CONCURRENT SESSION 2 – COVID-19 RESEARCH EFFORTS

Questions and Answers

- **Anonymous:** Question for Sanjiv: Has this RV-RT-PCR method been used to inform recommendations and control strategies in a COVID-19 outbreak environment?
    - **Sanjiv Shah, U.S. EPA:** This is a great question. We have not yet used the method; we just finished the work as soon as we could and produced the paper. There are a lot of other steps taken to prevent the SARS/COVID-19 transmission where possible. I hope that there is not more spread of this virus, and we do not have to use this method. However, if we must use this method to detect the presence of infectious virus, the virus survives for some time on surfaces – it can be anywhere from hours to a couple of days at the most they have shown on cardboard and other surfaces using different conditions. If they have to detect the presence of infectious viruses in such a short timeline, I am sure the method could be useful because the traditional PCR-based method takes anywhere from 3-5-7 days based on the concentration and other conditions of the surfaces and environment.
- **Air Force Research Laboratory:** Question for Christine: Do you have an explanation as to why dust increases viral recovery?
    - **Christine Tomlinson, U.S. EPA:** One thing I did not mention during the video is that even though we showed that difference, it was not statistically significant. However, if we were able to repeat the study a few more times and get some statistical representation, it could be that the virus congregates on the dust particles and then is able to be eluted a little more efficiently.
- **Centers for Disease Control and Prevention:** Question for Katherine: How practical is a 3-stage air filtration and purification system from an economic standpoint (compared to MERV-13) in community settings?
    - **Katherine Ratliff, U.S. EPA:** Another great question. That really is a hard thing to answer; there is a lot of costs/benefits and pros/cons to weigh when thinking about these different types of technologies. For the particular test conditions that we had in our chamber, there did not appear to be much efficacy between the MERV-13 and the 3-stage system and so, for example, if the MERV-13 is much less expensive to install or easier to maintain than a more sophisticated system from an economic standpoint, some end-users/stakeholders would opt to go with that particular technology. However, test conditions are representing one set of conditions with one particle size and there might be other conditions where you might be concerned about different droplet or aerosolized particle sizes that other technologies could or could not be more effective at capturing. There are a lot of considerations to weigh when thinking about cost/benefit analyses: cost to implement technology and the effectiveness of technology. Weighing those things as well as the maintenance required is all worth considering. It really depends on the end user and stakeholder and what sorts of effort they are able to put towards these types of technologies.
- **U.S. EPA:** Question for Katherine: Why was MS2 used as an aerosol virus as a surrogate for SARS-CoV-2 rather than using SARS-CoV-2 or another virus?
    - **Katherine Ratliff, U.S. EPA:** We used MS2 – I did not mention this in my presentation – it is a biosafety level 1 organism and is non-pathogenic, so it infects bacteria and does not actually

infect humans. We decided to use MS2 in these large-scale efficacy evaluation studies because it is much safer than using SARS-CoV-2. To aerosolize SARS-CoV-2, you would have to do it in a highly contained environment where lots of biosafety protocols would need to be in place. Those are not the type of laboratory conditions where we are able to conduct the large-scale tests we are interested in. At the same time MS2, is also hardier; it is more resistant to different types of disinfection technologies than SARS-CoV-2. So, there are multiple benefits for using MS2 in that we are confident that if a particular technology is effective against MS2, it will also likely work well against SARS-CoV-2 and it is also much safer than SARS-CoV-2 to handle in the laboratory.

- **Anonymous:** Question for Katherine: I know you did not discuss this, but do you think a MERV-13 filter treated with an antimicrobial (e.g., silver) would be more efficacious than MERV-13 alone with regard to efficacy in the air?
    - **Katherine Ratliff, U.S. EPA:** That is a really interesting question and is something we have thought about a little bit but unfortunately do not really have data to answer that question. Some things I would think about along those lines are the fact that those filters that are impregnated with different antimicrobial materials hypothetically would inactivate the virus more quickly once it is adhered to the filter. Either way, whether the filter has that impregnated material or not, the virus (or whatever airborne pathogen) is removed from the air stream. So, the primary objective in installing these filters is to remove those pathogens from the air stream, so if the pathogen's getting removed, then whether it is inactivated immediately or how quickly it is inactivated on the filter is a little bit of a different question. Maybe there could be benefits in that the filters, if you want to handle them right away or if there are concerns about handling the filters as you are removing them as part of maintenance activities, maybe those specialized filters with the impregnated materials might have some advantages. However, we have not done any testing to evaluate that; it is something that will be interesting future research to address those types of considerations.
- **U.S. EPA:** Question for Sang Don: Are there plans to test any other surfaces using the method that was developed?
    - **Sang Don Lee, U.S. EPA:** We tested those surfaces and are still analyzing the data. If we see any difference or unexpected results based on the different types of surfaces, then we will probably pursue both for the testing of different material types. However, at this point we are still analyzing the data and we should somewhat conclude what we observed and whether we met the objectives.
- **Anonymous:** Question for Katherine: What was the particle size distribution of the MS2 challenge aerosol?
    - **Katherine Ratliff, U.S. EPA:** It ranged in terms of the count median diameter in our tests from ~45 nanometers at the beginning of the test right after we aerosolized the bacteriophage to almost ~100 nanometers at 120 minutes. There was an increase in the median diameter over time due to the particles agglomerating. Even though the relative humidity in our test was quite low, the particles still agglomerate and interact with each other because there is a really high loading of particles in the test chamber. There was a distribution about that median, but the particles we were aerosolizing were quite small and because we wanted these particles to remain lofted and available for the technology to interact with or potentially inactivate if it were

able to during the test. I am happy to talk in more detail with whomever asked the question if they want to see more about the actual distribution of particle sizes.

- **U.S. EPA:** Question for Katherine: Do you expect that the challenge would have been greater for these technologies if the droplet size was larger than it was, since it was a small particle size distribution?
    - **Katherine Ratliff, U.S. EPA:** That is another good question. I think it could potentially depend on the technology type; with filters, there are definitely ways we could examine how the filters themselves are rated in terms of their MERV rating and potentially capture larger particles more effectively although there are nuances to that and certain particle sizes, being the most penetrative, are hardest to capture. However, when we think about the bipolar ionization or novel or emerging technologies or chemical technologies, there are a lot of open-ended questions in terms of how protective or vulnerable larger droplets might be. There is potentially a range of responses based on the pathogen and the technology-type for these tests.
- **Anonymous:** Question for Katherine: Did you measure the pressure drop across the filters that were used for 1 and 4 weeks? That might indicate damage that explains the different results.
    - **Katherine Ratliff, U.S. EPA:** Yes, we have a handful of pressure-drop measurements, flow measurements, as well as the efficacy measurements. This is something that will be ongoing in terms of testing and we are gearing back up to get some additional tests run with the filters from these time points as well as hopefully 30-60 days. So, there will be more data coming up soon and we will be able to examine things with more detail or with a greater number of replicates as well while examining those types of potential implications of having those filters out in the field and what it can mean for efficacy as well as pressure-drop. I encourage you to stay tuned.
- **DSO National Laboratories:** Question for Sang Don: Regarding recovery from fabric, could the low recovery, especially after 3 hours, be due to the porous nature of fabric? Maybe the swab stick and sponge stick are not suitable sampling tools?
    - **Sang Don Lee, U.S. EPA:** Yes – that might be. We only tested two commercially available sampling methods that have already established the sampling protocol, even though they are not targeting for COVID-19. However, the fabric results show some challenges in sampling to represent the actual status of the virus. Because of the drying issue and the decaying issue, sampling efficacy is impacted. So, to that extent, for surface sampling you do not have many different options. These are the most recently developed sampling methods and currently the most used one is a very small swab for very detailed sampling. That might work better, but we have not tested in this study; that will be a good next study to include to compare.
- **Anonymous:** Question for Katherine: Can you elaborate on any testing using low concentration hydrogen peroxide vapor?
    - **Katherine Ratliff, U.S. EPA:** The short answer is that we have not directly done testing with low concentrations of hydrogen peroxide vapor. We have done some testing with a photocatalytic device that supposedly emits low concentrations of hydrogen peroxide. The levels of hydrogen peroxide emitted by that technology are very low. So, I hesitate to say that it is a 'low hydrogen peroxide vapor technology' because it is not necessarily emitting hydrogen peroxide in the way that you would purposefully emit hydrogen peroxide from a chemical-emitting device. There are some results posted on our COVID-19 webpage; I would direct you to the photocatalytic device to learn more about that. More traditional low-concentration chemical hydrogen peroxide has not been tested or evaluated yet, but it is on our radar and would definitely be of interest down the road.