is control, not analysis
  - No easy path to data organization or analysis platform
  - Sensor placement
- Requires large commitment of facilities staff time

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Dataloggers

- Electronic Devices that measure T & RH for graphing and analysis on computer
- Main Types
  - Standalone, battery-powered
  - Hard wired to ethernet
  - Radio Frequency (transmitters and base station)

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Standalone Dataloggers

- Most popular and practical
- Options
  - Display
  - Range of brands and prices ($100 to $1000)
  - Various methods to get data to computer
    - USB cable
    - USB Flash Drive
  - Some offer remote probes

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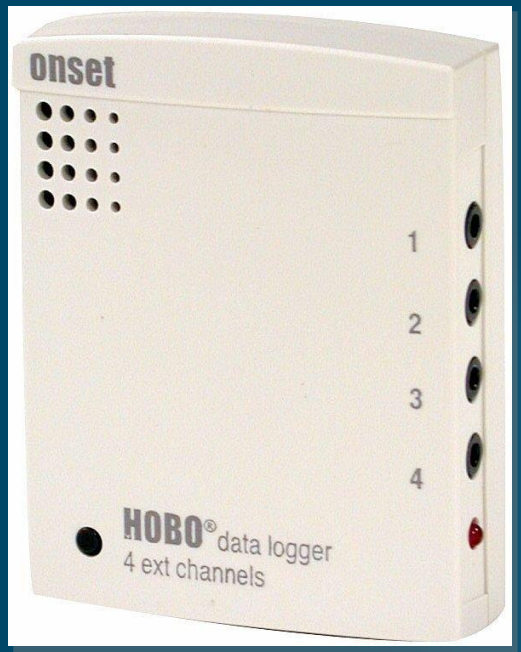

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RF and Ethernet-Connected

- Useful for real-time or inaccessible places
- RF models fussy to configure
- Ethernet-connected models not always practical

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Where to Monitor

- Near Collection, 4-6 feet from floor
- Away from supply ducts
- Wherever there is reason to believe conditions may differ
  - Source of heat, cold, moisture

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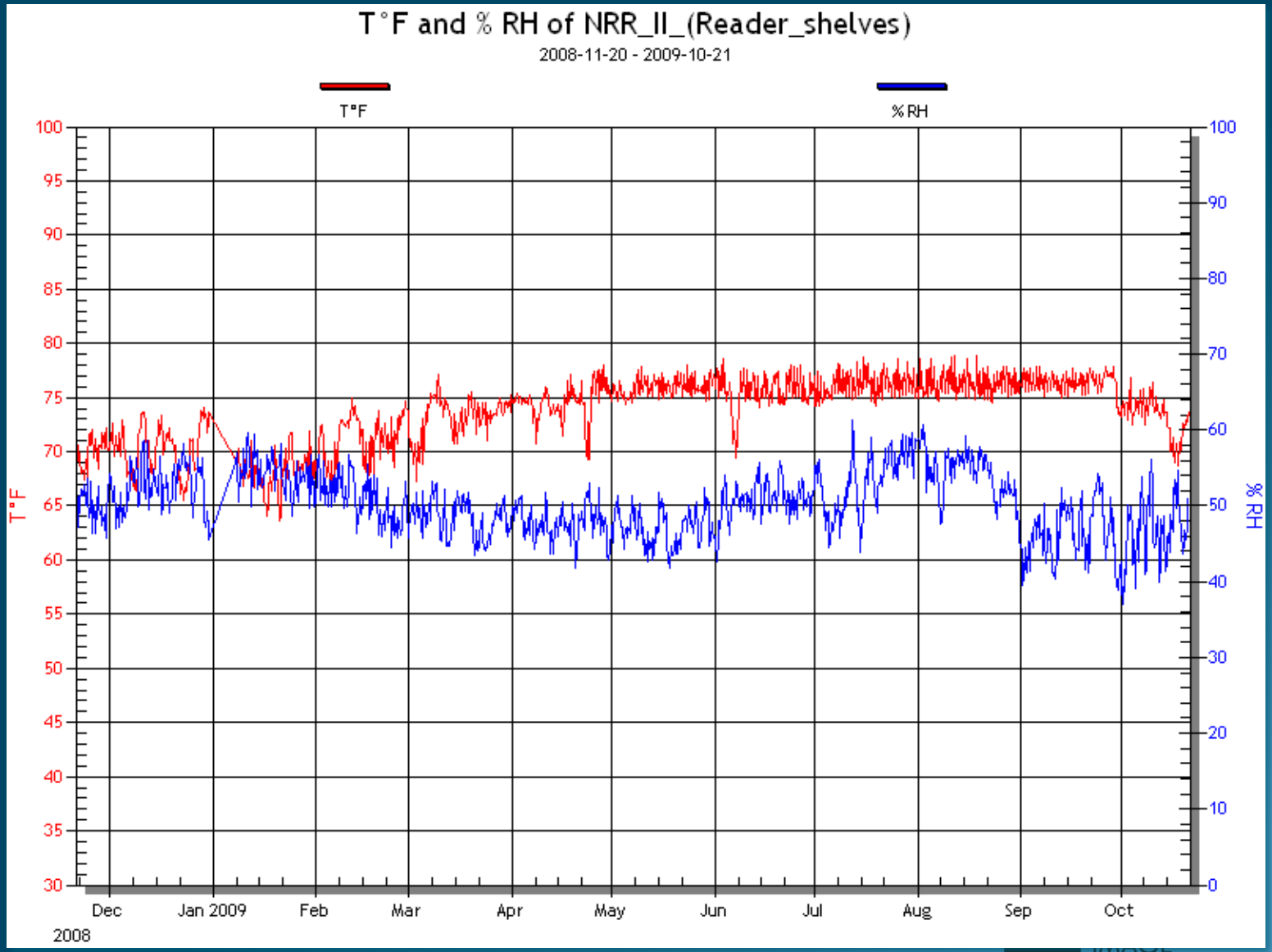
Data Manipulation and Analysis

- Consider both initial cost and the time and effort required to retrieve data and get it to proper analysis platform (software)
- Software is a separate expense
- Capabilities of Software are critically important
  - Include preservation analysis?
  - Easy to manipulate data?

Analysis



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Analysis with IPI's Preservation Metrics

Dataset	NRR_II_(Reader_shelves)
Risk Summary	
Natural Aging	RISK
Mechanical Damage	Good
Mold Growth	Good
Metal Corrosion	OK
Preservation Metrics	
TWPI	29
MRF	0
% DC Max	0.45
% EMC Min	8.5
EMC Max	10.2
EMC Mean	9.25
Data Overview	
Start	2008-11-20
End	2009-10-21
$T°F_{mean}$	73.8
$\%\ RH_{mean}$	50.2
$DP°F_{mean}$	54

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Preservation Quality Analysis - Based on observed environmental conditions, but independent of the collections within the space.

Date Range

Preset: All
Start: 2008-01-01
End: 2008-06-19

Datasets

(Max 5 per graph):

- [ ] AL-AUBURN-2008
- [ ] archives hall
- [x] archives library
- [ ] archives main
- [ ] archives media
- [x] P2_00051
- [x] P2_00278
- [x] P2_00279
- [x] P2_00298

Dataset	archives library	P2_00051	P2_00278	P2_00279	P2_00298
Risk Summary					
Natural Aging	RISK	RISK	RISK	RISK	RISK
Mechanical Damage	OK	RISK	RISK	RISK	OK
Mold Growth	Good	Good	RISK	Good	Good
Metal Corrosion	OK	RISK	RISK	RISK	RISK
Preservation Metrics					
TWPI	44	39	41	40	37
MRF	0	0.44	0.85	0.11	0.04
% DC Max	0.65	1	1.2	0.88	0.76
% EMC Min	7.4	10.1	10	9.8	8.6
EMC Max	9.7	13.7	14.2	12.9	11.4
EMC Mean	8.53	11.31	11.35	10.84	9.7
Data Overview					
Start	2008-03-14	2008-03-13	2008-03-13	2008-03-13	2008-03-14
End	2008-03-28	2008-06-18	2008-06-18	2008-06-18	2008-06-18
$T°F_{mean}$	70.1	65.6	65.3	66.4	69.8
$\%\ RH_{mean}$	38.9	63	63.2	60.4	54.2
$DP°F_{mean}$	42.9	52.2	51.8	51.8	51.9

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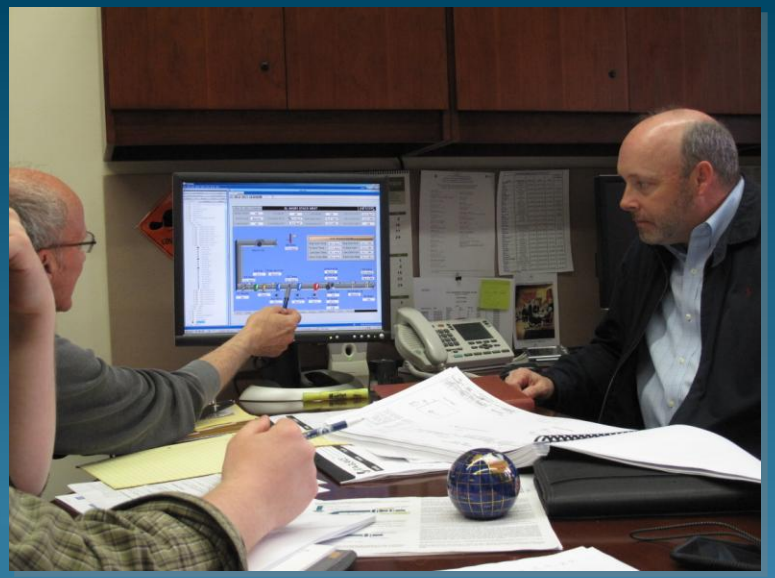
Keys to Data Analysis

- For Natural Aging
  - Most decay happens in summer
  - Cool and dry is the best
  - Limit is summer dew point achieved by system
  - Try to keep near 45 °F DP



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Keys to Data Analysis

- Mechanical & Biological Decay
  - High summer DP again
    - Watch for keeping spaces too cold without a low enough DP! Mold may result
  - Low winter DP
    - Extreme dryness may result from failure to humidify, especially in cold climates
      - But don't overdo it and try for 50 % RH

Keys to Energy Saving

- Understand basic functions and document performance of HVAC systems
- Opportunities
  - Unnecessary sub-cool and reheat
  - Fan speeds
  - Outside air controls
- Metrics suggest opportunities, evaluate results

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Final Thought

- Preservation should not abdicate its role in sustainable environmental management

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