National Institute of Standards and Technology
U.S. Department of Commerce

UVC Standards – Physical and Documentary

C. Cameron Miller, Toni Litorja, Thomas Larason,
Yuqin Zong & many others

NIST, Sensor Science Division

Discharge Lamps

Low pressure mercury
Medium pressure mercury
Xenon and pulsed xenon
Excimer lamps

Method for the Measurement of the Output of Monochromatic (254 nm) Low-Pressure UV Lamps#

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Illuminating Engineering Society

IES LM-9-09/R17

Approved Method: **Electrical and Photometric Measurement of Fluorescent Lamps**

Illuminating Engineering Society

IES LM-78-17

Approved Method **Total Flux Measurement of Lamps Using an Integrating Sphere**

LM-75-19 – IES Guide to Goniometer Measurements, Types, and Photometric Coordinate Systems

Measurement quantities:

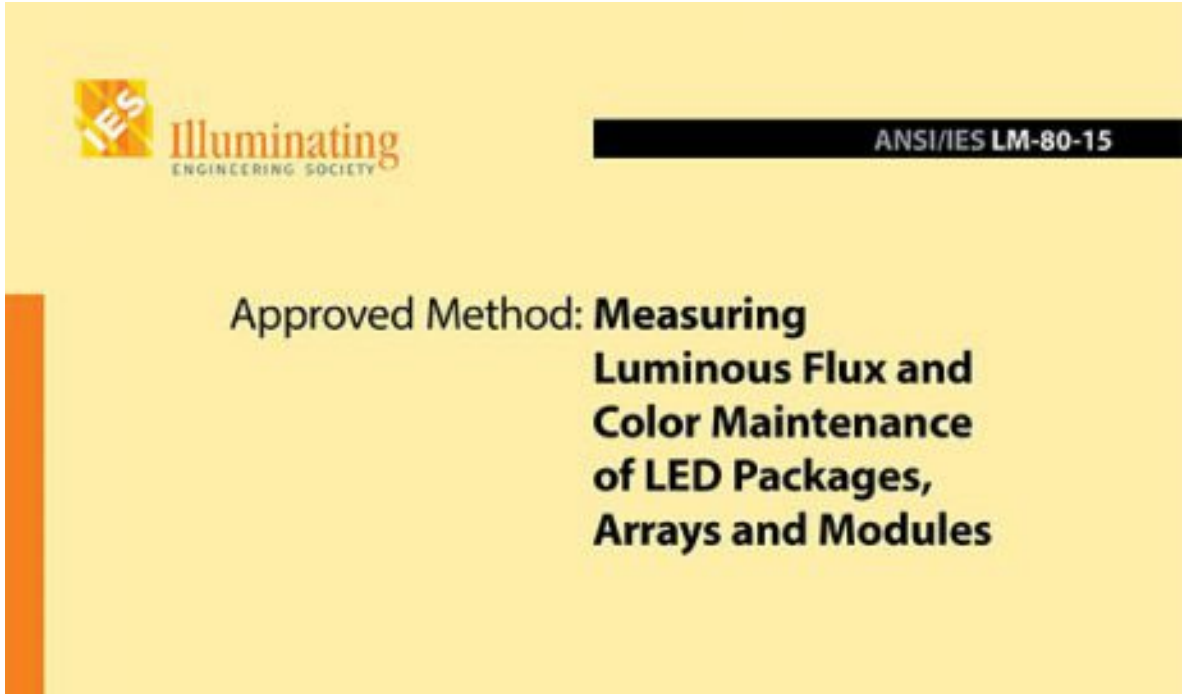
Total radiant flux (W) or (W/nm)

Radiant intensity distribution (W/sr)

Electrical power (W)

LED Chips and Arrays

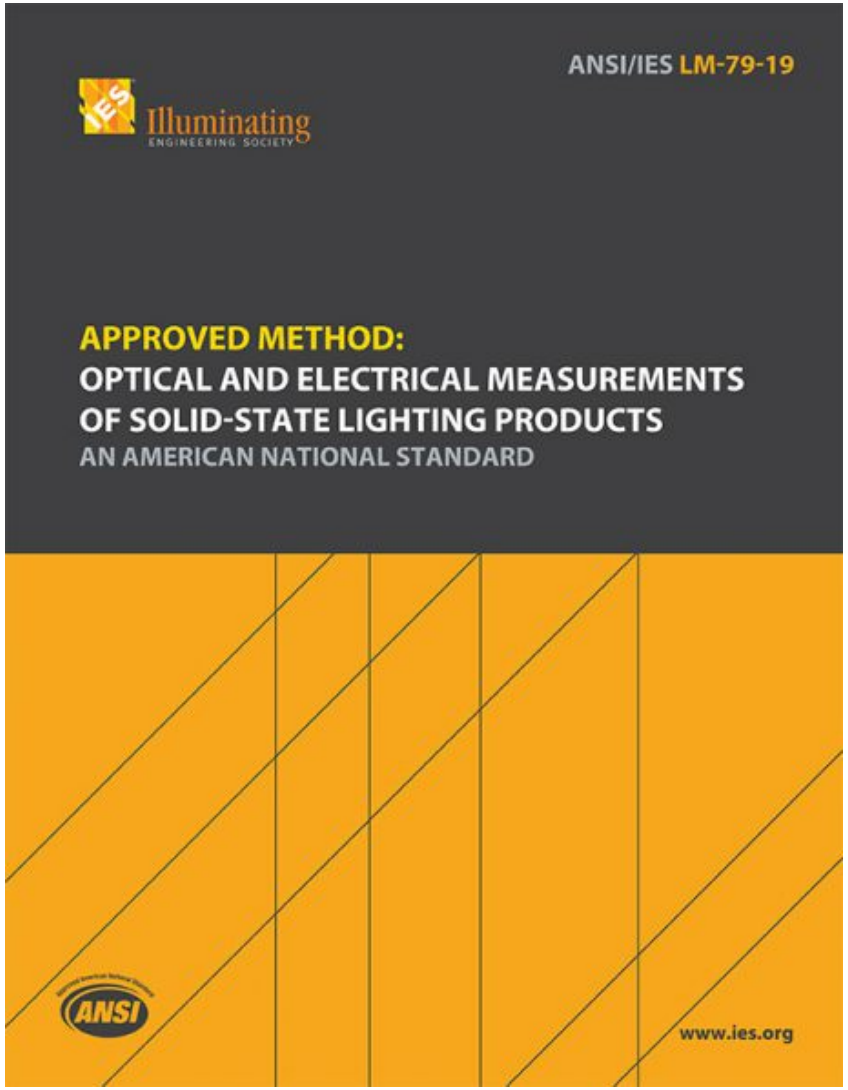
Leverage existing standards
Extension of existing infrastructure



Electrical and Optical
Radiant power maintenance

Complete UV Devices

Leverage existing standards
Extension of existing infrastructure



UV Device Irradiance

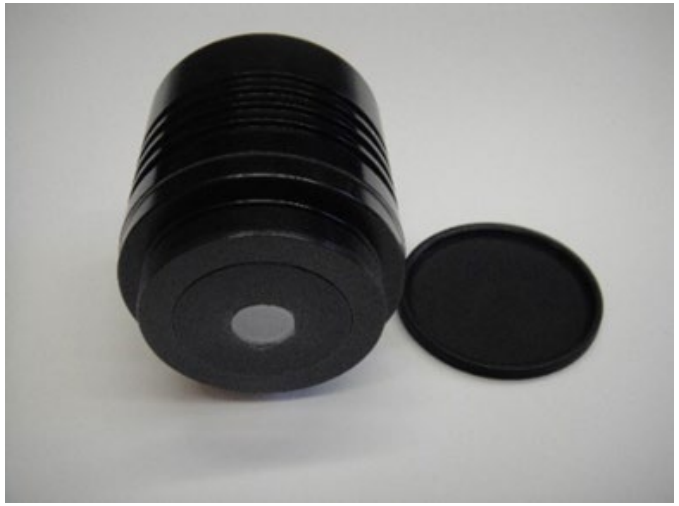
IES/TPC Project C303-16 - Application Distance Radiometry

This document describes the method for measuring illuminance, irradiance, and/or photon irradiance (i.e., photon flux density) at multiple points on a plane at a specific application distance.

Physical Standards from NIST

Wavelength (nm)	Expanded Uncertainty (*k*=2) %
200	1.07
250	0.95
300	0.97
350	0.99
400	1.04

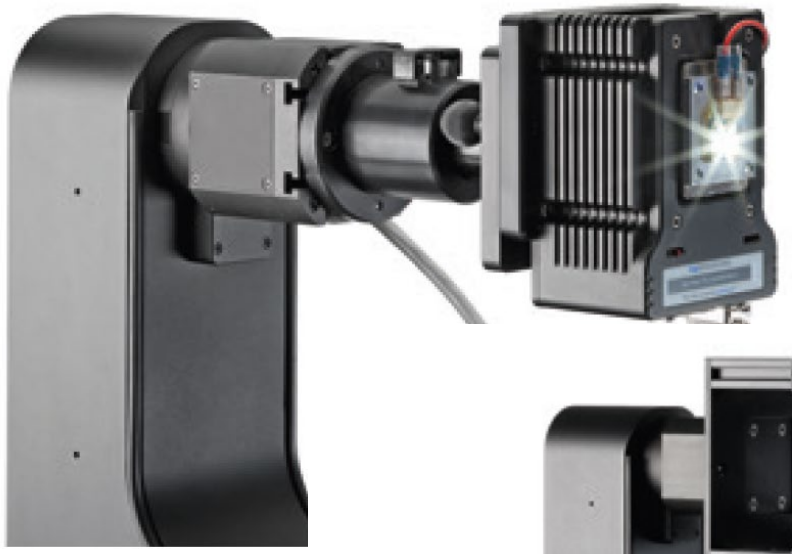
Wavelength (nm)	Expanded Uncertainty (k=2) %
250	1.74
350	1.27
450	0.91
555	0.77
900	0.57

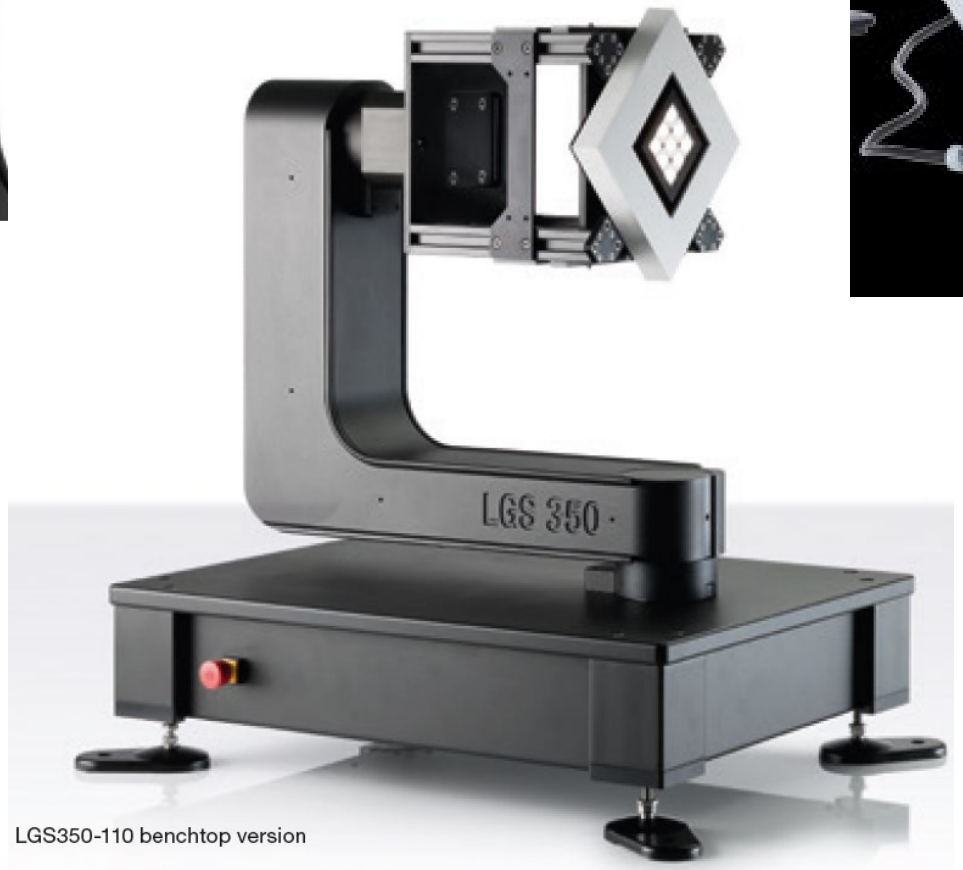


Wavelength (nm)	Expanded Uncertainty (k=2) %
200	4.7
250	1.8
300	1.0
350	0.82
400	0.60

?

UVC Chip & Array Calibration Facility





LGS350-110 benchtop version

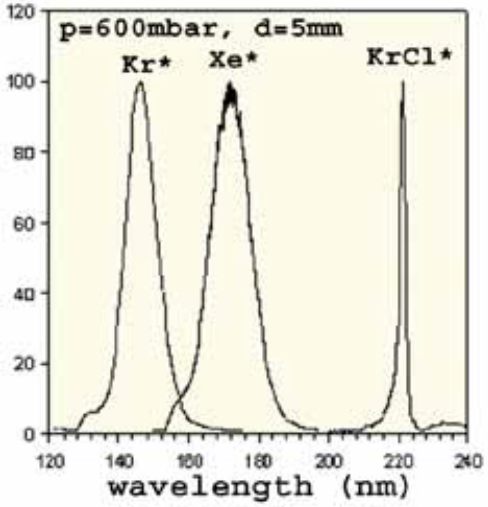
IES LM-85-14 “Approved Method: Electrical and Photometric Measurements of High-Power LEDs”

UVC Source Measurement Facility

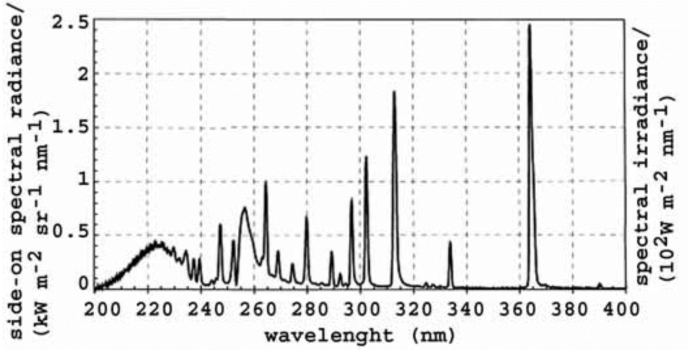
1.5 m sphere system coated with a PTFE film intended for UV water reactors

Spectroradiometer detection

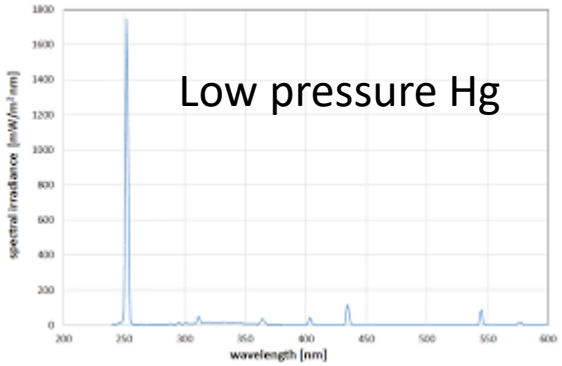
Sources and small products



Medium pressure Hg



Low pressure Hg

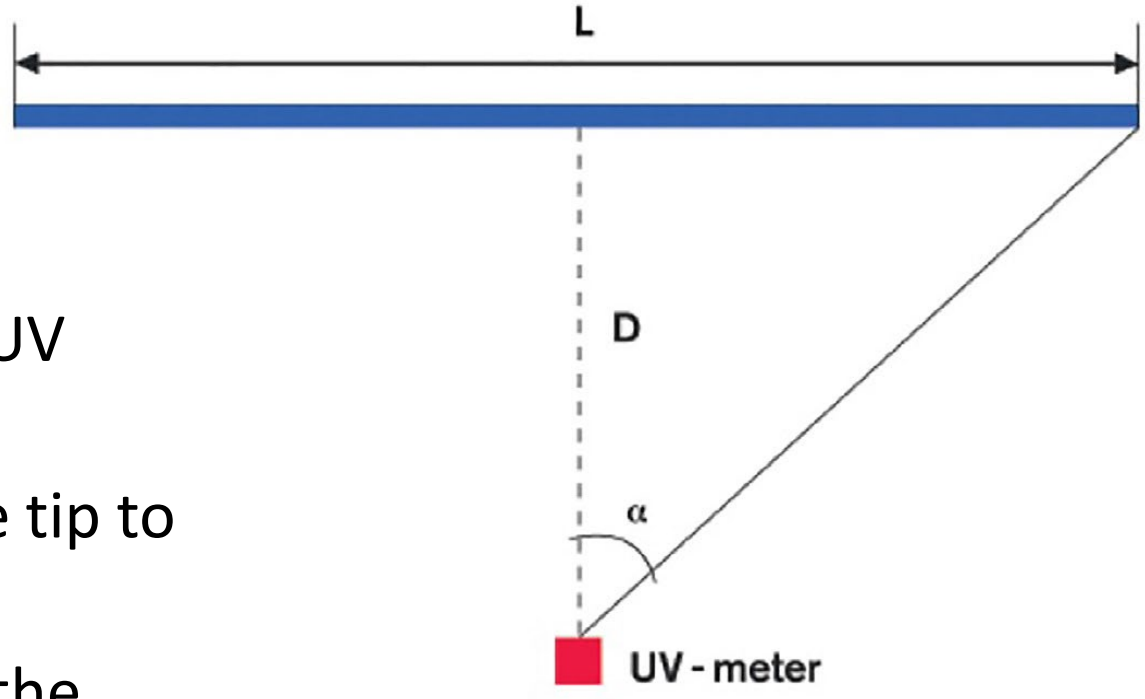


ArF*, KrCl*, KrF*, XeBr*, XeCl*, XeF*, emit at
193, 222, 248, 282, 308, 351 nm

NIST Research Comparing Methods

Keitz Formula (1971)

$$P = \frac{E 2\pi^2 DL}{2\alpha + \sin 2\alpha}$$



E is measured irradiance ($W \cdot m^{-2}$)

D is distance (m) from lamp center to the UV sensor.

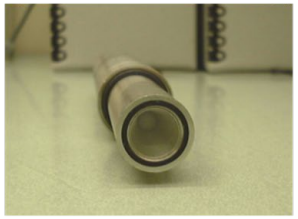
L is the lamp arc length (m) from electrode tip to electrode tip.

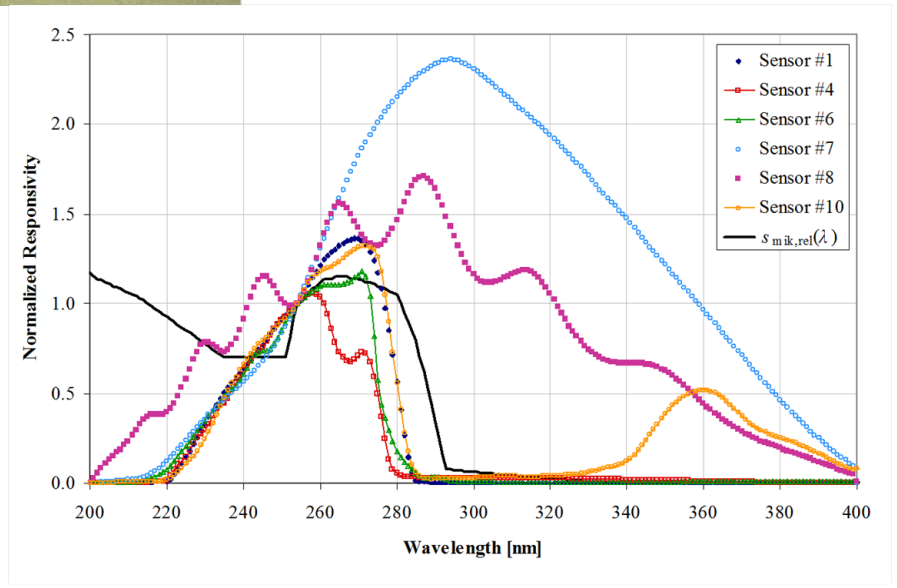
α is the half angle (radians) subtended by the lamp at the sensor position. That is, $\tan \alpha = L/(2D)$

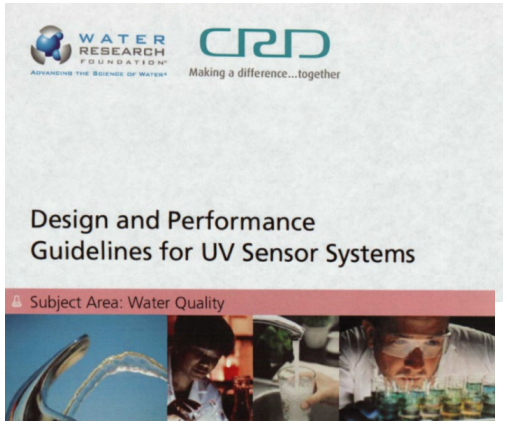
UVC Detector Measurement Facility

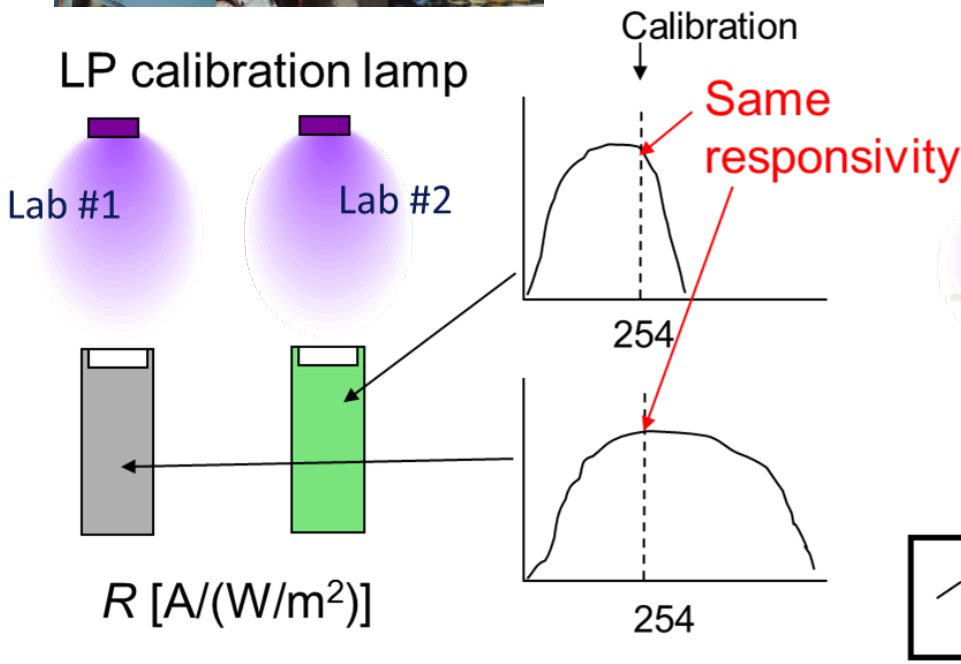


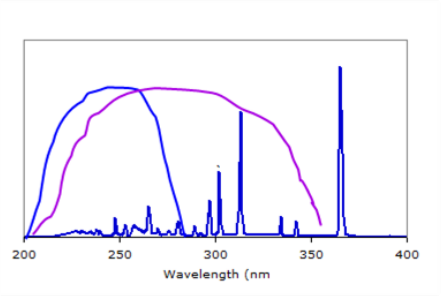


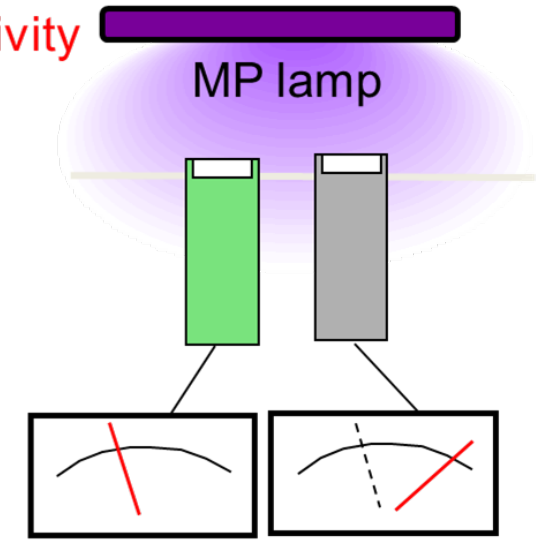






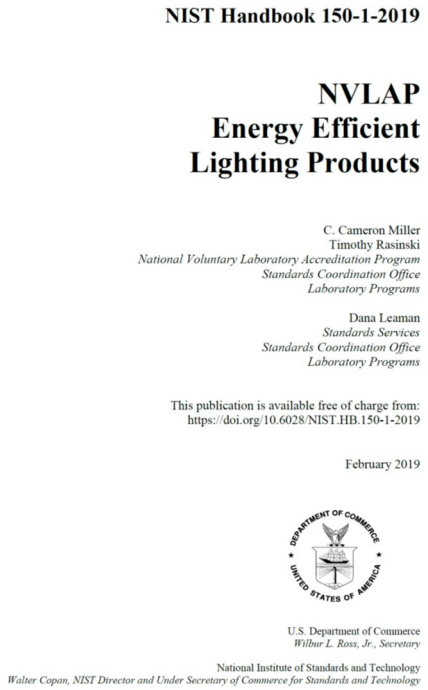




NIST Accreditation & Proficiency Testing

Leverage previous experience

- National Voluntary Laboratory Accreditation Program (NVLAP)
  - NIST Measurement Assurance Program (MAP)
    - MAP 1: 118 Laboratories worldwide
      Jan 2010 – Dec 2014
    - MAP 2: 128 Laboratories worldwide
      Jan 2015 – Dec 2020



NIST Handbook 150-1-2019

NVLAP
Energy Efficient
Lighting Products

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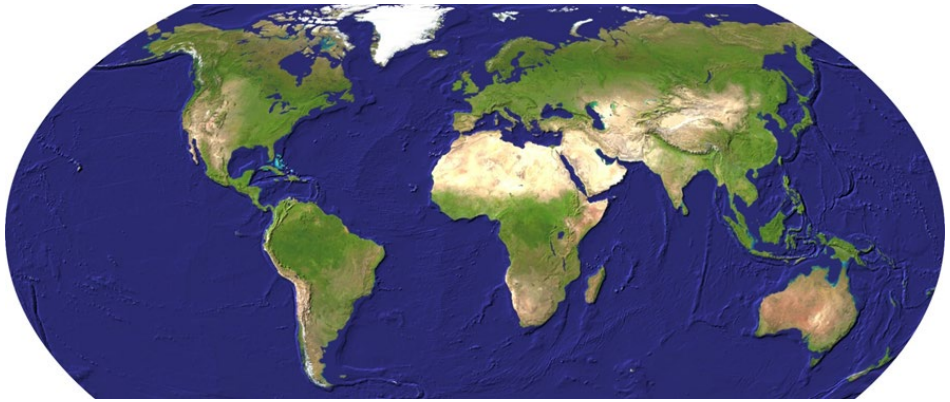
Wilbur L. Ross, Jr., Secretary

National Institute of Standards and Technology
Walter Copan, NIST Director and Under Secretary of Commerce for Standards and Technology



Summary

Memorandum of Understanding

- International Ultraviolet Association (IUVA)
- Illuminating Engineering Society (IES)

Four documentary standard topics

- Total radiant flux and radiant intensity distribution measurement of discharge sources;
- Total radiant flux and radiant intensity distribution measurement of LED chips and arrays;
- Total radiant flux and radiant intensity distribution of complete UV devices; and
- Application distance radiometry of UVC devices

NIST continues to improve infrastructure to support documentary standard development