

SELECTING A SPECTRUM OF LIGHT TO REDUCE RISK TO MUSEUM COLLECTIONS




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Justifiable Damage

MAKE EVERY PHOTON COUNT!



WHY STUFF GETS DAMAGED BY LIGHT

- 1) Light Sensitivity of Material.
- 2) Intensity of light, IR & UV.
- 3) Duration of exposure to light.
- 4) Spectrum of lighting source (SPD)

200 Lux

Low sensitivity objects to light



- ❖ DURABLE OIL AND ACRYLIC PAINTINGS

Just Noticeable Fade = 75 – 1,500 years

Total Fade = 2000 – 50,000 years

50 Lux

Very light sensitive objects

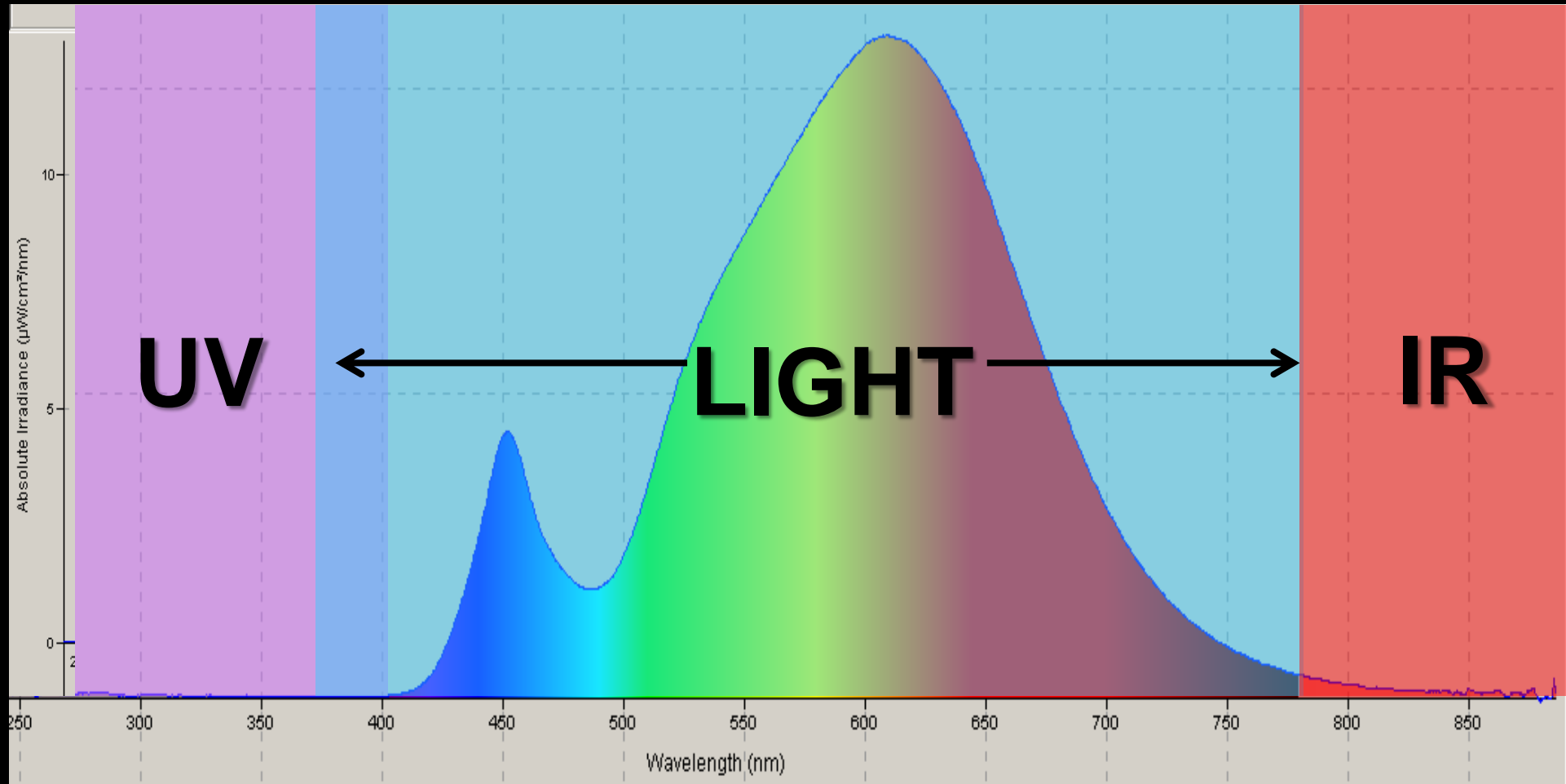


- ❖ TEXTILES
- ❖ WATERCOLORS
- ❖ WOOD
- ❖ COLOR PRINTS

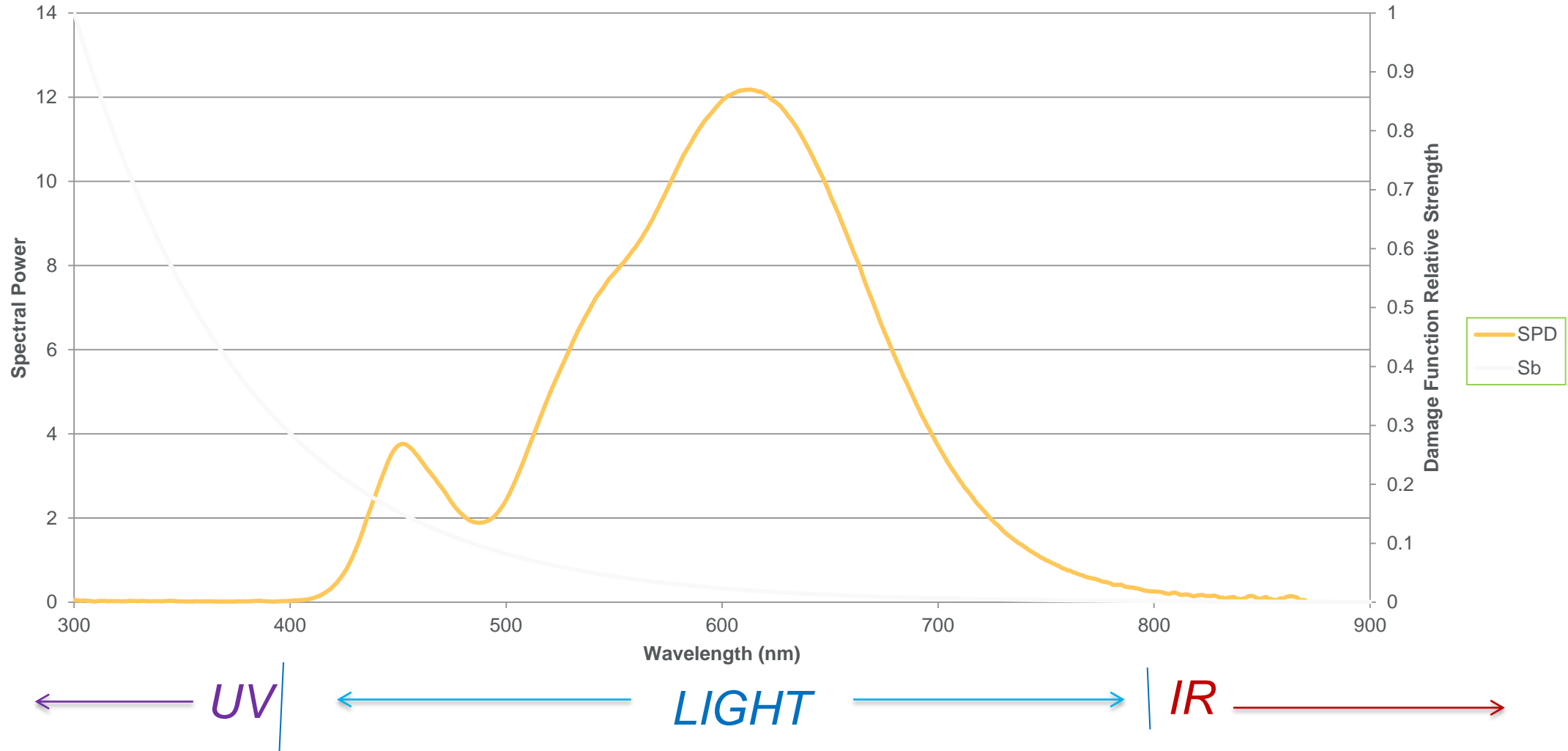
Just Noticeable Fade = 1.5 -20 years

Total Fade = 50-600 years

Assessing Light, UV and IR

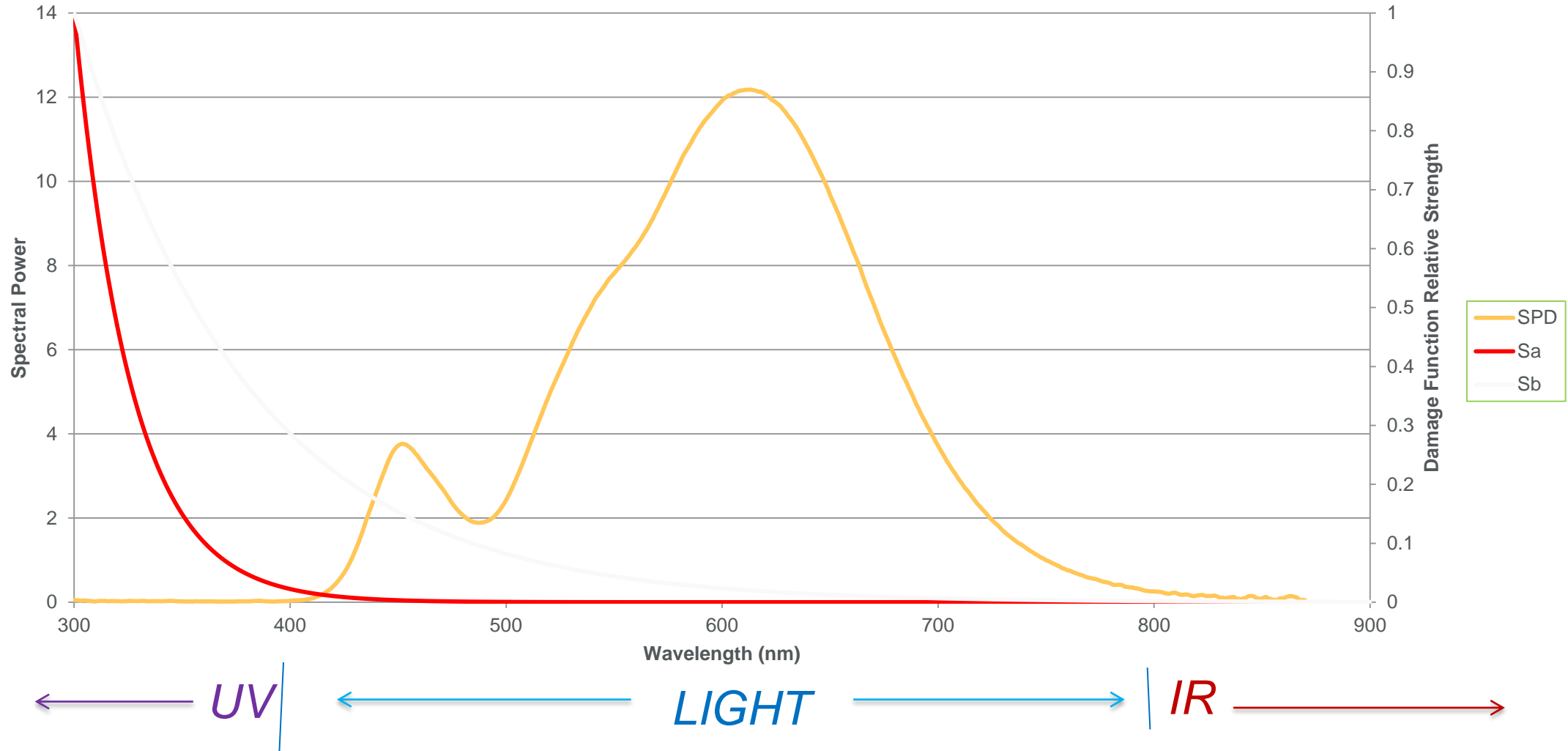


SPECTRAL DAMAGE FUNCTIONS (SDF)



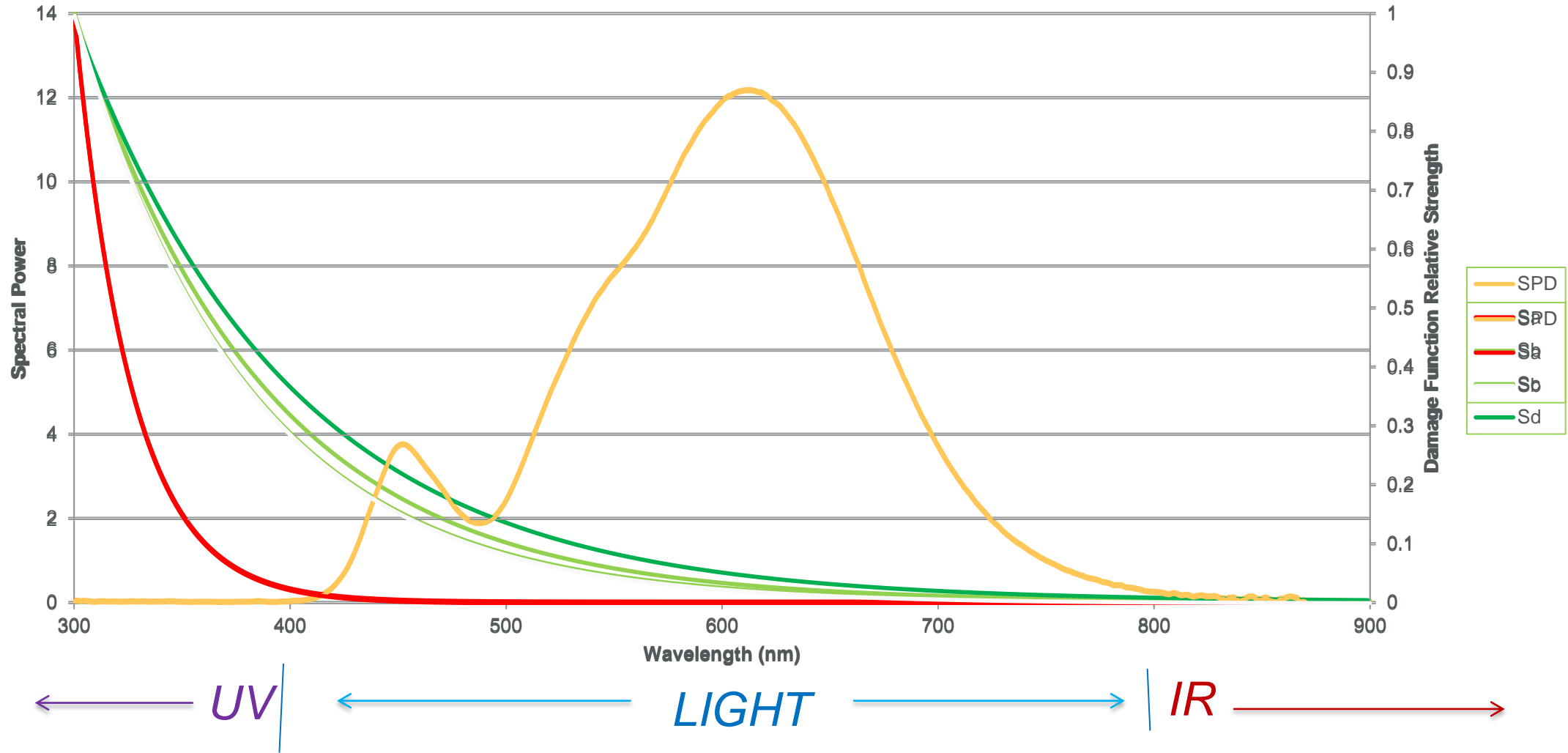
CIE:157:2004 "Control of Damage to Museum Objects by Optical Radiation"

SPECTRAL DAMAGE FUNCTIONS (SDF)



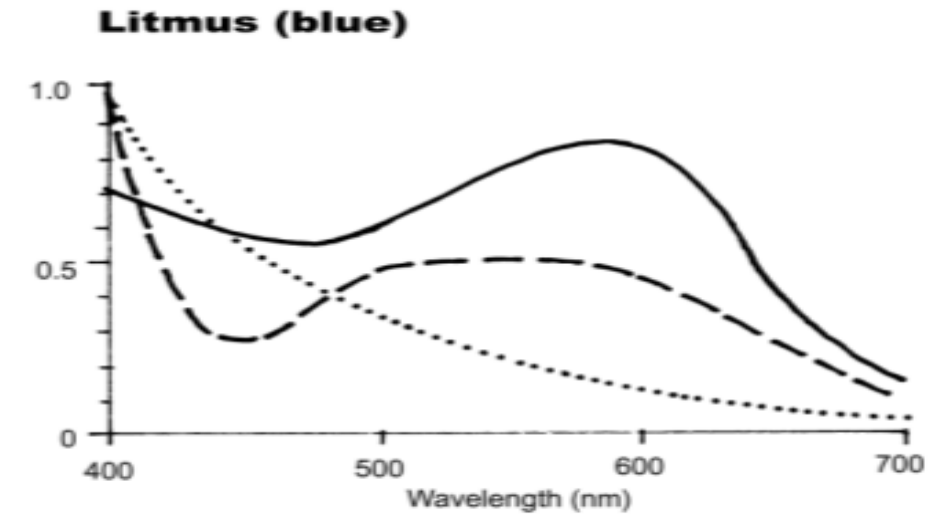
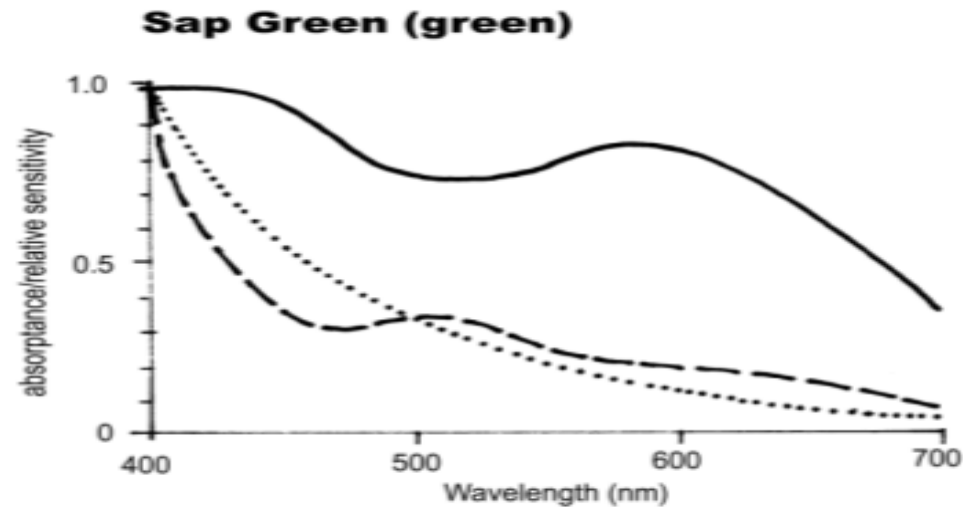
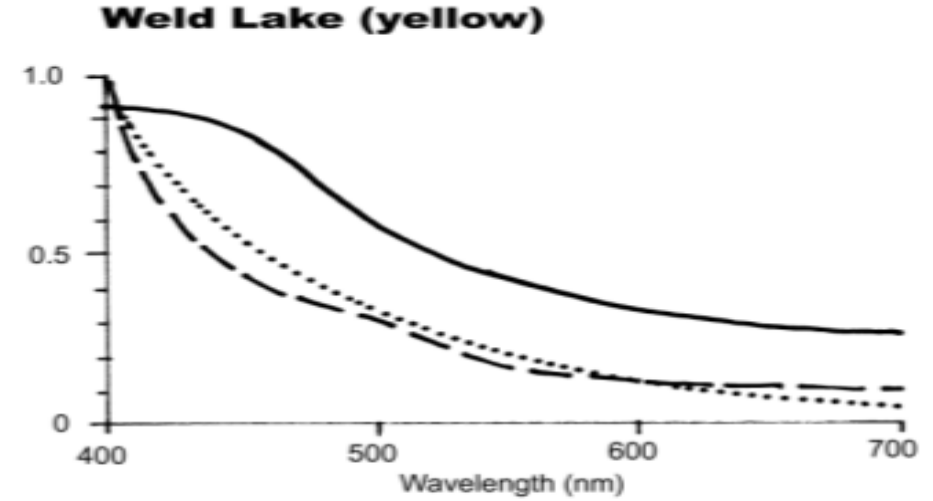
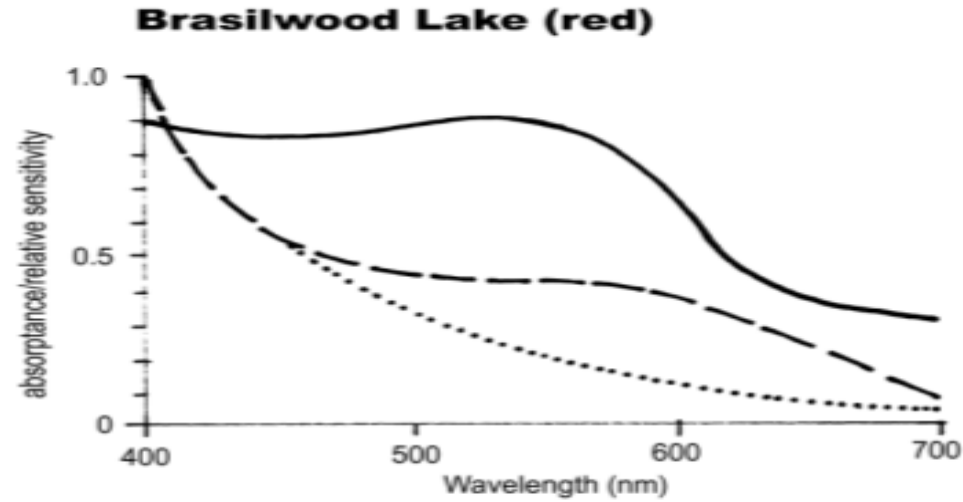
CIE:157:2004 "Control of Damage to Museum Objects by Optical Radiation"

SPECTRAL DAMAGE FUNCTIONS (SDF)



CIE:157:2004 "Control of Damage to Museum Objects by Optical Radiation"

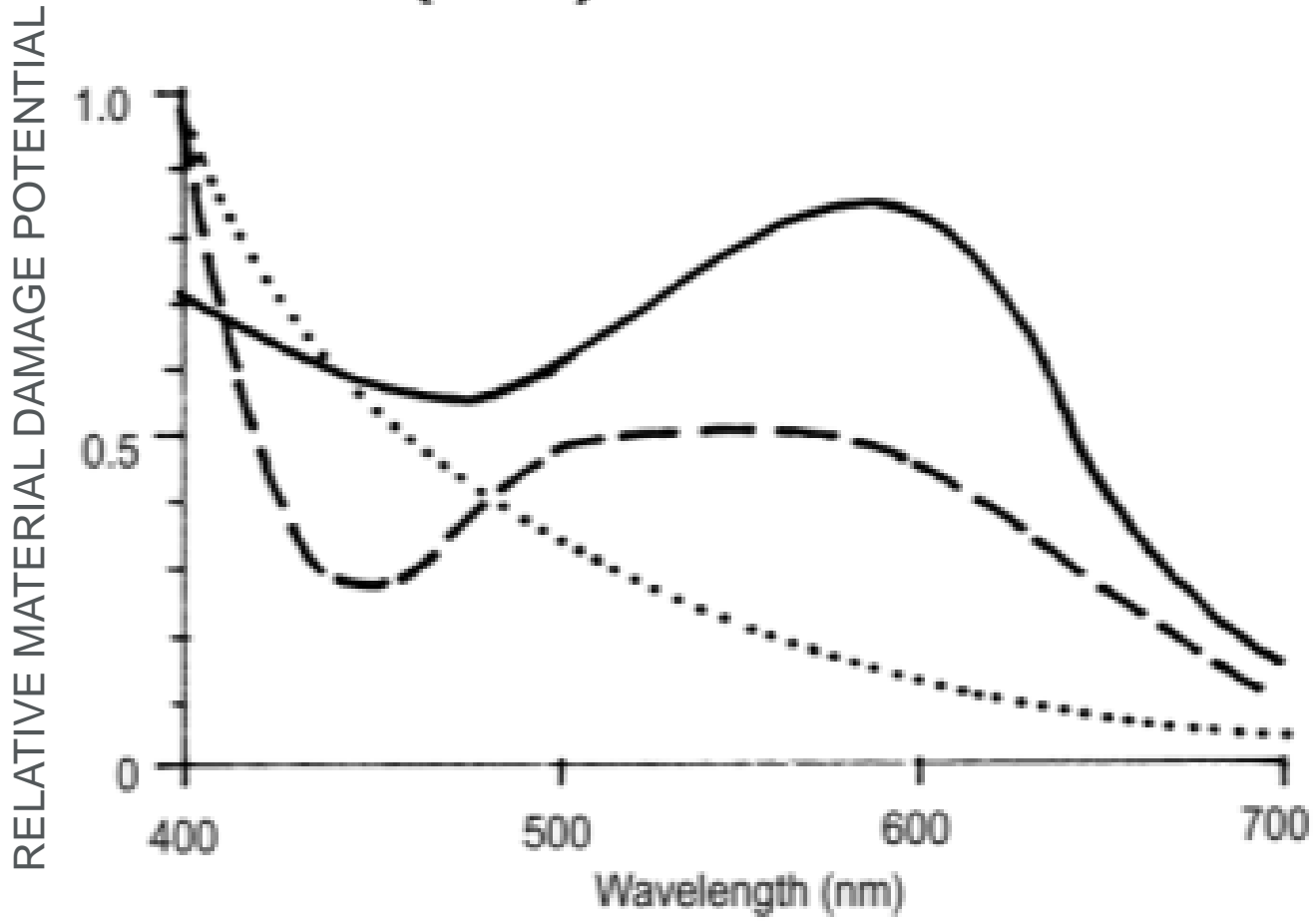
ACTION SPECTRA



CIE:157-2004: *The Control of Damage to Museum Objects by Optical Radiation*
(Cuttle and Ne'eman 1999, after Saunders and Kirby 1994.)

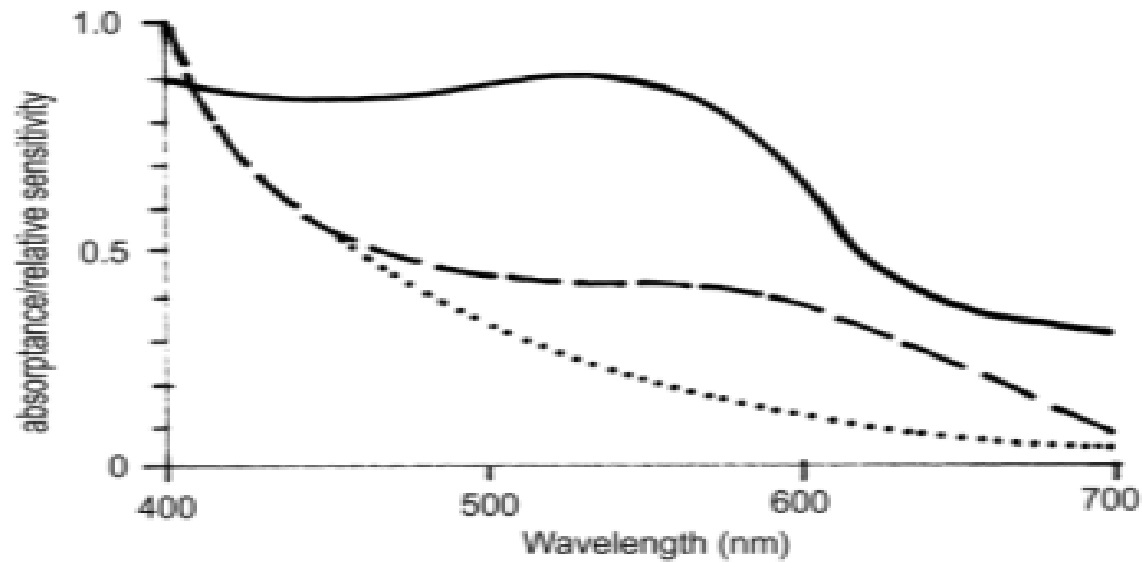
ACTION SPECTRA

Litmus (blue)

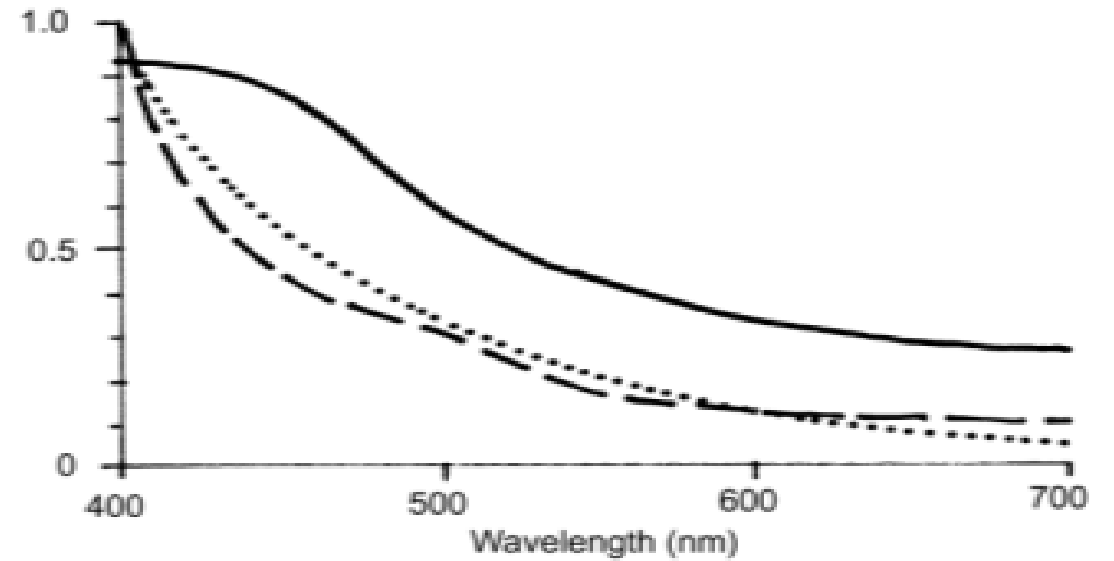


- ABSORBTANCE
- - - ACTION SPECTRA
- DAMAGE FUNCTION

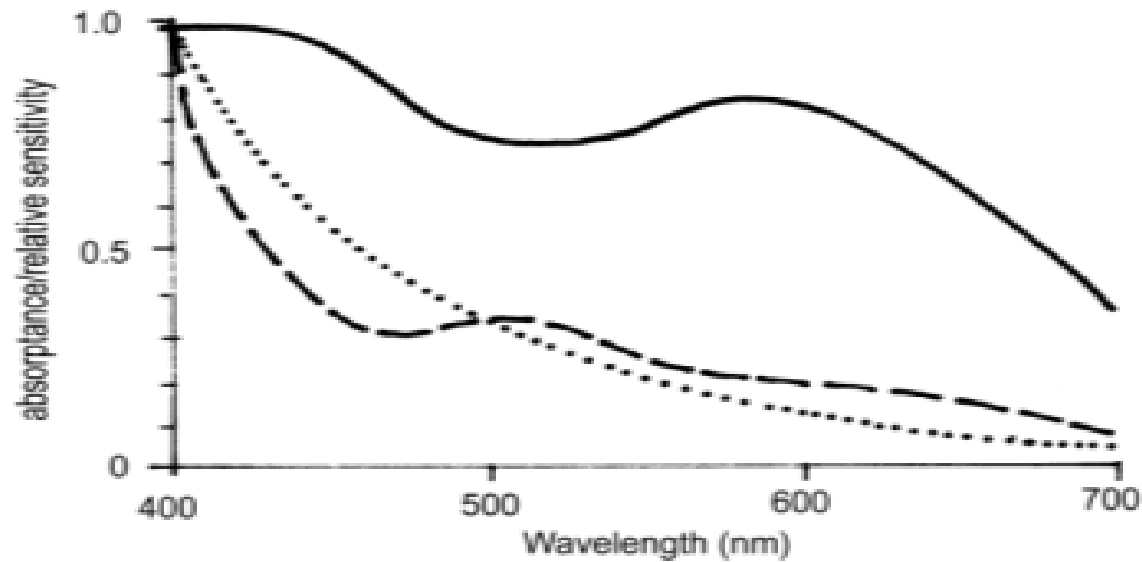
Brasilwood Lake (red)



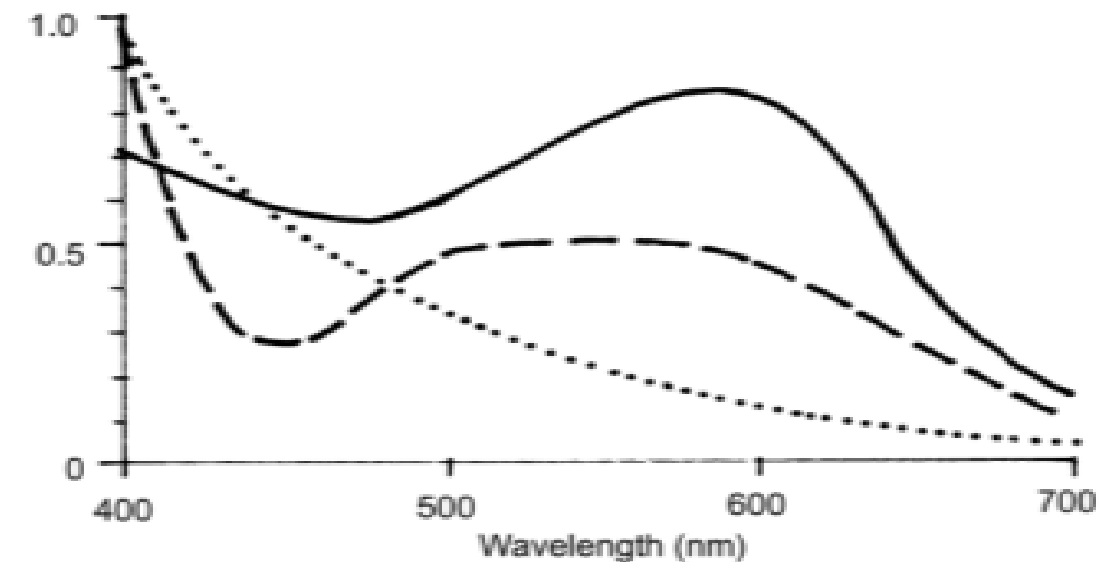
Weld Lake (yellow)



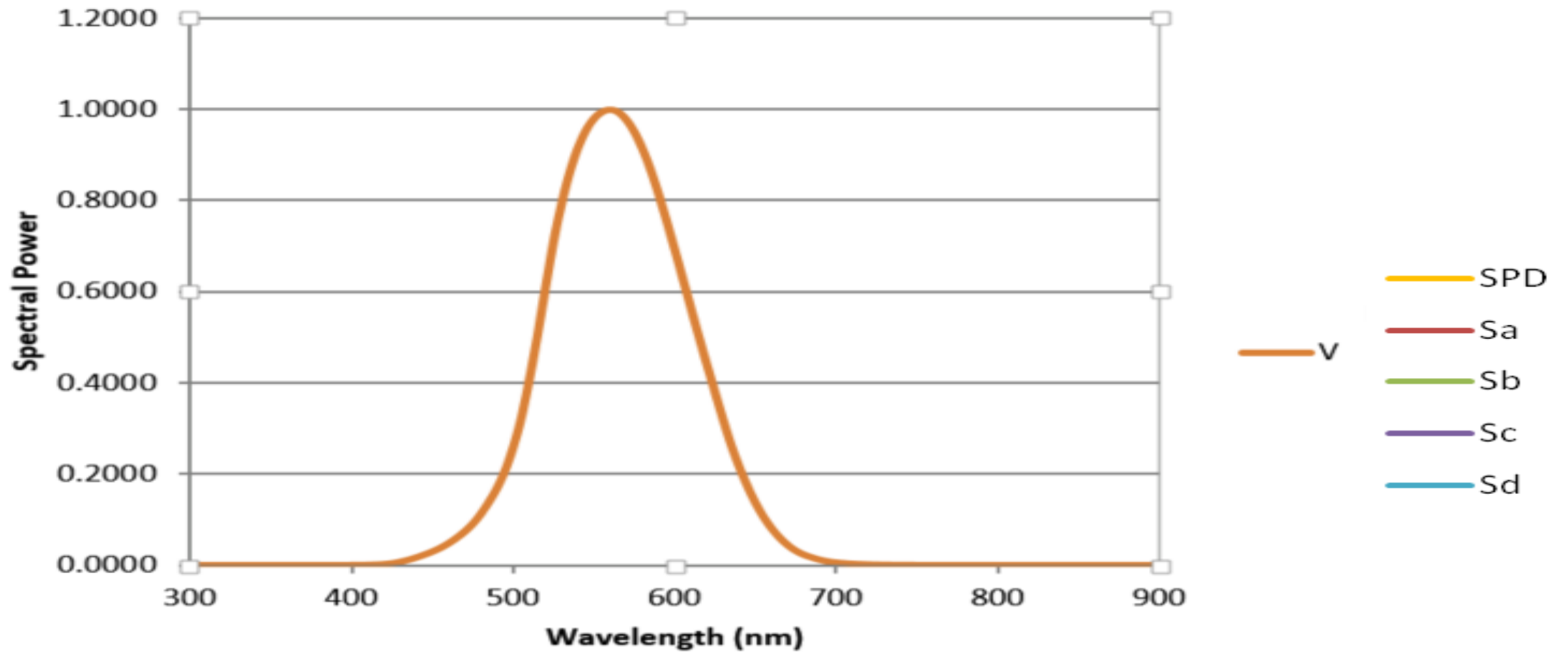
Sap Green (green)



Litmus (blue)



Luminosity Function



200 Lux

Low sensitivity objects to light



DURABLE
OIL AND
ACRYLIC
PAINTINGS

Just Noticeable Fade = 75 – 1,500 years

Total Fade = 2000 – 50,000 years

50 Lux

*Very and moderately
light sensitive objects*



- TEXTILES
- WATERCOLORS
- WOOD
- COLOR PHOTOGRAPHY

Just Noticeable Fade = 1.5 -20 years

Total Fade = 50-60,000 years

SDF 400-780nm

- **General**
- **Useful for assessing a lighting sources' damage potential to a group of objects (*not used to predict damage to specific objects*).**
- **Quaternary in importance after reducing illuminance, reducing duration of exposure and eliminating IR & UV**
- **Most useful for reducing damage potential of durable colors.**

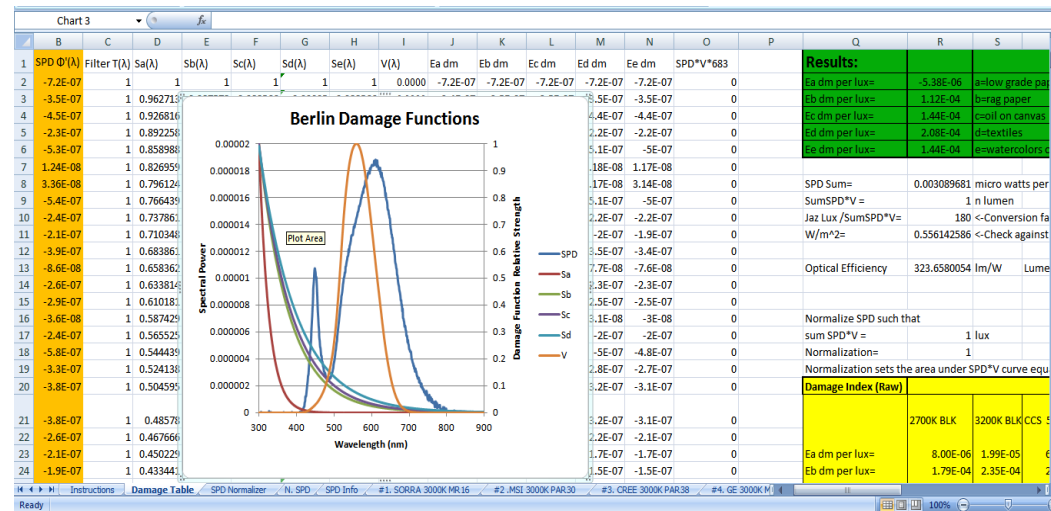
ACTION SPECTRUM

- **Specific**
- **Useful for predicting fading of specific objects.**
- **Requires spectroscopy to determine precisely what pigments and dyes are present.**
- **Not commonly used**

RESOURCES:

SDF SPREADSHEET BY MASAHIRO TOIYA, CCS LIGHTING AND SCOTT ROSENFELD, SMITHSONIAN INSTITUTION

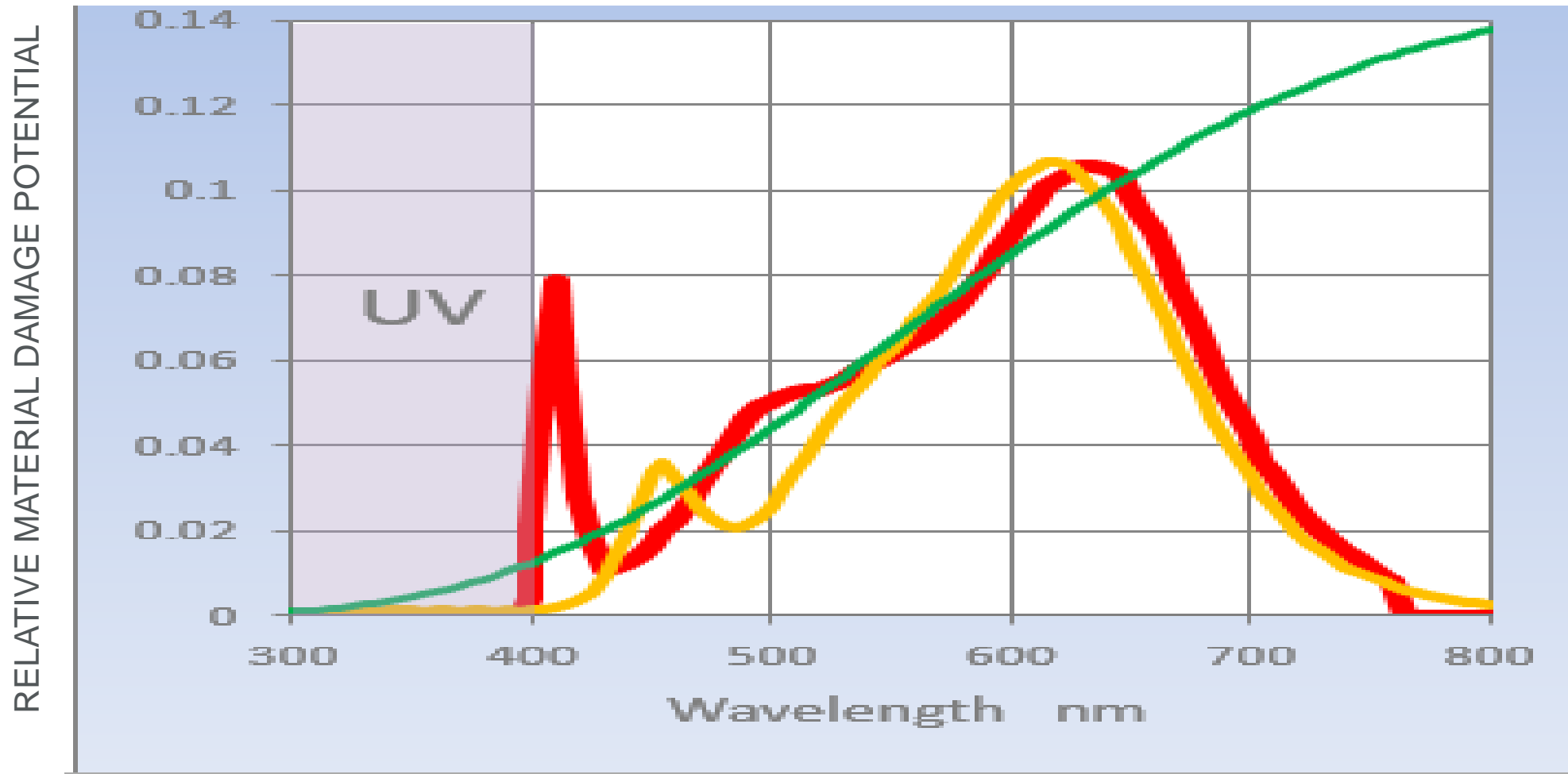
<http://tinyurl.com/museumlighting>



Joseph Padfield's website at the National Gallery UK

<http://research.nglondon.org.uk/scientific/spd/?page=home>

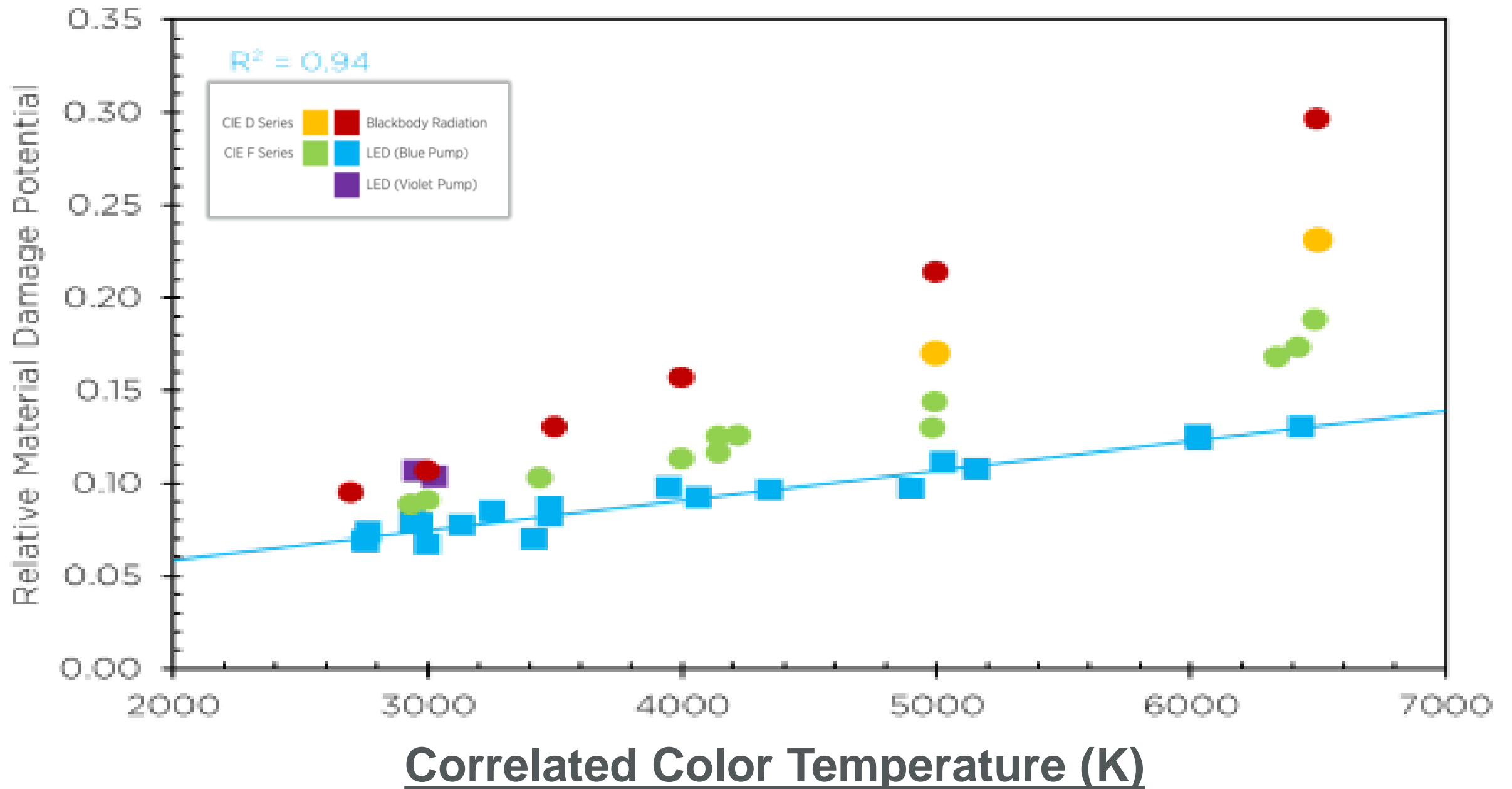
RELATIVE SPECTRAL DAMAGE FUNCTION



HALOGEN MR16 3K = 1

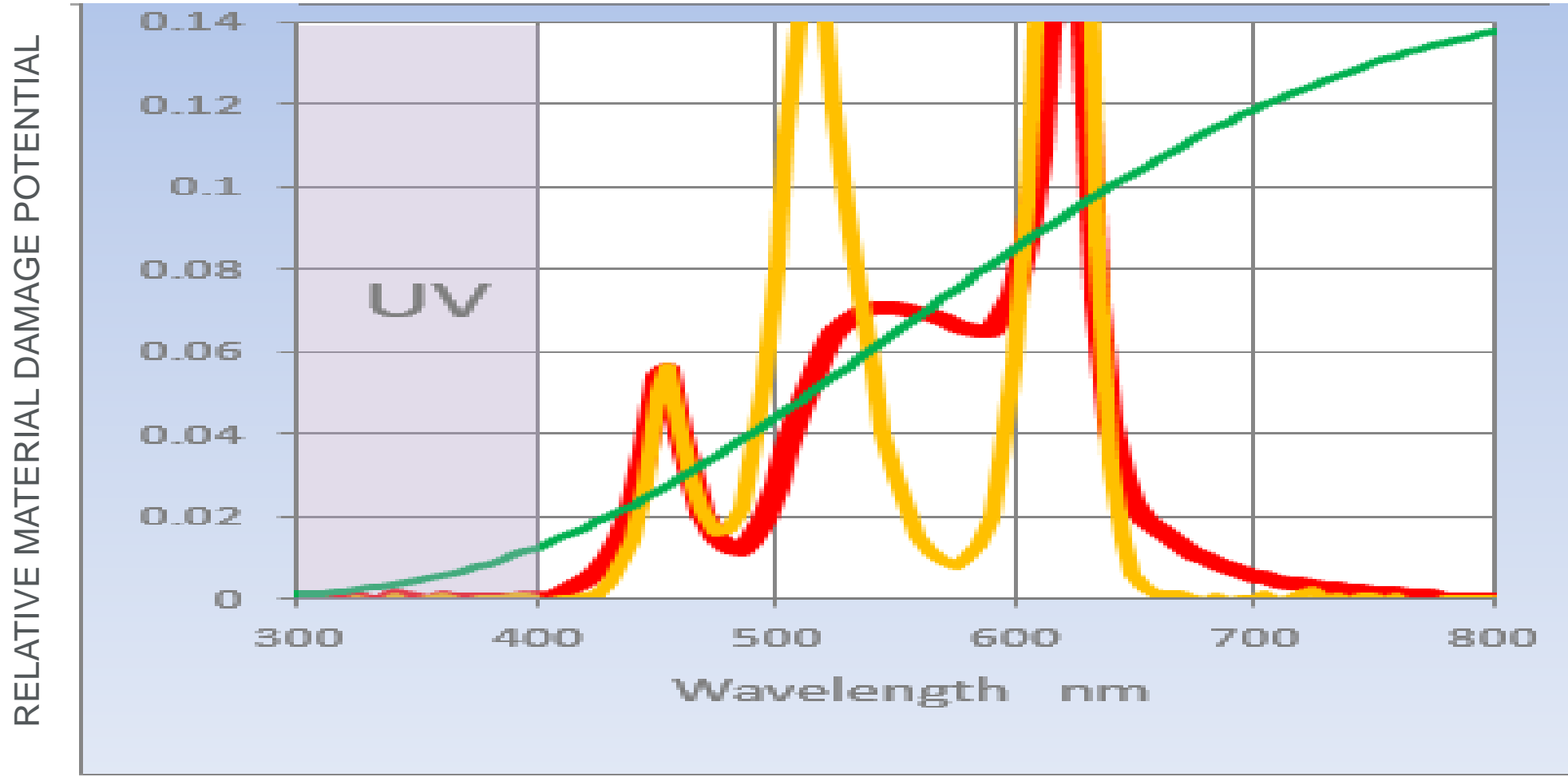
BLUE PUMP PHOSPHOR 3K/ 93CRI = .77

VIOLET PUMP PHOSPHOR 3K/ 97CRU = 1.3



Royer, Michael P. 2014. "TRUE COLORS: LEDS AND THE RELATIONSHIP BETWEEN CCT, CRI, OPTICAL SAFETY, MATERIAL DEGRADATION, AND PHOTOBIOLOGICAL STIMULATION." Pacific Northwest National Laboratory (PNNL),

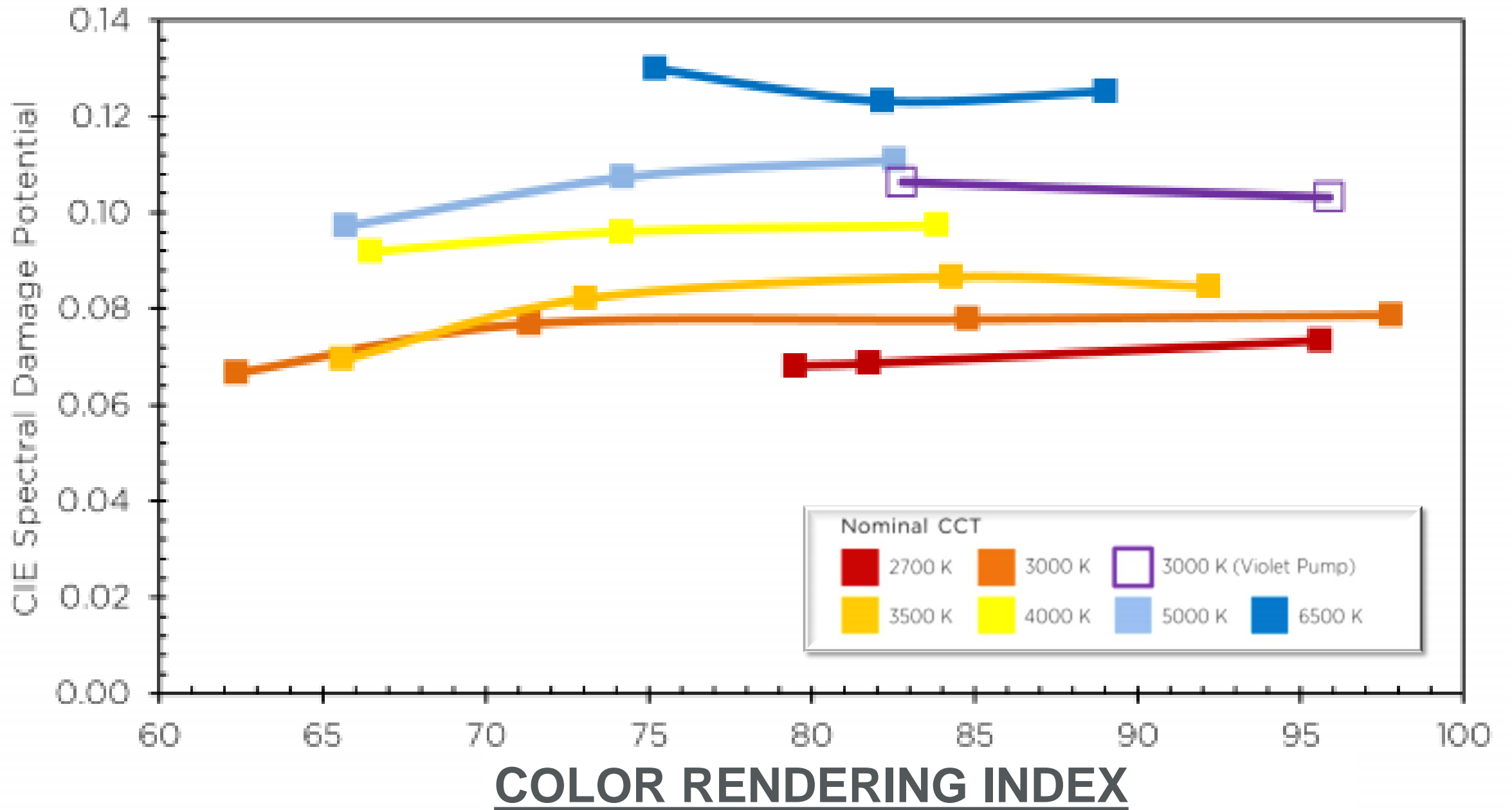
RELATIVE SPECTRAL DAMAGE FUNCTION



HALOGEN MR16 3K = 1

RGBW/ Rf 52/ Rg 108 = .78

RGBW/ Rf 88/ Rg 102 = .89



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Smithsonian
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