

# A case study in microbiological control: Advancing surface sampling for better contamination detection



Environmental monitoring (EM) of surfaces and air involves detecting and enumerating viable microorganisms in classified areas, providing crucial insights into microbial control within these facilities.<sup>1</sup> For both current Good Manufacturing Practice (cGMP) facilities and sterile compounding pharmacies, EM is vital to ensure that environmental conditions do not compromise the quality of therapeutic products and preparations.

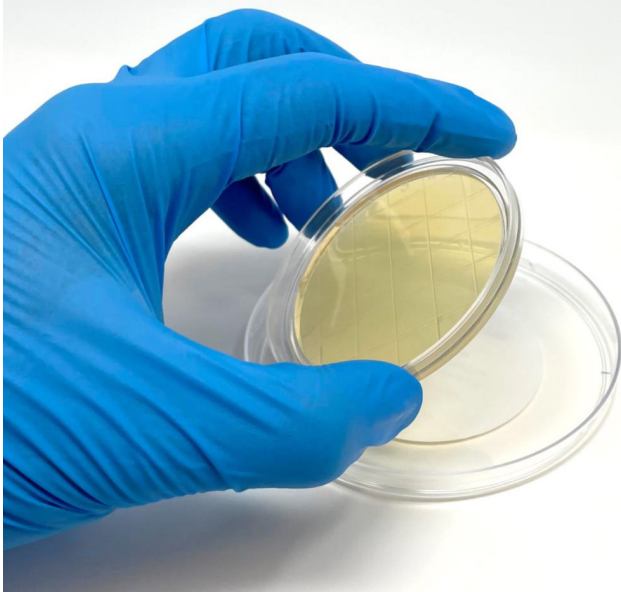
Monitoring viable particles in the air and on surfaces enables early identification of contamination risks, allowing timely interventions to support compliance with compendial standards such as USP General Chapters <797> *Pharmaceutical Compounding - Sterile Preparations* and <1116> *Microbiological Control and Monitoring of Aseptic Processing Environments*, and regulatory requirements and expectations such as US FDA cGMPs<sup>2</sup> and Annex 1 of the EU GMP guidelines.<sup>3,4</sup>

## Understanding surface sampling recovery efficiency

Viable surface sampling is designed to monitor microbial bioburden on surfaces within classified areas. This involves collecting microbial samples from specific, risk-based locations using contact plates or swabs. Surface sampling is compulsory for pharmaceutical manufacturers and sterile compounding facilities, providing essential data on environmental contamination levels and supporting proactive measures to maintain acceptable conditions.

The recovery efficiency of the surface sampling system is important for pharmaceutical producers to understand. Recovery efficiency is highly dependent on the sample collection method used, technique of the personnel collecting the sample, the sample collection device used, and environmental conditions. These factors define the surface sampling system, and understanding how each contributes to microbial recovery is essential to ensuring the integrity and accuracy of the sampling program, as well as for trending data over time to determine the controlled state of a classified area.

To help industry understand these factors and the variability associated with their sampling system, Enverify™ was created as the first standardized microbial coated test surfaces for viable surface sampling application (**Figure 1**).



**Figure 1.**



## A case study in microbiological control: Advancing surface sampling for better contamination detection

### Introduction

Recent revisions to compendia and regulatory guidance focus on the critical role of viable surface sampling. USP General Chapter <797> highlights the need to demonstrate surface sampling competency, whereas changes to the European Union (EU) GMP Annex 1 section on viable surface sampling further underscore the importance of understanding recovery efficiency as it relates to your environmental monitoring program. However, in many cases, the microbial recovery efficiency of the personnel using their sample collection device is largely unknown. Here we present the results from an extensive multisite surface sampling performance dataset that includes >1,000 sampling events across more than 300 facilities.

This study was enabled by the Enverify™ Viable Surface Sampling Competency Kit, which provides the first standardized microbial coated surfaces for evaluation of surface sampling performance. Each test surface has a precise quantity of viable microbes coated over the target area. They are stable at 2-8°C for >12 months and shippable anywhere in the world.

### Purpose

The purpose of this study was to understand the performance and variability of personnel collecting surface samples under actual conditions for manufacturing and compounding, including key contributors to surface sampling variability. This was accomplished by evaluating microbial recovery efficiency and aseptic technique of a large number of personnel in the field with standardized test surfaces.

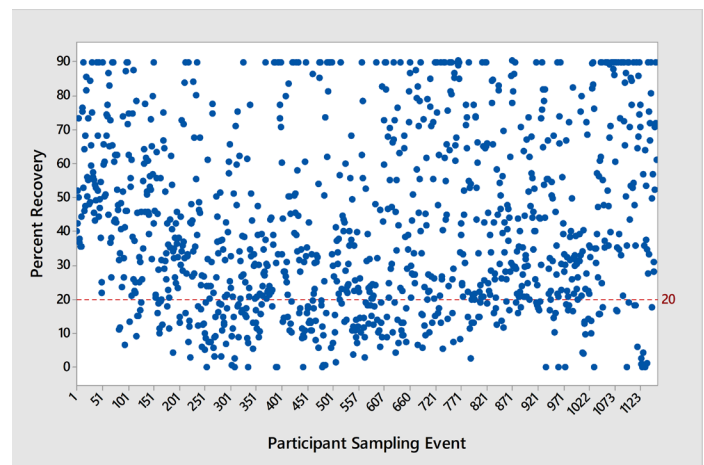
### Materials and methods

The Enverify™ Viable Surface Sampling Competency Kit ([Cat # 1800255](#)) included 3 microbial coated surfaces and 2 sterile blinded blanks. Each microbial coated test surface contained <100 colony forming units (CFU) of *Escherichia coli* ATCC® 25922™. The sterile blinded blanks were included to evaluate

aseptic technique. Each participant was instructed to receive the kit at their site, perform sampling using their sampling method and contact plates, and send the contact plates to a test lab for incubation and enumeration. The CFU results for each participant were then compared to the known quantity of CFUs on each Enverify™ test surface to determine the participant's recovery efficiency and confirm aseptic technique. The contact plate information for each participant was recorded throughout the study.

### Results

**Figure 2** shows the percent recoveries by 'participant sampling event' for this study (n = 1,155). Each data point is the average of 3 microbial coated test surface replicates. The red line at 20% recovery indicates a recovery efficiency PASS / FAIL threshold that was established based on earlier datasets and contact plate literature.



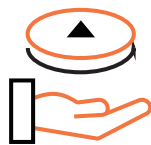
- 1,155 sampling events across >300 test facilities
- 22% of sampling events fell below 20% recovery
- 8.3% contaminated the contact plates during sampling

**Figure 2.** Contact plate % recovery by participant sampling event



#### Step 1

Enverify™ test surfaces shipped to participants



#### Step 2

Participant performs sample collection on Enverify™



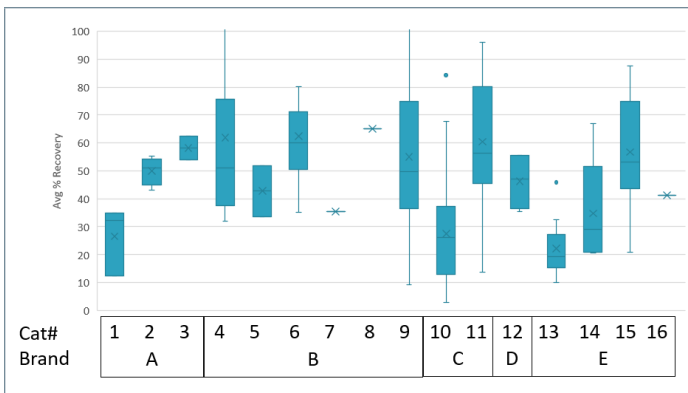
#### Step 3

Contact plates incubated and enumerated at lab



#### Step 4

Recovery efficiency and aseptic technique determined



**Figure 3.** Recovery efficiency of different contact plates

**Figure 3** shows the recovery efficiency of 16 different commercially available contact plates. These data were extracted from the larger surface sampling dataset. There was a high level of difference in the recovery efficiency of commercially available contact plates. These data underscore the need to understand the recovery efficiency of the specific contact plates used within a surface sampling system.

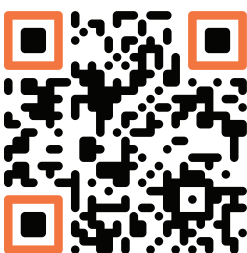
### Significance

This study represents an extensive, multi-facility dataset generated for viable surface sampling. The data offer valuable insights into the significant influence of aseptic technique and contact plate device performance on environmental monitoring outcomes and ultimately, the detection of contamination in classified areas.

There is a clear need for:

- Personnel collecting surface samples to demonstrate competency in surface sampling as part of their annual training.
- Understanding the recovery efficiency of the specific contact plates used within a surface sampling system.

These two actions will improve surface sampling consistency and accuracy of EM data generated and help with compliance with applicable regulations and compendia, such as US FDA



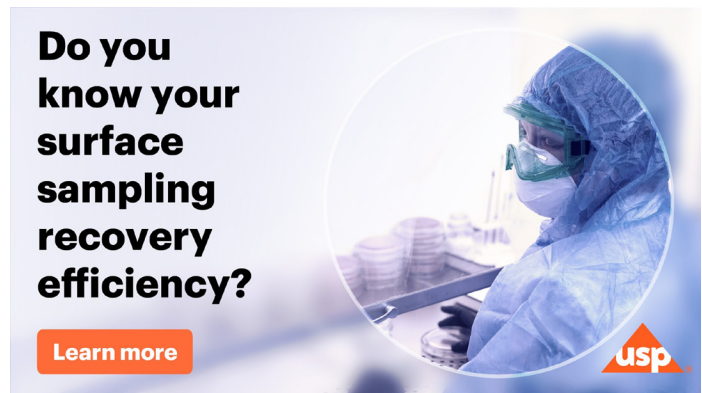
### More information

[www.usp.org/microbiology/enverify](http://www.usp.org/microbiology/enverify)

Questions: [microbiology@usp.org](mailto:microbiology@usp.org)

Ordering information:

[store.usp.org/product/1800255](http://store.usp.org/product/1800255)



cGMPs, EU GMP Annex 1 revisions, and USP General Chapter <797>. This study leveraged the Enverify™ Viable Surface Sampling Competency Kit, which provides the first reference microbial coated surfaces for comparison of sampling performance of personnel and sample collection devices.

### Conclusion

For facilities involved in sterile compounding and those regulated by cGMP, maintaining a robust viable EM program is essential. This program must be supported by consistent sampling methods and skilled personnel to ensure regulatory compliance, product and preparation quality, and patient safety. Real-world data from viable surface sampling studies, coupled with evolving regulatory guidance, highlight the critical need for thorough training and competency among EM personnel. Ensuring that surface sampling is accurate, consistent, and effective in detecting contamination enables a meaningful evaluation of cleanroom controls, supporting the conditions necessary for producing high-quality medicines. Incorporating a competency assessment for viable surface sampling into annual EM training programs is a crucial step in ensuring the reliability of data collected by EM personnel. By emphasizing consistent sampling techniques and qualified personnel, facilities can proactively mitigate contamination risks, uphold regulatory standards, and ultimately safeguard product quality and patient safety.

### References

1. Parenteral Drug Association. Technical Report No. 13 (Revised). Fundamentals of an Environmental Monitoring Program. 2022.
2. US FDA Current Good Manufacturing Practice (CGMP) Regulations <https://www.fda.gov/drugs/pharmaceutical-quality-resources/current-good-manufacturing-practice-cgmp-regulations>
3. USP General Chapter <797> Pharmaceutical Compounding – Sterile Preparations. In: USP-NF. Rockville, MD: USP; May 01, 2024.
4. EU GMP Annex 1. Volume 4. Brussels, 22.8.2022.C(2022) 5938.