Predicting the Decay of SARS-CoV-2 in Airborne Particles

Homeland Security
Science and Technology

SARS-COV-2 STABILITY PREDICTIVE MODEL

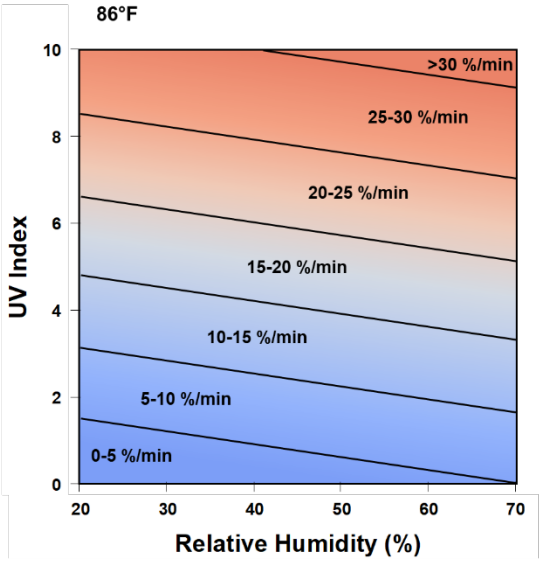
The Department of Homeland Security (DHS) Science and Technology Directorate (S&T) has developed a predictive model based on laboratory data to estimate decay of SARS-CoV-2, the virus that causes COVID-19, in airborne particles across a range of temperature, relative humidity, and sunlight levels (UV Index). The model has been integrated into a web-based application, which allows users to estimate time needed for decay of SARS-CoV-2 under combinations of these environmental conditions, and is located at: https://www.dhs.gov/science-and-technology/sars-airborne-calculator. This model will be updated as additional data on viral stability in airborne particles are generated by DHS S&T.

UNDERSTANDING TRANSMISSION TO CONTROL THE SPREAD

Minimizing person-to-person transmission of SARS-CoV-2 is critical to reducing the impact of COVID-19. Transmission of the virus is believed to occur through respiratory particles produced during breathing, talking, and coughing, as well as contact with contaminated surfaces.

S&T has studied the stability of SARS-CoV-2 in airborne particles generated from simulated saliva across a range of environmental conditions. The results demonstrate that stability of the virus is dependent on environmental conditions. The greatest stability was observed under cool, dry, and dark conditions, similar to those found indoors. Simulated sunlight with UV levels like those expected in natural sunlight rapidly inactivated the virus in airborne particles. Higher temperatures and relative humidity levels also increased the decay rate, but to a lesser degree than simulated sunlight.

These results informed development of a predictive model to allow estimation of the decay of SARS-CoV-2 under conditions relevant to the United States. This model is valid over a temperature range from 50-86°F, relative humidity of 20-70%, and sunlight levels with UV indices between 0-10.



The graph above displays the impact that relative humidity and UV index have on the decay rate of SARS-CoV-2 at a temperature of 86°F. As both parameters increase, the amount of decay per minute increases.

CURRENT DATA

Within the tool parameters:

- SARS-CoV-2 is **most stable** at 50°F, 20% relative humidity and a UV Index of 1
- SARS-CoV-2 is **least stable** at 86°F, 70% relative humidity and a UV Index of 10

USING THE PREDICTIVE TOOL

The predictive tool allows a user to estimate the time needed for decay of SARS-CoV-2 in airborne particles at temperature, relative humidity, and UV index levels of interest. Such information can be used by healthcare workers, emergency response teams, and the public to better understand the effect of environmental conditions on airborne particles containing SARS-CoV-2.

It should be noted that in order to fully assess the hazard posed by airborne particles containing SARS-CoV-2, additional information is needed, including how much infectious virus is shed by infected individuals into the air, and the amount of virus that needs to be inhaled to cause infection.