# TAILORED ROOM RECOVERY TESTING SOLUTIONS FOR CDMO CLEANROOM COMPLIANCE

## AT A GLANCE

An Indianapolis-based contract development and manufacturing organization (CDMO) for injectable pharmaceutical manufacturing partnered with Performance Validation (PV) for cleanroom recovery testing.

During a client's compliance audit relating to ISO 14644 and EU Annex 1 requirements, the CDMO realized they lacked proper testing documentation demonstrating room recovery requirements. This discovery led to the generation of corrective and preventive actions (CAPA), requiring the CDMO to implement comprehensive improvements.

Given they would need to generate the study protocol and perform testing within a tight timeframe, the CDMO sought an experienced partner. Fortunately, one was close by. PV had recently completed work on an aseptic smoke study for the CDMO's aseptic filling line. Based on the success of that project, PV was enlisted once more to handle the room recovery testing.

## Services Provided

- Document Generation
- Risk Assessment
- Assessment Methodologies
- User Requirements

## WHAT IS ROOM RECOVERY TESTING & HOW DOES IT WORK?

Most cleanrooms must meet ISO 14644 requirements, which specify requirements for the classification, design, and monitoring of cleanrooms and controlled environments to manage airborne particulate cleanliness and ensure product quality and safety.

Suppose the cleanroom meets the room recovery testing requirements for ISO 14644. In that case, the cleanroom inherently meets the EU Annex 1 requirement for room cleanup time for non-viable particulates, a guideline within the European Union's Good Manufacturing Practice (GMP) framework that outlines specific requirements for the manufacture of sterile medicinal products.

Room recovery testing in a cleanroom environment evaluates how effectively the HVAC system restores air quality after contamination. In these controlled spaces, the HVAC system constantly circulates highly filtered air, with supply air reducing airborne particulates and return air venting them out.

During pharmaceutical manufacturing, workers naturally shed skin, hair, and clothing particles, and maintaining a specific number of air changes per hour helps keep particulate levels within acceptable limits. If particle counts spike, robust airflow flushes out contaminated air, maintaining the cleanroom standard.

## CONDUCTING A COMPREHENSIVE ROOM RECOVERY TEST

PV conducted room recovery testing over the weekend in active manufacturing areas to avoid disrupting operations. In preparation, PV created a diagram detailing each room to be tested and the necessary sampling points, pre-determined by the client's room volume to meet ISO 14644 sampling requirements. Some rooms had as many as 17 sampling locations, and PV used six Lasair Pro particle counters to cover all points efficiently.

For each test, PV set up particle counters and placed them at designated locations. Using an Air Techniques 6D Laskin-Nozzle Aerosol Generator with a DEHS solution, PV simulated a high contamination scenario by generating particle levels ≥ 100 times the allowable limit for ISO 14644. Real-time particle counts from the particle counters, measuring particles at 0.5 microns, ensured precise tracking of airborne particulates.

After reaching the required high particle concentration, PV shut off the aerosol generator, exited the room, and allowed the HVAC system 20 minutes to clear the air. To confirm room recovery, PV aimed for a 2 log (99%) reduction in particle count. Data from each particle counter was analyzed to determine recovery time and to ensure that all testing locations demonstrated a 2 log reduction in particles to demonstrate the cleanroom's air filtration system's efficiency and stability.

## INNOVATIVE APPROACHES TO COMPLEX CHALLENGES

The PV team's expertise and adaptability enabled them to tackle multiple challenges, preventing potential delays and keeping the project on track.

**Testing Larger Rooms in Sections to Ensure Complete Results**
With limited particle counters available, PV implemented a sectional testing approach to achieve full validation coverage across larger rooms. Each particle counter was positioned per client SOP guidelines, even in areas with lower airflow, ensuring compliance and consistency.

This approach required strategic planning and extended testing time, but the PV team's adaptability ensured precise, reliable results and thorough validation.

**Minimizing Operational Disruptions Through Strategic Testing Scheduling**
PV strategically scheduled testing over the weekend to minimize any impact on the client's manufacturing operations. This approach ensured that critical validation work was completed without interfering with production schedules, allowing the client to maximize operational efficiency. By avoiding conflicts with other personnel who might have been in the testing areas, PV streamlined the process and eliminated unnecessary delays.

Working outside of standard hours, PV demonstrated flexibility and a commitment to aligning with the client's needs. Ultimately, PV delivered timely, efficient testing that enabled the client to maintain seamless production.

**Addressing Noncompliance with Actionable Recommendations**
During testing, one location did not meet the acceptance criteria. In response, PV provided the client with several targeted recommendations to resolve the issue. These included optimizing system airflows, repositioning the particle counter, and, given the location's low-risk nature, considering acceptance of the results.

The non-compliant area was located at the end of a dead-end hallway with no airflow or active operations, contributing to the failure to achieve the required 2-log reduction within 20 minutes. However, due to the isolated placement of the counter and its minimal impact on manufacturing processes, the client accepted the results, confident that the location posed little to no risk.

## START TO FINISH IN ~1.5 DAYS & WITHIN BUDGET

The CDMO successfully developed a comprehensive testing package that validated the compliance of its cleanroom manufacturing areas with ISO 14644 and EU Annex 1 requirements. By leveraging PV's expertise, the CDMO efficiently addressed any gaps and ensured its cleanroom operations met the highest industry standards.

PV completed the room recovery testing in ~1.5 days and within budget. Through PV's guidance, the CDMO confidently closed its CAPA, ensuring regulatory compliance and operational efficiency.

## YOUR VALIDATION PARTNER FOR WHAT'S NEXT

Performance Validation (PV) is a global Commissioning, Qualification and Validation partner for pharmaceutical and medical device manufacturers, extending its expertise to include Building Commissioning for Building Owners in a broader scope of industries. Headquartered in Indianapolis, IN, we specialize in turning compressed timelines into compliant ones across a diverse array of environments, using innovative, adaptive approaches that balance production realities with strict regulatory requirements. With Building Commissioning, we leverage our deep understanding of regulatory standards to ensure facilities operate at peak performance, enhancing efficiency, safety, and environmental sustainability. Our dedicated team, consisting of more than 95% engineers, works closely with regulators, equipment suppliers, and construction teams to keep validation and commissioning services ahead of production curves, ensuring quality and operational excellence across all projects