ATLAS
MATERIAL TESTING SOLUTIONS

How Many Hours In a Weather-Ometer® = 1 Year Florida or Arizona?

This question is often asked. Simple answers are full of pitfalls, and there is no general formula that can be used to correlate a Xenon-Arc Weather-Ometer® exposure to a natural exposure. All materials do not react the same to laboratory accelerated weathering exposures and/or conventional outdoor weathering tests. In addition, weather is ever changing and can never be assumed to be constant from year to year.

Correlation from laboratory accelerated to conventional outdoor exposures can be determined by performing both types of tests and comparing the degradation, providing that good test design and sound statistical methods are used.

Sometimes though, a quick answer is necessary and time may not permit a complete comparative study or simply may not be necessary. The answer can be material dependent and can vary with the type of arc lamp used for the test. One way to answer this question is to compare the total dosage of UV for one year in Florida or Arizona to the equivalent dosage produced in a Weather-Ometer®.

WARNING

This comparison is based on ultraviolet dosage only and does not take all other factors involved in weathering into consideration. In addition, this comparison may not be valid for light sources which do not accurately simulate natural sunlight throughout the ultraviolet and visible spectrums. Carbon-Arc and Fluorescent Sun Lamps fall into this category. Therefore, this comparison is only valid for the Xenon-Arc Lamp, whose spectral distribution curve is the closest representation to natural sunlight currently available in accelerated artificial light source weathering equipment.

What is the total amount of direct UV dosage as measured in the 295-385 nm bandpass?

Florida	**26° facing South (site latitude)**	**280 MJ/m²/year**
Arizona	**34° facing South (site latitude)**	**333 MJ/m²/year**

Most Atlas Weather-Ometers® measure and control irradiance at 340 nm using a narrow band filter. Energy at 340 nm is approximately 1.1% of the energy integrated in the total ultraviolet spectrum of 295-385 nm (TUVR).

1.1% of 280 MJ/m² TUVR = 3080 KJ/m² @ 340 nm ≈ 1 Year in Florida.
1.1% of 333 MJ/m² TUVR = 3663 KJ/m² @ 340 nm ≈ 1 Year in Arizona.

Note: Actual 340 nm measurements at Miami, Florida using an Atlas LM-3A: 3000 ± 300 KJ per year.

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Given that **Light Hours** $= \dfrac{\textbf{Kilojoules}}{\textbf{Irradiance} \times \textbf{3.6 Kiloseconds/Hour}}$

Example:

$$\text{Light Hours (Florida)} = \frac{3080\ \text{KJ}}{55\ \text{W/m}^2\ (@\ 340\ \text{nm.}) \times 3.6\ \text{Kiloseconds/Hour}}$$

Therefore:

1 Year in Florida (3080 KJ @ 340 nm.) ≈ 1556 Light Hours @ .55 $\mathbf{W/m^2}$ @ 340 nm.

1 Year in Arizona (3663 KJ @ 340 nm.) ≈ 1850 Light Hours @ .55 $\mathbf{W/m^2}$ @ 340 nm.

Double the Irradiance Cuts the Light Hours in Half.

If the test program includes a dark cycle you must determine the total test time including the dark cycles.

$$\textbf{Percentage of Light to Total Cycle Time} = \frac{\textbf{Light Hours per Cycle}}{\textbf{Total Cycle Time}}$$

and

$$\textbf{Total Hours in Weather-Ometer®} = \frac{\textbf{Light Hours}}{\textbf{Percentage of Light to Total Cycle Time}}$$

Example:

SAE J1960: 2 Hours Light, 1 Hour Dark per Cycle ⇒ Total Cycle Time = 3 Hours

$$\text{Percentage of Light to Total Cycle Time for SAE J1960} = \frac{2\ \text{Light Hours}}{[illegible]} = .66$$

$$\text{Total Hours in Weather-Ometer® (FL)} = \frac{1556\ \text{Light Hours}}{.66}$$

Therefore:

1 Year in Florida (3080 KJ @ 340 nm.) ≈ 2358 Total Hours in a Weather-Ometer® (SAE J1960).

1 Year in Arizona (3663 KJ @ 340 nm.) ≈ 2803 Total Hours in a Weather-Ometer® (SAE J1960).