DHS S&T Research & Development Response to SARS-CoV-2 / COVID-19

Homeland Security
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UNDERSTANDING TRANSMISSION TO CONTROL THE SPREAD

Efforts to control the spread of the SARS-CoV-2 rely on the virus' ability to survive in the air and on surfaces. S&T is executing high-impact projects to help answer critical questions about the SARS-CoV-2 virus, including:

- How stable is the virus in different conditions?
- How effective are different decontamination products on surfaces?
- How can we best clean personal protective equipment (PPE) and verify functionality?

S&T EFFORTS TO ANSWER CRITICAL QUESTIONS

Master Question List

A team of dedicated experts reviews all available information on the SARS-CoV-2 virus and condenses it into a concise format to aid decision makers and the public. This Master Question List (MQL) is updated weekly and available to the public: (https://www.dhs.gov/publication/st-master-question-list-covid-19). The MQL features information about virus spread, disease progression, effectiveness of treatments, decontamination methods, and more.

Laboratory Research

S&T provides DHS Components and stakeholders high-confidence guidance on SARS-CoV-2 through rapidly-executed applied-science studies and risk assessments to inform the operational response. Building on experience gained through response to the 2015 Ebola outbreak, S&T is executing laboratory studies at the National Biodefense Analysis and Countermeasures Center (NBACC) and with other qualified performers to produce informative data on SARS-CoV-2.

Research Collaborations

S&T is collaborating with domestic and international partners to address critical aspects of virus stability and decontamination, leveraging each laboratory's strengths.

Technology Scouting

To support DHS Component requests, S&T's Technology Scouting and Transition group is investigating different technologies for use in disinfecting surfaces and testing for the virus in humans.

S&T LABORATORY RESEARCH IS AT THE FOREFRONT OF THE COVID-19 FIGHT

S&T is currently executing SARS-CoV-2 studies at the NBACC laboratory facility. These studies are focused on answering the following questions:

- How long can SARS-CoV-2 survive on commonly used surfaces (e.g., stainless steel, nitrile, plastic) at different temperature, humidity, and solar levels?
- How long can SARS-CoV-2 survive in simulated human saliva droplets and respiratory fluids on surfaces?
- How long can SARS-CoV-2 survive in the air?
- How effective are various disinfectants at eliminating the SARS-CoV-2 virus?

NBACC EMERGING RESULTS (AS OF 4/21/20)

Although studies are ongoing, preliminary NBACC results have provided critical insight to SARS-CoV-2 surface stability. Key findings include:

1. **Solar radiation rapidly reduces virus stability on outdoor surfaces.** Testing of virus decay in droplets of simulated saliva on a stainless steel surface was conducted at several different intensities of artificial sunlight. Sunlight intensity ranged from darkness to "full" sunlight, which is equivalent to the intensity and composition of unobstructed sunlight at noon at ground level in the MidAtlantic Region on the first day of summer. The amount of time it takes for infectious virus to be reduced by half (half-life) in a droplet of simulated saliva on stainless steel at full solar intensity was approximately 2 minutes at room temperature.
   - Operational Relevance: This data suggests that outdoor surfaces exposed to direct sunlight are at lower risk for virus transmission.

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2. **Higher humidity may reduce virus survival.** When in saliva droplets, the virus is most stable at lower humidity.
   - Operational Relevance: This indicates that the virus is more likely to be stable and persist in areas of lower humidity. Increasing humidity levels may speed virus decay.
3. **The virus dies faster at higher temperatures.** The virus is less stable in saliva droplets on surfaces than in culture media and dies faster in saliva droplets at higher temperatures.
   - Operational Relevance: Increased temperatures may help kill the virus and reduce transmission.
4. **Bleach & Isopropyl Alcohol (IPA) are effective decontamination solutions.** Diluted bleach (1 cup in 1 gallon water) was effective in reducing virus infectivity at least >99.9% in saliva droplets after 5 minutes on a stainless-steel surface. 70% IPA killed > 99.9% virus in a wet droplet of saliva and >98.1%virus was inactivated on stainless steel after just 30 seconds.
   - Operational Relevance: Reinforces the effectiveness of these EPA recommended disinfectants for use by DHS and other entities to clean and disinfect facilities.
5. **Virus stability in saliva is not dependent on droplet size.** There is no statistical difference in half-life as a function of droplet size in saliva.
   - Operational Relevance: Surface stability data is applicable to a broad range of droplets generated by infected individuals (e.g., talking, coughing, medical procedures).

NBACC NEXT STEPS

In the coming weeks, NBACC will continue to execute laboratory research to refine and expand results. Anticipated gains in SARS-CoV-2 information include:

- Additional survival data on commonly used surfaces (e.g., stainless steel, nitrile, plastic) at different temperatures and humidity levels
- Aerosol survival data for indoor and outdoor conditions, including the effect of temperature, humidity, and sunlight on virus inactivation
- Effectiveness of other disinfectants to kill the virus in simulated saliva droplets and respiratory fluids on surfaces

OTHER LABORATORY RESEARCH

S&T is also initiating studies to understand:

- Effectiveness of different decontamination methods for Personal Protective Equipment (PPE) reuse, such as N95 masks
- Low-tech options to support PPE reuse
- SARS-CoV-2 survival in human waste streams
- SARS-CoV-2 exposure risks during stages of infection and resulting contamination levels on PPE

IMPACTS FOR DHS AND THE HOMELAND

S&T efforts, such as the **Probabilistic Analysis of National Threats Hazards and Risks** program, are essential to producing critical information that will help federal leaders, public health officials, and front-line operators make informed decisions about the guidance, types of equipment, and protocols needed to combat the spread of SARS-CoV-2.

S&T efforts are helping decision makers extend the lifespan of PPE available to healthcare workers by providing scientifically-backed methods to decontaminate and re-use PPE equipment such as masks.

Additionally, lab results generated by S&T can improve accuracy of public health modeling predictions for potential spread (illnesses/deaths) and improve understanding of the impact that specific interventions (social distancing, individual PPE, etc.) may have on combatting the pandemic.