

# ReCAP Environmental Standards

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Sept 5, 2014 (v2)

This memo describes the current environmental conditions in ReCAP’s modules and proposed changes to improve the preservation environment and reduce energy costs.

ReCAP operates its mechanical systems on a 24/7 basis, with a set point of 50F and 35% RH autumn through spring, and 55F 35% RH during the summer. Set points are accurate to  $\pm 3F$ , so ReCAP’s annual operating environment is commonly described as 50-59F, 35% RH. This provides an estimated annual Time-Weighted Preservation Index (TWPI) of 214.

### **OPERATING CHANGES FOR FY2015 (TO JUNE 30, 2015)**

Over the next three months (summer 2014), ReCAP will make plans close off Module 9 using the overhead doors between Modules 8 and 9, and adjust its set points to minimize energy consumption and wear on the mechanical systems. This is projected to reduce our cooling degree days for Module 9 by 50% over the course of FY15.

Starting July 1, 2014, ReCAP switched from a 24/7 operating schedule to an occupied/unoccupied schedule. We estimate that these changes will save approximately 1,000 cooling and heating degree days over the course of the year, a 15-25% reduction, at a TWPI that meets or exceeds current operations. This will give us a total of four sets of operations over the year, and the following are currently in discussion with preservation staff, facilities, and engineering:

<b>Summer (June – Sept)</b>			
Occupied Hours	Monday through Friday, 7AM to 7PM	Modules	60F / 35% RH
		Process Center and Offices	Cool to 72F
Unoccupied Hours	Mon – Fri, 7PM to 7AM; Sat – Sun, All day	Modules	55F / 35% RH
		Process Center and Offices	Cool to 76F
<b>Winter (Oct – May)</b>			
Occupied Hours	Monday through Friday, 7AM to 7PM	Modules	50F / 35% RH
		Process Center and Offices	Heat to 68F; Cool to 74F
Unoccupied Hours	Mon – Fri, 7PM to 7AM; Sat – Sun, All day	Modules	45F / 35% RH
		Process Center and Offices	Heat to 60F; Cool to 76F

## **FUTURE OPTIMIZATIONS AND EQUIPMENT UPGRADES**

Data from our building automation system (BAS), power meters, and standalone environmental loggers will be collected during FY15 to guide further optimizations.

On theoretical grounds, an algorithm for ideal optimization would use data on dew point, hours of occupancy, kwh costs, and TWPI targets to compute settings on a constant basis. In practice, mechanical systems and BAS would have to be substantially redesigned to allow this type of operation.

ReCAP's major maintenance projections forecast replacement of the mechanical systems in Modules 1 and 2 in the next 1-3 years, with modules 3 and 4 soon after. We will work without our suppliers and support team to specify new and replacement control and mechanical systems that will allow the greatest flexibility in optimizing our environment.

## **TWPI AND PRESERVATION METRICS**

Temperature and relative humidity alone are poor indicators of performance in preservation environments. Going forward, ReCAP will accompany its reports on preservation environments with Time-Weighted Preservation Index numbers (TWPI), to facilitate like-to-like comparisons between environments. TWPI was developed by the Image Permanence Institute to assign a rate value to changing environmental conditions, so that the lifespan of materials in different environment could be compared in a meaningful way.

TWPI numbers are given in relative years, so that a TWPI 50 is read as "in this environment, it will take 50 years for 50 years of aging will occur", while a TWPI of 100 is read as "in this environment, it will take 100 years for 50 years of aging will occur", making TWPI 100 twice as good as TWPI 50.

The critical research finding that supports the TWPI model is that cycling of environments causes no additional decay in and of itself.<sup>1</sup> This finding allows ReCAP to take greater advantage of low dew point conditions for free-cooling and dehumidification, while also allowing periods of higher temperature and/or humidity, to reduce energy consumption during high-demand seasons and peak hours. TWPI assesses the cumulative and ongoing impact of conditions. Any reduction in energy use that has a neutral or positive impact on TWPI can be considered for ReCAP's operations.

Additional information about IPI's work is available at:

<https://www.imagepermanenceinstitute.org/environmental/research>

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<sup>1</sup> Rapid, dramatic cycling of conditions can cause mechanical damage, such as planar distortion or micro-cracking, but this concern largely pertains to uncontrolled environments or HVAC system failures, and to media types that are not common in ReCAP, such as lacquers or painted surfaces. In practice, we would (and should) provide protective enclosures to buffer against these changes when they are a concern for specific items. For the majority of materials, the cycling described in this memo is well within their safe tolerances and risk is further mitigated by the close packing of collections, which reduces the actual rate of change experienced by the materials in storage.