

Clean Manufacturing: High Tack Polymeric Flooring Thomas Mulligan, May 2003

High technology companies manufacture, process, and package in cleanrooms and critical environments to eliminate the threat of particle, bacteria and static contamination from damaging our products. The decision to initiate the activities in a cleanroom is a major commitment in time, money, and manpower.

Building today's cleanroom requires extensive planning and careful design for optimum function. Twenty-first century technology, equipment, and materials, along with the latest personnel training and safety programs are all targeted at the immediate objectives of satisfying the customer and making a profit.

Despite the great cost and effort involved in cleanroom manufacturing, a major threat to a successful operation, foot and wheelborne contamination, is very often not addressed or given low priority in planning and design. Practical experience and industry studies have proven feet and wheels are the single major source of contamination entering the critical environment.

Foot and wheel contamination occur in layers and of varying sizes. Foot contamination control requires a minimum of three steps with each foot on a tack surface for full decontamination. Current standard operating procedures (SOP's) in many of our most sophisticated manufacturing facilities depend on adhesive peel off mats to control this contamination. Adhesive peel off mats must be of a size that allows enough footsteps (or wheel turns) to be effective.

Two things to consider in using peel off mats are the disposal costs and the possibility that the process of peeling an adhesive mat does not place particulates back into the environment.

A second part of SOP's is regularly scheduled floor cleaning. This is vitally important, but depending only on a single cleaning each day or even each shift perpetuates a myth that a recently cleaned floor that looks bright and shiny is contaminant free.

The Facts

Both inside and outside the cleanroom, the floor cleaning process often involves wet mopping with non-particulating mops, detergents and disinfectants. After completing the cleaning process we allow the liquid to dry on the floor. The contamination remaining in the liquid and any residue from the detergent become potential airborne contaminants minutes after the cleaning process is completed.

This contamination, added to the contamination generated by walls, ceilings, processes, personnel, and carts, threatens to move throughout the entire clean environment, air locks, and gowning rooms, and enter into the critical clean area.

Across the range of clean manufacturing industries, high quality, expensive floors are installed in hopes they will not contribute to the contamination problem. Vinyl flooring products and epoxy floors cannot control the contamination that touches their

surfaces. With personnel and carts continuously crossing the floor surfaces, you must put your floors to work; - make them part of your contamination control system.

A system of high tack polymer floor covering installations in the traffic areas throughout the support rooms and cleanroom environment results in an unavoidable, low cost solution to two major contamination threats.

Typical locations for installations include hallways, airlocks, air showers, gowning rooms; product and material transfer areas and even inside the cleanroom.

Glaxo SmithKline - Comparison Study, Journal of Parental Sciences 2002
The results for mean viable counts and percentage reduction values for wheel and foot borne contamination.

Table 1: Adhesive peel off mat.

Contamination surface	Mean viable counts (cfu/40cm ²)				Mean percentage reduction	
	Before peel off mat		After peel off mat		TSA	SDA
	TSA	SDA	TSA	SDA		
Wheelborne	539	151	403	110	25.2%	27.15%
Footborne	698	226	618	192	11.5%	15.0%

Contamination surface	Mean viable counts (cfu/40cm ²)				Mean percentage reduction	
	Before polymeric flooring		After polymeric flooring		TSA	SDA
	TSA	SDA	TSA	SDA		
Wheelborne	347	53	2	0	99.4%	100%
Footborne	472	122	1	0.2	99.8%	99.850%

As shown above, 99% of the viable contamination can be removed from feet and wheels prior to reaching the clean area. The contamination is held on the surface of the polymer flooring even with the movement of personnel and carts. This can greatly reduce airborne particulate wherever the high tack floor is installed.

The size and placement of the large areas of polymer floor covering are determined by the amount of traffic, both personnel and carts, your cleaning schedule, and the level of cleanliness targeted.

Examples:

To insure maximum contamination removal in a gowning room, design the high tack polymer flooring of a size to handle the movement of personnel during the busiest shift change. In most cases the "Z" type movement by personnel in a gowning room as they are picking up hairnets, booties, etc., allows enough footsteps to optimise effectiveness.

In a pharmaceutical facility, placement of the polymer flooring outside individual suites and along connecting hallways can eliminate a great deal of the threat of cross contamination.

In a raised floor cleanrooms, placement of polymer flooring on ramps and on non perforated gowning room floors, both on the clean and cleaner sides of step over benches, guarantees the ultimate in low particulate counts.

Maintenance:

Cleaning the polymer flooring completely rejuvenates its contamination control capabilities. The floor covering is simply cleaned with facility approved detergents and disinfectants. All contaminants are collected in the liquid and removed when the surface is squeegee dried. (Many floor cleaning machines can also be used on the material). A well-designed system can be cleaned within your current cleaning schedule. The large areas can be cleaned in sections eliminating the need to shut down rooms.

Relevant Facts:

Donning clean shoe covers and then walking across unprotected floors will trap and carry particles and bacteria. Polymer flooring works very well in conjunction with shoe covers. The surface is comfortable to walk on and will not pull off booties.

A well maintained polymer floor covering system would continue to remove the maximum amount of contamination for 3 to 5 years. The easily removed floor covering can then be recycled after its active life.

The thin, but strong, low profile flooring is easy for carts to negotiate and can handle even heavy fork truck traffic.

Conclusion

While initial installation may cost more than disposable products, the payback could be realized in a matter of months. Polymer floor covering can solve many concerns that sophisticated cleanroom facilities must address; a substantial reduction of particle and bacterial counts, lowering the overall cost of contamination control and the elimination of disposable waste.