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DICE - SEEING THE UNSEEN

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Background

Antibiotic resistance is a major global threat, identified by the World Health Organization as one of the top ten public health risks. To combat this, reducing healthcare-associated infections (HAIs) is crucial, with effective environmental hygiene being essential to slow resistance and protect patients. The DICE system - Detect, Identify, Correct, Educate - offers a technology-enabled approach to prevention infection, designed for both routine management and crisis situations like pandemics. DICE's constant monitoring enables rapid interventions and evidence-based reporting for regulatory compliance and patient safety.

Methods

Study Design

- ARM 1. Blind EVS personnel to the BioTorch™ pre-clean data
- ARM 2. EVS personnel provided BioTorch™ pre-clean data

Primary Outcome

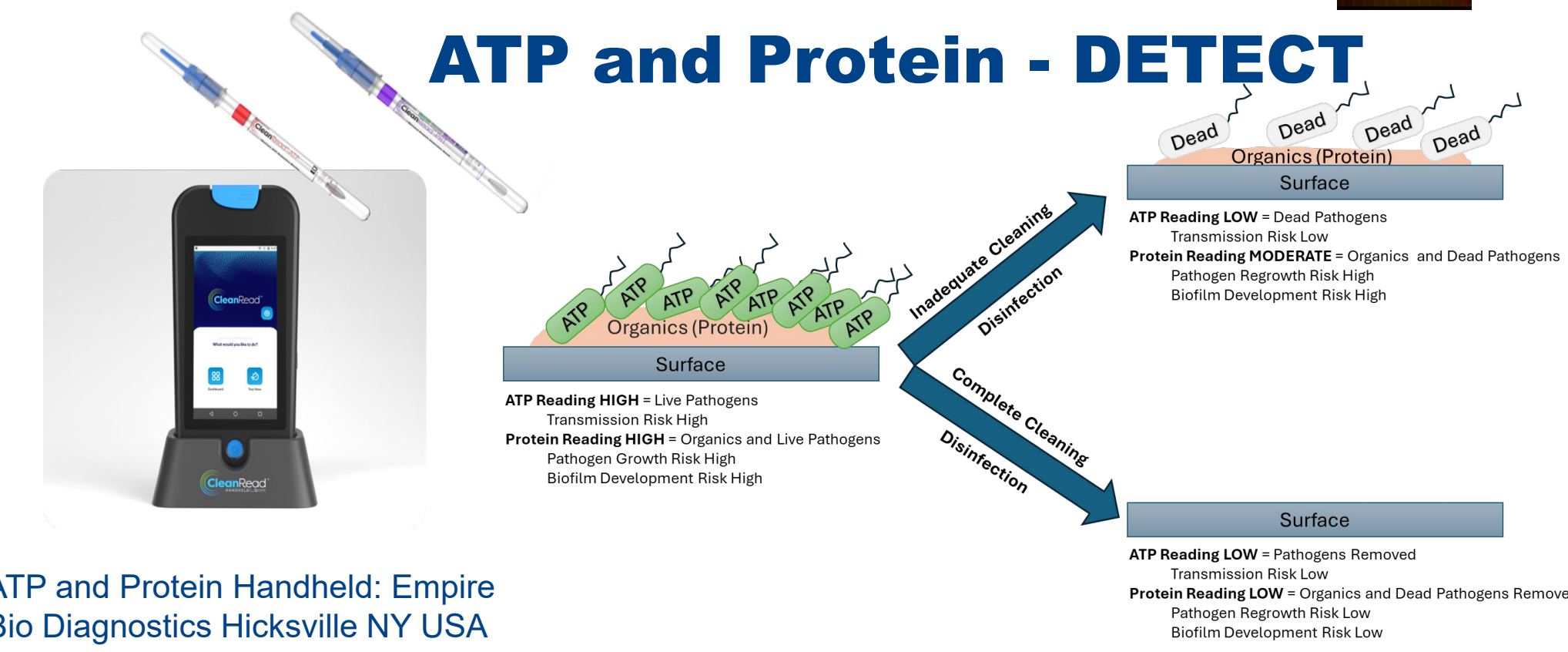
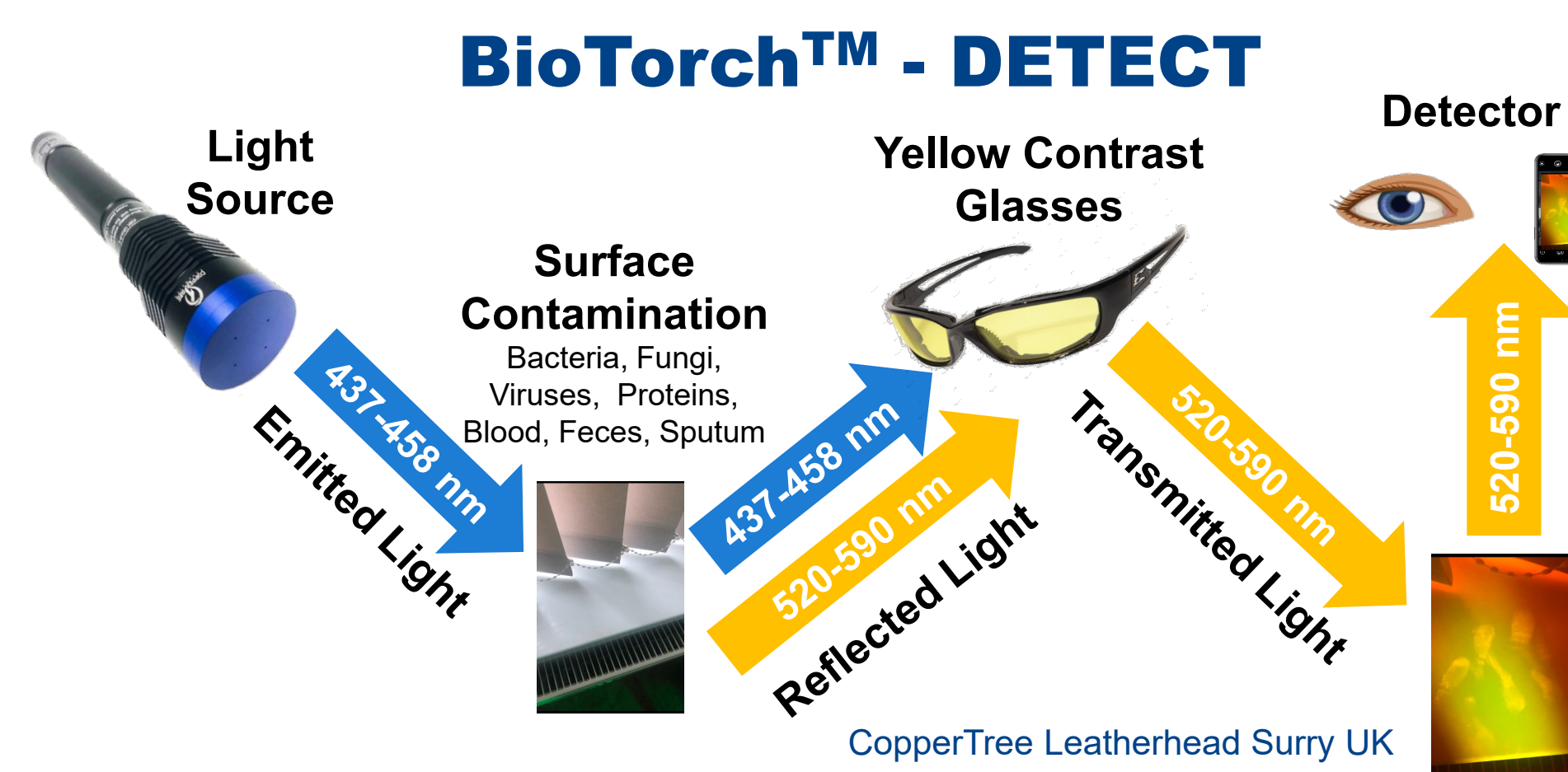
- Demonstrate that the BioTorch™ can detect contaminated areas before cleaning
- Demonstrate that the BioTorch™ can examine cleaned areas and validate cleaning
- Demonstrate that the BioTorch™ can guide cleaning.

Secondary Outcome

- Measure protein levels on surfaces before and after cleaning
- Calculate cleaning efficacy using protein measurements

Data Collection

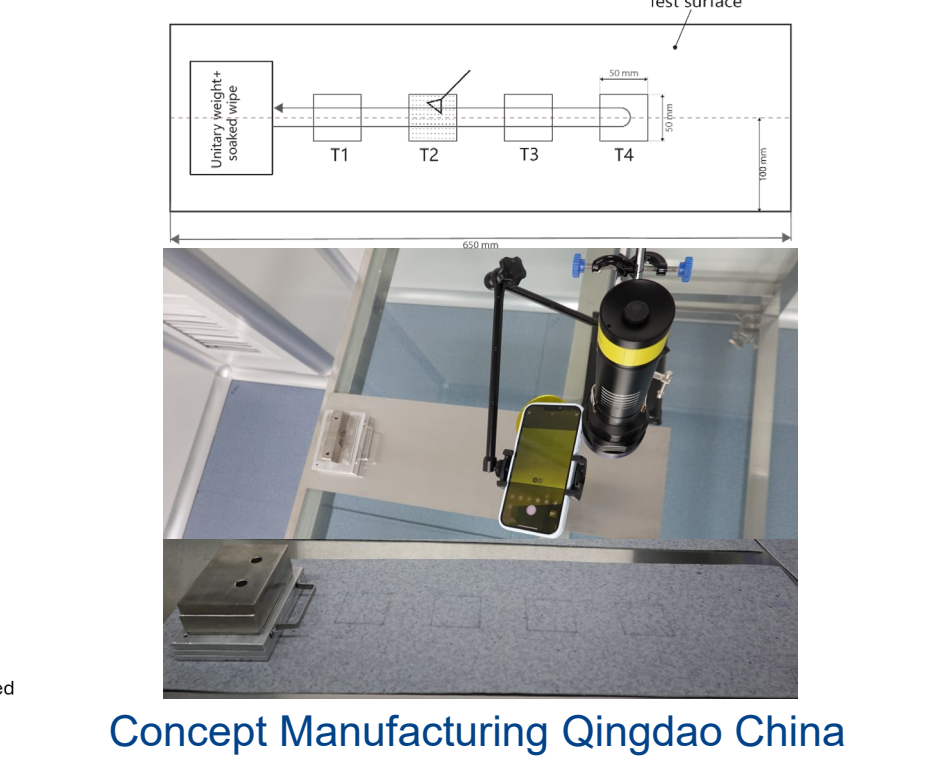
- <https://www.surveymonkey.com/r/DICE>



LAMP - IDENTIFY



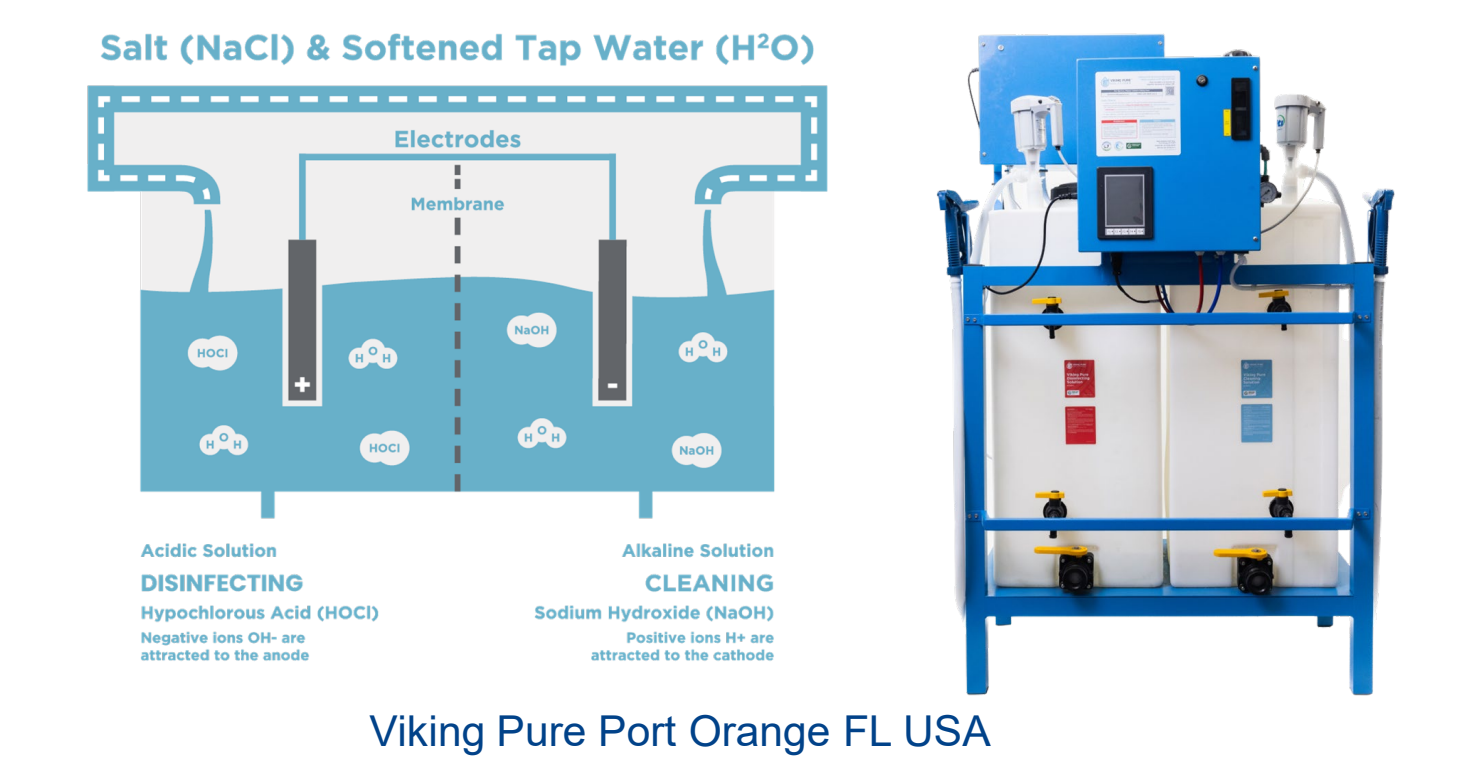
Modified EN16615 Wiping Test



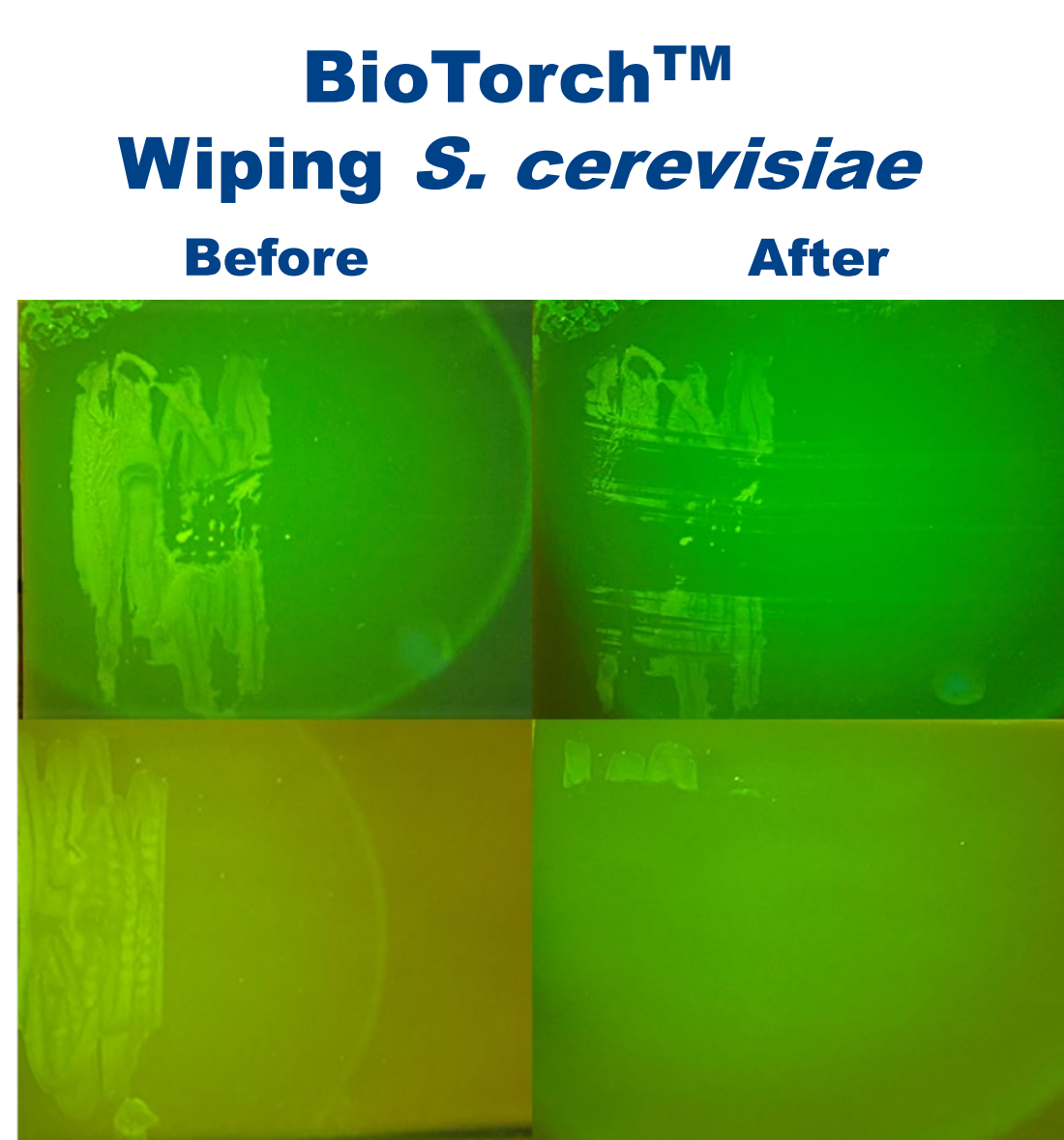
Health Grade Ultra-Microfiber (HGUM) - CORRECT



Site Generated HOCl - CORRECT



Results

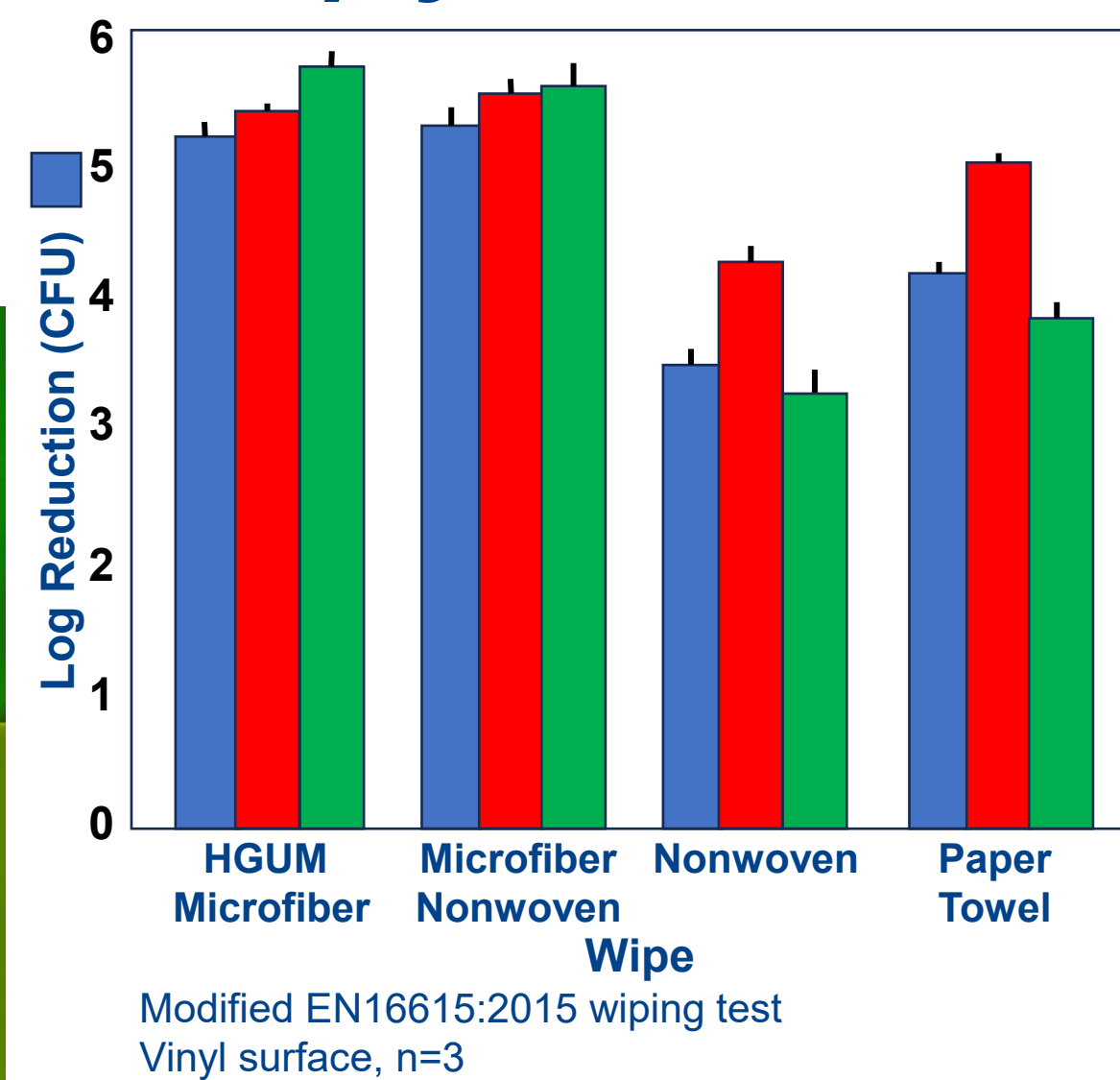


Yeast dried 60 min before wiping Porcelain surface

E. coli LAMP Detection on Surface Before and After Wiping

Action	Results
Dirty surface without <i>E. coli</i>	Negative
Dirty surface with <i>E. coli</i>	Positive
<i>E. coli</i> dried on surface, treated with leave-on disinfectant	Positive
<i>E. coli</i> dried on surface, treated with leave-on disinfectant, wiped with HGUM wipe	Negative

Microfiber Wiping *Staphylococcus aureus*



Modified EN16615:2015 wiping test Vinyl surface, n=3

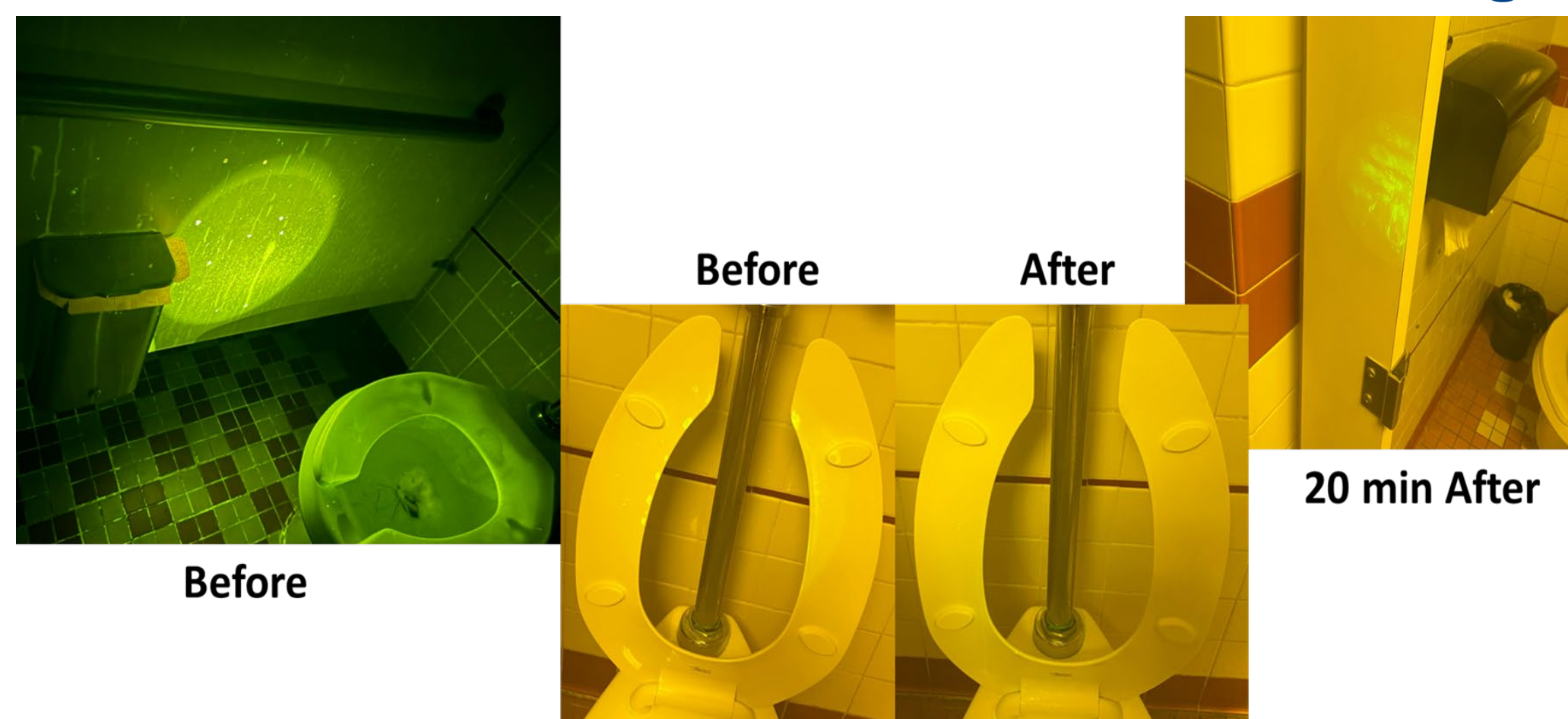
ATP and Protein Pre- and Post- Cleaning

Operating Room Site	ATP (RLU/25cm ²)		
	Pre-Clean	Post-Clean	Delta (%)
Cord to Boom Equipment	3441	4575	33.0 POS
Backwall Anesthesia Cart	841	219	-74.0 NEG
Computer Keyboard	2458	6056	146.4 POS
Module on IV Pump	384	195	-49.2 NEG
Cord of SCD Machine	385	262	-31.9 NEG
OR Storage Cabinet Handle	589	403	-31.6 NEG
Wall Behind Sharps Container	617	303	-50.9 NEG

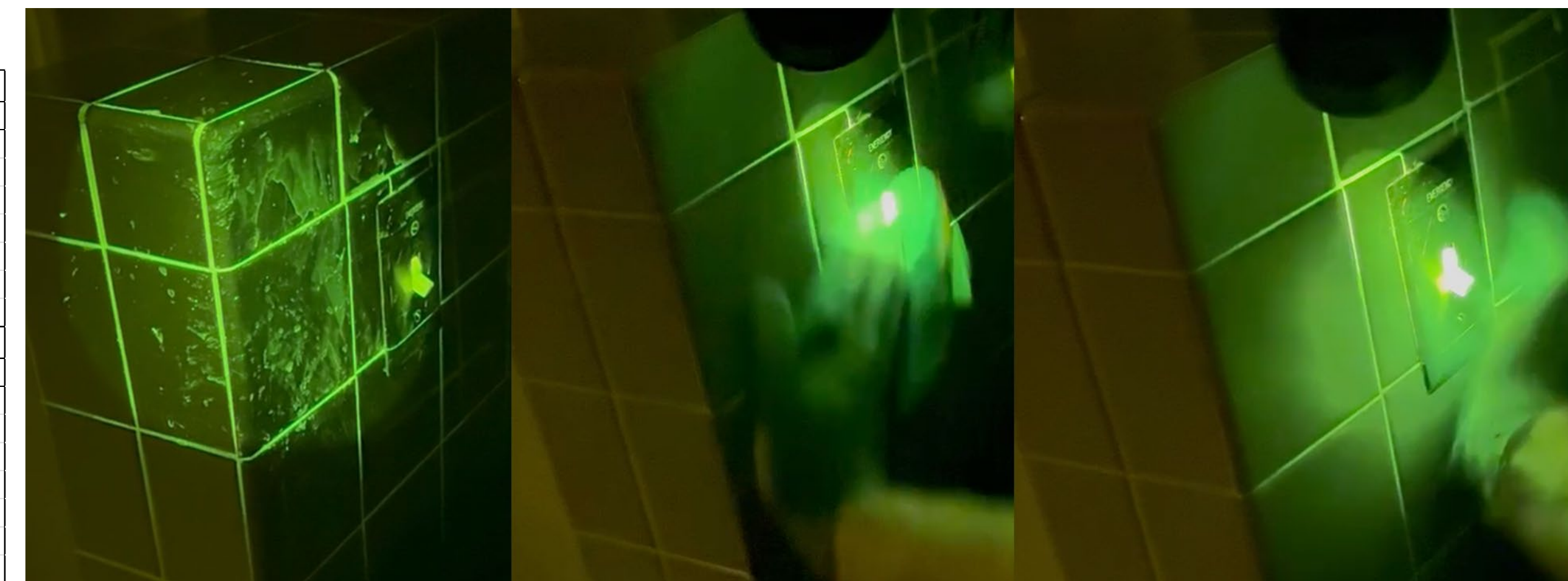
Operating Room Site	Protein (ug/25cm ²)		
	Pre-Clean	Post-Clean	Delta (%)
Cord to Boom Equipment	2.9	3.8	31.0 POS
Backwall Anesthesia Cart	104	5	-95.2 NEG
Computer Keyboard	44.3	49.1	10.8 POS
Module on IV Pump	19.3	15.3	-20.7 NEG
Cord of SCD Machine	1.3	0.1	-92.3 NEG
OR Storage Cabinet Handle	25.6	3	-88.3 NEG
Wall Behind Sharps Container	33.9	4.3	-87.3 NEG

One swab per site - Empire Bio Diagnostics Hicksville NY USA
Protein - BCA Assay Pierce Biotechnology Rockford IL USA
ATP - 3M St Paul Mn USA

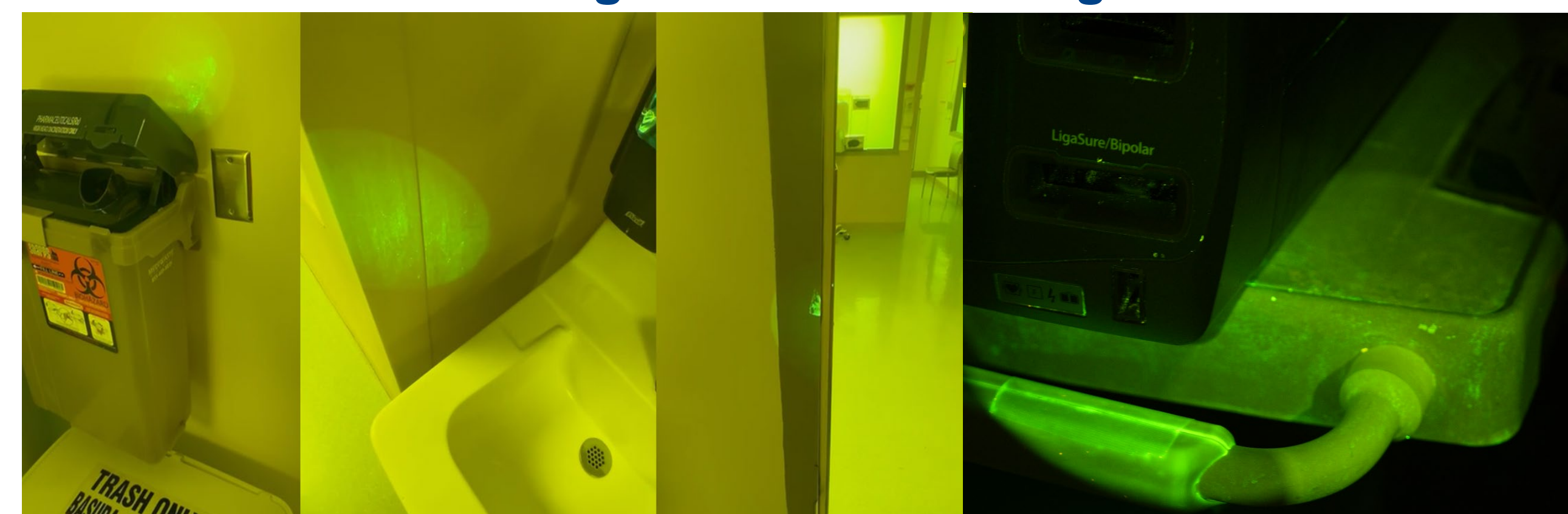
BioTorch™ Identified Contamination and Verified Cleaning



Before, During, and After Wiping with HOCl and HGUM



BioTorch™ Identified Cleaning Misses Next to High Touch Areas



Summary

Detect - Visualize residual biological material and pathogens before they become a hazard

Identify - Pinpoint persistent contamination and recognize specific pathogens to better target hidden high-risk areas

Correct - Apply enhanced cleaning devices, disinfectants, and cleaners matched to robustly remove contaminants and kill pathogens

Educate - Use practical tools to improve front-line knowledge of hygiene behaviors and surface cleanliness allowing for real-time feedback and change

References

- Dancer, S.J., 2023. Hospital cleaning: past, present, and future. *Antimicrobial Resistance & Infection Control*, 12(1), p.80.
- Tang, X., Qi, Q., Li, B., Zhu, Z., Lu, J. and Liu, L., 2025. Recent Advances on Fluorescent Sensors for Detection of Pathogenic Bacteria. *Chemosensors*, 14(5).
- Verran, J. and Boyd, R.D., 2001. The relationship between substratum surface roughness and microbiological and organic soiling: a review. *Biofouling*, 17(1), pp.59-71.

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