Dr. Zaida Figueroa
Designated Federal Officer (DFO)
1200 Pennsylvania Avenue,
NW Washington, DC 20004
figueroa.zaida@epa.gov

Comments by Byoplanet International on the Charge to the Science Advisory Board Covid-19 Review Panel

Dr. Figueroa:

Byoplanet International, LLC ("Byoplanet") appreciates the opportunity to submit the following comments on the U.S. Environmental Protection Agency's ("EPA" or "Agency") notice regarding the convening of a panel of experts to provide scientific and technical guidance on issues related to the COVID-19 Pandemic.

Interest of Byoplanet International

Byoplanet International, LLC is the manufacturer of patented, air assisted, induction charged electrostatic sprayers (AAIC ES). Byoplanet began in the halls of the University of GA where electrostatic technology was first invented for agricultural applications. From those early years, Byoplanet adapted the technology for infection control, which led to early success in the cruise line industry in the fight against norovirus. Byoplanet Senior Vice President of R&D is Steve Cooper, one of the original inventors of the AAIC electrostatic technology and known expert in the field. Byoplanet has a strong interest in providing safe and effective technologies.

We'd like to take this opportunity to address those instances in the COVID panel review that mention electrostatic sprayers:

Our comments are focused on the following research categories:

1. Environmental Disinfection, specifically addressing contact time
2. Human Health Risks of Exposure to Disinfectants, specifically addressing respiratory exposure

Research Question: ***Do methods of application of List N products via fogging and/or electrostatic spraying provide the necessary contact time on surfaces to be efficacious against SARS-CoV-2?***

The agency's question on contact time, can be addressed by referencing standard spray application usage instructions which include the phrase "...spray until thoroughly wet..". Unlike foggers, AAIC ESs are directed sprayers the operator is in control and can ensure proper surface wetness in much the same way they would when using any other coarse sprayer. To help ensure proper operation of the spray system, we offer guidance to the user that describes how best to use the equipment to ensure proper wetness – please see Appendix A for examples.

Byoplanet would also like to reference EPA/600/R-18/283 – September 2018 report "Evaluation of Electrostatic Sprayers for Use in Personnel Decontamination Line Protocol for Biological Incident Response Operation". In this report the ESS Electrostatic sprayer (this device is also an AAIC ES) was compared in a non-electrostatic electric back pack sprayer and in this report it states: "*Overall, both sprayers achieved a surface log reduction (LR) of greater than or equal to 6, with no statistically significant difference between the two sprayers (p-value = 0.49).*."

In the research questions the terms electrostatic spraying and fogging appear to be conflated as similar application methods. There is however, a clear distinction between fogging and electrostatic spraying.

Fogging is defined by the EPA as "*Applying a liquid chemical by rapidly heating it to form fine droplets that resemble smoke or fog.*" It is a process of filling the environment with droplets of disinfectant and relying on random air currents to deliver the disinfectant to the surface.

AAIC electrostatic spraying is the process of inducing an electric charge onto droplets of disinfectants as they leave the nozzle in a directed spray pattern. This creates a *driving force* toward the target and a repulsion force between the droplets. The result is significantly improved mass transfer and a 360 degree wrap-around to hidden surfaces areas. The target surface becomes completely wetted with disinfectant.

Given the fundamental differences between these two operations, we would recommend decoupling any research on foggers and AAIC electrostatic equipment.

Research Question: ***The EPA has exposure data for trigger pump spray and hand-held spray wants (hand-held mechanical application). Are there any novel SARS-CoV-2 control application techniques (e.g., electrostatic sprayer) that would not be represented by the currently available exposure data?***

In reference to the Agency's question regarding exposure data, we would again reference EPA/600/R-18/283 – September 2018 report "Evaluation of Electrostatic Sprayers for Use in Personnel Decontamination Line Protocol for Biological Incident Response Operation". The report states: "*The quantity of liquid waste generated by the electrostatic sprayer was almost 75 times less than the amount generated by the backpack sprayer.*" By virtue of the amount of disinfectant that is directed to the target, AAIC ES requires significantly less disinfect than non-electrostatic course sprayers.

Byoplanet has set forth practices that evaluate electrostatic sprayers for environmental decontamination, disinfection, and sanitization in commercial settings as they relate to performance, and device safety – please see Appendix B. The specification of these conditions provides a basis for standardization and serves as a guide to investigators wishing to compare the relative performance and safety of electrostatic sprayers.

More specifically, please refer to our standardized protocol for determining the concentration of aerosols during and post spray with and without electrostatics – see Appendix B. When an electrostatic sprayer meets the performance standards we've set forth, the electrostatic force reduces the concentration of aerosols by at least 2 fold when compared to non-electrostatic spraying.

Although electrostatic spraying reduces the concentration of aerosols, we recommend that equipment manufacturers provide clear guidance on what disinfectants are approved for use in the sprayers. This guidance, among other metrics, should include exposure data through air sampling in accordance with NIOSH protocols to validate the appropriate PPE and reentry time recommendations specific to that disinfectant. To help enforce those recommendations, Byoplanet will not honor any warranties if there is evidence of unapproved chemistry usage.

Given this issue is considered a long-term research question, Byoplanet would offer our expertise in helping the agency craft the studies to further substantiate the safety and efficacy of AAIC ES delivery systems.

Again, thank you for the opportunity to contribute information for consideration by the panel. Should you have any further questions, please do not hesitate to contact me.

Keri Lestage

COO, Byoplanet International

klestage@byoplanet.com

Appendix A

Examples of instructions to users teaching how to use the equipment correctly to ensure the surface is thoroughly wet.

- "https://servicetechteam.zendesk.com/hc/en-us/articles/360041249711-CS-2000-Operator-Manual - pg. 9

Definition of contact time

- https://byoplanet.zendesk.com/hc/en-us/articles/360040169511-5-How-long-does-the-product-need-to-stay-wet-on-the-surface-to-be-effective-

Appendix B

Standard Practices for Evaluating Electrostatic Sprayer Performance and Safety

1. Scope:

These practices cover the evaluation of electrostatic sprayers for environmental decontamination, disinfection, and sanitization in commercial settings as they relate to performance and device safety during operation. The specification of these conditions provides a basis for standardization and serves as a guide to investigators wishing to compare the relative performance and safety of electrostatic sprayers.

This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

2. Referenced Documents

2.1 UL 73: Standard for Motor-Operated Appliances

2.2 UL 60335: Safety of Household and Similar Appliances

3. Performance

3.1 Mass Transfer to Standardized Target – A properly configured electrostatic sprayer should demonstratively increase mass transfer onto targets, especially onto hidden areas including the backside of target objects. Electrostatic sprayer performance should be evaluated based on mass transfer to a standardized target using a proven quantitative fluorometric analysis method, as referenced in the attached publication list. The fluorometric analysis for mass transfer should be conducted for charged spray and uncharged spray to show the benefit of adding an electrostatic charge. See Appendix A for quantitative fluorometric analysis protocol.

3.2 Reduction of Lingering Aerosols – A properly configured electrostatic sprayer should reduce the residence time of sprayed airborne particulate. Charged spray should deposit significantly faster than uncharged spray. Electrostatic sprayer performance should be determined by a lingering aerosol test using an aerosol monitor in an enclosed cube space. Electrostatic aerosol test should result in an at least 2x decrease of lingering aerosols compared to an uncharged system. See Appendix B for lingering aerosol test protocol.

4. Safety

4.1 Leakage Current – Electrostatic sprayer safety should be evaluated based on the leakage current test as specified in standards UL 73 and UL 60335 to determine maximum leakage current requirements under foreseeable conditions for which a product may be subjected.

4.2 Capacitive Discharge – An electrostatic sprayer must exhibit minimal capacitive discharge that is the device must not create an arc when touched. An appropriate capacitive discharge test should be completed to limit excess discharge current from a normal contact point of the device.

Quantitative Spray Mass Transfer Analysis- Fluorometric Method

Objective

The objective of the mass transfer analysis is to quantify surface coating uniformity as it relates to efficacy of disinfectant products. Increased mass transfer onto target surfaces yields greater efficacy against pathogens in the environment and can reduce the spread of infection compared to uncharged sprayers (figure 1).

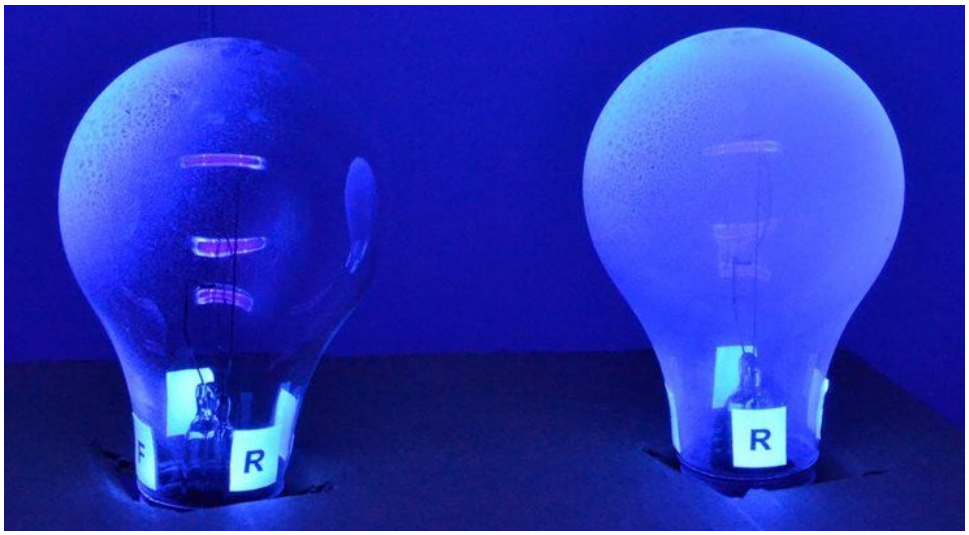

Figure 1: Deposition comparison between an uncharged sprayer (left) and charged electrostatic sprayer (right). The charged electrostatic sprayer yielded greater surface coating uniformity compared to the uncharged sprayer.

Data Collection

To quantify mass transfer, fluorometric analysis is used to determine the amount of spray deposited onto the target surface. A standard tracer-tagged solution of fluorescent pigment, NaCl, surfactant, and distilled water with a resistivity equal to 50 Ωm is used to spray at least 3 ft from the target surface (Anantheswaran, 1981). The sprayed side of the target should be washed off with 1 mL of surfactant and 1000 mL of distilled water. The volume of sprayed liquid and the mass of tracer deposited onto the target should be calculated from values of fluorescent tracer concentration measured in the wash liquid using a Turner Model 111 fluorometer (Anantheswaran, 1981).

Results

Mass transfer should be calculated and expressed as ng of tracer material deposited per cm2 of target area (Giles, 1985) (figure 2). A properly configured electrostatic sprayer should demonstratively increase mass transfer onto the target surface compared to an uncharged sprayer.

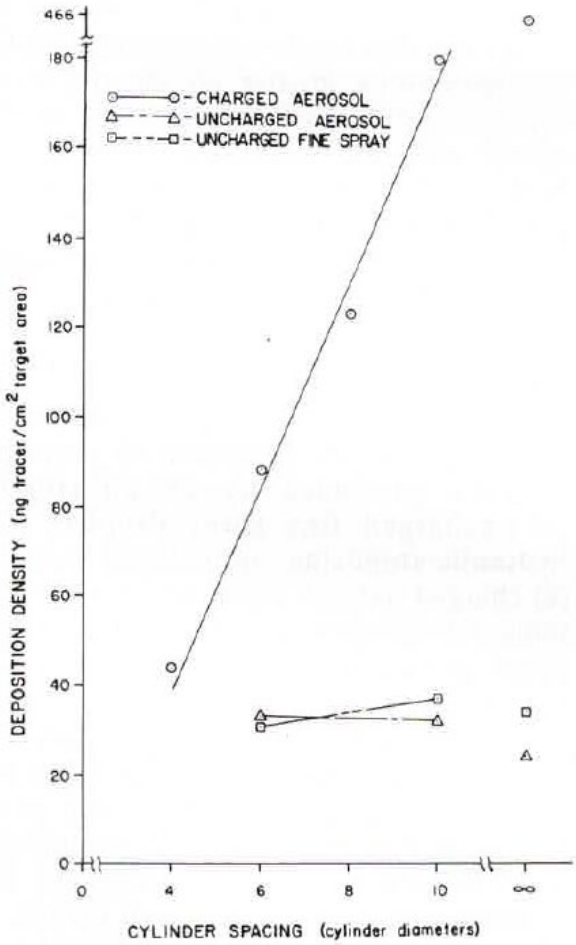

Figure 2: Comparison of mass transfer between charged aerosol, uncharged aerosol, and uncharged fine spray versus target object spacing.

Lingering Aerosol Test Protocol

Objective

The objective of a lingering aerosol test is to quantify the residence time of sprayed airborne particulate.

Test Setup

1. 10′ x 10′ x 10′ enclosed cube space (1000ft³) – positioned on a concrete floor inside a building
2. Construction
    a. Structure: ¾″ SCH40 PVC pipe w/ ¼″ braided polyester rope (cross-tied for structure reinforcement)
    b. Covering: 4mil black polyethylene sheeting (draped across tubing structure – secured w/duct-tape)
    c. Antistatic Measures: Aluminum tinfoil sheeting draped across enclosure, adhered by spray-mount glue and overlapping across ceiling section of booth. A wire is affixed to sheeting and grounded building steel frame.

Sampling Equipment

1. DustTrak Aerosol Monitor – Model 8520 (intake flow rate of 1.7L/min confirmed)
    a. >10µm standard intake nozzle w/4ft Tygon tubing for remote sampling (impactor plate removed)
    b. 10mm Nylon Dorr-Oliver Cyclone 4µm droplet discriminator
2. Commercial Electric Digital Multimeter – Model MS8260A

Data Collection

1. Position the aerosol monitor intake tube opening in the middle of the booth space at a 4′ distance from the floor elevated by a wooden stand.
2. Open and ventilate booth space to fresh air by virtue of a box fan for 10 mins.
3. Prior to the start of the test, operator enters the booth, sealing the opening behind them, the aerosol monitor is keyed to a new log file to start a new recording.
4. Starting at the base of one of the four wall surfaces, use an electrostatic sprayer to apply the spray in a left/right overlapping pattern of 7 individual passes at approx. 36″ from sprayer tip to wall surface. Each 10′x10′ area treatment lasts approx. 10 seconds. Once all four walls are treated, treat the ceiling and the floor in the same fashion.
5. Once treatment is completed, turn the sprayer off and leave the sprayer on the floor within the treated space. Operator leaves the space through an overlapping flap opening in the corner of the booth. Close the flap behind the operator and leave the treatment area for 30 minutes for recording.
6. After the 30 min recording period, open the booth, stop recording, and left to ventilate the space as described in step 2.
7. Repeat steps 1-6 using an uncharged sprayer.

Results

1. Results should be reported as aerosol concentration (mg/m3) as a function of elapsed time. Criteria of acceptability includes at least 2x decrease of lingering aerosols compared to an uncharged system

References and Publication List

1. Cooper, Steven C. and S. Edward Law. 1987. Bipolar spray charging for leaf-tip corona reduction by space-charge control. IEEE Trans. IA-23(2):217-223.
2. Cooper, Steven C. and S. Edward Law. 1987. Transient characteristics of charged spray deposition occurring under action of induced target coronas: space-charge polarity effect. Proceedings of the 1987 Oxford University Conference on Electrostatics. British Inst. of Phys. Conf. Ser. No. 85 (Section 1):21-26. ISBN 0-85498-177-2.
3. Law, S. Edward and Steven C. Cooper. 1988. Depositional characteristics of charged and uncharged droplets applied by an orchard air carrier sprayer. Trans. of ASAE 31(4):984-989.
4. Law, S. Edward and Steven C. Cooper. 1989. Target grounding requirements for electrostatic deposition of pesticide sprays. Trans. of ASAE 32(4):1169-1172.
5. Dai, Y., S.C. Cooper and S.E. Law. 1992. Effectiveness of electrostatic, aerodynamic and hydraulic spraying methods for depositing pesticide sprays onto inner plant regions and leaf undersides. ASAE Paper No. 92-1094 (microfiche), St. Joseph, MI.
6. Evans, Mark D., S. Edward Law and Steven C. Cooper. 1994. Fluorescent spray deposit measurements via light intensified machine vision. Applied Engineering in Agriculture 10(3):441-447.
7. Law, S. Edward, Steven C. Cooper and Whitney B. Law. 1999. Bipolar spray charging for enhanced deposition onto nonconductive and electrically isolated targets. Refereed Proceedings of the 1999 Cambridge University Conference on Electrostatics. British Inst. of Physics Conf. Ser. No. 163:243-248. ISBN 0-7503-0638-6.
8. Law, S. Edward and Steven C. Cooper. 2001. Air-assisted electrostatic sprays for postharvest control of fruit and vegetable spoilage microorganisms. IEEE Trans. IA-37(6):1597-1602.
9. Law, S. Edward, Steven C. Cooper and Mark A. Harrison. 2004. Electrostatic spray application of decontaminant agents onto the human body as a bioterrorism countermeasure: process development and evaluation. Refereed Proceedings of the 2003 Internat. Conf. on Electrostatics. British Inst. of Physics Conf. Ser. No. 178 (Section 7):331-336. ISBN 0-7503-0949-0.
10. Cooper, Steven C. and S. Edward Law. 2006. Electrostatic sprays for sunless tanning of the human body. IEEE Trans. IA-42(2):385-391.

11. Law, S. Edward, Steven C. Cooper and Mark A. Harrison. 2004. Electrostatic spray application of decontaminant agents onto the human body as a bioterrorism countermeasure: process development and evaluation. Refereed Proceedings of the 2003 Internat. Conf. on Electrostatics. British Inst. of Physics Conf. Ser. No. 178 (Section 7):331-336. ISBN 0-7503-0949-0.

12. Anantheswaran, R. C. and S. Edward Law. 1981. Electrostatic precipitation of pesticide sprays onto planar targets. Trans. of ASAE 24(2):273-276 & 280.

13. Giles, D. Kenimer and S. Edward Law. 1985. Space charge deposition of pesticide sprays onto cylindrical target arrays. Trans. of ASAE 28(3):658-664.