



Standard Guide for Use of Lighting in Laboratory Testing¹

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1. Scope

1.1 The use of artificial lighting is often required to study the responses of living organisms to contaminants in a controlled manner. Even if the test organism does not require light, the investigator will generally need light to manipulate the samples, and the test might be conducted under the ambient light of the laboratory. One will need to consider not only whether the particular test organism requires light for growth, but also whether the environmental compartment relevant to the test is exposed to light and, if so, what the attributes of light are in that compartment. The light could affect growth of the organism or toxicity of a contaminant, or both. For instance, it has been shown that the toxicity of some organic pollutants is enhanced dramatically by the ultraviolet (UV) radiation present in sunlight (1, 2).² Furthermore, the level of ambient lighting in the laboratory (which might affect the test) is not standardized, nor is it comparable to natural environments. It is thus important to consider lighting in all forms of environmental testing. When light is used in the test, one should determine whether the spectral distribution of the radiation source mimics sunlight adequately to be considered environmentally relevant. Also, the container or vessel for the experiment must be transparent, at the point of light entry, to all of the spectral regions in the light source needed for the test.

1.2 It is possible to simulate sunlight with respect to the visible:UV ratio with relatively inexpensive equipment. This guide contains information on the types of artificial light sources that are commonly used in the laboratory, compositions of light sources that mimic the biologically relevant spectral range of sunlight, quantification of irradiance levels of the light sources, determination of spectral outputs of the light sources, transmittance properties of materials used for laboratory containers, calculation of biologically effective radiation, and considerations that should go into designing a relevant light source for a given test.

1.3 Special needs or circumstances will dictate how a given light source is constructed. This is based on the requirements of

the test and the environmental compartment to which it is targeted. Using appropriate conditions is most important for any experiment, and it is desirable to standardize these conditions among laboratories. In extreme cases, tests using unusual lighting conditions might render a data set incomparable to other tests.

1.4 The lighting conditions described herein are applicable to tests with most organisms and using most chemicals. With appropriate modifications, these light sources can be used under most laboratory conditions with many types of laboratory vessels.

1.5 The attributes of the light source used in a given study should list the types of lamps used, any screening materials, the light level as an energy fluence rate (in W m^{-2}) or photon fluence rate (in $\mu\text{mol m}^{-2} \text{s}^{-1}$), and the transmission properties of the vessels used to hold the test organism(s). If it is relevant to the outcome of a test, the spectral quality of the light source should be measured with a spectroradiometer and the emission spectrum provided graphically for reference.

1.6 The sections of this guide are arranged as follows:

Title	Section
Referenced Documents	2
Terminology	3
Summary of Guide	4
Significance and Use	5
Safety Precautions	6
Lamps	7
Artificial Lighting	7.1
Light Sources	7.2
Construction of Artificial Light Sources that Mimic Sunlight	8
Sunlight	8.2
Visible Light	8.2
Visible Light Plus UV-B Radiation	8.3
Simulated Solar Radiation	8.4
Transmission Properties of Lamp Coverings and Laboratory Vessels	9
Lamp Coverings	9.2
Laboratory Vessels	9.3
Measurement of Light	10
Light Components	10.1
Measurement of Light Quantity	10.2
Spectroradiometry	10.3
Biologically Effective Radiation	11
Considerations for Designing Light Sources for Environmental Testing	12

1.7 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.8 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the*

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² The boldface numbers in parentheses refer to the list of references at the end of this guide.